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Trajectories of regulatory behaviors in early infancy: Determinants of infant self-distraction and self-comforting

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Abstract

The ability to effectively regulate emotions is an important marker for early socioemotional development. The uses of self-comforting behaviors and self-distraction have been empirically supported as effective regulatory strategies for infants, though research on determinants of such behaviors is scarce. Thus, a more thorough examination of the development of regulatory behaviors is needed. For the current study, 135 mothers, fathers, and their infants participated in laboratory visits at 3-, 5-, and 7-months of age where parent sensitivity and infant regulatory strategies were coded from the Still Face Paradigm. Parents also filled out questionnaires about infant temperament and parental involvement. Using multi-level modeling to examine levels and trajectories of self-comforting and self-distraction, the current study found: 1) infants higher in temperamental surgency used more self-distraction and self-comforting, 2) infants lower in surgency with highly involved parents increased in self-distraction at a faster rate, particularly with highly involved fathers, and 3) infants used self-comforting more than average with fathers when the infant was also lower in temperamental regulation. In addition, we examined trajectories of parent involvement and temperament in relation to infant regulatory strategy.

Keywords

infancy; emotion regulation; temperament; parent involvement

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[1] b_0 represents the estimated level of regulatory behavior at the initial visit. b_1 represents the rate of change in regulatory behavior at the initial visit, or the linear slope. ξ_0 represents the individual variation in intercept parameters and ξ_1 represents the individual variation in linear slope parameters.

[2] For example, effects for *parent* and *surgency* were examined as main effects on both intercept and slope as well as with interactions between parent and surgency as they relate to the intercept and slope terms. The same was done for parent involvement, negative affectivity, temperamental regulation, and alternate regulatory behavior. In all, three covariates were included in each model (demographic risk, parent order, parent sensitivity), six predictors (parent, parent involvement, the three temperament factors, and alternate regulatory behavior), nine two-way interactions between the six predictors, and four three-way interactions between parent, involvement, each of the temperament factors and alternate behavior. Each of these predictor and interaction terms were examined as predictors of the intercept and slope estimates. In the model, b_0 represents the intercept, b_2 represents the effect of parent on initial level of regulatory behavior, b_4 represents the effect of surgency on initial level of regulatory behavior, and b_{11} is the effect of the interaction between parent and surgency on the initial level of regulatory behavior. The slope term is represented by b_{23}, with effects of parent, surgency, and their interaction on the slope represented by b_{24}, b_{26}, and b_{31} respectively. Other predictors and covariates were also included, as described in the Results section, but not represented here.

The ability to effectively regulate emotions is an important marker for early socioemotional development (Kopp, 1989) and can lead to positive outcomes and socially appropriate behaviors later in life (Calkins, Gill, Johnson, & Smith, 1999). Alternatively, the inability to successfully regulate emotion has been linked to both externalizing (Halligan et al., 2013) and internalizing (Eisenberg et al., 2001) behaviors in early childhood. Thus, it is important to fully understand how emotion regulation strategies develop early in development. Parenting and family environment factors have been shown to relate to emotion regulation during early childhood (Morris, Silk, Steinberg, Myers, & Robinson, 2007), but to gain a better understanding of how differences in regulatory behaviors emerge, infancy may be a particularly relevant period for studying emotion regulation in the context of developing infant-parent dynamics. Moreover, theories of temperament often include regulatory abilities as reflecting aspects of temperament (Rothbart & Posner, 2000) and research examining the degree to which measures of temperament correlate with observed regulatory behaviors during infancy have shown significant, albeit modest effects (Braungart-Rieker, Garwood, Powers, & Notaro, 1998), Therefore, the current study examines potential determinants of regulatory behavior trajectories, including parent involvement and temperament during infancy.

Additionally, how an infant uses regulatory behaviors has been well researched with mothers but not as much with fathers. In recent decades, the impact a father has on infant and child development has become increasingly important. Thus, an examination of infant regulatory behaviors with both mothers *and* fathers is necessary in order to understand this integral component of infant development. The present study used the Still-Face Paradigm (SFP; Tronick, Als, Adamson, Wise, & Brazelton, 1978) as a way to gain insight about infants' developing abilities to regulate. The SFP is a widely used laboratory procedure used to examine infant behavioral responses to a frustrating interactive situation with caregivers. The paradigm consists of three episodes (play, still-face, reunion) in which the parent initially engages in play with the infant, then becomes unresponsive during the still-face episode, and finally resumes playing with the infant during the reunion phase. In general, infants tend to have decreased positive affect and increased negative affect from the play to still-face episodes (Mesman, van IJzendoorn, & Bakersmans-Kranenburg, 2009). In addition to affect, infant regulatory behaviors, or behaviors infants tend to use to alleviate the negative affect they feel during the still-face episode are sometimes coded and studied in relation to parenting behaviors and other factors (Mesman et al., 2009). *Emotion regulation* refers to the ability to modify, inhibit, or maintain the occurrence or intensity of emotion (Eisenberg & Spinrad, 2004), and learning to regulate emotion is an essential component of infant emotional development (Kopp, 1982; 1989). While the development of emotion regulation continues through childhood, theorists posit that, as a newborn, infants have limited ability to regulate their own emotions. Initially, infants younger than 3-months of age use more intrinsic, reflexive coping mechanisms, such as sucking or rooting. At this age, the external aid of parents is relied upon to help the infant regulate emotions and reduce distress (Kopp, 1982). As the infant develops, specifically between 3-months to 7-months, infants are more aware of themselves and their surroundings. Now, internal motor and cognitive control increases and infants become more able to purposefully regulate their own emotions in developmentally appropriate ways (Kopp, 1989). This is also the same time frame when infants' internal working models of the infant-parent attachment system begin to emerge and depend on characteristics of their caregiving history (Ainsworth, Blehar, Waters, & Wall, 1978).

Two behavioral regulation strategies have been empirically supported as regulatory where the occurrence of the behavior relieves negative arousal (Ekas, Lickenbrock, & Braungart-Rieker, 2013). Infants use *self-comforting* behaviors, such as lip smacking or thumb sucking, to regulate arousal (Stifter & Braungart, 1995). In a distress inducing task, Stifter and Braungart (1995) found that 5- and 10-month olds used more self-comforting behaviors to regulate negative affect than other forms of regulatory behaviors, such as orienting or avoidance behaviors. *Self-distraction*, or the use of gaze aversion and looking away from a stimulus, has also been empirically supported as an effective regulatory strategy for infants (e.g., Ekas et al., 2011; Stifter & Moyer, 1991). Specifically, infants tend to look away from intense or inconsistent stimuli in order to regulate arousal. Self-distraction has been found to increase as infants develop (Ekas et al., 2013; Rothbart et al., 1992). This developmentally appropriate shift in regulatory strategy could be due to the fact that by about four months of age, infants are better able to disengage their attention from faces and focus on other objects (Rothbart et al., 1992). This ability to purposefully disengage from a frustrating stimulus and focus on another object helps allay an infants' distress (Stifter & Braungart, 1995). In addition, these two regulatory behaviors (self-comforting and self-distraction) have been found to decrease infant negative affect during laboratory tasks. Specifically, using the same sample as the current study, (Ekas, Lickenbrock, & Braungart-Rieker, 2013) found that an infants' use of self-comforting and self-distraction can lessen the amount of distress they exhibit. They also found that negative affect during the still-face episode of the SFP decreased within three seconds of the use of those regulatory strategies. In addition, the same study examined self-comforting and self-distraction over time, and found that self-comforting decreased and self-distraction increased with age with both mothers and fathers, perhaps reflecting developmentally appropriate norms.

