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## Infant Emotion Regulation: Relations to Bedtime Emotional Availability, Attachment Security, and Temperament

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### Abstract

The present study examines the influences of mothers' emotional availability towards their infants during bedtime, infant attachment security, and interactions between bedtime parenting and attachment with infant temperamental negative affectivity, on infants' emotion regulation strategy use at 12 and 18 months. Infants' emotion regulation strategies were assessed during a frustration task that required infants to regulate their emotions in the absence of parental support. Whereas emotional availability was not directly related to infants' emotion regulation strategies, infant attachment security had direct relations with infants' orienting towards the environment and tension reduction behaviors. Both maternal emotional availability and security of the mother-infant attachment relationship interacted with infant temperamental negative affectivity to predict two strategies that were less adaptive in regulating frustration.

### Keywords

Maternal Emotional Availability; Attachment Security; Infant Temperament; Emotion Regulation

### 1. Introduction

The ability to regulate emotions and related behaviors in socially adaptive ways is an essential aspect of children's successful development (Calkins & Leerkes, 2010; Halberstadt, Denham, & Dunsmore, 2001; Kopp, 1989; Thompson, 1994). Lack of emotion regulation skills during infancy and toddlerhood is not only indicative of later aggressive or withdrawn behaviors (Calkins, Smith, Gill, & Johnson, 1998) but also predictive of problems in cognitive and social development through the preschool and early school years (Eisenberg, Cumberland, & Spinrad, 1998; Morris, Silk, Steinberg, Myers & Robinson, 2007).

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Both theory and empirical studies indicate that the parent-infant relationship exerts significant influence on infants' regulatory capacities (Cassidy, 1994; Kogan & Carter, 1996; Sroufe, 1995, 2005). The quality of parent-child interactions has been particularly emphasized as an influence on children's developing emotion regulation (Spinrad & Stifter, 2002; Sroufe, 1995). It is during healthy interactions with parents that a child acquires knowledge of emotions and adaptive regulatory strategies (Chang, Schwartz, Dodge, & McBride-Chang, 2003; Parke, Cassidy, Burks, Carson, & Boyum, 1992). Indeed, the ways in which mothers respond to their children's emotional cues are related to children's emotional competence (Eisenberg et al., 1998; Morris et al., 2007). Despite the wealth of studies examining relations between the quality of parenting and child regulatory outcomes, most studies relate individual dimensions of parenting (e.g., sensitivity) in relation to various aspects of emotional competence in infants, toddlers, and preschoolers (e.g., emotion understanding, intensity and duration of emotional expression, and emotion regulation strategies). We thus employ, in the present study, the multidimensional construct of emotional availability that involves affective attunement to the child's emotions, needs, and goals, an acceptance of both positive and negative emotions in the child, and adaptive regulation of emotional exchanges during interactions with the child (Biringen, 2000; Emde & Easterbrooks, 1985). Emotionally available parents engage in sensitive, structuring, nonintrusive, and non-hostile behaviors that enable the child to use the parent for comfort and support as well as engage in adaptive emotion regulation strategies (Biringen, 2000; Biringen, Robinson, & Emde, 1998; Kogan & Carter, 1996; Little & Carter, 2005).

The present study examines parental emotional availability during the context of bedtime as a predictor of child emotion regulation. Bedtime is a naturalistic, daily-occurring context for which parents have the goal of bringing the child to a comfortable, restful, and non-distressed affective state so that the child can fall asleep and sleep throughout the night, typically apart from parents. Cessation of parent-infant interactions and separation from parents during bedtime may potentially be distressing for children who wish to maintain contact or interaction with their parents (Sadeh, Tikotzky, & Scher, 2010). Emotionally available parents who respond contingently and appropriately to child signals, make effective use of bedtime routines to facilitate children's sleep by avoiding intense or high-level stimulation of the child when the child is settling to sleep at bedtime, and refraining from overt and covert expressions of irritability or anger when interacting with the child. These routines are expected to promote a safe and secure affective state in their children, and to enable adaptive emotion regulatory capabilities during distressing situations.

Taken together, the findings of studies that have examined individual dimensions of parenting (i.e., sensitivity, structuring, intrusiveness, or hostility) in relation to infant emotional competence indicate that early caregiving plays an important role in the development of children's emotion regulation (Kogan & Carter, 1996; Leerkes, Blankson, & O'Brien, 2009). Children with mothers that respond sensitively to their changing emotional cues tend to show lower negative reactivity and more regulatory strategies than children whose mothers are less sensitive (Spinrad & Stifter, 2002). Sensitive responsiveness to children's distress also seems to engender children's use of more age-appropriate emotion regulation strategies that are less self-oriented (e.g., thumb sucking) and more parent-oriented (e.g., focuses gaze on parent; Eisenberg et al., 1998). Parents structure children's

self-regulation of emotion through encouraging the child to shift attention, and modeling the use of adaptive strategies in response to distress (Cole, Dennis, Smith-Simon, & Cohen, 2009; Raikes & Thompson, 2006). Mothers who engage in emotionally available structuring pace their activity level in response to the child's cues such as gaze aversion, scaffold self-soothing by providing security objects, and provide positive guidance that will help children learn to regulate their emotions in adaptive ways (Calkins et al., 1998; Leerkes et al., 2009). When parents react negatively (e.g., reject, punish, or ignore) to children's distress, negative arousal is less likely to decrease, and maladaptive regulation in the form of minimization or over-regulation of emotions is likely to occur (Cassidy, 1994). Studies have shown that maternal intrusive and hostile behaviors (e.g., being constantly at the child, expressing irritation or anger, and scolding or teasing) that exert excessive or negative control over the child are linked with greater orienting towards sources of frustration and fewer adaptive emotion regulation strategies in the child (Calkins et al., 1998; Chang et al., 2003; Little & Carter, 2005).

