Published in final edited form as:
Infancy. 2012 September 1; 17(5): 455–478. doi:10.1111/j.1532-7078.2011.00099.x.

Infant Distress and Regulatory Behaviors Vary as a Function of Attachment Security Regardless of Emotion Context and Maternal Involvement

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Abstract

Differences in infant distress and regulatory behaviors based on the quality of attachment to mother, emotion context (frustration versus fear), and whether or not mothers were actively involved in the emotion-eliciting tasks were examined in a sample of 98 16-month-old infants and their mothers. Dyads participated in the Strange Situation, a limiting task designed to elicit infant frustration, and a novelty task designed to elicit infant fear. Mothers were asked to remain uninvolved during the first minute of each task, and then instructed to engage with their infants as they wished for the remaining three minutes. Independent of concurrent maternal sensitivity, resistant infants were significantly more distressed than secure and avoidant infants. Avoidant infants engaged in fewer active mother-oriented regulation behaviors than secure and resistant infants and engaged in more self-soothing in the mother involved condition than the mother uninvolved condition. Resistant infants engaged in more physical comfort with their mothers and more venting than both secure and avoidant infants, and exhibited a smaller variety of adaptive non-mother-oriented strategies than did secure infants. There were few differences in infant distress and regulatory behaviors as a function of emotion task and maternal involvement. Limitations and implications for future research are discussed.

The ability to control one's emotions, particularly negative emotions, develops rapidly in early childhood (Kopp, 1989), and appropriate control of negative emotions is linked with adaptive social relationships, fewer behavioral problems, and academic success (Calkins & Leerkes, 2010). Thus, identifying factors that are linked with adaptive emotional self-regulation in early childhood is of paramount importance. Drawing from theoretical and empirical work in the developmental (Cole, Martin, & Dennis, 2004) and clinical fields (Keenan, 2000), we define emotional self-regulation as those behaviors, skills, and strategies, whether conscious or unconscious, automatic or effortful, that serve to modulate, inhibit, and enhance emotional experiences and expressions (Calkins & Leerkes). The purpose of this study is to examine the extent to which infant distress and the use of specific regulatory behaviors varies as a function of the quality of the infant-mother attachment relationship, the nature of the emotion context (frustration vs. fear), and mothers' involvement during the emotion-eliciting tasks.

Over the infancy and toddler period, infants progress from nearly complete reliance on their caregivers for emotion regulation to independent self-regulation (Kopp, 1989; Sroufe, 1996).

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The shift to independent regulation is supported by developments in the motor, cognitive, and language domains that allow infants to become more purposeful in their attempts to control affective arousal by approaching, retreating, redirecting attention, and self-soothing in a flexible manner (Bronson, 2000; Kopp 1989). Moreover, it is widely believed that individual differences in the development of emotional self-regulation are influenced by caregiving practices (Thompson, 1994; Morris, Silk, Steinberg, Myers, & Robinson, 2007). One perspective about the way in which caregiving affects emotion regulation is through the emerging attachment relationship.

Bowlby (1969/1982) argued that infants develop an "internal working model," or a schema about the self and the caregiver, that is constructed out of repeated early interactions. Sensitive caregiving was hypothesized to lead to a secure attachment and expectations that emotional needs would either be met by the caregiver or managed with skills developed through interactions with the caregiver. In contrast, insensitive caregiving was hypothesized to lead to an insecure attachment and expectations that emotional needs would not be met by the caregiver or the self. These expectations would then affect future adaptation. Ainsworth, Blehar, Waters, and Wall (1978) provided the first empirical support demonstrating links between sensitive caregiving and attachment quality, and argued that infants' regulatory strategies, both dyadic and independent, are reinforced by the accompanying reduction in arousal and positive reactions from mothers which contribute to a sense of efficacy in their ability to self-regulate (Bell & Ainsworth, 1972).

Subsequently, Cassidy (1994) and Bridges and Grolnick (1995) argued that infants learn to express and regulate their emotions, particularly negative ones, in a manner that allows their attachment needs to be met in light of their caregiving experiences. Secure infants experience maternal sensitivity in response to a broad range of emotional signals, which promotes open and flexible communication of both positive and negative affect and flexible regulation of emotion based on the demands of the situation. Avoidant infants experience maternal rejection, which promotes the minimization of affect and fewer mother-oriented (e.g., proximity seeking, looking toward mother, asking the mother for assistance) and more self-oriented (e.g., self-soothing, self-distraction) regulation behaviors in an effort to prevent additional rejection. Resistant infants, in contrast, experience inconsistent care or maternal unavailability, which promotes the maximization or heightening of affect and frequent use of mother-oriented regulation behaviors in an effort to gain the mother's attention. These patterns, which serve different functions in the context of the parent-infant relationship, are thought to become internalized and then generalize to other contexts in which they may be less adaptive.

The results of several studies, in which infant regulation was observed within the Strange Situation and in other contexts, are consistent with the view that infant regulatory behaviors vary across attachment groups. Securely attached children display less negative affect and more positive affect in frightening and frustrating situations than insecurely attached children (particularly resistant infants), suggesting they are better regulated (Diener, Mangelsdorf, McHale, & Frosch, 2002; NICHD Early Child Care Research Network, 2004; Smith, Calkins & Keane, 2006). Moreover, infants with secure attachment relationships utilize a broader range of competent regulatory behaviors and more caregiver-oriented regulation behaviors such as social referencing and help seeking than insecure infants; whereas insecure infants, particularly avoidant infants, engage in more self-soothing and solitary exploration with toys than securely attached infants (Braungart & Stifter, 1991; Diener et al., 2002; Nachmias, Gunnar, Mangelsdorf, Parritz & Buss, 1996; Schieche & Spangler, 2005). In the present study we address three limitations that have been relatively consistent in the prior literature linking attachment and emotion regulation. First, we observe emotion regulation behaviors outside of the Strange Situation to explore how infants

regulate their emotions involving frustration and fear. Second, in contrast to some other studies, we compare all three primary attachment groups rather than combining the resistant and avoidant infants into one insecure group (e.g., Nachmias et al, 1996). This is critically important as there are different theoretically-derived predictions about the pattern of affect regulation that insecure-avoidant and insecure-resistant infants may utilize. Third, in contrast to some other studies (e.g., Diener et al., 2002), we control for concurrent measures of maternal sensitivity to rule out the possibility that attachment-based differences in emotion regulation are a function of maternal behavior in the moment. This is important given evidence that concurrent measures of maternal sensitivity and infant affective and regulatory behaviors are correlated (Calkins & Johnson, 1998; Crockenberg & Leerkes, 2004). To our knowledge, no prior study has simultaneously addressed all of these limitations.