The effect the use of self-comforting and self-distraction had on an infant's negative affect was also similar during infant-mother and infant-father SFP interactions (Ekas et al., 2013). Diener, Mangelsdorf, McHale, and Frosch (2002) examined behavioral strategy use with mothers and fathers in relation to infant-parent attachment and found that infants tend to use similar behaviors with mothers and fathers. Specifically, infants who were considered self-soothers with fathers were also self-soothers with mothers (r=.26, p<.05). Similarly, Bridges, Gronick, and Connell (1997) found marginally significant relations between infant strategy use with mothers and fathers for parent orienting (r=.23, p<.10) and object orienting (r=.22, p<.10). Ekas et al. (2013) also examined infant-mother and infant-father interactions, but did not include both parents in the same model, and therefore were unable to statistically infer differences between infant regulatory use with mothers and fathers. Thus, the current study adds to the literature by comparing infant-mother and infant-father interactions in one model to assess cross parent differences.

While it is apparent that infants use self-comforting and self-distraction to regulate negative arousal during the SFP with mothers and fathers, there remains a gap in the literature in explaining how individual differences in the ability to regulate develop. Thus, as an extension of (Ekas et al., 2013), the current study will compare predictors of trajectories of self-comforting and self-distraction with each parent during the SFP at 3, 5, and 7 months. We focus on two characteristics that are considered more extrinsic (parenting) or intrinsic (temperament) to infants as potential predictors of regulatory trajectories.

Regulatory Behaviors and Parenting

Sensitivity

Infant responses to a distressing situation have been measured to evaluate regulatory behaviors. Parent sensitivity, or the parent's ability to recognize and appropriately respond to an infant's emotional cues (Ainsworth, Blehar, Waters, & Wall, 1978), is often examined in conjunction with these behaviors. Specifically, when an infant is upset, a sensitive parent would correctly identify the reason for the infant's distress and respond appropriately in order to soothe the infant, whereas an intrusive parent might try to advance his or her own agenda instead of responding to the infant's cues. Many studies have found that higher levels of maternal sensitivity are related to an infant's more regulated behavior during the SFP (Braungart-Rieker et al., 2001; Gunning, Halligan, & Murray, 2013; Kogan & Carter, 1996; Mesman et al., 2009). Specifically, Braungart-Rieker and colleagues (2014) found that trajectories of mother and father sensitivity during the SFP were positively related to observed infant regulatory behaviors. Similarly, Conradt and Ablow (2010) found that maternal sensitivity during the SFP was related to decreased heart rate and increased RSA in infants, both indicative of physiological regulation. Thus, as the relation between sensitivity and infant regulation is well established, the current study controls for parent sensitivity in models predicting regulatory strategies with mothers and fathers in order to assess the unique effect other determinants, such as parent involvement may have on infant regulation.

Involvement

The parenting literature often examines multiple facets of parental involvement, specifically responsibility in childcare, accessibility to the child, and most importantly in the current study, direct engagement with the child (Pleck, 2010). This third component of parental involvement may be particularly salient in studies of child outcomes. Although there is ample evidence from research showing that increased sensitivity in the lab is related to infant emotional behavior, if the parent does not engage in frequent or a variety of behaviors at home, the infant may not have sufficient interactions in which to learn how to regulate emotions from parents. This may be particularly important to study for the infant-father relationship because there appears to be more variability in father involvement than mother involvement, at least during infancy (Pleck, 2010). There has been little attention, however, toward examining the degree to which parental involvement is related to infant regulation.

In a study comparing toddler behavior during distressing laboratory contexts in which mothers were either allowed to be involved or not, Diener and Manglesdorf (1999) found that toddlers were less distressed and made more attempts to engage mothers when mothers were involved. Thus, within distressing contexts, having mothers involved appears to be important in facilitating toddler regulation. Previous research has also found that positive maternal interactions in a laboratory setting are related to infant regulatory control and compliance (Calkins, Smith, Gill, & Johnson, 1998) though Calkins et al. did not extend their findings to interactions in the home. Using a longitudinal design, Bridgett and colleagues (2011) found that the amount of time mothers spent in childcare activities with their infants at six months of age was directly related later to toddler effortful control, a regulatory capacity that develops near the end of the first year of life. Though Bridgett and colleagues used parent report of effortful control and not observation during a task such as the SFP, their findings suggest that parent involvement in the home may have direct effects on the development of regulatory processes. Like Bridgett et al. (2011), the current study employs a longitudinal design but examines parental involvement of both mothers and fathers and observationally rated regulatory behaviors during early infancy. The present study also controls for laboratory levels of sensitivity to more carefully address unique contributions of parental involvement.

Regulatory Behaviors and Infant Temperament

In addition to parenting behaviors, aspects of infant negative temperament are often studied in conjunction with regulatory strategy. Temperament has been defined as biologically based individual differences in reactivity and regulation (Rothbart & Bates, 2006) and is often described as having three dimensions: negative affectivity or difficult temperament, surgency, and regulation (Gartstein & Rothbart, 2003; Putnam, Ellis, & Rothbart, 2001). Surgency is often thought of as heightened activity level and positive affect or approach tendencies; negative affectivity is thought of as exhibiting higher irritability, fear, sadness, anger, frustration, and discomfort; and finally, regulation refers to the intrinsic modulation of emotional reactivity (Gartstein & Rothbart, 2003; Rothbart, Adahi, & Evans, 2000). Interestingly, negative aspects of temperament are often studied in relation to infant behavior and parenting, but more positive aspects of temperament, such as surgency are typically neglected (Clark, Kochanska, & Ready, 2000).

In addition, temperamental regulation and observed regulatory behaviors are rarely studied together. Included in the temperament framework are many aspects of genetic, neural, psychophysiological, and behavioral responses (Goldsmith, Pollak, & Davidson, 2008). Similarly, the study of emotion regulation involves overt behaviors but also the underlying biological processes (Cole, Martin, & Dennis, 2004; Goldsmith et al., 2008). The current study attempts to examine the effects parenting and temperament (including a broader measure of temperamental regulation) can have on the observed behaviors thought to regulate emotions in infants. Therefore, the current study examines all three dimensions of temperament in relation to infant regulatory behaviors and parenting.

There are mixed findings regarding infant regulatory behaviors during the SFP and infant temperament (see Mesman et al., 2009 for a meta-analysis). Braungart-Rieker and colleagues (1998) found that increased observed negative affectivity was related to lower use of self-comforting and self-distraction behaviors during the SFP at 4 months of age. Similarly, Rothbart and colleagues (1992) found that 4 month old infants who were able to disengage from a frustrating stimulus were lower in mother-reported negative affect, such as fear and distress to limitations. Alternatively, other studies did not find a relation between temperament and regulatory strategy use in infant (Fuertes, Lopes dos Santos, Beeghly, &

Tronick, 2006); Conradt and Ablow (2010) controlled for infant negative affect, but did not examine it as a predictor of SFP responses. Notably, none of the aforementioned studies included surgency or temperamental regulation in relation to infant regulatory strategies during the SFP. Therefore, the current study adds to existing literature on infant temperament and regulation by providing a comprehensive examination of temperament and SFP responses.