Along with parenting quality, the mother-infant attachment relationship has both theoretical and empirical links to children's emotion regulation. According to attachment theory, parent-initiated regulation of emotions during face-to-face interactions in the earliest months, help infants to gain the ability for dyadic coregulation in the first year (Cassidy, 1994; Sroufe, 1995). With repeated interactions with parents in emotion-laden contexts, infants become increasingly able to autonomously use strategies to regulate their emotional arousal (Calkins et al., 1998; Feldman, Greenbaum, & Yirmiya, 1999; Kopp 1989). The organization of behaviors within the attachment relationship thus affects how children organize and regulate their emotions and behaviors towards the environment (Ainsworth, 1979; Sroufe & Waters, 1977; Thompson, 2008).

Attachment theory posits securely attached children to show more adaptive emotion regulation than children with insecure attachment (Bridges & Grolnick, 1995; Cassidy, 1994; Sroufe, 2005). Children who have confidence in the parent's capacity to provide assistance in regulating their affective states will be able to better regulate emotional arousal and also effectively explore their environment which, in turn, has positive implications for adjustment (Eisenberg et al., 2001; Sroufe, 1995, 2005). Indeed, secure attachment is associated with more adaptive emotion regulation (Diener, Mangelsdorf, McHale, & Frosch, 2002; Waters et al., 2010), including more parent-oriented and less object-orientated emotion regulation strategies during a frustration task (Braungart & Stifter, 1991; Diener et al., 2002; Leerkes & Wong, 2012).

On the other hand, children with insecure attachments show greater emotion dysregulation (Sroufe, 2005), placing them at greater risk for externalizing and internalizing problems, and psychopathology (Cassidy, 1999; Madigan, Moran, Schuengel, Pederson, & Otten, 2007). Insecure-avoidant infants who likely experienced repeated rejection from their parent tend to engage in less parent-oriented, more object-oriented, and more self-comforting emotion regulation strategies (Braungart & Stifter, 1991; Crugnola et al., 2011; Diener et al., 2002; Leerkes & Wong, 2012; Martins, Soares, Martins, Tereno, & Osório, 2012). Insecure-resistant infants are more likely to employ high levels of parent-oriented emotion regulation strategies possibly due to their uncertainty of parental emotional availability based on a

history of inconsistent care (Bridges & Grolnick, 1995; Cassidy, 1994). They are also more likely to use tension-reduction strategies, such as hitting or throwing the object (e.g., toy) when distressed (Calkins & Johnson, 1998; Leerkes & Wong, 2012).

Both temperament and attachment perspectives on children's emotional development agree that the emotion regulation abilities of infants are based on an interaction between the infant's temperamental characteristics and environmental influences (Calkins & Leerkes, 2010; Sroufe, 1995; Thompson, 1994). Given the bidirectional nature of parent-infant interactions, the present study also examines whether infant temperamental reactivity moderates the relation between bedtime parenting quality/parent-infant relationship and infant emotion regulation. Children who are temperamentally reactive may be more sensitive to their environment, namely parenting quality and the attachment relationship, given their greater likelihood of becoming distressed in a frustrating situation, greater dependence on external sources of regulation, and higher risk for maladjustment (Kiff, Lengua, & Zalewski, 2011; Stupica, Sherman, & Cassidy, 2011). As stipulated by the differential susceptibility hypothesis, reactive infants may be differentially susceptible to both positive and negative parenting quality, and to both secure and insecure attachment (Ellis, Boyce, Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2011). Studies have found parenting quality to more strongly predict social-emotional and behavioral outcomes for temperamentally reactive children than for less reactive children (Belsky, 2005; Belsky & Pluess, 2009; van IJzendoorn & Bakermans-Kranenburg, 2012). Leerkes et al. (2009), for example, found that maternal sensitivity to child distress was associated with lower emotion dysregulation only for highly reactive 24-month olds. In addition, Ursache, Blair, Stifter, and Voegtline (2013) found that 15-month olds with both high emotional reactivity and high emotion regulation were the most likely to have caregivers who showed more supportive parenting.

The differential susceptibility hypothesis and empirical findings suggest that high maternal emotional availability marked by sensitivity to child cues, appropriate structuring, and non-intrusive and non-hostile responses during bedtime are more likely to influence the emotion regulation abilities of highly reactive infants than those of low reactive infants. High emotional availability may predict greater use of adaptive regulatory strategies, whereas low emotional availability may predict greater use of less-adaptive regulatory strategies for highly reactive, but not low reactive, infants. Similarly, infant temperament may interact with attachment security to predict emotion regulation strategies such that highly reactive infants, compared to low reactive infants, may use more adaptive strategies when securely attached, and to use more of the less-adaptive strategies when insecurely attached. It is plausible that the relations between particular emotion regulation strategies and insecure attachment (e.g., the greater use of tension reduction behaviors in resistant infants) as found in previous studies are stronger for highly reactive infants.

### **The Present Study**

According to Thompson (1994), emotion regulation “consists of extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features, to accomplish one's goals” (pp. 27–28).

Working with this definition, the present study's goal is to examine whether the "extrinsic and intrinsic processes" involved in both maternal parenting quality and the mother-infant attachment relationship, and the "intrinsic processes" of infant temperamental negative affectivity, predict the behavioral emotion regulation strategies that infants employ to "modify emotional reactions" (i.e., frustration) in service of the "goals" of playing with an attractive toy (and mother). The regulatory strategies of orienting towards the environment, focusing on the mother and/or toy, self-comforting, avoidance, and tension reduction behaviors will be examined (Stifter & Braungart, 1995).