There is also evidence that infants use different regulatory behaviors depending on two features of the observational context: the extent to which the caregiver is available to provide assistance and the nature of the emotion-eliciting task (frustrating inducing versus fear inducing). Kopp (1989) argued that young children would be better equipped to use more purposeful and sophisticated behaviors aimed at eliminating the source of distress with caregiver support. Consistent with this view, Grolnick, Bridges, and Connell (1996) demonstrated that toddlers used more active distraction behaviors when mothers were involved in a delay task, and Diener and Mangelsdorf (1999) demonstrated that toddlers were better regulated when their mothers were allowed to intervene freely during fear and frustration tasks, as evidenced by the display of more positive affect. In regard to the emotion context, both discrete affect theory and a functionalist approach to emotions underscore the likelihood that children may use different regulatory behaviors depending on the specific emotion being regulated (Buss & Goldsmith, 1998). Consistent with this view, Diener and Mangelsdorf (1999) demonstrated that toddlers engaged in more regulatory behaviors of various types (e.g., social referencing, problem solving, leave taking, engaging with mother) during frustration than fear inducing episodes. In addition, Buss and Goldsmith demonstrated that infant regulatory behaviors were more effective at reducing arousal during frustration-inducing tasks than fear-inducing tasks. Both sets of authors acknowledge the possibility that these differences are due to different task demands (e.g., mothers could not help their toddlers leave the area in the former, and infants could not flee from frightening stimuli as they were confined in a chair in the latter).

An important new direction in this area of research is systematically integrating the research on attachment-based differences and context-based difference in infants' distress and emotion regulation by examining the possibility that attachment classification moderates the effects of emotion context or maternal involvement on infant emotion regulation. For example, securely attached infants may demonstrate greater differences in their regulatory behaviors depending on whether or not mothers are actively involved than other infants. Securely attached infants may try harder than other infants to elicit maternal support from uninvolved mothers based on their prior positive interactions with their mothers and resulting confidence in their mothers, or their regulatory efforts may be undermined because their mothers' behavior violates their expectations more so than avoidant or resistant infants. In addition, securely attached infants, who have a history of feeling protected by their mothers, may mobilize more active regulatory behaviors in the face of a frightening stimulus than avoidant and resistant infants, which may reduce task-based differences in the use of their regulatory behaviors. We address these issues in the current investigation by examining the extent to which attachment status moderates the effects of maternal involvement and emotion context on regulatory behavior.

In sum, the goals of this study are to examine the extent to which infant distress and the use of specific regulatory behaviors vary as a function mother-infant attachment, the emotion context (frustration or fear), and whether or not the mother is involved in the emotion-eliciting tasks. We examine both main effects and interactions among these factors. We measured the extent to which infants engaged in active mother-oriented behaviors (look at mother, seek proximity to mother, play with mother, and help seek to mother) and engaged in physical soothing with mother (which primarily consisted of sitting on the mother's lap, a more passive regulatory behavior). We also measured the following non-mother oriented regulatory behaviors: look away, self-soothe, play/distract, problem solve, help-seek to experimenter, withdraw, and venting. We consider venting (e.g., hitting or throwing the stimulus, tantrum) maladaptive because it is associated with higher distress in the moment and behavioral problems over time (Calkins & Dedmon, 2000; Calkins & Johnson, 1998). In contrast, we view the other regulatory behaviors as adaptive based on prior research linking them with lower negative affect via concurrent correlations or sequential analyses and/or with more adaptive child outcomes over time (Buss & Goldsmith, 1998; Calkins & Johnson, 1998; Crockenberg & Leerkes, 2004, 2006; Crockenberg, Leerkes, & Jó, 2008; Diener et al., 1999; Grolnick, et al, 1996; Jahromi, Putnam, & Stifter, 2004).

In sum, our primary hypothesis was that infant distress and regulatory behaviors would vary based on attachment classifications such that: a) resistant infants would display more distress than secure and avoidant infants as reported by Diener et al. (2002), and avoidant infants would display less distress than secure infants as theorized by Cassidy (1994); b) resistant infants would engage in more mother-oriented behaviors than secure and avoidant infants, and avoidant infants would engage in less mother-oriented behaviors than secure infants based on theory (Cassidy, 1994; Bridges & Grolnick, 1995) and research (Braungart & Stifter, 1991; Diener et al., 2002; Nachmias, Gunnar, Mangelsdorf, Parritz & Buss, 1996; Schieche & Spangler, 2005); c) secure infants would engage in a larger variety of regulatory behaviors than resistant and avoidant infants given the view that they are more flexible in the regulation of emotion (Cassidy, 1994); and d) resistant infants would engage in more venting than secure and avoidant infants based on prior research (Calkins & Johnson, 1998) as venting may serve the theorized goal of maximizing infant distress (Cassidy, 1994). Based on Diener and Mangelsdorf's (1999) research on context effects, we also predicted that infants would a) engage in more adaptive regulatory behaviors during the frustration task than the fear task, and b) be less distressed and engage in more adaptive regulatory behaviors, both mother and non-mother-oriented, when their mothers were involved versus uninvolved. In addition, we examined the possibility that attachment status would moderate the effects of emotion context and maternal involvement on infant affect and regulatory behaviors. As there is no prior research on this topic, we did not formulate specific hypotheses in regard to this research question.

