Frustration in Infancy: Implications for Emotion Regulation, Physiological Processes, and Temperament

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Abstract:

A study sample of 162 six-month-old children was selected from a larger sample of 346 infants on the basis of parents' report of their infants' temperament and a laboratory assessment of temperament. Infants were classified as easily frustrated and less easily frustrated and compared on a number of emotion regulation, physiology, and temperament measures. Results indicated that male and female infants were equally likely to be classified as frustrated and less easily frustrated; however, male infants were less able to regulate physiologically. Easily frustrated infants used different emotion regulation strategies and were observed to be less attentive and more active than less easily frustrated infants when observed in the laboratory. These infants were also characterized by their parents as more active, less attentive, and more distressed to novelty. Infants classified as easily frustrated were more reactive physiologically and less able to regulate physiological reactivity than their less easily frustrated counterparts. It is hypothesized that this cluster of characteristics may constitute a unique temperamental type that may have implications for other types of behavioral functioning. Limitations of the study are that observations are based on a single brief assessment of the infant, modest effect sizes were found, and the study is cross-sectional.

Article:

Much of the research on the dimensions and characteristics of early personality, or temperament, has focused on early patterns of negative affect. For example, a number of studies have examined early distress to novelty (Calkins, Fox, & Marshall, 1996; Fox, Schmidt, Calkins, Rubin, & Coplan, 1996; Kagan, Snidman, & Arcus, 1998), a pattern of negative affect that is marked by inhibition, vocal and facial indicators of fear, low heart rate (HR) variability, and right frontal electroencephalograph (EEG) asymmetry (Calkins & Fox, 1992; Calkins et al., 1996; Fox, 1989; Kagan, Reznick, & Snidman, 1988). A second pattern of negative affect may be characterized by anger and low tolerance for frustration (Braungart-Rieker & Stifter, 1996; Calkins & Fox, 1992; Stifter & Fox, 1990). Although there has been considerable research investigating the origins, correlates, and underlying physiology of fearful reactivity, there has been less research on frustrated reactivity. The aim of this study was to examine early infant frustration in relation to (a) characteristic patterns of emotion regulation, (b) physiological functioning, and (c) other dimensions of temperament in an effort to understand better this type of negative reactivity and its possible influence on early personality development.

FRUSTRATION REACTIVITY AND EMOTION REGULATION

In a recent series of studies, several researchers have suggested that frustration reactivity may constrain the development of appropriate regulatory behaviors (Calkins, 1994; Calkins & Fox, 1992; Fox & Calkins, 1993; Stifter & Fox, 1990). The relation between regulation and laboratory-elicited negative affect has been examined in a number of these studies. In one study, Stifter and Braungart (1995) examined changes in the types of regulatory behaviors infants use to manage emotional reactivity and observed that there were relations between these behaviors and changes in negative affect. In another study of the efficacy of regulatory behaviors, Rothbart and colleagues (Rothbart, Posner, & Boylan, 1990) observed that at least one specific emotion regulation behavior, that of attentional control, is related to decreases in negative emotionality in infancy. Similarly, Calkins and Johnson (1998) demonstrated that there are relations between regulatory behaviors and the tendency to be distressed by frustrating situations. Finally, Buss and Goldsmith (1998) observed that a number of different behaviors that infants display when observed in frustrating or constraining situations appear to reduce negative affect. Thus, the notion that certain behaviors serve to minimize frustration reactivity has gained clear support. The limitations of this work, though, are that it consists largely of laboratory assessments of behavioral indexes of temperament and does not attempt to externally validate this assessment with other types of measures, including possible physiological correlates.

A second issue with respect to frustration reactivity is its effect on developing regulatory ability. Braungart-Rieker and Stifter (1996) demonstrated that frustration reactivity at 5 months of age was related to the use of fewer emotion regulation behaviors at 10 months of age. What is unclear, though, is whether some types of emotion regulation behaviors are more likely to be associated with heightened frustration over time than others. A small number of studies conducted with children of various ages suggest that it might be possible to identify profiles of infants at higher risk for regulatory difficulties. For example, Aksan and colleagues (Aksan et al., 1999) reported that a preschool temperament type characterized by noncontrolled–expressive behavior was predicted by infant distress to limitations. The finding that anger and frustration may, in some circumstances, predispose a child to difficulties regulating emotion led to the first question addressed in this study: What types of emotion regulation strategies do frustrated infants display in situations that elicit distress? This question was addressed by comparing a selected sample of easily frustrated infants to less easily frustrated infants, as measured both in the laboratory and by parents, on measures of emotion regulation. A selected groups approach was used to address the problem that, in a normal sample of infants, laboratory responses to frustration are often skewed (in the direction of relatively low frustration responses among middle-class samples) and that most studies report low agreement between maternal report of frustration and laboratory behavior. This selection strategy maximized the likelihood of having sufficient numbers of easily frustrated infants to identify meaningful differences. Based on previous work, it was hypothesized that easily frustrated infants would display a pattern of regulatory behaviors that may fail to reduce negative affect in a particular situation. Therefore, the first hypothesis was that easily frustrated infants were expected to display more physical signs of frustration (banging, kicking) and more frustration-focused behavior, both of which might serve to increase associated arousal and interfere with the use of other strategies.

Alternatively, less easily frustrated infants were expected to display strategies such as distraction, self-soothing, or help seeking, that may serve to decrease frustration arousal.