Whether an emotion regulation strategy is adaptive often depends on the goals of the infant in the current situation that the infant faces (Thompson, 1994). In the present study, infant emotion regulation will be assessed during a frustrating situation, a common occurrence for infants (Stifter & Braungart, 1995). When infants are denied access to an attractive toy as well as responses from the mother, they may experience frustration. Research has shown that certain regulatory behaviors are more adaptive than others in reducing frustration (Stifter & Braungart, 1995; Buss & Goldsmith, 1998; Diener & Mangelsdorf, 1999; Ekas, Braungart-Rieker, Lickenbrock, Zentall, & Maxwell, 2011); thus, it may be most adaptive to orient towards the toy and the mother at first, but turn to other strategies, such as redirecting attention towards the environment, that will help reduce frustration when the mother continues to be unresponsive. In addition, strategies such as avoidance (e.g., pushing back on the high chair in which they are seated) or tension reduction behaviors (e.g., actively banging legs against the high chair) may be less adaptive in that they either maintain or increase infants' frustration.

The study hypotheses are as follows. First, maternal bedtime emotional availability at 12 and 18 months was expected to predict infants' use of emotion regulation strategies at 12 and 18 months, both concurrently and longitudinally. When emotional availability was high, infants were expected to engage in emotion regulation strategies that would be adaptive in a situation during which the infant is denied access to an attractive toy as well as responses from the mother: orient (redirect attention) towards the environment, focus less on both the source of frustration (the attractive toy) and the mother who is unavailable, and self-comforting. Conversely, infants were expected to engage in more of the less-adaptive strategies – avoidance and tension reduction behaviors – when emotional availability was low. Second, infant attachment security at 12 months was expected to predict infants' use of emotion regulation strategies at 12 and 18 months. In line with attachment theory and previous findings, secure infants were expected to engage in more adaptive strategies than insecure infants; insecure-avoidant infants were expected to engage in less mother-oriented, more object (toy)-oriented, and more self-comforting strategies (Braungart & Stifter, 1991; Crugnola et al., 2011; Diener et al., 2002; Leerkes & Wong, 2012); and insecure-resistant infants were expected to engage in more mother-oriented, avoidance, and tension-reduction strategies (Crugnola et al., 2011; Leerkes & Wong, 2012), compared to secure infants. Third, infant temperamental negative affectivity (at 12 and 18 months) was expected to moderate the relation between maternal bedtime emotional availability and infant emotion regulation strategies at 12 and 18 months. In accordance with the differential susceptibility hypothesis, high maternal emotional availability was expected to predict greater use of adaptive strategies, and low emotional availability to predict greater use of less-adaptive

strategies, for infants high on negative affectivity, compared to infants low on negative affectivity. Finally, infant temperamental negative affectivity (at 12 months) was expected to moderate the relation between attachment security and emotion regulation strategies at 12 and 18 months. As predicted by the differential susceptibility hypothesis, secure infants were expected to use more adaptive strategies compared to insecure infants, and insecure infants to use more less-adaptive strategies compared to secure infants, only among infants high on negative affectivity.

## 2. Method

### 2.1. Participants

The sample of 144 mothers and their infants came from a larger NIH-funded two-year longitudinal study of parenting, infant sleep, and infant development (SIESTA – Study of Infants’ Emergent Sleep TrAjectories). A total of 167 mothers who were 18 years or older, of any ethnic background, and fluent in English were recruited from the obstetric floors of the Mt. Nittany Medical Center Mother and Baby Clinic and the Milton S. Hershey Medical Center in central Pennsylvania, shortly after mothers had given birth. The 23 families who had dropped out of the study by 12 months or were missing data for all study variables were not included in the present study. No sociodemographic differences were found between these mothers not included in the study, and the mothers in the final study sample.

The final study sample included 78 (54.2%) female and 54 (37.5%) first-born infants. Mothers’ average age was 30.2 years ( $SD = 5.2$ ), 84.7% of mothers were married, 34.0% graduated from college, and 30.6% obtained graduate or professional degrees. Two-thirds (66.0%) of mothers were employed, and the average family income was \$71,575 (ranging from \$5,000 to \$350,000). The ethnic composition of the sample was: 86.1% White, 3.5% African American, 2.1% Asian, 4.9% Latino, and 2.8% Other.

### 2.2. Measures

**2.2.1. Bedtime parenting quality (12 and 18 months)**—Video recordings of infant bedtimes were obtained when infants were 12 and 18 months of age. A digital video recorder, night-vision cameras, and microphones were used to capture parent-infant bedtime interactions. Cameras were focused on areas in which parent-infant bedtime interactions took place: the infant’s typical sleep location (e.g., crib), a chair in the infant’s or parents’ room, and another room such as the living room or basement. Parents were instructed to start the video recording approximately one hour before they began to get their infant ready for bed. The average length of infant bedtimes was 45.89 minutes ( $SD = 30.10$ ) at 12 months, and 49.95 minutes ( $SD = 37.41$ ) at 18 months.

Video-recordings of bedtime parenting could not be obtained or coded for 40 families at 12 months, and 55 families at 18 months. Reasons included attrition, no consent for video-recording, unspecified negative life events, and lack of bedtime interaction (e.g., a bedtime routine that was too short to assess parenting quality, bedtime activities carried out in a room without a camera, and video recording turned on after the infant was already asleep).