Method

Participants

Participants in this study were 99 mothers and their infants who were recruited from a participant database from another study on the origins of maternal sensitivity, child care centers, and local parenting organizations. Inclusion criteria were that the focal child be 16 months old, the mother's only or eldest child, and typically developing. One dyad was eliminated from the analyses because they did not complete the Strange Situation resulting in an analytic sample of 98 dyads. Mothers' age ranged from 19 to 47 years (M = 29.82), education ranged from less than a high school diploma to a graduate degree (32% did not have a college degree), and annual income ranged from $5,000 to $170,000 ($Mdn$ = $60,000). Seventy-five mothers were European American, 19 African American, 2 Asian American, and 3 were multiracial. Most (82%) were married, living with, or dating their

child's father. Ten mothers were single mothers with no father involvement. Infants were full term and healthy; 50 were male.

Procedures

Participants of a prior study were invited, by phone, to participate in this study when their children were 15 months old. In addition, flyers describing the study were distributed to local child care centers and parenting organizations. Interested parties called us and were screened for inclusion criteria. Mothers who agreed to participate were mailed a consent form and demographic questionnaire, and mothers and infants visited campus for an observation of mother-infant interaction within one month of the child's 16-month birthday. During the laboratory visit, mothers and infants were first observed during Ainsworth et al.'s (1978) Strange Situation in which mothers and their infants engaged in a series of brief separations and reunions. After the Strange Situation, infants and mothers were given the option of a brief break, during which they were free to have a snack, nurse, and play. Once infants were calm, they engaged in a limiting task, designed to elicit infant frustration, and then a novelty task, designed to elicit infant fear. During the emotion-eliciting tasks, mothers were seated on a couch and asked not to interact with their infants for the first minute of each task (i.e., mother-uninvolved portion of each task). Mothers were provided a magazine to read to help them adhere to these instructions. After a minute, mothers were instructed that they could interact with their toddlers as they wished (i.e., mother-involved portion of the task). Infants were seated on a rug on the floor at the onset of the tasks. A basket of toys was within reach of infants and mothers. Inspection of the videos demonstrated that mothers primarily adhered to the instructions to be uninvolved and then involved.

During the *limiting task,* the researcher offered the infant a toy phone that made noise and lit up. Once the infant was interested in the phone, the researcher placed it in a clear plastic jar and closed the lid tightly so it was impossible for the infant to open. The jar was placed on the floor near the infant. The researcher encouraged the infant to open the jar with verbal prompts. After 4 minutes, the researcher opened the jar and allowed the infant to play with the phone.

During the *novelty task,* the main researcher left the room and a research assistant dressed in a green monster costume entered the room and stood quietly at the door for 10 seconds. The research assistant spoke a script ("Hello, I'm an ogre…what are you doing" etc.) in a neutral voice as she approached within 2 feet of the infant, crouched down and repeated the script. The researcher then crossed the room, danced while humming a nursery rhyme, and then slouched in a chair pretending to sleep while snoring loudly. The researcher pretended to wake up, approached the infant again, crouched down next to the infant and repeated the script until 4 minutes passed.

Data from the observational tasks were missing as follows: 4 infants did not complete the frustration task because they never became interested in the telephone. One infant did not complete the fear task because he was inconsolable prior to its onset. One infant each did not complete the mother-uninvolved portion of the frustration task and fear task because they were relatively distressed at the onset of the task and their mothers were signaled to become involved early.

Mothers received $25 gift cards for completing the assessments.

Measures

Attachment security at 16 Months—Infant attachment security during the Strange Situation was coded using procedures outlined by Ainsworth and colleagues (1978). The

Strange Situation involves a series of separations and reunions between the caregiver and infant, and assesses the extent to which infants use their caregiver as a secure base for exploration and safe haven in times of distress (Ainsworth et al., 1978). Two certified reliable coders double coded 25 videos using the traditional 3 category coding system (ABC); agreement was 88%, $\kappa = .78$. Sixty-eight infants were classified as secure, 20 as avoidant, and 10 as resistant. Attachment disorganization was not rated.

Observed behaviors during emotion-eliciting tasks—Infant affect, infant emotion regulation, and maternal behavior were event-based continuously coded from digital media files using the Observer 5.0 (Noldus Information Technology, Wageningen, The Netherlands). Teams of two worked on each coding system; coders were blind to other data. Reliability cases were selected at random and disagreements were resolved via consensus.

Infant affect: Infant affect was rated on a 7-point scale ranging from *high positive affect* (1) to *high negative affect* (7), adapted from Braungart-Rieker and Stifter (1996) based on infants' vocalizations, facial expressions, and body tension. Inter-rater reliability was calculated based on 21 tapes; weighted $\kappa = .92$. The proportion of time the infant was distressed was calculated by dividing the duration of task time infants were rated a 5 (mildly distressed), 6 (moderately distressed), or 7 (intensely distressed) by the total duration of the task; this quotient was then multiplied by 100 so possible scores ranged from 0 to 100. The peak level of distress displayed by infants was recorded as a measure of the intensity of distress. As not all infants became distressed, this score ranged from 4 (neutral) to 7. These scores were calculated separately for the mother-involved and uninvolved portions of each emotion task resulting in 8 measures of infant distress.