Frustration Reactivity and Physiological Processes

One significant point of agreement among temperament theorists is that temperamental differences reflect biological or physiological differences (Goldsmith et al., 1987; Gunnar, 1990; Rothbart & Derryberry, 1981). An area of research where significant physiology –temperament– behavior links have been identified is the work that has examined relations between emotion HR measures. The work on inhibited temperament has demonstrated that highly fearful children have higher and more stable resting HRs (Kagan et al., 1998). However, there has been limited research on resting HR and anger and frustration in infants.

Another dimension of cardiac activity that has been linked to temperament and emotion regulation in young children is HR variability. Although there are multiple ways to measure this variability, Porges (1985, 1991, 1996) and colleagues have developed a method that measures the amplitude and period of the oscillations associated with inhalation and exhalation. Thus, this measure refers to the variability in HR that occurs at the frequency of breathing (respiratory sinus arrythmia [RSA]) and is thought to reflect the parasympathetic influence on HR variability via the vagus nerve (Porges, 1996; Porges & Byrne, 1992). High resting RSA is one index of autonomic functioning that has been associated with appropriate emotional reactivity (Calkins, 1997; Stifter & Fox, 1990) and good attentional ability (Richards, 1985, 1987; Suess, Porges, & Plude, 1994). Several studies have linked high resting RSA in newborns with good developmental outcomes, suggesting that it may be an important physiological component of appropriate engagement with the environment (Hoffheimer, Wood, Porges, Pearson, & Lawson, 1995; Richards & Cameron, 1989). This research suggests that children with low RSA may be at risk because they may have difficulty attending and reacting to environmental stimulation (Porges, 1991; Wilson & Gottman, 1996).

A third dimension of cardiac activity that may be relevant to a study of the psychophysiological correlates of frustration refers to changes in cardiac activity in response to an external stress or challenge. HR changes are thought to be a primary indicator of attention (see Ruff & Rothbart, 1996). Typically, deceleration of HR reflects attention directed outward (processing novel stimulation, for example), and acceleration reflects attention directed inward (during problem-solving conditions; Ruff & Rothbart, 1996). Thus, it may be useful to examine whether individual differences in the ability to control attention, as indexed by HR changes, are related to frustration.

Finally, a measure of cardiac change that may be more directly related to the kinds of difficulties displayed by frustrated infants is a decrease (suppression) in RSA during situations in which coping or emotional and behavioral regulation is required. Suppression of RSA during demanding tasks may reflect physiological processes that allow the child to shift focus from internal homeostatic demands to demands that require internal processing or the generation of coping strategies to control affective or behavioral arousal (Porges, 1996). Thus, suppression of RSA is thought to be a physiological strategy that permits sustained attention and behaviors indicative of active coping that are mediated by the parasympathetic nervous system (Porges, 1991, 1996; Wilson & Gottman, 1996). Recent research indicates that suppression of RSA during challenging situations is related to better state regulation, greater self-soothing, and more attentional control in infancy (DeGangi, DiPietro, Porges, & Greenspan, 1991; Huffman et al., 1998), fewer behavior problems and more appropriate emotion regulation in preschool (Calkins, 1997; Calkins & Dedmon, 2000; Porges, Doussard-Roosevelt, Portales, & Greenspan, 1996), and sustained attention in school-age children (Suess et al., 1994).

Frustration Reactivity and Other Temperamental and Behavioral Dimensions

Research on the inhibited child has suggested that this temperamental type is delineated not only by the response of the child to a single type of elicitor such as novelty (Kagan, Reznick, & Gibbons, 1989), but by responses in other situations as well. This work suggests that it is important to examine associated behaviors that may be either a consequence or a correlate of the temperamental category, as such behaviors may have implications for how a particular temperamental trait influences personality development. Aksan et al. (1999) noted that temperamental types are best examined in the context of clusters of associated temperament dimensions or behaviors. For example, among inhibited children there is a pattern of response to novelty, associated physiological markers, and behavioral indexes such as motor activity, internalization of parental standards, and conversational style that may be associated with the temperament category (Kagan et al., 1989; Kagan et al., 1988). Because so few studies have been conducted with frustrated infants and children, there are few clearly identified associated indexes. Research on early problem behavior suggests that hyperactivity may be observable in the first year of life (Campbell, 1991, 1995) and may be related to the child's tendency to avoid or evade restrictions on their movements (Calkins & Fox, 1992). Thus, in this study, we examined whether easily frustrated infants are likely to be more active than their less frustrated counterparts. Second, research on emotion regulation suggests that these infants may have shorter attention spans or longer latencies to organize a response requiring focused attention (Kochanska, Tjebkes, & Forman, 1998; Ruff & Rothbart, 1996). Thus, difficulties in the control of attention and the ability to sustain attention may be related to frustration reactivity.

In sum, the goal of this investigation was to characterize the functioning of infants characterized, across laboratory and home contexts, as easily frustrated. In observing these infants, the assumption was that they would display differentially adaptive regulatory behavior, different patterns of resting and response measures of cardiac functioning, and different associated temperament dimensions. Finally, gender differences and interactions of frustration and gender were also examined. Recent data suggest that although sex differences in temperament are rarely found in infancy, regulation differences may be observed between males and females (Weinberg, Tronick, Cohn, & Olson, 1999). The overall goal of the study was to illuminate differences between infants who experience frustration readily versus those who are able to manage frustration.