The emotional quality of bedtime parenting was coded by the author and another coder using the Emotional Availability Scales (EAS; Biringen et al., 1998). Four dimensions of emotional availability that were adapted to the bedtime context (according to Teti, Kim, Mayer, & Counterline, 2010) were scored. Sensitivity assessed mothers' accurate, appropriate, and prompt responses to their infants during bedtime activities. Structuring assessed mothers' successful use of bedtime routines to guide infants toward sleep. Mothers were scored lower on sensitivity and structuring if they took longer than 1 minute to respond to their infants who became distressed after being put down to sleep. Non-intrusiveness assessed whether mothers initiated new interactions that interfered with the infant falling asleep, or overly insisted that the infant fall asleep. Non-hostility assessed mothers' expression of covert (e.g., impatience) and/or overt (e.g., anger) hostility during interactions with their infants. The two child emotional availability scales (responsiveness and involvement) were not included in the present study because the focus was on the parents' contribution to the quality of parent-infant interaction, and the behavioral repertoire of the infants during the bedtime context was limited and thus less readily scoreable.

Intra-class correlations (absolute agreement) for the four emotional availability dimensions ranged from .98 to 1.00 for 8 (7.7%) randomly-selected 12-month tapes, and 9 (10.1%) randomly-selected 18-month tapes. At each time point, z-scores for the four dimensions were computed and combined to create a composite emotional availability score in which higher scores indicate higher emotional availability ( $\alpha = .82$  at 12 months,  $\alpha = .90$  at 18 months).

**2.2.2. Infant attachment security (12 months)**—When infants were 12 months of age, infants and their mothers completed the Strange Situation procedure (Teti & Kim, in press), a measure of mother-infant attachment security. The procedure is comprised of eight 3-minute episodes. In Episode 1, the infant and mother are introduced to the room with developmentally-appropriate toys on the floor, and two chairs (one for the mother and another for the stranger who enters the room later). In Episode 2, the infant plays with the toys, and the mother takes a seat on one of the chairs. An adult stranger (female) enters the room in Episode 3. In Episode 4, the mother is cued to leave the room. The stranger comforts the infant if he/she becomes distressed. The mother returns to the room during Episode 5, and comforts the infant if distressed and re-engages the infant with the toys. The stranger leaves. In Episode 6, the mother leaves the room for the second time. This episode is cut short if the infant becomes highly distressed. The stranger re-enters the room in Episode 7, and comforts the infant if distressed. Finally, in Episode 8, the mother returns and the stranger leaves for the second time. The primary focus is on the child's proximity- and contact-seeking behavior, contact-maintaining behavior, resistant behavior, and avoidant behavior during the two reunion episodes (5 and 8). Secure (B), insecure-avoidant (A), and insecure-resistant (C) classifications were obtained using Ainsworth's tripartite classification system (Ainsworth, Blehar, Waters, & Wall, 1978). The third author who trained and achieved reliability through the University of Minnesota workshop coded the Strange Situations. In the present study, inter-rater reliability (Cohen's K) on 22 (15.3%) tapes was .73. A total of 94 (65.3%) infants were classified as secure, 25 (17.4%) as insecure-avoidant, 8 (5.6%) as insecure-resistant.

**2.2.3. Child temperament (12 and 18 months)**—Child temperament was measured using the Infant Behavior Questionnaire–Revised (IBQ-R; Rothbart & Gartstein, 2000) at 12 months, and the Early Childhood Behavior Questionnaire (ECBQ; Putnam, Gartstein, & Rothbart, 2006) at 18 months. The IBQ-R is a 191-item measure of infant (3 to 12 months) temperament. Parents rated each item on a scale of 0 to 7, in which 0 is “not applicable”, 1 is their infant “never engages in the behavior”, and 7 is their infant “always engages in the behavior”. The IBQ-R yields 14 subscales and 3 higher-order factors of Surgency/ Extraversion, Negative Affectivity, and Orienting/Regulation (Gartstein & Rothbart, 2003). Surgency/Extraversion is comprised of the subscales of approach, vocal reactivity, high intensity pleasure, smiling and laughter, activity level, and perceptual sensitivity ( $\alpha = .78$ ). Negative Affectivity includes the subscales of sadness, distress to limitations, fear, and falling reactivity ( $\alpha = .61$ ). Orienting/Regulation is the combination of the subscales of low intensity pleasure, cuddliness, duration of orienting, and soothability ( $\alpha = .64$ ).

The ECBQ is a 201-item measure of child (18 to 36 months) temperament. Similar to the IBQ, a 0 to 7 rating scale is used for all items, and 18 subscales and 3 higher-order factors can be derived (Putnam et al., 2006). The Surgency/Extraversion factor includes the subscales of impulsivity, activity level, high intensity pleasure, sociability, and positive anticipation ( $\alpha = .62$ ). Negative Affectivity includes the discomfort, fear, sadness, frustration, soothability (reverse-coded), motor activation, perceptual sensitivity, and shyness subscales ( $\alpha = .74$ ). The Orienting/Regulation factor is comprised of the subscales of inhibitory control, attentional shifting, low intensity pleasure, cuddliness, and attentional focusing ( $\alpha = .71$ ). The temperament factor of Negative Affectivity indicating child temperamental reactivity was included as a moderator in the present study.

**2.2.4 Infant emotion regulation (12 and 18 months)**—At 12 and 18 months, infants and mothers completed the Toy Removal Task (Stifter & Braungart, 1995). Infants were seated in a high chair with the mothers seated slightly to the side of the infant. For 90 seconds, the infants and mothers played with a toy (Busy Box). Mothers were then instructed to get up from her seat, remove the toy from the infant and place it on the chair so that the toy was in the infant’s sight but out of reach. For the next two minutes, mothers did not look at or respond to their infant; instead, they engaged in conversation with a research assistant. This segment of the task was designed to emulate situations when the mother’s attention is distracted away from the infant, such as when she answers the phone. The toy removal episode was cut short if the infant engaged in 20 seconds of hard crying. After two minutes of toy removal or 20 seconds of hard crying, whichever came first, mothers were asked to return the toy to the infant, but also to not interact with her infant for one minute, again engaging in conversation with a research assistant. At the end of the toy return episode, mothers resumed interaction with their infants. The average length of the toy removal episode was 113.6 seconds ( $SD = 26.8$ ) at 12 months, and 111.6 seconds ( $SD = 28.2$ ) at 18 months.