Infant regulation: Drawing from prior work (Buss & Goldsmith, 1998; Calkins & Johnson, 1998; Crockenberg & Leerkes, 2004; Diener et al., 1999; Grolnick, et al, 1996; Jahromi, Putnam, & Stifter, 2004), six categories of emotion regulation behaviors were coded: gaze, body position, soothing, distraction, problem solving, and venting. Within a category, all codes were mutually exclusive; thus evidence of inter-rater reliability is presented for each category and was based on 17 double-coded videos. Across categories, multiple behaviors were coded simultaneously (e.g., look at mother and self-soothe could co-occur). Two types of gaze away were coded: *look away* from stimulus (character/phone), but not at mother and *look at mother*; Kappa (k) = .84. Two types of body position were coded: *withdraw* from stimulus and *seek proximity to mother* (coded whenever an infant reached for, walked toward, or attempted to climb onto mother); $k = .73$. Two types of soothing were coded: *bodily contact with mother* (e.g., leans against, sits on lap, allows mother to hug, stroke, etc) and *self-soothing* (e.g., thumb/finger sucking, hair twirling, rocking, etc); $k = .88$. Two types of active distraction were coded: *independent play/distraction* (e.g., touching or playing with toys in basket, singing songs, etc.) and *play/distraction with mother* (i.e., any of the prior behaviors in which the mother was also engaged); $k = .87$. Three types of problem solving were coded: *help seek to mother* (ask mother for help verbally or by gesture), *help seek to experimenter* and independent *problem solving* (e.g., trying to open the jar, asking/telling the character to leave); $k = .67$. Finally, *venting* (e.g., throw or stomp on jar; yell at or push experimenter; tantrum on floor, etc) was coded; $k = .56$. In all cases, percentage agreement for codes within a category was higher than 87%.

Efforts were then made to reduce the number of variables in a manner consistent with the study conceptualization. First, we created a new variable, named *active mother-oriented regulation* by using the "lump" command in Bakeman and Quera's (1995) General Sequential Querier program to combine look at mother, seek proximity to mother, play with mother, and ask mother for help because all involve active solicitation of the mothers' help or active engagement with the mother. As these behaviors were in different behavioral

categories and could co-occur, it was important to not simply sum their durations because those scores would be artificially high. The lump command recodes the separate codes into a single category and lumps sequences and co-occurrences of the same code together. We maintained physical soothing with mother as a separate measure for two reasons. First, this behavior was primarily passive in that it consisted of infants allowing mothers to comfort them physically via touch; the most common form of this behavior was sitting in the mother's lap. Second, this behavior often co-occurred with the more active mother-oriented regulation behaviors (40 to 65% of the time across tasks), and combining them may have obscured important differences in the manner in which infants use their mothers as a source of regulation. The duration of time infants engaged in each behavior during each task was calculated. Because the mother-uninvolved and involved portions of each task were of different duration (1 versus 3 minutes), the percentage of time that infants engaged in each regulatory behavior of interest was calculated separately for the mother-involved and uninvolved portion of the frustration and fear tasks; these scores were then multiplied by 100. These scores had a possible range from 0 to 100.

Finally, we created two measures to reflect the variety of regulation behaviors infants used: one for the variety of mother-oriented behaviors and the other for the variety of adaptive non-mother-oriented behaviors. We converted each raw duration score into a dichotomous variable in which 0 indicated the behavior was not used in a specific task and 1 indicated that it was used. We then summed these within tasks to create a measure of the number of distinct behaviors that infants engaged in within a category. Possible scores ranged from 0 to 5 for mother-oriented behaviors (look at mother, seek proximity to mother, play with mother, ask mother for help, and physical soothe with mother) and 0 to 6 for adaptive non-mother-oriented behaviors (look away, self-soothe, problem-solve, self-distraction/play, help seek from experimenter, and withdraw).

Maternal sensitivity: Maternal sensitivity was rated during the mother-involved portion of the frustration and fear-eliciting tasks based on the appropriateness and quality of maternal behaviors, given concurrent infant affect, using a three step process. First, maternal behavior was coded using 12 mutually exclusive categories described in Table 1. Inter-coder reliability for maternal behavior was calculated based on 20 tapes, $\kappa = .89$. Second, the maternal behavior and infant affect code files described above were merged. Third, a sensitivity rating was assigned to each moment of the interaction based on the specific combination of maternal behavior and infant affect using a 3-point scale (1 = *insensitive*, 2 = *moderately sensitive*, 3 = *sensitive*). For example, drawing the infant's attention toward the task is rated as *sensitive* (3) if the infant was neutral (a rating of 4 on the infant affect scale) or positive (a rating of 1, 2, or 3 on the infant affect scale), but *insensitive* (1) if the infant was distressed (a rating of 5, 6, or 7 on the infant affect scale). Other behaviors, such as intrusiveness are rated as *insensitive* (1) regardless of infant affect. Sensitivity ratings for discrete maternal behaviors during infant positive, neutral, and negative affect appear in Table 1. Mothers' average sensitivity during the frustration and fear task respectively were calculated to yield measures of *observed sensitivity.* Sensitivity ratings derived from this continuous coding scheme correlate positively with global ratings of sensitivity and predict subsequent child outcomes such as anxiety demonstrating the validity of this approach (Crockenberg & Leerkes, 2006).

Results

Preliminary Analyses

First, missing data from the emotion eliciting tasks was computed for 7 dyads using multiple imputation in SPSS version 18 using an iterative Markov chain Monte Carlo method.

Overall, there was 3% of missing data among the variables; creating five imputed datasets was appropriate for this amount of missingness (Rubin, 1987). Demographic variables, predictor variables, and dependent variables were included in the imputation model in order to preserve relationships among the focal variables. Each substantive analysis was conducted separately with each imputed data set; results were combined by computing the average across the five data sets.