METHOD

Participants

Three hundred and forty-six 6-month-old infants (179 boys and 167 girls) were recruited for a temperament screening involving both maternal report and laboratory assessment. Seventy percent of the families were European American and 30% were African American. The families were classified into socioeconomic status (SES) groups on the basis of employment and education information provided by the parents on the screening questionnaire (Hollingshead, 1975). Sixty- seven percent of the families were classified as middle class, 20% as lower class, and 13% as upper class (M= 37.6). Seventy-seven percent of the children came from intact homes. These racial and SES characteristics are representative of the county where recruitment took place. The parents of this larger recruitment sample were contacted through local childcare centers, pediatricians' offices, direct-mail marketing lists, and county health and human services facilities. Parents completed a temperament questionnaire (Infant Behavior Questionnaire [IBQ]; Rothbart, 1981) or were assisted in completing the form if they had reading difficulties, and the children were assessed for frustrated temperament in the laboratory.

Procedures

After parents indicated that they were interested in participating in the study they were contacted by telephone to schedule a laboratory assessment. Assessments were primarily scheduled for early morning, but often infants were brought to the lab at other times of day. If an infant fatigued during the assessment it was curtailed and rescheduled, if possible. At the time of initial contact, parents were mailed an IBQ and asked to complete the questionnaire and bring it with them to the laboratory assessment.

Infants were assessed in the laboratory playroom during several procedures. First, the experimenter placed three disposable pediatric electrodes in an inverted triangle pattern on the infant's chest while the child was lying on the floor. The electrodes were connected to a preamplifier, the output of which was transmitted to a vagal tone monitor (VTM-I, Delta Biometrics, Inc., Bethesda, MD) for R-wave detection. The vagal tone monitor displayed ongoing HR and computed and displayed RSA (vagal tone) every 30 sec. A data file containing the interbeat intervals (IBIs) for the entire period of collection was transferred to a laptop computer for later artifact editing (resulting from child movement) and analysis.

Although participants were assessed in a number of procedures, the focus of this investigation is on the emotion and attention tasks. Many of these paradigms were adapted from the Laboratory Temperament Assessment Battery (Lab-Tab, Version 2.03; Goldsmith & Rothbart, 1993). All emotion tasks were separated by tasks involving interaction with the mother to limit carryover effects. Infants were only assessed in the next procedure if they were calm and displaying no distress. It was not uncommon for breaks to be taken for feeding or diaper changing. The tasks of interest were conducted as follows.

Activity level. While the mother and experimenter were going through the procedures, the infant was placed on his or her back beneath an activity gym, which had four colorful toys hanging above the child. A second experimenter sat nearby in the event that the child needed assistance.

Baseline HR. Two minutes of the child's resting HR were recorded while the child sat in a high chair. The high chair was designed to transition infants to upright sitting and was angled slightly to provide support. Mothers were asked to limit interaction with their children during data collection. The experimenter remained in the room for the collection of HR but was seated behind the child.

Attention task. The infant was seated in a high chair and a large colored plastic block was placed on the tray directly in front of the infant for 2 min. The mother and the experimenter sat nearby but were uninvolved in the task.

Frustration task 1: Plastic barrier task. The experimenter placed a string of colorful toys on the high-chair table within the child's reach. The child was allowed to manipulate the toy for 1 min, and the mother was encouraged to help the child become interested in the toy if necessary. Following the period of manipulation, the toy was removed from the child's hands and placed on a hook behind a clear plastic barrier, out of reach. The toy remained out of reach for a period of 2 min, or until there had been 20 sec of hard crying.

Frustration task 2: Arm restraint. The child was seated in the high chair and the mother was asked to sit in front of the infant and hold the child's arms firmly at his or her side for a period of 2 min or 20 sec of hard crying. The mother was asked to look away from her child during the restraint period.

Frustration task 3: Maternal prohibition. The mother and child were seated on a quilt on the floor, with the child surrounded by the supportive cushion, and the mother was given a musical rattle that her child had not seen before. She was instructed to play with the rattle for 1 min, and then to place the toy off the quilt, out of the child's reach. She was instructed not to allow her child to have the rattle for 1 min.

Measures

Five types of measures were derived from the laboratory assessments. These were: emotional reactivity and regulation measures, physiological measures (resting RSA and heart period [HP] and RSA and HP during the attention task), attention measures, activity level measures, and maternal report of temperament measures. For the behavioral measures (emotion, activity level, and attention), the approach to the data reduction process involved creating standardized summary scores of measures that were conceptually related. This method of creating summary scores is common in studies of temperament where many behaviors are hypothesized to tap into the same dimension (Calkins & Johnson, 1998; Coplan, Rubin, Fox, Calkins, & Stewart, 1994; Kagan et al., 1988; Stifter & Braungart, 1995). The creation of these summary scores is described next for each measure, with correlations across measures and scale reliability reported where appropriate.

Temperament measures. The IBQ (Rothbart, 1981) was used to generate measures of maternal perception of temperament. The IBQ is a 94-item questionnaire, with questions rated on a 7-point scale. The questions concern infants' emotional and behavioral responses across a number of everyday situations. The questionnaire shows good internal consistency and convergence with other similar scales (Matheny, 1997). The mothers' responses to the IBQ questions were reduced to six subscales: smiling and laughter, distress to limitations, distress to novelty, soothability, duration of orienting (attention), and activity level. Alpha re- liabilities for the scales exceeded .70 for all but the soothability scale, which had a reliability of .56.