For every 5 seconds of the toy removal episode, six regulatory strategies were scored (Stifter & Braungart, 1995). Orienting was scored when the infant’s eyes were focused on the environment or down on their own body for one second or longer. When the infant looked at or towards the mother, looks to mother was scored; when the infant looked at the toy, looks



to toy was scored. Self-comforting was scored when the infant engaged in repetitive fine motor movements including sucking on fingers, rubbing the face, stroking head or ears, and clasping clothes. Avoidance was scored when the infant had an arched back, pushed back against the high chair, strained forward, and physically turned the head away. Tension reduction behaviors included repetitive and active banging with hands, feet, or back on the high chair.

Coders who were blind to the other study variables coded the regulatory strategies. The inter-rater reliability (ICCs) of rater pairs for 27 (10.2%) randomly-selected cases across regulatory strategies ranged .85 to .99. The scores for each of the regulatory behavior codes were summed and divided by the total number of 5-second intervals in the toy removal episode. The resulting proportion variables had a possible range of 0 to 1. The majority of infants engaged in orienting, looks to mother, and looks to toy (which were normally distributed), but only a third to two-thirds of infants engaged in self-comforting, avoidance, and tension reduction behaviors (which were positively skewed). Thus, whereas all behaviors were dichotomized and included as binary (“engaged” vs. “not engaged”) variables in analyses, only the normally distributed behaviors of orienting, looks to mother, and looks to toy were included as continuous proportion outcome variables in analyses.

### 2.3. Data Analysis

Logistic regression models were estimated to examine whether infants’ use of emotion regulation strategies was predicted by maternal bedtime emotional availability and infant attachment security, and whether child temperamental negative affectivity moderated the relations between emotional availability and regulatory strategies, and between attachment security and regulatory strategies. Separate logistic regression analyses were conducted at each time point: (a) concurrent relations between emotional availability, temperament, and emotion regulation at 12 months; (b) emotional availability and temperament at 12 months predicting emotion regulation at 18 months; and (c) concurrent relations between emotional availability, temperament, and emotion regulation at 18 months.

The strategies of orienting, looks to mother, and looks to toy at 12 and 18 months were included as continuous outcome variables in hierarchical multiple regression, ANOVA, and ANCOVA analyses. In order to obtain the best predictive model, the models including the significant moderators were trimmed (i.e., non-significant terms starting with the largest tail probability were removed) until only significant interaction and/or main effects remained.

## 3. Results

### 3.1. Preliminary Analyses

**3.1.1. Descriptives**—The descriptives for all predictor, moderator, and outcome variables are provided in Table 1. Zero-order correlations between all study variables (except for infant attachment classifications) are provided in Table 2. In addition, one-way ANOVAs indicated that there were significant differences between the three infant attachment classifications (secure, insecure-avoidant, insecure-resistant) in 12-month parent-rated negative affectivity,  $F(2, 126) = 8.95, p < .001$ . Tukey’s post-hoc comparisons indicated that insecure-resistant infants’ negative affectivity ( $M = 3.92, SD = .85$ ) was rated by their parent

as higher than that of insecure-avoidant ( $M = 2.98$ ,  $SD = .63$ ) and secure ( $M = 3.26$ ,  $SD = .50$ ) infants.

**3.1.2. Covariates**—Correlations between demographic variables (child gender, maternal age, maternal employment status, maternal marital status, family income, and number of children in the home) and child regulatory strategies indicated that child gender, maternal age, and family income were related to avoidance, looks to toy, and orienting: Male infants ( $M = .23$ ) engaged in more avoidance than female infants ( $M = .15$ ) at 18 months,  $r(123) = 2.14$ ,  $p < .05$ ; mothers' age was negatively correlated with avoidance at 12 months,  $r(138) = -.21$ ,  $p < .05$ , and positively correlated with looks to toy at 18 month,  $r(124) = .32$ ,  $p < .001$ ; and family income was inversely related to orienting at 18 months,  $r(109) = -.21$ ,  $p < .05$ ). These demographic variables were thus included as covariates in analyses for the corresponding outcome variables.

### 3.2. Emotional Availability as Predictor of Emotion Regulation Strategies

Contrary to expectations, maternal bedtime emotional availability at 12 and 18 month did not predict infants' emotion regulation strategies concurrently or longitudinally (all  $ps > .05$ ).

### 3.3. Attachment Security as Predictor of Emotion Regulation Strategies

Infant attachment security at 12 months was expected to predict infants' use of emotion regulation strategies at 12 and 18 months. Two significant relations were found at 12 months: A one-way ANOVA indicated that secure infants ( $M = .60$ ) engaged in more orienting towards the environment than insecure-resistant infants ( $M = .37$ ),  $t = -2.69$ ,  $p < .01$ . Also, logistic regression analyses indicated that insecure-resistant infants had a decreased log odds of 2.30 in the use of tension reduction compared to secure infants, Wald statistic = 4.44,  $p < .05$ . That is, insecure-resistant infants were less likely to engage in tension reduction behaviors than secure infants.