The Current Study

Previous research exists on the link between maternal sensitivity, infant negative affect, and infant regulatory responses. Less research exists, however, on the associations between father behaviors and infant responses. Furthermore, while relations between parent sensitivity and infant emotion regulation have been examined, little research has focused on involvement in the home and how it might relate to regulatory strategies during early infancy. In addition, it is possible that multiple dimensions of an infant's underlying temperament may impact parenting, and infant responses during the SFP. Building on Ekas and colleagues' (2013) study examining infant regulatory strategies used during the SFP, the current study examines determinants of levels and trajectories of self-comforting and self-distraction with mothers and fathers using the same sample. Specifically, the current study has two aims:

1) Examine determinants of self-comforting and self-distraction trajectories, including parent involvement and several dimensions of infant temperament, in order to extend the literature on predictors of infant regulatory responses beyond parent sensitivity and infant negative affectivity.

a. We expected that higher levels of parent involvement would increase the use of developmentally appropriate regulatory strategies, as parents are initially integral to helping infants learn how to regulate emotions (Kopp, 1989), and increased engagement may lead to increased regulation. Given that the use of self-comforting typically decreases whereas self-distraction increases during early infancy, we expect that infants who have parents who are more involved at home will decrease in the use of self-comforting and increase in the use self-distraction at a faster rate than infants whose parents are less involved.

b. We expected that higher temperamental infant negative affectivity would be related to less use of infant regulatory behaviors (Braungart-Rieker et al., 1998); analyses involving surgency were more exploratory. In addition, we would expect that higher ratings of infant temperamental regulation would be associated with increased levels of regulation during the SFP, though, because we are also controlling for negative affect, this association may be more complex.

2) The focus of the current study is to examine determinants of infant regulatory behaviors However, it is also possible that regulatory behaviors may affect trajectories of parenting and temperament; thus, exploratory analyses examining such relations will also be conducted.

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Method

Participants

The current study was part of a larger study (N=135) exploring the socio-emotional development of infants. Various recruitment methods were used, including announcements at birth classes, flyers at a local hospital, and business cards and an informational booth at community events. Mothers, fathers, and their infant attended six laboratory visits when the infants were 3-, 5-, 7-, 12-, 14-, and 20-months of age (+/− 14 days). The current study uses data from only the first three visits. In the full sample, 52.6% (*n* = 71) infants were girls, and parents were primarily Caucasian (90.4% mothers, 87.4% fathers) and middle class (average income $45,000 - $59,999). Many of the parents had completed some college (59.3% mothers, 53.7% fathers), with some participants earning a post-graduate degree (20% mothers, 20.1% fathers). Parent age at the first visit ranged from 17 - 44 for mothers (*M*= 29.34, *SD*= 5.32) and 18 - 44 for fathers (*M*= 30.79, *SD*=5.62). Of the 135 infants, 62 were first-born children, 38 infants were second-born, and the remaining 30 infants were from families with three or more children. Sibling information was not available on the remaining 5 infants. Attrition analyses indicated that of the original 135 families in the sample, 130 returned for the 5-month visit and 125 returned for the 7-month visit, resulting in 7% attrition. Statistical comparisons between the full sample (*n*=135) and the sample used in analyses (*n*=125) indicated that the remaining sample had higher education levels for mothers and fathers, and mothers were more likely to be older and European American. As multi-level modeling (MLM; Singer, 1998) with likelihood-based estimation accounts for missing data, all families involved in the data collection visits were included in the current analyses. To incorporate these differences into missing values estimation using maximum likelihood estimation, a cumulative demographic risk variable was calculated and included in subsequent analyses.

Procedures

Prior to each laboratory visit, parents were mailed questionnaires which they completed and returned during the visit. Parents responded to demographic questions as well as a measure of infant temperament. The laboratory visits at 3, 5, and 7 months included infant-parent interactions tasks that were later coded for parent and infant behaviors. Mothers and fathers participated in the Still-Face Paradigm (SFP; Tronick, Als, Adamson, Wise, & Brazelton, 1978) with parent order counterbalanced to control for order effects. The first parent was asked to put the infant in a booster seat and then sit down directly across from the infant. The parent then participated in three 90-second segments of the SFP—play, still-face, and play reunion. A soothing episode between parents allowed the child to return to a neutral or positive state. Then, the second parent entered the room and repeated the same procedure as the first parent. For the first "play" episode, parents were told to engage with their infant as they typically would, while keeping the infant in the booster seat. During the "still-face" episode, parents are instructed to stop interacting with their infant and show no emotion in their face. For the last "reunion" episode, parents resumed interacting with their infant as they did during the first episode.

Measures

Infant Regulatory Behaviors—Infants' behaviors were coded on a second-by-second basis as present or absent during the still-face episode of the SFP. Similar to other studies, (Braungart-Rieker et al., 1998; Toda & Fogel, 1993) coders rated infants' *self-distraction*, defined as focused gaze toward objects (e.g., pictures on the wall, seat strap, hands, etc.); and *self-comforting*, defined as thumb or finger sucking, rubbing hands together, and other tactile behaviors aimed at the infants own body. Parent orienting, defined as looking toward the parent's face, escape, and high intensity motor behaviors were also rated but were not included in the present study given that distracting oneself and self-comforting are considered standard regulatory behaviors (Ekas, Braungart-Rieker, Lickenbrock, Zentall, & Maxwell 2011; Stifter & Braungart, 1995).

Coders were trained using sample videotapes and did not code individually until they were reliable with a gold-standard coder (Cohen's $\kappa \geq .70$). In addition, coders did not code the same infant more than once per time point and reliability was calculated on approximately 25% of the videotapes. Cohen's κ averaged .85 for self-distraction (range = .75 to .93) and .91 for self-comforting (range = .72 to .99) across age (3, 5, 7 months), and parent (mother, father) during the still-face episode. To compare across individuals, proportion scores were created for self-distraction and self-comforting by dividing the number of times each behavior was coded by the total number of codeable intervals during the still-face episode.

Parental Involvement—Both mother and father involvement were measured using a diary-like checklist, which was developed for the larger longitudinal study. Based on research using similar items (McBride, Schoppe, Ho & Rane, 2004) parents were asked to indicate whether they engaged in an activity with their infant on a typical day: for example, bathing, changing diapers, feeding, calm or active playing, going on outings, and teaching. Several of these behaviors reflect primary caregiving which are thought necessary to infant development, such as bathing and feeding. Other items are considered more secondary in nature (playing and teaching), and thus differentiate between less involved and more highly involved parents. The checked items were averaged to yield proportion scores (0 – 1.0) for involvement at each time point. Reliability statistics were not able to be calculated because, as a checklist, not all items are endorsed by every parent.

Infant Temperament—Infant temperament was measured at 3, 5, and 7 months using the Infant Behavior Questionnaire-Revised (IBQ-R; Gartstein & Rothbart, 2003). Mothers rate infant behavior on a seven-point Likert scale, ranging from 'never' to 'always,' across 191 questions. The IBQ-R measures three factors of temperament with 10 individual scales loading onto each of the larger factors (Putnam, Rothbart, & Gartstein, 2008). Surgency includes approach, high intensity pleasure, smiling and laughter, and vocal reactivity. Negative affectivity includes distress to limitations, recovery, and sadness. Regulation includes cuddliness, duration of orienting, and low intensity pleasure. Overall reliability of the surgency scale of the IBQ at each age ranged from a Cronbach's alpha of .70 to .77 (mean: .74). Reliability of the negative affectivity scale ranged from .70 to .79 (mean: .75), and reliability of the regulation scale ranged from .60 to .69 (mean: .63).