Emotional reactivity and regulation measures: Frustration distress. Following from Rothbart (Rothbart & Derryberry, 1981) and Stifter and Fox (1990), measures of frustration distress were operationalized as the latency to fuss or cry (in sec), the intensity of distress (scored every 10 sec on a scale of 0 to 5, with 0 indicating no distress and 5 indicating a full-blown scream or cry), and the duration of fussing and crying in sec. Descriptive statistics for these three measures for the three frustration tasks appear in Table 1.

Coder reliability for these measures across the three tasks was computed on 10% of the larger sample using Pearson correlations, and ranged from .89 to .99. The three frustration tasks are similar to those used by temperament researchers and others to elicit anger and frustration in infants and young children (Goldsmith & Rothbart, 1993; Matheny & Wilson, 1981). However, it is possible that emotions other than anger (sadness, fear) could be elicited during the tasks. The term distress was used to characterize the vocal affective responses of the children.

To generate by-task indexes of frustration distress, summary scores reflecting the measures of reactivity (latency, duration, and intensity) were computed for each frustration task. Within each of the three frustration tasks, these measures were highly intercorrelated; rs ranged from .30 to .93, with all ps < .001. Given the high intercorrelations among individual measures, by-task summary scores were computed by standardizing and summing the reversed latency measure, the mean intensity measure, and the duration of fussing measure. Thus, for each task, a single summary score of distress in response to frustration was computed. Cross-episode correlations for these task summary measures were significant; rs

TABLE 1
Descriptive Statistics for Laboratory and Maternal Report Measures of Frustration

	M	*SD*	*N*
Barrier task—distress			346
Latency (sec)	63.99	47.69	
Intensity (1 = low, 5 = high)	1.79	1.02	
Duration (sec)	0.16	0.22	
Summary score	0.00	2.78	
Arm restraint—distress			344
Latency (sec)	18.28	0.30	
Intensity (1 = low, 5 = high)	3.03	1.20	
Duration (sec)	0.44	0.30	
Summary score	0.00	2.65	
Maternal prohibition—distress			316
Latency (sec)	29.09	25.40	
Intensity (1 = low, 5 = high)	1.90	1.08	
Duration (sec)	0.18	2.72	
Summary score	0.00	2.72	
IBQ distress to limits	3.23	0.74	346

ranged from .26 to .34, ps < .001. Because a number of children fretted out prior to the maternal prohibition task (n = 30), this task was not used to select easily frustrated infants. It should be noted that 113 of 346 infants displayed no distress during the barrier task, 20 infants showed no distress during the arm restraint task, and 84 infants showed no distress during the maternal prohibition task.

Based on the task intercorrelations, a summary score was created by summing the distress scores from the barrier task and the arm restraint task. This scale had an alpha reliability of .83, with M = –.02, and a range from –9.02 to 11.00. The summary variable of distress was normally distributed, with a skewness of .11. Positive scores on the frustration distress index indicated that the child was reactive to the frustrating tasks (shorter latency to cry or fuss, higher intensity fussing or crying, longer duration fussing and crying). Low or negative scores on the dimension of distress indicated that the child was less reactive to the frustration tasks. There was no significant relation between either race or SES and the laboratory measure of frustration. The correlation between the laboratory index of frustration and maternal report of distress to limits on the IBQ was modest, though significant ($r = .13$, $p = .01$).

To generate groups of infants who could be characterized as easily frustrated versus less easily frustrated, children scoring at or above the 50th percentile on both the laboratory index of frustration and the maternal report of distress to limitations were selected for membership in the easily frustrated group. Thus, this group consisted of infants scoring .32 or above on the laboratory measure and 3.20 or above on the maternal report. The less easily frustrated group consisted of infants scoring below the 50th percentile on both the laboratory assessment and the maternal report. Of the larger sample, 77 infants met the criteria for the less easily frustrated group, and 85 met the criteria for the easily frustrated group. Further, the sociodemographics of these two groups of infants (hereafter referred to as the selected sample) matched those of the larger recruitment sample (Hollingshead index = 35.6, 70% White, 79% from intact homes).

Emotion regulation behaviors. In addition to the emotion measures, each frustration episode was coded for behaviors commonly considered indicators of emotion regulation. These regulation strategies were chosen based on previous research measuring regulation in infants and young children (Calkins, 1997; Calkins & Johnson, 1998; Stifter & Braungart, 1995). These behaviors, which were coded for presence or absence in 10-sec intervals for the entire task, included:

1. Self-comforting: Thumb sucking, hair-twirling, or other automanipulative behavior.
2. Mother orientation: Looking to mom, talking to or playing with mother, touching or pulling on mom.
3. Distraction: Attending to or manipulating an object other than the task object.
4. Physical: Banging, kicking, throwing, hitting the task object, or any of these directed toward mother or experimenter.
5. Orienting to task object: Looking at, touching, or manipulating task object.
6. Scanning: Visually exploring the environment, with duration of orienting on a given object less than 2 sec. With the exception of physical regulation, which could occur in conjunction with other behaviors, all behaviors were treated as nonoverlapping. To obtain summary scores for the use of various strategies, means (proportion of time) for each of the six types of behaviors were computed across the three tasks for the three frustration tasks. Mean proportions across the selected sample were: scanning, M = .63; distraction, M = .18; task object focus, M = .10; focused on mom, M = .08; self-comfort, M = .02; and physical, M = .06.