### 3.4. Temperamental Negative Affectivity as Moderator of the Relation between Emotional Availability and Emotion Regulation Strategies

Infant temperamental negative affectivity as rated by the parent was expected to moderate the relations between maternal bedtime emotional availability and infant emotion regulation strategies at 12 and 18 months. Multiple regression analyses indicated that emotional availability interacted with infant negative affectivity to predict the regulatory strategy of looks to mother at both 12 months,  $t = -2.23$ ,  $p < .05$  ( $f^2 = -.05$ ), and 18 months,  $t = -2.46$ ,  $p < .05$  ( $f^2 = -.07$ ). The simple slopes when infants were low on negative affectivity ( $-1 SD$  below the mean; gradient =  $.02$ ,  $p < .01$ , at 12 months; gradient =  $.02$ ,  $p < .01$ , at 18 months), and when infants were high on negative affectivity ( $+1 SD$  above the mean; gradient =  $-.01$ ,  $p < .05$ , at 12 months; gradient =  $-.02$ ,  $p < .01$ , at 18 months) were significant (Aiken & West, 1991). As can be seen in Figure 1, for 12 month old infants with lower negativity, the higher the emotional availability of the mother the more these infants looked to the mother. On the other hand, for infants rated as high in negative affectivity the greater the mother's emotional availability the less they looked to their mothers when frustrated. The same result emerged at 18 months<sup>1</sup>. As the slopes were in opposite directions, contrastive effects, and

not differential susceptibility, were indicated (Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2007).

### 3.5. Temperamental Negative Affectivity as Moderator of the Relation between Attachment Security and Emotion Regulation Strategies

Mother-rated infant temperamental negative affectivity (at 12 months) was expected to moderate the relations between infant attachment security (at 12 months) and emotion regulation strategies at 12 and 18 months. Infant attachment security interacted with temperamental negative affectivity to predict the regulatory strategy of avoidance at 18 months. Logistic regression analyses indicated that for infants high on temperamental negative affectivity, the probability of avoidance at 18 months was higher for insecure-avoidant infants than for secure infants, Wald statistic = 5.30,  $p < .05$  (Figure 2). The simple slope when infants were high on negative affectivity (+1 *SD* above the mean) were significant, gradient = -2.18,  $p < .05$ , whereas, the simple slope when infants were low on negative affectivity (-1 *SD* below the mean) were not, gradient = .37,  $p > .05$ .

## 4. Discussion

The present study examined the influences of mothers' emotional availability towards their infants during bedtime, infant attachment security, and interactions between bedtime parenting quality and attachment with infant temperamental negative affectivity, on infants' emotion regulation strategy use during a frustration task at 12 and 18 months. Whereas emotional availability was not directly related to infants' emotion regulation strategies, infant attachment security had direct relations with infants' orienting towards the environment and tension reduction behaviors. Although the differential susceptibility of infants high on negative affectivity was not supported, both maternal emotional availability and infant attachment security interacted with temperamental negative affectivity to predict the use of less-adaptive strategies.

Infants' emotion regulation strategies were assessed during a frustration task that required infants to regulate their frustration levels while denied access to an attractive toy as well as mothers' support. As infants in this frustrating situation needed to distract themselves away from the inaccessible toy and the unresponsive mother until they became accessible again, greater use of orienting (redirecting attention towards the environment), and less focus on the toy and mother (i.e., the sources of frustration) were expected to be more adaptive. In addition, as indicated in previous findings, greater use of self-comforting was considered to be more adaptive in reducing frustration, whereas greater use of avoidance and tension reduction behaviors was expected to either maintain or increase infants' frustration (Braungart & Stifter, 1991; Crugnola et al., 2011; Diener et al., 2002; Leerkes & Wong, 2012).

In contrast to previous studies that have shown links between the quality of parent-child interactions and infant emotion regulation (Eisenberg et al., 1998; Leerkes et al., 2009; Spinrad & Stifter, 2002), mothers' emotional availability during infant bedtime was not

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<sup>1</sup>The figure at 18 months looked similar to that at 12 months and was thus not included.

significantly related to infants' regulatory strategies at 12 and 18 months. Although the reason for this null finding is not clear, it is possible that the above average levels of parenting quality found in the present community sample may have lacked enough variance to detect meaningful differences in infants' strategy use. Despite the lack of direct relations between maternal emotional availability and infants' regulatory strategies, the quality of bedtime parenting interacted with infant temperamental negative affectivity to predict infants' use of the less-adaptive strategy of looks to mother. In the use of the less-adaptive strategy of looks to mother at 12 and 18 months, highly negative infants focused less on the unresponsive mother when mothers engaged in emotionally available bedtime parenting, and focused more on the unresponsive mother when mothers showed low emotional availability, than low negative infants. As the slope for low negative infants was in the opposite direction of the slope for high negative infants (and not zero), these findings suggest a contrastive effect (not differential susceptibility) of infant temperamental negative affectivity (Belsky et al., 2007). High negative infants who are more prone to experience frustration may provide more opportunities for their mothers to help with emotion regulation. If these mothers engage in emotionally available parenting that responds sensitively to these infants' emotional cues, structures adaptive ways of regulating emotions, and refrains from intrusive/hostile responses, these infants may be better able to independently use strategies that would help them regulate their frustration. Having prior experiences of high emotional availability during the bedtime context may enable these high negative infants to focus less on the mother whose attention is temporarily distracted away from the infant. On the other hand, the positive relation between emotional availability and looks to mother for low negative infants is a more puzzling finding. Infants who are less likely to get frustrated may rely more on their mothers' assistance during frustrating situations if their mothers typically engage in emotionally available parenting, and less so if parenting quality is low.