Covariates—Parent order during the SFP, parent sensitivity, and demographic risk were included in all analyses as covariates.

Parent Order: The order in which parents participated in the SFP was recorded at each time point ('0' if the father completed the SFP first, '1' if the mother completed the SFP first). While parent order was counterbalanced during data collection, it is still possible that parent order may affect infant regulatory behaviors, thus it was included in analyses as a time varying covariate in to ensure that whether the mother or father participated in the SFP first did not relate to infant behaviors.

Parent Sensitivity: Parent sensitivity was also assessed during the SFP and included as a time varying covariate in analyses. For a detailed description of this coding system, see Braungart-Rieker et al., (2014).

Coders rated degree of sensitivity and intrusiveness when the infant was 3-, 5-, and 7-months of age during the play and reunion episodes of SFP on separate five-point Likert scales every 10 seconds. *Sensitivity* was coded when the parent responded to the infant's state by appropriately altering their own behavior and responsivity in accordance with the infant's behavioral changes. *Intrusiveness* was coded when the parent's behavior was incongruous with the infant's behavior. For example, if a parent is playing with an infant's hands and arms and the infant is happy and engaged, a sensitive parent may continue playing to maintaining the infant's positive affect. If the infant is upset, or averting his/her gaze from the parent and the parent continues to play with the infant's hands, the parent is displaying intrusive behaviors and not adjusting to the infant's needs. Sensitivity and intrusiveness (reverse scored so that high scores indicate higher sensitivity and lower intrusiveness) were highly correlated at each age and for both parents. Thus, sensitivity and intrusiveness were averaged to create a composite variable for parent sensitivity. While coders rated sensitivity and intrusiveness concurrently for each participant, to maintain independence, coders did not rate both mother and father SFPs within the same family. Inter-rater reliabilities (interclass correlations) were obtained from approximately 25% of the tapes using gold standard coders. Average ICCs are reported for the play and play resume episodes at each time point for mothers (sensitivity: M=.94, range=.88 - .96; intrusiveness: M=.93, range= .88-.96) and for fathers (sensitivity= M=.92, range=.90-.95; intrusiveness: M=.91, range= .84-.95).

Demographic Risk: A cumulative demographic risk variable was calculated using four factors which indicated differences between the full sample (n=135) and the sample at 7-months (n=125): mother and father education, mother age, and mother minority status. Parents reported on their education level on a nine point Likert-scale, ranging from "less than ninth grade" (1) to "completing a graduate degree" (9). Both education and age variables were reverse scored so that higher scores indicated a higher demographic risk. In addition, mother's minority status was also classified as Caucasian (0) and African American/Hispanic/Asian (1) based on mother's responses on the demographic questionnaire. All four variables were transformed into z-scores in order to create comparable scoring. These were then averaged to create a demographic risk composite, which had sufficient internal consistency (Cronbach's α = .65). Higher scores indicate greater risk.

Results

Descriptive results for the study variables as well as multi-level growth curve models for infant regulatory behaviors (self-distraction and self-comforting) are presented. Growth curve modeling is a commonly used method which allows for the interrelated nature of repeated-measures data (Willett, Ayoub, & Robinson, 1991). In addition, multi-level modeling approaches allow for the inclusion of time varying and time invariant covariates of a behavior (Boyle & Willams, 2001). Thus, the current study uses multi-level growth modeling to examine time varying (sensitivity, temperament) and time invariant (parent order, demographic risk, mother v. father) covariates of level and trajectory of infant self-distraction and self-comforting. First, unconditional models are conducted to determine whether there is sufficient variation within the self-distraction and self-comforting to include covariates in analyses. Then, conditional models are conducted to assess individual change and average change over time for each outcome variable. Growth curve estimates for self-distraction and self-comforting trajectories are presented along with estimates of determinants of each behavior: parent sensitivity, parent effect (mother v. father), parent involvement, and infant temperamental surgency, negative affectivity, and regulation.

Descriptive Statistics

Results for descriptive means, standard deviations, zero-order correlations and longitudinal correlations among each variable can be found in Tables 1 and 2. Infant temperamental factors were significantly related within time point, as well as between factors within and over time. Surgency, negative affectivity, and regulation were fairly stable across time. In addition, regulation was positively correlated with surgency and negatively correlated with negative affectivity at each time point, while surgency and negative affectivity were unrelated at each time point.

Multi-level Growth Curve Modeling

Using SAS PROC MIXED (Singer, 1998), we fit multilevel growth models (MLM; Singer & Willett, 2003) for self-distraction and self-comforting behaviors with mothers and fathers. Self-distraction and self-comforting were log-transformed to account for non-normality in the data. In addition, analyses used a heterogeneous compound symmetry covariance structure, allowing the residuals for mother and father interactions with infants to covary across mother-father dyads. This accounts for non-independence in the data which occurs when examining dyads (Kenny & Kashy, 2011).

Unconditional Models of Infant Regulatory Behaviors—In multi-level growth curve modeling, the first step is to determine the shape of model to use in further analyses and assess whether there is, in fact, growth in the outcome variable. Therefore, we tested no change and linear change models for both self-distraction and self-comforting. For the no change model, an intercept only model excluding time as a predictor of infant regulatory behavior was examined. For the linear model, infant age was included in the model and centered at the first visit so that the intercept reflected initial level of regulatory behavior at 3 months of age.

$$\begin{array}{lll} \text{No Change Unconditional Model}^1 & & \text{Linear Change Unconditional Model} \\ \text{Level}-1: & y_t = b_0 + \sigma^2{}_e & \text{Level}-1: \quad y_t = b_0 + b_1\,(\text{year}) + \sigma^2{}_e \\ \text{Level}-2: & b_{0i} = \beta_{00} + \xi_{0i} & \text{Level}-2: \quad b_{0i} = \beta_{00} + \xi_{0i} \\ & & \qquad b_{1i} = \beta_{10} + \xi_{1i} \end{array}$$

In each case, the linear model fit the data better based on comparison of the Bayesian Information Criteria (BIC). For self-distraction and self-comforting, BICs were −542.3 and −627.8 respectively for the no change model, and −588.7 and −647.5 respectively for the linear change models. We also examined the −2Log-likelihood (-2LL) values, which can be compared using a chi-square difference test (Tabachnick & Fidell, 2006). With a two degree of freedom difference, the difference between −2LL values must be larger than 5.99 to indicate a significantly better model fit. In this case, the difference for no change and linear models for self-distraction was 65.6, and for self-comforting was 39.2, indicating that the linear model fit the data significantly better than the no change model.

Next, we examined the amount of variance in self-distraction and self-comforting to determine if there was sufficient variance to conduct further analyses. For these unconditional models, one model was conducted for each log-transformed outcome variable. Variance parameter estimates and solutions for fixed effects from the unconditional models can be seen in Table 3. For regulatory behaviors, tests of fixed effects indicated that infants exhibited both self-distraction and self-comforting with mothers and fathers (all intercepts were significantly greater than zero, see Table 3). Tests for average linear slopes indicated that, as expected, self-distraction showed significant increases over time whereas self-comforting showed significant decreases over time (Ekas et al., 2013).