The tapes were coded for regulation behavior by the first author and two research assistants, who coded 10% of the tapes together for training purposes and an additional 10% independently for reliability. Reliability correlations for the distress measures ranged from .85 to .99. For regulation behaviors, the Cohen's kappas averaged .71 and ranged from .58 to .87. Intercorrelations among most measures were modest, with scanning being the only variable related to all other variables. More time spent scanning was negatively related to orienting to mom, $r = .31$, $p <.001$, less time orienting to the focal object, $r = –.46$, $p < .001$, and less distraction, $r = –.69$, $p < .001$. Orienting to mother was negatively related to distraction, $r = –.23$, $p < .01$. Examination of the distribution of these summary measures indicated that self-comfort, physical, and task-object focus were skewed, with few infants displaying the behavior for a short amount of time and most infants not displaying the behavior. These behaviors were rescored as 1 (present) or (absent). For the selected sample, 67 infants displayed physical regulation, 72 oriented to the focal object, and 57 displayed self-comforting.

Physiological measures. To generate measures of cardiac activity from which to derive measures of resting HP and RSA and HP and RSA in response to challenge, the IBI files were edited and analyzed using MXEDIT software (Delta Biometrics, Bethesda, MD). Editing the files consisted of scanning the data for outlier points relative to adjacent data and replacing those points by dividing them or summing them so that they would be consistent with the surrounding data. Data files that required editing of more than 5% of the data (e.g., 10–15 data points in a 2-min period) were not included in the analyses. The data files of some 13 selected children were not included in the analyses. The HR data collection equipment failed on several occasions ($n = 4$). However, the most common explanation for missing data was that the child pulled on the HR leads, which resulted in movement artifact affecting greater than 5% of the data in the HR file ($n = 9$).

Analysis of the IBI data consisted of applying the Porges (1985) method of calculating RSA. This method applies an algorithm to the sequential HP data. The algorithm uses a moving 21-point polynomial to detrend periodicities in HP slower than RSA. Then, a band-pass filter extracts the variance of HP within the frequency band of spontaneous respiration in infants and young children, .24 to 1.04 Hz. Although lower frequency bands may be studied, research with young children has consistently examined this higher band and identified associations to child functioning (Huffman et al., 1998; Porges et al., 1996; Stifter & Fox, 1990). The estimate of RSA is derived by calculating the natural log of this variance and is reported in units of ln(msec)2. HP and RSA were calculated every 20 sec for the 2-min baseline period and the 2-min attention episode. Mean RSA values across the entire sample were 3.62 for baseline ($SD = .88$) and 3.50 for the attention task ($SD = .81$). Mean HP values across the selected sample were 433.36 msec for baseline ($SD = 30.27$ msec) and 428.27 msec for the attention task ($SD = 32.54$ msec).

Attention measures. Attention behavior was coded following Kochanska (Kochanska et al., 1998). Behavior was coded for each 10-sec interval of the task. Using a 3-point scale, the infant's intensity of interest was scored (0 = no interest in any facial region, 2 = all three facial regions show interest). The infant's intensity of looking at the block and intensity of manipulation were scored on 4-point scales (0 = does not look/manipulate at all, 3 = looks/manipulates for 9–10 sec). In addition, the latency to first look away from the block and overall duration of orienting and duration of manipulating were coded. These six measures were highly intercorrelated and were standardized and summed to yield a single measure of lab attention (alpha reliability = .72, M = .00, SD = 1.83). Reliability was calculated using Cohen's kappas for the interest, looking, and manipulating codes, and ranged from .81 to .87.

Activity measures. Infants' response to the activity gym was scored for two types of behaviors. First, the frequency of the child's body movements (trunk, arms, and legs) was scored on a 5-point scale ranging from 1 (not at all active) to 5 (constant activity). Second, the intensity of the child's body movements was scored using a 5-point scale from 1 (very low intensity) to 5 (very high intensity). The mean for frequency of movement across the selected sample was 3.09, whereas the mean for intensity of movement was 2.85. These two measures were correlated ($r = .67$, $p < .001$) and were standardized and summed to create a single lab activity level score (M = .00, SD = 1.83).

RESULTS

Preliminary analyses examined frustration group differences on several sociodemographic measures to determine whether particular measures should be included in subsequent analyses or as covariates in the analyses. Five types of measures were examined: sex of child, SES, race of mother, marital status of mother, and birth order. Analyses revealed that there was no relation between frustration group and sex of the child (47 of the 85 infants in the easily frustrated group were girls compared with 36 of the 77 infants in the low frustration group), marital status, and child birth order. Because there were no hypotheses regarding marital status and birth order, these were excluded from subsequent analyses. Sex of child was included in analyses because it was of interest whether frustration group interacted with the sex of the child in predicting regulatory behaviors. There was a relation between frustration group status and race, $x^2 = 6.23$, $p = .01$. More children of African American mothers were included in the easily frustrated group. There was also a difference between the low and easily frustrated groups in terms of SES, $t(161) = 1.95$, $p = .05$. Easily frustrated children had family Hollingshead SES scores that were significantly lower (M = 34), than families of children in the low frustration group (M = 37.5). Because there were no a priori hypotheses regarding either SES or race, these factors were treated as covariates in all analyses. However, all significant covariate effects were reported. Subsequent analyses examined frustration group differences in terms of emotion regulation, physiology, and temperament. These analyses are described separately later. In addition, for behavioral measures from tasks other than the frustration tasks, distress was scored and treated as a covariate when there were group differences in distress during that task. Finally, estimates of effect size, using R and eta squared, are included for all analyses.