As a secure attachment relationship indicates a history of positive interactions during which the mother adequately met the infants' regulatory needs and provided assistance in regulating emotions, secure infants were expected to engage in more adaptive regulatory strategies than insecure infants (Cassidy, 1994; Sroufe, 1995, 2005; Roque Verrísimo, Fernandes, & Rebelo., 2013; Thompson, 2008). As expected and consistent with previous studies (e.g., Leerkes & Wong, 2012), secure infants used the adaptive strategy of orienting towards the environment more than insecure-resistant infants. This finding suggests that infants with secure attachment were better able to regulate their frustration through shifting their attention towards the environment, and that a history of positive interactions with mothers was directly predictive of infants' more adaptive strategy use. Contrary to expectations and previous findings, insecure-resistant infants were less likely to engage in the less-adaptive strategy of tension reduction compared to secure infants. One potential explanation for this unexpected finding may be that although insecure-resistant infants have been found to display higher levels of tension reduction behaviors (typically measured during the Strange Situation procedure in previous studies), they are also most prone to high levels of distress (Braungart & Stifter, 1991), compared to insecure-avoidant and secure infants. It may be that when faced with a frustrating situation in which the mother is purposely unresponsive, insecure-resistant infants may become too distressed to engage in any regulatory strategy (Braungart-Rieker & Stifter, 1996; Calkins & Johnson, 1998). That

mothers in the present study rated insecure-resistant infants higher on temperamental negative affectivity than insecure-avoidant and secure infants lends support to this explanation.

The hypothesis that insecure infants would use more less-adaptive strategies compared to secure infants, only among highly negative infants, was supported. At 18 months, insecure-avoidant infants with high negative affectivity were more likely to engage in the less-adaptive strategy of avoidance, than secure infants with high negative affectivity. For highly negative infants, secure attachment provided benefits such that infants were less likely to use less-adaptive avoidance strategies (e.g., arching back, pushing back against the high chair) when frustrated, whereas insecure attachment increased the likelihood of such avoidance strategies.

A primary goal of the present study was to examine whether temperamentally reactive infants (i.e., those infants who are high on negative affectivity) were differentially susceptible, for better and for worse, to maternal emotional availability and attachment security in relation to their emotion regulation abilities. Although the findings discussed above indicated the moderating role of infant temperamental negative affectivity in the use of two strategies that were less adaptive in regulating frustration, they did not provide support for the differential susceptibility of infants high on negative affectivity during the toy removal episode of the frustration task. When the mother-infant relationship quality was high, infants rated as high on negative affectivity focused less on the unresponsive mother and engaged in less avoidance behaviors, whereas they engaged in more of these less-adaptive strategies when parent-infant relationship quality was low. In contrast, among infants who were low on negative affectivity, the strategy of looks to mother was positively related to maternal emotional availability, and avoidance strategies did not differ by attachment classification. It may be that for these low negative infants who are less likely to get frustrated, maternal emotional availability and attachment security has less straightforward relations with emotion regulation strategy use during a frustration task.

One limitation of the present study is the homogenous sample of primarily middle-class Caucasian families, which limits the generalizability of the findings. It will be important for future research to address whether these findings are relevant to more diverse samples. Another limitation is the lack of power to detect significant relations due to the (a) small numbers of infants with insecure-resistant (6.3%) and insecure-avoidant (19.7%) classifications, and (b) inability to include the strategies of self-comforting, avoidance and tension reduction as continuous variables. More comparable numbers of insecure-resistant, insecure-avoidant, and secure infants may reveal relations between attachment security, temperamental negative affectivity, and emotion regulation strategies of infants that were expected but not found in the present study. In addition, only mother-rated infant temperament was included. Although mothers' perceptions of their infants' temperament have been found to relate to parenting quality and child outcomes, it may be important to include objective measures of infant temperament in future work. Finally, the findings are limited to infant's relationships with their mothers. More work needs to be done on other external factors, such as fathers, siblings, daycare, and peer groups, that may influence the emotion regulation abilities of infants.

The present study adds to the literature by examining both maternal emotional availability during the less-studied context of infant bedtime and infant attachment security as predictors of infant emotion regulation strategies. As well, the differential susceptibility of temperamentally reactive infants was examined, considering the moderating role of infant characteristics in infants' emotional development. The findings point to the complex relations between parenting quality, infant attachment security, and infant reactive temperament in relation to the specific strategies that infants engage in when they experience frustration. Clearly, there is still a wealth of knowledge to be gained with regards to the development of emotion regulation in children. Future studies might further explore how the adaptiveness of particular regulatory strategies may depend on the specific "goals" of the particular situation that infants are in; determine whether and how disorganized attachment (characterized by atypical emotional reactions and bizarre behaviors; Main & Solomon, 1986) relates to specific emotion regulation strategies; and conduct cross-cultural studies that can provide insights into the universal and culture-specific processes of emotion regulation in the first years of life.

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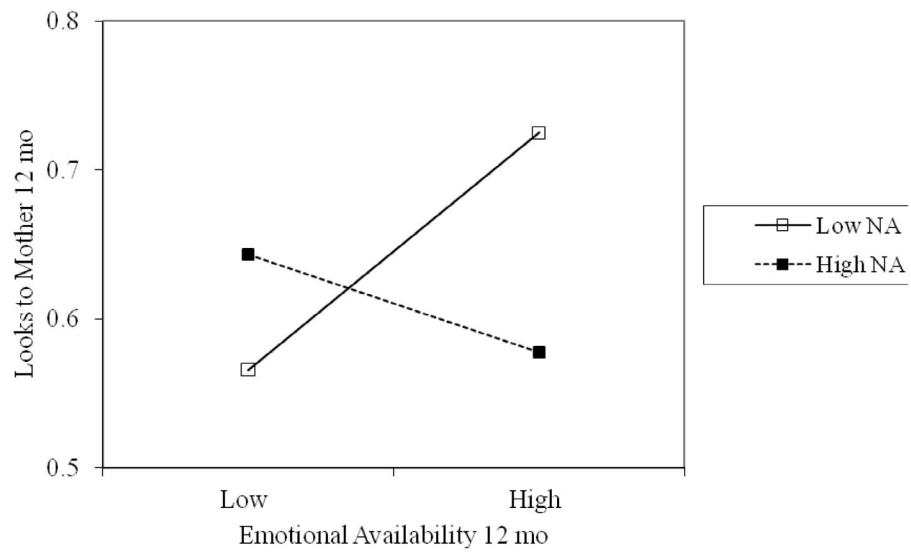