In terms of individual variation, parameter estimates were examined to determine whether there was sufficient variation in levels and trajectories of self-distraction and self-comforting to be able to predict differences using predictors. Estimates for self-comforting levels and slopes were significant, indicating that there was significant variability within infant initial behaviors at 3 months as well as in linear trajectories over time to be able to use predictors in conditional models. There was not, however, sufficient variation in levels of self-distraction, although there was for slopes. Therefore, we must be cautious in interpreting significant effects related to initial levels of self-distraction. In addition, we compared models in which the intercept and slope were fixed versus models in which the intercept and slope were estimated as random effects (Stram & Lee, 1997). In each case (for both self-distraction and self-comforting), models in which the intercept and slope were considered random effects fit the data significantly better than fixed effects models when compared using the −2LL difference test. Thus, random effects conditional models were conducted to examine differences between individuals' intercepts and slopes. Several determinants were included in conditional models to predict levels (intercepts) and trajectories (slopes) of both self-distraction and self-comforting.

Unconditional no change and linear models were also compared for parent involvement and each temperament factor (regulation, negative affectivity, surgency). Similar to the infant regulatory behaviors, in each case the linear model fit the data significantly better than the no change model. Thus, conditional models will include estimates of both intercept and linear change. Means and variance estimates for the linear models are presented in Table 4.

Conditional Models

Infant Regulatory Behavior Trajectories: In order to answer questions proposed by our first hypothesis, four time varying predictors (parent involvement and three temperament factors-surgency, negative affectivity, and temperamental regulation) were examined in random effects conditional models predicting self-distraction or self-comforting. A fifth time varying covariate , the alternate infant regulatory behavior, was also included in order to examine the effect one regulatory behavior may have on the other. For example, in the model examining self-distraction, self-comforting was included as a determinant and vice versa. Parent ("mother" effect coded as −1, "father" effect coded as 1) was included as a time invariant predictor of infant regulation, such that the intercept reflected mean infant use of self-distraction and self-comforting, and effects for parent indicated a difference from the mean. Each predictor was centered at its grand mean to allow the intercept to provide a meaningful estimate of level of infant self-distraction and self-comforting when other variables are zero, or in this case, at their mean (Raudenbush & Bryk, 2002). In addition, parent order and parent sensitivity during the SFP were entered as time varying covariates in each analysis, and demographic risk was included as a time invariant covariate. Each predictor was included as a main effect as well as included in an interaction term with the slope variable in order to relate the predictor to the change over time as well.

$$y_t = b_0 + \cdots + b_2\,(\text{parent}) + \cdots + b_4\,(\text{surgency}) + \cdots + b_{11}\,(\text{parent}^{*}\text{surgency}) + \\ b_{19}\,(\text{parent}^{*}\text{involvement}^{*}\text{surgency}) + \cdots + b_{23}\,(\text{year}) + b_{24}\,(\text{year}^{*}\text{parent}) + \cdots + b_{26}\,(\text{year}^{*}\text{parent}) + \cdots \\ b_{31}\,(\text{year}^{*}\text{parent}^{*}\text{surgency}) + \cdots + b_{39}\,(\text{year}^{*}\text{parent}^{*}\text{involvement}^{*}\text{surgency}) + {\sigma^2}_e$$

Two conditional models were tested to predict self-distraction and self-comforting (see Table 4). Neither parent order nor demographic risk emerged as significant correlates of self-distraction or self-comforting. Parent sensitivity was related to self-distraction, but not self-comforting, such that infants used less self-distraction at the initial laboratory visit when parents were more sensitive.

Self-distraction: Parental involvement and infant surgency predicted both level and change in infant self-distraction behaviors. Specifically, the initial average proportion of self-distraction behaviors used was higher for infants higher in surgency, yet those infants increased in self-distraction at a slower rate than those lower in surgency (see Table 4). Infants of highly involved parents also increased in using self-distraction to regulate behavior at a faster rate than infants whose parents were lower in involvement. In addition, a two-way interaction between parent involvement and surgency emerged, such that infants with parents who were less involved, and who were also lower in surgency, increased in self-distraction at a slower rate than infants with parents who were more involved (Figure 1). A significant three-way interaction between parent, parent involvement, and infant surgency also emerged such that rates of change differed depending on which parent was interacting with the infant. Infants lower in surgency with a highly involved father increased in self-distraction at a faster rate than infants lower in surgency with a less involved father, and also faster than with mothers (whether the infant was high or low in surgency, or the mother was more or less involved; see Figure 2). Interestingly, self-comforting was also related to change in self-distraction, such that infants with higher initial levels of self-comforting increased in their use of self-distraction at a faster rate.

Self-comforting: Infant surgency also predicted infant self-comforting behaviors. Specifically, infants used more self-comforting behaviors initially when higher in surgency, but also decreased in self-comforting faster when infants were higher in surgency. In addition, there was a significant difference between infant behaviors with mothers and fathers. A comparison of the simple slopes using the Aiken and West (1991) method indicated that infants who were rated lower in temperamental regulation used more self-comforting with fathers than if they were rated higher in regulation (see Figure 3), yet the slope for mothers was fairly stable. Parent reported temperamental regulation did not seem to relate to observed self-comforting behaviors with mothers.

Parenting Trajectories: In order to explore the possibility that infant regulatory behaviors or infant temperament may affect levels or changes in parental involvement, we also examined the effects of infant determinants on parenting behaviors (see Table 5). Overall, mothers were more involved with their infants than fathers. There was also a significant interaction between parent (mother v. father) and infant temperamental regulation in predicting initial levels of involvement. Specifically, fathers were less involved than mothers with infants higher in parent reported temperamental regulation (see Figure 4).

Infant Temperament Trajectories: In addition, infant regulatory behaviors may affect the development of infant temperament. Thus, we also conducted analyses with temperament dimension as a time varying outcome, predicted by observed regulatory behaviors and parent involvement. Not surprisingly, levels and changes in self-distraction were related to infant temperamental regulation and surgency as reported by parents. Specifically, infants who used more self-distraction had higher levels of temperamental regulation and surgency. In addition, rates of change in temperamental regulation and surgency decreased at a faster rate when infants used more self-distraction.

Discussion

As an extension of Ekas et al.’s (2013) examination of trajectories of infant regulation of negative affect with mothers and fathers, the current study adds to the literature by including predictors such as parent involvement and multiple dimensions of infant temperament to the study of individual differences in infant regulatory strategy. As expected, self-comforting decreased and self-distraction increased over time (Ekas et al., 2013). In addition, higher initial use of self-comforting was related to increased use of self-distraction over time. Those infants who are better able to regulate their emotions using self-comforting at three months of age also better regulate their emotions by using self-distraction later in infancy. Interestingly, however, self-distraction did not predict self-comforting, suggesting that these two behaviors develop independently but also in a specific temporal pattern. Given that self-comforting is a regulatory behavior often seen in early infancy, but over time self-comforting decreases in favor of more age appropriate strategies such as self-distraction, this finding is intriguing

Several additional predictors emerged in the development of infant regulatory strategies. Parental involvement in the home was consistently related to regulatory strategy during the SFP, even after controlling for parental sensitivity during the SFP. In particular, infants whose parents were more involved at home had a higher rate of change in self-distraction but lower initial levels of self-comforting. As both self-comforting and self-distraction have been empirically supported to be regulatory in that their use is related to subsequent decreases in negative affect (Ekas et al., 2013; Stifter & Braungart, 1995), we would expect that parents' repeated interactions with infants at home would teach infants how to better regulate behaviors.