Group Differences in Emotion Regulation

To examine whether there were group differences in emotional regulation behaviors, two types of analyses were conducted. First, a repeated measures analysis of variance (ANOVA) was conducted examining the three types of emotion regulation behaviors that were normally distributed (orienting to mother, distraction, and scanning) with frustration group and sex of child as between-subject factors and using SES and maternal race as covariates. This analysis revealed a significant interaction between frustration group and strategy, $F(2, 316) = 7.74$, $p < .01$. No interactions were found involving group and sex. Follow-up ANOVAs indicated that there were several significant differences between easily frustrated and less easily frustrated infants. Table 2 presents the means, by group, for each of these three measures of emotion regulation and the significance test. As the table indicates, easily frustrated infants engaged in less distraction, more scanning, and more orienting to mom than did less easily frustrated infants.

TABLE 2
Emotion, Attention, and Temperament Measures for Easily Frustrated and Less Easily Frustrated Infants

	Less Easily Frustrated (n = 77)		*Easily Frustrated (n = 85)*				
	M	*SD*	*M*	*SD*	*F*	*p*<	*R (eta)*^{2}
Emotion regulation							
Distraction	0.23	0.18	0.13	.13	13.64	.00	.08
Mother	0.05	0.07	0.10	0.12	3.91	.05	.03
Scanning	0.62	0.2	0.66	0.20	3.41	.06	.02
Physical[a]	16		29		6.84	.01	.03
Focal object[a]	22		29			*ns*	
Self[a]	20		19			*ns*	
Attention	0.27	0.92	–0.26	1.03	6.78	.01	.04
Activity level	–0.31	1.8	0.21	1.87	6.81	.01	.04
Temperament (IBQ)							
Soothing	5.40	1.2	5.27	0.96	2.84	.10	.01
Attention	4.22	1.18	3.50	1.18	18.57	.00	.08
Distress to limits	2.60	0.46	3.80	0.62	14.83	.00	.57
Distress to novelty	2.30	0.63	2.80	0.93	10.89	.00	.11
Smiling	5.10	0.74	5.00	0.79		*ns*	
Activity level	3.80	0.75	4.60	1.1	14.83	.00	.12

[a]Means for measures are percentages. Statistical test is Wald.

To examine whether group differences existed between the two groups of infants on the measures of physical regulation, focal object orienting, and self- comforting, separate logistic regressions were conducted, with maternal race and SES entered first in the equation, followed by frustration group, to predict group membership on each of the three dichotomous measures. The frequencies for the three measures appear in Table 2, with the norm of infants displaying the behavior and the number of infants not displaying the behavior indicated in parentheses. Significance tests indicated that the infants who displayed physical signs of regulation were more likely to be members of the easily frustrated group than the less easily frustrated group. No relations existed between frustration group membership and the likelihood of self-comforting or focal object orienting.

Group Differences in Physiology

To examine whether there would be differences between easily frustrated and less easily frustrated infants in terms of resting and response measures of cardiac activity, repeated measures ANOVAs were conducted on RSA and HP, with SES and race treated as covariates and group and sex of child as between-subject factors. The findings from this analysis are depicted in Figure 1. The analysis of RSA indicated that there was a significant main effect of group, $F(1, 145) = 5.66$, $p < .05$, $\eta^2 = .04$. As Figure 1 indicates, easily frustrated infants displayed higher RSA across

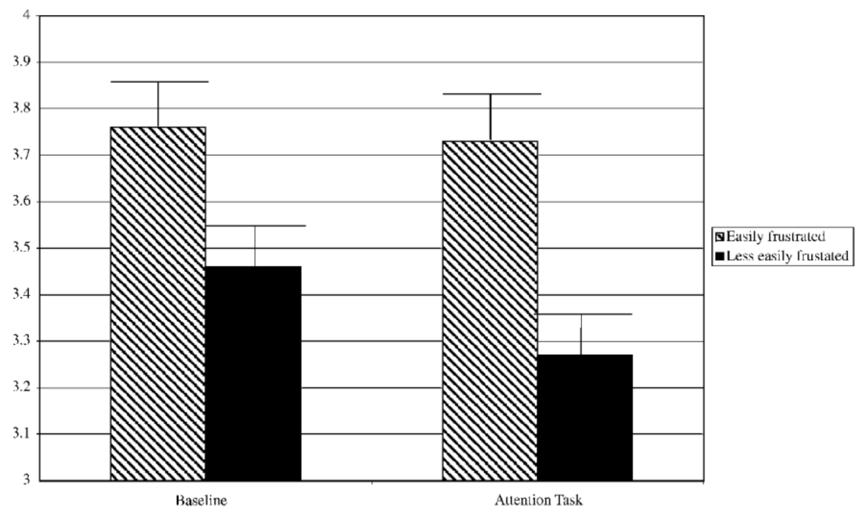

FIGURE 1 Baseline respiratory sinus arrythmia and attention respiratory sinus arrythmia in ln(msec^2) for easily frustrated and less easily frustrated infants.

both baseline and the attention task than did less easily frustrated infants. A significant task effect was found, $F(1, 145) = 5.03$, $p < .05$, $\eta^2 = .03$, which suggested that across both groups there was a significant decrease in RSA from baseline to task. However, a trend toward an interaction of group and task was also found, $F(1, 145) = 3.14$, $p < .10$. As the figure indicates, easily frustrated infants did not show a decrease in RSA to the attention task, $F(1, 73) = .09$, p = ns, whereas less easily frustrated infants did, $F(1, 74) = 7.28$, $p < .01$, $\eta^2 = .09$. No effects of the co- variates race and SES were found, $\eta^2 = .006$ and .001 for SES and race, respectively.