Second, potential covariates (infant gender, age, minority status, maternal education, age, income, and maternal sensitivity) were screened by examining whether they differed by attachment classification and correlated with infant distress and emotion regulation behaviors. Only maternal sensitivity during the mother-involved portion of the frustration and anger tasks met criteria. Specifically, there was a mean difference in sensitivity during the anger task, $F(2,95) = 4.85$, $p < .01$, and during the fear task, $F(2,95) = 3.05$, $p < .05$. Follow-up Bonferonni comparisons indicated that mothers of resistant infants were significantly less sensitive ($M = 2.45$, $SE = .10$) than mothers of secure ($M = 2.72$, $SE = .04$) and avoidant infants ($M = 2.86$, $SE = .07$) during the frustration task. Mothers of resistant infants were significantly less sensitive ($M = 2.49$, $SE = .10$) than mothers of secure infants ($M = 2.86$, $SE = .03$) during the fear task as well. Furthermore, as illustrated in Table 2, maternal sensitivity correlated significantly with a number of concurrent indicators of infant distress and emotion regulation. Thus, maternal sensitivity during the mother-involved portions of the frustration and fear tasks were controlled in all analyses examining mean differences in infant affect and regulatory behaviors as a function of infant-mother attachment and task characteristics.

Mean Comparisons

Next, we ran a full factorial MANCOVA to examine overall differences in infants' distress and the use of emotion regulation behaviors based on the repeated factor task (frustration vs. fear), repeated factor mother involvement (involved versus uninvolved), between subjects factor attachment classification (secure, avoidant, resistant), and all interactions while controlling for maternal sensitivity during the mother-involved portions of the frustration and fear tasks.

The results indicated there was a significant omnibus effect for attachment, $F(26, 164) = 1.78$, $p < .05$. The omnibus tests for the interactions between attachment and emotion task, attachment and maternal involvement, and attachment and task and involvement were all non-significant: $F(26,164) = .64$, 1.254, and 1.25, respectively. Thus, the means and univariate tests based on attachment classification, collapsed across task and maternal involvement, are presented in Table 3. The omnibus tests for the effects for task, $F(13,81) = 2.56$, and maternal involvement, $F(13,81) = 1.39$, were not significant; but the omnibus test for task by maternal involvement was significant, $F(13,81) = 3.02$, $p < .05$. The means and univariate tests for mean differences based on task and maternal involvement are presented in Table 4.

Main effects of attachment classification

As displayed in Table 3, indicators of infant distress and use of regulatory behaviors varied as a function attachment classification, and these effects were largely consistent with prediction. Consistent with the hypotheses, infants classified as resistant were significantly more distressed than both secure and avoidant infants as evidenced by a greater proportion of time in distress and higher peak distress. Contrary to the hypotheses, avoidant infants did not display less distress than secure infants. Consistent with the hypothesis, avoidant infants spent less time engaging in active mother-oriented regulation behaviors and used a smaller variety of mother-oriented regulation behaviors than both secure and resistant infants.

Somewhat consistent with the hypotheses, secure infants engaged in a wider variety of adaptive non-mother-oriented behaviors (i.e., look away, self-soothe, problem solve, self-distract, and help-seek from the experimenter) than resistant infants, but did not differ from avoidant infants. Resistant infants engaged in fewer adaptive regulation behaviors than both secure and avoidant infants. As hypothesized, resistant infants engage in more venting than both secure and avoidant infants; they also engaged in significantly more physical soothing with mothers, a passive mother-oriented strategy, and less withdrawal from the aversive stimulus than both secure and avoidant infants.

Effects of emotion task

As displayed in Table 4, the proportion of time infants were distressed and peak distress did not vary as a function emotion task. Likewise, there were no task differences in the duration or variety of mother-oriented behaviors. In terms of other regulatory behaviors, infants looked away more during the frustration task than the fear task, and self-soothed and vented more during the fear task than the frustration task.

Effects of maternal involvement

Next we describe the main effects of maternal involvement and whether they were moderated by emotion task. Infants were distressed for a marginally greater proportion of time during the mother-involved portion of the tasks. In terms of mother-oriented regulatory behaviors, infants engaged in marginally more active mother-oriented behaviors during the mother-uninvolved portion of tasks. In terms of other regulatory behaviors, infants looked away more often when their mothers were involved regardless of task. Finally, infants vented more when their mothers were involved, an effect that was accounted for by infant venting during the fear task.

Interactions between attachment and context

Although the omnibus effect was not significant, the univariate effect of attachment classification by maternal involvement on self-soothing was significant, $F(2, 93) = 3.29$, $p < .05$, $\eta^2 = .07$. Post hoc analyses indicated that avoidant infants engaged in significantly more self-soothing when their mothers were involved ($M = 16.98$, $SE = 3.46$) than uninvolved ($M = 6.23$, $SE = 3.26$), $t(18) = 7.72$, $p < .01$. Self-soothing did not vary based on maternal involvement for secure or resistant infants, $t(66) = 1.16$ and $t(9) = 2.07$, both *ns*. As this was the only significant interaction between task characteristics and attachment of the 39 interactions tested (emotion task X attachment, mother involvement by attachment, and task X involvement X attachment for 13 outcomes), it may be function of chance.

In sum, there were consistent effects of attachment classification on infant distress and regulatory behaviors that were primarily unaffected by emotion task or maternal involvement. Most of these differences were moderately large (Cohen, 1988). In contrast, there were few effects of emotion task and maternal involvement on infant distress and regulatory behaviors and most differences were in the small range. The omnibus effect of task by involvement appeared to be fully accounted for by the robust interaction that was apparent for infant venting.

Discussion

The purpose of this study was to examine the extent to which infant distress and use of specific regulatory behaviors vary as a function of infant mother attachment status, the type of emotion context, and whether or not the mothers were actively involved during the emotion-eliciting tasks. Consistent with predictions derived from attachment theory, infants varied in their distress and the types of emotion regulatory behaviors they engaged in

depending on their attachment status. There was less consistent evidence that affect and regulatory behaviors varied based on the nature of the emotion task and whether or not infants' mothers were involved. Moreover, there was little evidence suggesting that these contextual effects were moderated by attachment status.