Although this was true for self-distraction, it was not for self-comforting. It is possible that infants whose parents are highly involved respond more quickly to infant signals when they are younger. Thus, infants of highly involved parents would not need to rely as heavily on self-comforting strategies as those whose parents are less involved. But over time, infants of highly involved parents learn to use other strategies such as visual re-orientation when they are developmentally more able to control the direction of their gaze. More research about the particular types of behaviors highly involved parents are doing in the home with infants would help sort out these processes.

In addition, although previous research has found that temperamental negative affect relates to lower levels of infant regulation (Braungart-Rieker et al., 1998), the current study found that patterns emerged for the relation between regulatory strategy and surgency but not negative affect. Specifically, higher surgency was related to higher initial levels of both self-comforting and self-distraction, but also slower rates of change for both behaviors. As changes in these behaviors through infancy have been shown to relate to higher levels of effortful control later (Gartstein, Bridgett, Young, Panksepp, & Power, 2013), it is possible that high surgent infants become less regulated as they develop. Surgency reflects an infants' underlying propensity to react to stimuli with smiles, pleasure, and positive approach behaviors. It is possible that these infants are generally more reactive and thus exhibit more behaviors overall, regulatory or not.

Furthermore, whereas Ekas and colleagues (2013) examined the same sample's trajectories of regulatory strategy and found no parent differences, we found that including involvement and temperament in our models indicated differences for infant-mother and infant-father interactions. Specifically, rates of change in self-distraction were different for infant-mother and infant-father pairs depending on involvement and surgency. Infants lower in surgency increased in self-distraction faster when father involvement was higher and slower when father involvement was lower. It is possible that increased direct paternal engagement at home teaches infants to use self-distraction to regulate arousal. Infants who experience more interactions with fathers may learn to redirect their attention to fathers when the interaction is disrupted (as it is during the SFP). Low surgent infants with more involved fathers are thus better able to rely on this effective strategy during infant-father interactions. In the current study, surgency was related to infant regulatory behaviors directly and also through parenting. To our knowledge, very few studies have examined surgency in relation to regulatory behaviors (Gartstein et al., 2013; Dollar & Stifter, 2012); thus the current study adds to existing literature by including positive aspects of infant temperament. Future research should include surgency, as well as negative affectivity and temperamental regulation in the study of infant behaviors and parenting in order to form a more comprehensive picture of infant development.

Initial levels of self-comforting were also higher with fathers when infant temperamental regulation was lower. This is a curious finding, given that we would expect the regulatory strategy of self-comforting to be higher if parent reported temperamental regulation was higher. It is possible, however, that engaging in a structured laboratory task with fathers is an unusual circumstance for the infant, so they used more self-comforting with fathers to compensate for the unfamiliar situation. It is also possible that a parent report of temperament measures broad aspects of regulation and infants' ability to effectively recover from distress. In contrast, the assessment of self-comforting addresses how much of this particular strategy is observed but not necessarily how effective it is. Thus, parent report of temperamental regulation and observational ratings of infants' use of self-comforting may be assessing very different aspects of infants' regulatory functioning.

We also examined predictors of parenting and temperament trajectories. Parental involvement trajectories were not related to surgency, negative affectivity, and observed infant regulatory behaviors. Mothers and fathers did differ, however, in their involvement with infants depending on infant temperamental regulation. Similar to previous research, fathers were less involved than mothers overall (Planalp, Braungart-Rieker, Lickenbrock, & Zentall, 2013), but in particular with infants rated higher in regulation. Volling and Belsky (1991) found that fathers engage more with temperamentally difficult three months old infants than easy infants. Though we did not find differences depending on negative affectivity, it is possible that fathers engage more with poorly regulated infants in order to help the mother take care of a more reactive child.

In addition, self-distraction predicted initial levels and change over time in surgency and temperamental regulation. Specifically, infants who used more self-distraction were rated higher in surgency and regulation initially, but decreased in both over time. It is possible that parents' reports of these temperament dimensions were initially higher because they reflected biologically based reactivity and regulation. Thus, when infants are higher in surgency (positive reactivity) distraction may aid in its eventual reduction over time. It is not clear, however, why greater levels of distraction would lead to decreases in parent reported regulation over time. Bridgett and colleagues (2009) found a similar pattern and suggested that parent reported temperamental regulation decreases as the cognitive ability to willfully use distraction increases. Alternatively, it may be that our examination of change in temperamental regulation is restricted because we focused on infants from 3-7 months. Future studies examining changes in temperament, particularly regulation, should expand this time frame.

Several limitations exist in the current study. First, we used parent reports of involvement and temperament, but observationally coded regulatory strategy. Further studies should include multiple measures of each construct to more fully examine the relation between regulatory strategy, parent involvement, and temperament. In addition, while the SFP is a validated laboratory task in which to study infant and parent behaviors, it is limited in that it does not necessarily reflect behaviors that may occur outside this context. Situations that are more distressing to infants may elicit different regulatory responses and relations with parenting and temperament. Furthermore, the SFP elicits frustration from infants, but not necessarily other emotions, such as fear. Future studies might address determinants of regulatory behaviors in other emotion eliciting contexts. Our sample was also fairly high functioning, middle-class and Caucasian. Thus, our findings are not generalizable to other populations.

To our knowledge, the current study is the first to examine parent involvement and developmental trajectories of infant regulatory strategy. In addition, we provide a comprehensive look at temperament and it’s relation to infant regulation during the SFP. Findings suggest that factors other than parent sensitivity and negative affect affect infants’ use of regulatory strategy during a stressful situation. This builds on previous literature examining temporal associations of infant regulatory strategy and also provides a comprehensive look at developmental determinants of infant regulatory control.

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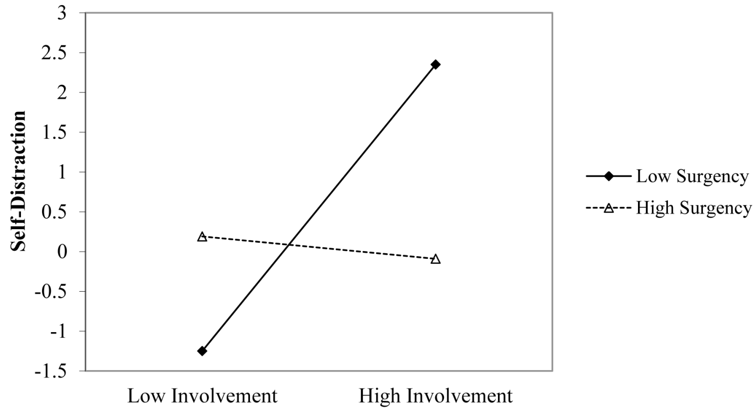

Figure 1.

Two-way interaction between parent involvement and infant surgency for linear changes in self-distraction over time.