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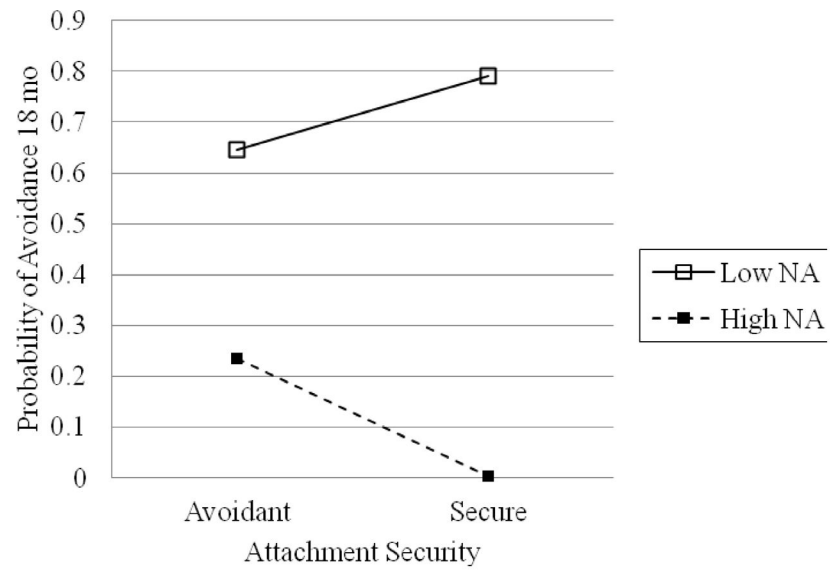
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- We examine infants' emotion regulation strategies during a frustration task.
- Infant attachment security directly predicts regulatory strategies.
- Maternal emotional availability and infant attachment security interact with infant reactive temperament to predict less adaptive strategy use.



**Figure 1.** Moderation of the relation between maternal bedtime emotional availability and the strategy of looks to mother by infant temperamental negative affectivity at 12 months.



**Figure 2.** Moderation of the relation between infant attachment security and the probability of avoidance by infant temperamental negative affectivity.



**Table 1**

Descriptive Statistics for Maternal Bedtime Emotional Availability, Infant Temperament, and Infant Emotion Regulation Strategies) (n = 144).

	M	SD	SE
Emotional Availability			
12 months	18.88	3.33	.33
18 months	18.99	3.66	.39
Infant Temperamental Negative Affectivity			
12 months	3.26	.58	.05
18 months	2.59	.52	.05
Infant Emotion Regulation Strategies			
Orienting			
12 months	.60	.24	.02
18 months	.53	.26	.02
Looks to Mother			
12 months	.63	.22	.02
18 months	.62	.22	.02
Looks to Toy			
12 months	.36	.21	.02
18 months	.46	.25	.02
Self-Comforting			
12 months	.24	.27	.02
18 months	.18	.25	.02
Avoidance			
12 months	.08	.12	.01
18 months	.19	.22	.02
Tension Reduction			
12 months	.11	.16	.01
18 months	.08	.12	.01

**Table 2**  
 Correlations between Maternal Emotional Availability, Infant Temperamental Negative Affectivity, and Emotion Regulation Strategies during Toy Removal Task at 12 and 18 months (n = 144).

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Emotional availability (12 mo.)	1															
2. Emotional availability (18 mo.)	.43***	1														
3. Negative affectivity (12 mo.)	-.10	-.10	1													
4. Negative affectivity (18 mo.)	-.03	-.09	.51***	1												
5. Orienting (12 mo.)	.15	.02	-.07	-.09	1											
6. Look to mom (12 mo.)	.07	-.03	-.06	-.03	-.40***	1										
7. Look at toy (12 mo.)	-.07	.14	-.06	.06	-.23**	.13	1									
8. Self-comforting (12 mo.)	-.03	.05	-.08	.05	.05	.13	-.01	1								
9. Avoidance (12 mo.)	-.06	-.15	.07	.16	-.003	.03	.01	-.10	1							
10. Tension reduction (12 mo.)	.01	.04	.08	.01	-.12	.08	-.09	-.17*	.02	1						
11. Orienting (18 mo.)	-.002	-.04	.03	-.06	.26**	-.02	-.11	.04	-.11	-.06	1					
12. Look to mom (18 mo.)	-.10	-.04	.09	.07	-.30**	.06	.18	-.03	-.04	.06	-.38***	1				
13. Look at toy (18 mo.)	.05	-.07	-.08	-.01	-.04	.10	.20*	.11	.02	.02	-.45***	-.10	1			
14. Self-comforting (18 mo.)	-.14	.10	-.04	.04	.003	-.06	-.04	.30**	-.08	-.14	-.01	.10	-.03	1		
15. Avoidance (18 mo.)	.11	-.16	-.002	.03	.03	-.02	-.07	.003	.18*	-.06	-.21*	.04	.12	-.16	1	
16. Tension reduction (18 mo.)	.00	.08	-.03	-.12	-.05	.02	.07	-.10	-.03	-.07	-.10	.12	-.14	-.03	.13	1

\*  $p < .05$ ,

\*\*  $p < .01$ ,

\*\*\*  $p < .001$