The repeated measures ANOVA also indicated that there was a significant Sex × Task effect, $F(1, 145) = 4.02$, $p <.05$, $\eta^2 = .03$. Follow-up tests revealed that boys did not decrease RSA to the attention task, M change score = .02, although girls did, $F(1, 73) = 6.08$, $p < .01$, Mchange score = .20, $\eta^2 = .08$.

A repeated measures ANOVA using HP and examining group, sex, and task differences with SES and race as covariates revealed only a significant task effect, $F(1, 145) = 10.42$, $p < .001$. For both groups of infants and both sexes there was a significant decrease in HP (increase in HR) from baseline to the attention task. Again, SES and race were not significantly related to measures of HP, $\eta^2 = .007$ and .001 for SES and race, respectively.

Frustration Group Differences in Temperament

Group differences in laboratory attention. To examine frustration group differences in attention, an ANOVA was conducted with the attention summary score as the dependent measure, group and sex as between-subject factors, and SES and race as covariates. This analysis revealed a significant group effect. As Table 2 indicates, easily frustrated infants scored lower on the attention task than did less easily frustrated infants. A significant sex effect was also found, $F(1, 158) = 5.18$, $p < .05$. Boys scored lower on the attention task, M=–.37, than did girls, M=.56, $\eta^2 = .06$. No interaction of sex and frustration group was found. No effects were found for the covariates race and SES, $\eta^2 = .001$ and .002 for SES and race, respectively.

Group differences in laboratory activity level. To examine frustration group differences in attention, an ANOVA with the activity summary score as the dependent measure, group and sex as between-subject factors, and SES and race as covariates was conducted. This analysis revealed a significant group effect. As Table 2 indicates, easily frustrated infants scored higher on the activity task than did less easily frustrated infants. No effects were found for the covariates race and SES, $\eta^2 = .004$ and .007 for SES and race, respectively.

Group differences in maternal report of temperament. A repeated measures ANOVA was conducted on the six IBQ temperament scales to examine group and sex differences on maternal ratings of temperament. This analysis revealed a significant Group x Scale interaction, $F(5, 790) = 25.20$, $p < .001$. As Table 2 indicates and follow-up ANOVAs revealed, easily frustrated infants were rated by mothers as more active, more distressed to limits, more distressed to novelty, displayed shorter orienting, and were less soothable.

This analysis also revealed significant effects of the covariates race, $F(1, 158) = 23.01$, $p < .001$, and SES, $F(1, 158) = 9.40$, $p < .01$. Several post hoc analyses were conducted to explore the nature of these effects and their potential influence on group membership and interactions with group membership. First, African American participants were compared to White participants on the measure of SES using a t test. There was no significant difference between the two racial groups on the measure of SES. Next, correlations between SES and temperament scales were conducted, first for the entire sample of 162 and then for each frustration group separately. These analyses revealed that SES was significantly and negatively related to scale scores for activity level, distress to limits, and distress to novelty ($rs > .20$, $p < .05$ for all three scales). Mothers with lower SES scores rated their infants as more active and more distressed to both novelty and limits than did mothers with higher SES scores. No differences in the magnitude or direction of these correlations were found when the analyses were run separately by frustration group. To assess the impact of race, ANOVAs were conducted on the six scales with frustration group and racial group, and SES as a covariate. These analyses revealed that mothers of African American infants rated their children as more easily soothed, more distressed to novelty, and displaying more smiling ($p < .05$ for all effects). There was a trend for these mothers to rate their children as distressed to limits ($p = .09$). However, there were no interactions of frustration group and race.

DISCUSSION

The goal of this study was to identify a group of infants that displayed frustration in two contexts (home, as observed by mothers, and laboratory), and examine multiple dimensions of the infants' behavior thought to be related to frustration. Toward this end, we screened a large and representative sample of infants, identified easily frustrated and less easily frustrated groups, and assessed them behaviorally and physiologically in the laboratory and in terms of maternal assessment of temperament. The findings revealed that the infants differed on a number of dimensions that may be usefully considered in the context of emerging personality and the development of self-regulation.

The first task in this study was to identify a group of infants that would display frustration in a standard laboratory battery and in the home, and a group that was considered not easily frustrated. These two groups of infants were different on some sociodemographic measures, notably SES and race, but not on others. Interestingly, these differences appear to have been a consequence of maternal report, as there were no significant relations among SES, race, and laboratory frustration, nor, indeed, between these sociodemographic measures and any laboratory measure. Sociodemographic differences were not the focus of this study, but possible sources of differences in perception of infant behavior or actual infant behavior include genetic mediation of personality traits, prenatal experiences, parent psychological state and expectations, or socialization influences that are a consequence of a high-risk parenting context. There have been almost no studies of difference in infant temperament as a function of sociodemographics, so clearly this is an issue in need of further investigation.

The temperament groups also did not differ in terms of gender representation, which is consistent with much of the existing temperament literature. Other gender differences were found, however. Regardless of temperament group, boys displayed less physiological regulation and poorer attention skills than did girls. These two are likely to be linked, as decreases in RSA have been found to be a function of attentional focus (Calkins & Dedmon, 2000). In addition, maturational differences may also play a role. However, there are relatively few studies to suggest that there are clear sex differences in attention this early in development. There are however, more consistent findings of sex differences in regulation (see Stifter & Spinrad, this issue; Weinberg et al., 1999), suggesting that perhaps early physiological differences play a role in later behavioral differences.