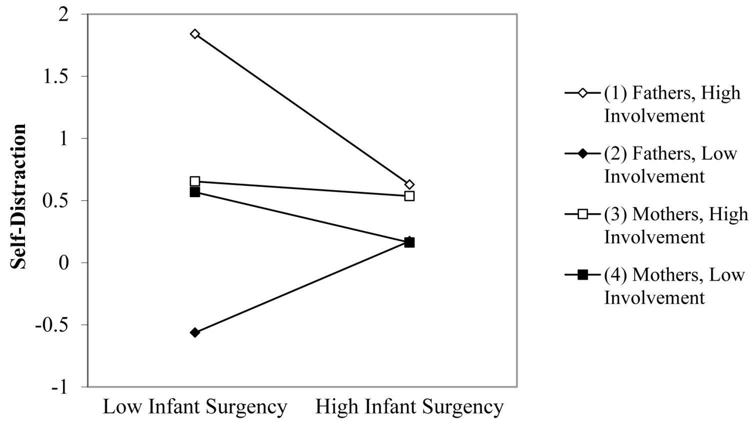

Figure 2.

Three-way interaction between parent involvement and infant surgency for mothers versus fathers in linear changes in self-distraction over time.

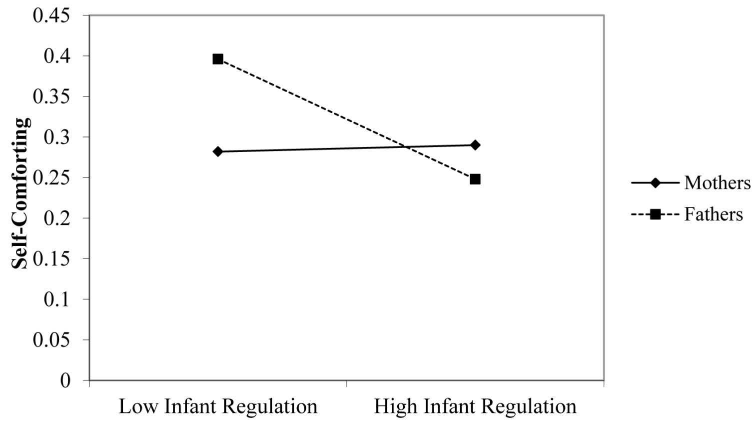

Figure 3.

Interaction between infant temperamental regulation with mothers versus fathers in initial levels of self-comforting.

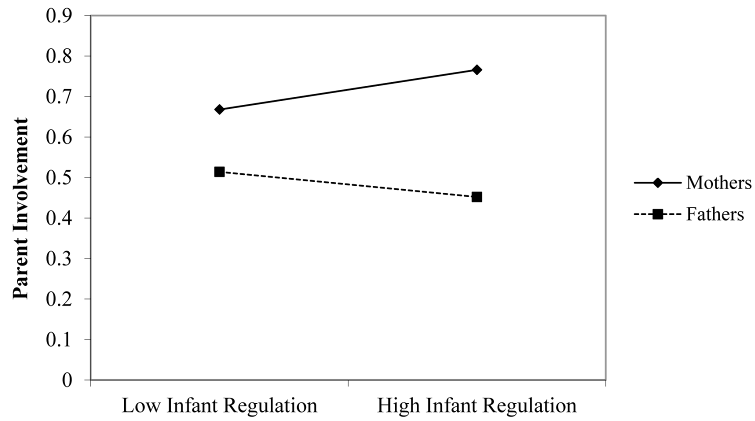

Figure 4.
Interaction between infant temperamental regulation with mothers versus fathers in initial levels of parent involvement.

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Table 1

Means, standard deviations, and zero-order correlations for each study variable within each time point

	1.	2.	3.	4.	5.	6.	7.	8.	9.
3-months									
1. Self-distraction - M	1.00								
2. Self-distraction - F	.23*	1.00							
3. Self-Comforting - M	.001	−.05	1.00						
4. Self-Comforting - F	−.06	.05	.36***	1.00					
5. Involvement - M	−.01	.03	−.05	.10	1.00				
6. Involvement - F	.05	−.002	−,09	−.004	.09	1.00			
7. Surgency	−.01	.04	.14	.13	.10	.20*	1.00		
8. NegAff	.03	.06	−.06	.02	.004	.02	.03	1.00	
9. Regulation	−.05	.02	.16	.02	.15	−.01	.45***	−.41***	1.00
Mean (std. dev)	.47 (.29)	.47 (.27)	.23 (.26)	.24 (.25)	.70 (.15)	.47 (.16)	3.72 (.67)	2.96 (.59)	4.86 (.61)
5-months									
1. Self-distraction - M	1.00								
2. Self-distraction - F	.33***	1.00							
3. Self-Comforting - M	.06	.12	1.00						
4. Self-Comforting - F	.01	.04	.26**	1.00					
5. Involvement - M	−.02	.03	−.03	.07	1.00				
6. Involvement - F	−.01	.06	.14	−.01	.07	1.00			
7. Surgency	.01	−.09	−.15	.03	.24*	.01	1.00		
8. NegAff	−.05	−.08	.02	−.14	−.12	.18*	.11	1.00	
9. Regulation	.12	.09	−.09	−.06	.23*	−.08	.44***	−.32***	1.00
Mean (std. dev)	.71 (.27)	.69 (.29)	.19 (.21)	.18 (.23)	.78 (.14)	.50 (.19)	4.50 (.60)	3.00 (.62)	5.02 (.53)
7-months									
1. Self-distraction - M	1.00								
2. Self-distraction - F	.60***	1.00							
3. Self-Comforting - M	.08	.17	1.00						
4. Self-Comforting - F	.16	.23**	.24**	1.00					
5. Involvement - M	.13	.12	.11	.05	1.00				
6. Involvement - F	.10	.03	−.02	.09	.09	1.00			
7. Surgency	.08	.01	−.01	−.04	.19*	.003	1.00		
8. NegAff	−.15	−.01	−.15	−.17	.14	.14	.11	1.00	
9. Regulation	.001	−.05	.13	.10	.06	−.07	.51***	−.30**	1.00
Mean (std. dev)	.70 (.28)	.69 (.29)	.13 (.20)	.11 (.18)	.81 (.13)	.56 (.21)	4.83 (.56)	3.09 (.58)	4.87 (.56)

*Note: = $p < .05$,

** = $p < .01$,

*** = $p < .001$.

M = Mother; F = Father; NegAff = Negative Affectivity.