Attachment-Based Differences

A number of the attachment-based differences in infant behaviors were consistent with Cassidy's (1994) and Bridges and Grolnick's (1995) argument that infants' emotion expression and regulation are influenced by their attachment experiences. For the sake of clarity, we discuss the pattern of findings separately for each of the three primary attachment groups beginning with securely attached infants. Consistent with Diener et al.'s finding (2002), secure infants were distressed for a smaller proportion of time and displayed less intense distress during the emotion-eliciting tasks than resistant infants, although they did not differ from avoidant infants. The finding that secure infants did not differ from avoidant infants in terms of observed distress is consistent with prior research (Nachmias et al, 1996; Diener et al, 2002) and may be a function of security subgroups. That is, out of the 68 securely attached infants, 50 were classified as B1/B2, the subtypes characterized by lower distress levels (Ainsworth et al., 1978). Alternatively, avoidant infants may be minimizing their distress if they are in fact physiologically more distressed than secure infants (Hill-Soderlund et al., 2008). This possibility should be addressed by future research.

The pattern of findings with regard to emotion regulation behaviors was consistent with our prediction that secure infants would be more flexible in their use of regulation behaviors than resistant and avoidant infants, from whom they differed in unique ways. Specifically, secure infants spent proportionately more time engaged in active mother-oriented regulation behaviors such as looking at mother, seeking proximity to mother, and asking the mother for help, and engaged in a broader variety of these behaviors than avoidant infants, but did not differ from resistant infants in this regard. In contrast, secure infants engaged in less physical soothing with the mother (which primarily involved sitting on the mother's lap), a more passive strategy, than resistant infants. Further, secure infants engaged in more withdrawal from the aversive stimuli, a behavior demonstrated to be effective at reducing arousal in the short-term (Crockenberg & Leerkes, 2004), and a broader variety of adaptive non-mother-oriented regulation behaviors than resistant infants. Thus, consistent with the view that secure infants are equipped to respond flexibly to distressing situations (Cassidy, 1994), the pattern of mean differences suggest that securely attached infants are equipped with more diverse regulatory tools than avoidant and resistant infants to respond adaptively in both frustrating and frightening situations

In contrast, rather clear biases for emotion expression and emotion regulation were apparent for avoidant and resistant infants. First, consistent with theory (Bridges & Grolnick, 1995; Cassidy, 1994) and prior research (Diener et al., 2002), avoidant infants appeared to minimize their reliance on their mothers in emotionally arousing contexts. As predicted, avoidant infants displayed a lower proportion and less intense distress than resistant infants, but did not differ from secure infants as described above. Moreover, we found that avoidant infants spent less time engaging in active mother-oriented regulation behaviors than both secure and resistant infants and less time engaging in passive physical comfort with their mothers than resistant infants. In addition, avoidant infants engaged in a smaller variety of distinct types of mother-oriented regulation than both secure and resistant infants. The finding that avoidant infants engaged in more self-soothing in arousing contexts when their mothers were actively involved than uninvolved is particularly interesting and may reflect avoidant infants' effort to prevent further rejection from mothers (Bridges & Grolnick).

The pattern of findings for resistant infants were highly consistent with the view that resistant infants heighten their negative emotions and engage in more mother-oriented behaviors in an effort to elicit and maintain maternal contact and intervention (Bridges & Grolnick, 1995; Cassidy, 1994). In comparison to secure and avoidant infants, resistant infants displayed proportionately more frequent and more intense distress across tasks. Resistant infants also spent significantly more time in passive body contact with their mothers, the less active of the mother-oriented behaviors, than secure and avoidant infants. It seems that this passive mother-oriented strategy may not be particularly effective for resistant infants given the high level of distress observed in them. This difference is not a function of concurrent maternal sensitivity as that was controlled in the analyses. Thus, it may be that resistant infants really do heighten their affect in an effort to maintain proximity with their mother as Cassidy (1994) theorized. Although resistant infants did not differ from secure infants in their use of active-mother oriented behaviors, there was some evidence that resistant infants had a less well-developed repertoire of non-mother oriented behaviors than other infants. Specifically, resistant infants withdrew or moved away from the distressing stimuli less often than both secure and avoidant infants. Rare use of withdrawal may serve to maintain resistant infants' distress. In addition, although resistant infants did not differ from secure infants in the proportion of time they engaged in adaptive non-mother oriented regulation behaviors such as self-soothing, problem solving, and looking away, they used a smaller variety of such behaviors. Resistant infants were also most likely to engage in venting, a behavior reflecting dysregulation that is linked with maladjustment over time (Calkins & Dedmon, 2000).

In the current investigation, we found more attachment-based mean differences in the use of specific regulatory behaviors than did Diener et al. (2002). This finding, despite our small group sizes, may be a function of task differences. We suspect that our emotion-eliciting tasks were more distressing than the competing demands task that Diener and colleagues used in their study. If this is the case, our finding suggests that attachment status is particularly relevant to the use of regulatory behaviors in highly stressful situations, consistent with the theoretical notion that the attachment system is designed to promote survival (Bowlby, 1969/1982). A novel contribution of our design was our ability to examine the possibility that attachment interacted with emotion task (frustration vs. fear) and maternal involvement in the task in relation to infant affect and regulatory behavior. That moderating effects were not apparent (other than attachment by mother involvement in relation to self-soothing) demonstrates that attachment relationships are relevant for the modulation of both frustration and fear arousal in infants both when their mothers are actively engaged or disengaged in the task at hand. Moreover, the fact that our findings remain significant over and above concurrent maternal sensitivity rules out the possibility that mean differences are merely an artifact of what mothers were doing in the moment. This lends strong support to the view that it is the history of interactions with mothers that affects infants developing repertoire of emotion expression and regulation via the internal working model (Cassidy, 1994).