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Table 2

Longitudinal correlations within each variable, between time points

	3m-5m	3m-7m	5m-7m
1. Self-distraction - M	.02	−.13	.22*
2. Self-distraction - F	.02	−.04	.29***
3. Self-Comforting - M	−.08	−.06	.24**
4. Self-Comforting - F	.14	−.06	.01
5. Involvement - M	.41***	.40***	.33***
6. Involvement - F	.51***	.33***	.38***
7. Surgency	.69***	.57***	.66***
8. NegAff	.61***	.55***	.76***
9. Regulation	.61***	.50***	.62***

*Note: = $p < .05$,

** = $p < .01$,

*** = $p < .001$

Table 3

Unconditional Models: Growth Curve Estimates, Standard Errors, and Significance Values for Linear Models of each study variable

Model	Parameter	Estimate	SE	p-value
MEANS: Solution for Fixed Effects				
Self-distraction	Intercept Slope	.46 .40	.01 .06	<.0001 <.0001
Self-comforting	Intercept Slope	.28 −.26	.01 .05	<.0001 <.0001
Parent Involvement	Intercept Slope	−.003 .17	.01 .03	.734 <.0001
Temperament -- Regulation	Intercept Slope	−.01 .08	.−5 .16	.910 .613
Temperament – Negative Affectivity	Intercept Slope	−.08 .49	.05 .16	.127 <.01
Temperament -- Surgency	Intercept Slope	−.53 3.41	.06 .15	<.0001 <.0001
INDIVIDUAL VARIATION: Covariance Parameter Estimates for Individual Models				
Self-distraction	Intercept Slope	.003 .19	.003 .07	.127 .004
Self-comforting	Intercept Slope	.01 .09	.003 .05	<.01 .041
Parent Involvement	Intercept Slope	.01 0	.002 0	<.0001 n/a
Temperament -- Regulation	Intercept Slope	.32 −.50	.04 .10	<.0001 <.0001
Temperament – Negative Affectivity	Intercept Slope	.31 2.99	.04 .46	<.0001 <.0001
Temperament -- Surgency	Intercept Slope	.39 2.37	.05 .40	<.0001 <.0001

*Note: = $p < .05$,

** = $p < .01$,

*** = $p < .001$

Table 4

Conditional Models: Predicting Infant Regulatory Behavior Trajectories[a]

	Self-Distraction				Self-Comforting			
	Level		Linear Change		Level		Linear Change	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Parent[b]	−.001	.02	.005	.08	.02	.03	−.19	.18
Involvement	.14	.13	.89	.60	.05	.22	2.22	1.41
Surgency	.06***	.02	−.23	.07	.05*	.02	−.22**	.09
NegAffectivity	.01	.02	−.10	.09	−.01	.02	−.06	.10
Regulation	−.03	.02	.10	.10	−.04	.02	.17	.11
Self-Distraction	n/a	n/a	n/a	n/a	−.04	.06	.31	.33
Self-Comforting	.09	.06	.61*	.27	n/a	n/a	n/a	n/a
Parent X Inv	−.19	.13	.84	.56	−.14	.21	−1.17	1.35
Parent X Surg	−.02	.01	.03	.06	.02	.01	−.03	.07
Parent X NegAff	−.01	.02	.06	.07	−.01	.02	−.03	.08
Parent X Reg	.01	.02	−.07	.07	−.04*	.02	.11	.08
Parent X SlfDistract	n/a	n/a	n/a	n/a	−.02	.06	.18	.21
Parent X SlfComfort	−.01	.05	.07	.26	n/a	n/a	n/a	n/a
Inv X Surg	.11	.10	−1.05*	.46	−.07	.11	.54	.54
Inv X NegAff	.23	.12	−.48	.56	−.11	.14	−.04	.64
Inv X Reg	.07	.14	.10	.65	−.15	.15	.31	.73
Inv X SlfDistract	n/a	n/a	n/a	n/a	−.39	.41	−2.61	2.23
Inv X SlfComfort	−.49	.36	−1.05	1.82	n/a	n/a	n/a	n/a
Parent X Inv X Surg	.04	.09	−.93*	.41	−.08	.10	.27	.47
Parent X Inv X NegAff	−.03	.10	.24	.47	−.03	.12	.73	.54
Parent X Inv X Reg	.0002	.12	.74	.56	.10	.13	−.41	.63
Parent X Inv X SlfDist	n/a	n/a	n/a	n/a	.23	.39	1.63	2.34
Parent X Inv X SlfComf	.53	.34	−.26	1.74	n/a	n/a	n/a	n/a

*Note: = $p < .05$,

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** $= p < .01$,

*** $= p < .001$.

[a] Parent order, demographic risk, and parent sensitivity were entered in all analyses as covariates.

[b] Parent was coded as −1 (mother) and 1 (father) so that the intercept and slope indicate an average level and rate of change in regulatory behavior.

Inv = Involvement; Surg = Surgency; NegAff = Negative Affectivity; Reg =Regulation; SlfDist = Self-Distraction; SlfComf = Self-Comforting.

Table 5

Conditional Models: Predicting Parent Involvement Trajectories[a]

	Parent Involvement			
	Level		Linear Change	
	Est.	SE	Est.	SE
Parent[b]	−.12***	.01	−.02	.06
Surgency	.02	.02	−.06	.08
Negative Affectivity	.001	.02	.11	.08
Regulation	.01	.02	−.02	.09
Self-Distraction	−.03	.12	.39	.73
Self-Comforting	−.16	.12	1.05	.65
Parent X Surg	.01	.01	−.11	.07
Parent X NegAff	−.02	.03	.08	.08
Parent X Reg	−.04*	.02	.09	.09
Parent X SlfDistract	−.04	.12	.02	.71
Parent X SlfComfort	.02	.12	.06	.63

*Note: = $p < .05$,

** = $p < .01$,

*** = $p < .001$.

[a]Parent order, demographic risk, and parent sensitivity were entered in all analyses as covariates.

[b]Parent was coded as −1 (mother) and 1 (father) so that the intercept and slope indicate an average level and rate of change in parent involvement.

Surg = Surgency; NegAff = Negative Affectivity; Reg =Regulation; SlfDistract = Self-Distraction; SlfComfort = Self-Comforting

Table 6

Conditional Models: Predicting Infant Temperament Trajectories[a]

	Surgency				Negative Affectivity				Regulation			
	Level		Linear Change		Level		Linear Change		Level		Linear Change	
	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE
Parent[b]	−.003	.02	.06	.09	.002	.02	.005	.08	.004	.02	−.05	.09
Involvement	.16	.17	−.36	.98	−.12	.15	.35	.93	.18	.16	−1.55	.95
Self-Distraction	.96***	.27	−5.09**	1.63	−.39	.23	.92	1.40	.74**	.26	−5.04**	1.53
Self-Comforting	.05	.30	.57	1.53	.30	.25	−1.30	1.30	−.30	.28	2.50	1.43
Parent X Inv	−.05	.13	.88	.66	.09	.11	.05	.55	−.08	.12	.51	.61
Parent X SlfDistract	−.01	.25	−1.25	1.40	−.21	.21	.33	1.17	.12	.24	.14	1.31
Parent X SlfComfort	.02	.25	−.07	1.32	.01	.21	−.40	1.11	−.15	.23	−.26	1.23
Inv X SlfDistract	2.05	1.90	−19.95	11.91	2.22	1.61	−11.26	10.22	.21	1.78	10.56	11.21
Inv X SlfComfort	1.22	1.92	−2.07	10.04	.60	1.63	−1.61	8.56	−1.58	1.80	2.24	9.42
Parent X Inv X SlfDist	2.38	1.70	−17.21	10.56	−.22	1.43	−6.05	8.88	.99	1.59	−2.87	9.87
Parent X Inv X SlfComf	−.68	1.69	7.92	8.97	−.65	1.42	3.20	7.54	−.34	1.58	6.26	8.38

*Note: = $p < .05$,

** = $p < .01$,

*** = $p < .001$.

[a]Parent order, demographic risk, and parent sensitivity were entered in all analyses as covariates.

[b]Parent was coded as −1 (mother) and 1 (father) so that the intercept and slope indicate an average level and rate of change in infant temperament.

Inv = Involvement; SlfDist = Self-Distraction; SlfComf = Self-Comforting