Emotion Context

In contrast to Diener et al's (1999) research in which regulation behaviors consistently varied by emotion task and mother involvement, we found relatively few effects of this type. In regard to emotion task, infants engaged in more self-soothing during the fear task than the frustration task, perhaps because there was relatively little else infants could do to cope with the character approach. That infants looked away less during the fear task than the frustration task may be adaptive in that maintaining attention on a perceived threat is likely adaptive for survival. These differences are consistent with the functionalist perspective in

that infants utilized some different regulatory behaviors depending on the nature of the negative emotions experienced or task characteristics (Buss & Goldsmith, 1998).

Maternal Involvement

In regard to maternal involvement, infants engaged in marginally more active mother-oriented regulation behaviors when mothers were uninvolved, and more looking away when mothers were involved. Diener and Mangelsdorf (1999) reported similar findings such that infants used more help seeking when mothers were uninvolved, apparently in an effort to get their mothers involved, and more social referencing when their mothers were involved. Infants also engaged in more venting when mothers were involved during the fear task. Perhaps venting occurred more in this context because infants felt simultaneously frightened by the monster and frustrated that their mothers were not assisting them in fleeing. Inconsistent with results reported by Diener and Mangelsdorf, infants in this study were marginally more distressed when mothers' were involved than when they were uninvolved in the task. Given the design, it is difficult to know if this is because the infants experienced the tasks as more distressing the longer that they went on, or because even though mothers were allowed to intervene they were instructed not to do the two things distressed infants appeared to want most: open the jar during the frustration task or leave the room during the fear task. A major difference in our approach versus that of Diener and Mangelsdorf is that we rated and controlled for the quality of maternal sensitivity during the involved portions of the tasks. The relative lack of context differences we find compared to their results suggests that the impact of mother involvement on infant's concurrent emotion regulation behaviors is primarily a function of the sensitivity with which mothers are involved.

Limitations and Directions for Future Research

Several limitations of the current work should be noted. First, this is a relatively small and low risk sample resulting in small groups of insecurely attached infants which makes mean comparisons difficult. Nevertheless, we chose to present these differences because we believe that replication of these effects, even in small samples, could be a useful addition to the literature. Given that avoidant and resistant infants are theorized to engage in entirely different patterns of affect regulation, combining them into a single insecure group may obscure important group differences. Second, in the present study, the emotion-eliciting tasks followed the Strange Situation, and it is possible that the observed effects of infant regulatory behaviors were a function of carryover from the Strange Situation to the emotion tasks. However, our findings are unlikely to be solely accounted for by these carryover effects because we did not begin the distress-eliciting tasks until infants appeared calm and because other research studies have reported similar effects even when infant attachment security and regulatory behaviors were assessed one week (Nachmias et al., 1996) or 2 to 3 years apart (Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002; Kochanska, Philibert, & Barry, 2009; Volling, 2001). Regardless, future investigators might consider using a longer break or positive tasks between the Strange Situation and emotion-eliciting tasks or conduct them on different days to better rule out the possibility of carryover effects. Third, the emotion-eliciting tasks used were brief, laboratory assessments. However, they were sufficient to elicit a wide range of infant affect and regulatory behavior; and infant affect and regulatory behavior observed in these types of settings have predictive validity to various child outcomes (Calkins & Dedmon, 2000; Crockenberg & Leerkes, 2006; Crockenberg et al., 2008). Fourth, we are unable to rule out the possibility that infant temperament may account for some of the findings that we attribute to attachment security. That is, similar behaviors (e.g., distress, contact with mother) across the Strange Situation and other emotion eliciting tasks may simply reflect cross-context stability in temperament. Strengths of this study include careful continuous coding of infant affect, emotion regulation, and maternal behavior observed in two different emotion-eliciting contexts, and the inclusion of maternal

sensitivity as a control in the analyses, which rules out the possibility that attachment-based differences are solely a function of the quality of concurrent maternal behavior.

In future research, it will be important to examine the pattern of affect and emotion regulation behaviors used by disorganized infants. The possibility that the effects of emotion context and mother involvement on infant affect and regulatory behaviors vary based on infant attachment classifications warrant additional investigation as to our knowledge our study is the only one to have tested these possibilities. Moreover, as noted by Diener et al., (2002), the possibility that the extent to which specific regulatory behaviors reduce or maintain infant arousal varies by infants' attachment status should be examined. For example, mother-oriented behaviors may reduce arousal for secure infants but increase arousal for resistant infants. For statistical reasons, substantially larger samples are needed to examine these possibilities thoroughly.

In sum, our findings add to the accumulating literature demonstrating meaningful differences in infant arousal and regulatory behavior based on attachment security. That these effects were independent of concurrent sensitivity lends credence to the view that it is the internal working model, or schema about self and other that forms based on the history of interactions with mothers, that explains distinct patterns of affect expression and regulation (Cassidy, 1994).

Acknowledgments

This research was supported by the Eunice Kennedy Shriver National Institute for Child Health and Human Development (R03 HD048691) and by a New Faculty Grant and Summer Excellence Award from the Office of Sponsored Programs and seed money from the Human Environmental Sciences Center for Research at The University of North Carolina at Greensboro. We are grateful to the families who generously gave their time to participate in this study; to Kathy Siepak, Regan Burney, Stephanie Parade, Ani Vosbikian, Brent Finger, Amy Bodsford, Amina Smith, Geralynn Sylver, Michael Berwanger, Jennifer Butler, and Allison Meyers for assistance with data collection, entry, and coding.

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Table 1

Maternal Behavior Codes and Sensitivity Ratings Based on Concurrent Infant Affect

		Sensitivity Rating If: Infant Affect		
Maternal Behavior	**Description**	**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 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. A detailed codebook is available from the first author upon request.

Table 2

Correlations Between Maternal Sensitivity and Concurrent Infant Behaviors

	Maternal Sensitivity	
	Frustration Task	**Fear Task**
Infant Distress		
Proportion Task	−.77**	−.44**
Peak	−.50**	−.22*
Mother-Oriented Regulation Behaviors		
Active M	−.31**	−.22*
Phys soothe M	.03	.24*
Variety Mother	.11	.00
Adaptive Regulation Behaviors/Non-Mother-Oriented		
Look away	.18t	−.38**
Self-soothe	−.32**	.04
Problem-solve	.17t	.03
Play/distract	.17t	−.08
Help-seek E	.03	--
Withdraw	−.35**	−.35**
Variety Adapt	.19t	−.07
Maladaptive Regulation Behavior		
Vent	−.40**	−.45**

Note:

t p<.10,

* p < .05,

** p < .01.

Table 3

Attachment-based mean differences in infant affect and regulatory behaviors

	Secure n=68 M (SE)	Avoidant n=20 M (SE)	Resistant n=10 M (SE)	F	η^2
Infant Distress					
Proportion Task	17.72 (1.72)$_a$	15.10 (1.72)$_a$	35.58 (4.91)$_b$	9.67**	.17
Peak	5.07 (.07)$_a$	4.91 (.13)$_a$	5.83 (.20)$_b$	8.02**	.15
Mother-Oriented Regulation Behaviors					
Active M	14.53 (.98)$_a$	7.84 (1.81)$_b$	19.80 (2.66)$_a$	8.22**	.15
Phys soothe M	32.12 (2.48)$_a$	25.90 (4.58)$_a$	58.43 (6.73)$_b$	8.22**	.15
Variety Mother	2.46 (.08)$_a$	1.86 (.15)$_b$	2.54 (.23)$_a$	6.06**	.12
Adaptive Regulation Behaviors/Non-Mother-Oriented					
Look away	28.11 (1.27)	26.24 (2.34)	33.75 (3.44)	1.63	.03
Self-soothe[1]	10.41 (1.56)	11.60 (2.87)	9.98 (4.22)	.12	.00
Problem-solve	4.01 (.52)	2.98 (.96)	2.58 (1.41)	.92	.02
Play/distract	7.48 (1.11)	7.49 (2.04)	.97 (3.0)	2.11	.04
Help-seek E	1.66 (.34)	1.64 (.63)	1.12 (.93)	.48	.01
Withdraw	4.43 (.34)$_a$	4.21 (.63)$_a$	1.69 (.92)$_b$	3.86*	.08
Variety Adapt	3.09 (.08)$_a$	2.97 (.15)$_{ab}$	2.36 (.22)$_b$	3.39*	.07
Maladaptive Regulation Behavior					
Vent	4.03 (1.18)$_a$	1.92 (2.18)$_a$	13.47 (3.16)$_b$	4.72*	.09

Note.

*$p < .05$,

**$p < .01$.

All means are adjusted for maternal sensitivity during the mother-involved portions of the frustration and fear eliciting tasks. Means with different subscripts differ significantly at p < .017 based on a Bonferroni correction.

[1]There is a significant difference in self-soothing based on attachment classification by maternal involvement as described in the text.

Table 4

Mean Comparisons of Infant Distress and Regulatory Behaviors as a Function of Emotion Task and Maternal Involvement

	Anger Task		Fear Task		Univariate F-tests and η^2					
	M-Uninvolved	M-Involved	M-Uninvolved	M-Involved	Emotion Task		M Involvement		Task X Inv	
	M (SE)	M (SE)	M (SE)	M (SE)	F	η^2	F	η^2	F	η^2
Infant Distress										
Proportion	20.29 (2.71)	20.89 (1.96)	21.06 (4.23)	23.95 (3.53)	.03	.00	3.17^{t}	.03	.01	.00
Peak	5.05 (.10)	5.28 (.10)	5.24 (.15)	5.51 (.14)	.79	.00	.02	.00	.95	.01
Mother-Oriented Regulation Behaviors										
Active M	22.41 (2.88)	12.54 (1.40)	10.27 (2.32)	10.99 (1.50)	.41	.00	2.88^{t}	.03	2.60	.03
Phys soothe M	12.35 (2.69)	27.83 (3.65)	48.78 (5.29)	66.29 (4.72)	2.57	.03	1.90	.02	.13	.00
Variety Mother	1.77 (.15)	2.84 (.15)	1.88 (.17)	2.52 (.13)	.31	.00	.51	.00	.17	.00
Adaptive Regulation Behaviors/Non-Mother-Oriented										
Look away	33.15 (1.92)	46.73 (2.88)	16.03 (2.25)	21.54 (2.58)	7.10**	.07	7.75**	.08	2.58	.03
Self-soothe	3.53 (1.38)	7.98 (1.74)	13.01 (3.68)	18.15 (3.49)	3.94*	.04	1.36	.02	.41	.00
Problem-solve	7.70 (1.62)	4.76 (1.06)	0.03 (.04)	0.27 (.57)	.35	.00	1.57	.02	.83	.01
Play/distract	2.17 (.92)	13.35 (3.00)	3.45 (1.77)	2.27 (1.86)	.15	.00	1.10	.01	.46	.01
Help-seek E	4.72 (1.25)	1.15 (.44)	0.00 (.01)	0.00 (.00)	2.35	.02	.95	.01	.97	.01
Withdraw	2.70 (.66)	4.67 (.44)	4.72 (.84)	1.67 (.50)	.22	.00	.30	.00	1.59	.02
Variety Adapt	3.22 (.14)	3.64 (.15)	2.27 (.14)	2.19 (.13)	.34	.00	.18	.00	.67	.00
Maladaptive Regulation Behavior										
Vent	3.67 (1.34)	2.32 (.71)	7.27 (2.25)	10.67 (2.62)	13.23**	.12	4.66*	.05	23.42**	.20

Note.

$^{t}p < .10$,

$^{*}p < .05$,

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

All means adjusted for maternal sensitivity during the mother-involved portions of the frustration and fear eliciting task.