In comparing the two groups of frustrated infants on regulatory measures, several differences were observed, only some of which were predicted. First, easily frustrated infants were more likely to be among the group of infants that displayed physical types of responses to frustration (kicking, banging), and they displayed less distraction than did less easily frustrated infants. However, among both groups of infants, the most common response to frustration was scanning the environment, and the least common response was a physical one. It may be the case that some infants react negatively because they have not developed effective behaviors for coping when goals are blocked, movement is inhibited, or needs are denied. As a consequence, when confronted with such situations these infants may be overwhelmed by the frustration, become distressed, and engage in less adaptive and more physical types of behaviors. Eisenberg, Fabes, Nyman, Bernzweig, and Pinuelas (1994) argued that both high levels of emotional arousal and low emotional regulation play a role in the display of aggressive behavior. Another interpretation of this observed relation between distress and physical responses is that acting-out physically is simply another manifestation of distress, one that reflects anger. An unexpected difference between the two groups was that the easily frustrated infants sought help from the mother more than the less easily frustrated infants. This may be a result of the greater distress that they experienced, given their own inability to self-soothe or distract. However, mothers' inability to act, given the task instructions, made this strategy ineffective. These infants may have come to rely more on their caregivers because of their own limited regulatory abilities.

One hypothesis about the outcome of this regulatory strategy is that the implications for self-regulated behavior later in development probably depend on parents' scaffolding and inclination to intervene and provide external regulation for the child. In a study with toddlers, we found that mothers who completed tasks for their children, rather than allowing children to complete them on their own, had more frustrated toddlers (Calkins & Johnson, 1998). Thus, it will be important to examine whether and how these easily frustrated infants are supported in their efforts to establish their own emotion regulation repertoires.

Our second set of findings related to physiological differences between the two groups of infants. Consistent with previous work (Stifter & Fox, 1990), easily frustrated infants had higher RSA than less easily frustrated infants, a finding that may reflect their greater level of emotional reactivity. Of particular interest, though, was whether they could control that reactivity to deal with task demands. Consistent with work on older children, and in particular older children with undercontrolled behavior problems (Calkins & Dedmon, 2000), we found that easily frustrated infants had difficulty with the suppression of RSA during an attention-demanding task. Behavior coded during the task also indicated that they were not as focused on the task as were their less easily frustrated counterparts. It is not clear whether these physiological differences lead to behavioral differences or whether they are merely a by-product of attentional focus. Longitudinal data examining the consequences of physiological responding in infancy could disentangle the direction of effects. In either case, though, the infant's inability to sustain attention could undermine skills such as emotion regulation (Rothbart et al., 1990).

A third cluster of findings related to differences in other temperament dimensions. Easily frustrated infants were more active and less attentive both in the laboratory and as rated by mothers. They were also more distressed to novelty. These findings are consistent with what other researchers have found and suggest that there is support for the idea that easily frustrated infants may be characterized by a cluster of behaviors that may constrain the development of adaptive self-regulatory behavior (Aksan et al., 1999). A lack of focused attention coupled with a tendency to be very active and easily distressed may predispose the child to be unable to exert control over his or her behavior. However, it is important to note that it is our assumption that a number of factors may also affect the developmental trajectory of easily frustrated infants. The extent to which the environment supports the development of self-regulation for these infants is likely to be one such factor.

There are some limitations to this study that must be acknowledged. First, it should be noted that only a modest relation was found between the maternal report of frustration and the laboratory observation of frustration. When considered in the context of the existing temperament literature, however, this result is not surprising. First, most of the temperament work reports that either maternal data (see Goldsmith et al., 1987; Lemery, Goldsmith, Klinnert, & Mrazek, 1999) or laboratory data (see Braungart-Rieker & Stifter, 1996; Buss & Goldsmith, 1998) were collected. Second, in the articles that report both (Calkins & Johnson, 1998; Kochanska et al., 1998; Stifter & Jain, 1996), little or no relation is observed. Kochanska (Kochanska et al., 1998) and Manglesdorf (Mangelsdorf, Schoppe, & Buur, 2000) both argued that these low relations are a function of different contexts and suggested that the best way to capture infant behavior accurately across multiple contexts is to use a multiobserver approach. In this study, both maternal report and laboratory observations are informative of the infant's behavior. Infants who, across both contexts, are above average on measures of frustration are clearly different, both behaviorally and physiologically, from infants who are consistently low on this temperament dimension.

A second limitation of this study is that although there are many significant differences between the two groups of infants, the magnitude of the differences is, in most cases, small. In light of the selection procedure that was used, we might have expected larger differences. Two points are relevant here. First, these may not have been “extreme” infants, given that the criterion for inclusion was that they were above the mean on two measures of frustration. Second, in the context of the short laboratory assessments, with most tasks lasting 2 or 3 min, modest effects are not surprising. In addition, laboratory assessments are not without other significant shortcomings. Factors that may confound the data collection process when assessing infants in the laboratory include fatigue and hunger. Given that several infants fretted prior to the maternal prohibition task, this is an important factor. Finally, variability in the developmental level of the child may play a role as well. Infants of this age may differ considerably in perceptual, motor, and cognitive skills that will likely influence their behavioral and emotional responses to the tasks. Thus, it is important not to rule out the possibility that easily frustrated infants may differ on dimensions of behavior that were not assessed in this study, and that it is these differences that may be playing a role in the behaviors that were observed.

The strength of this study is that it is a large-scale assessment of a representative sample of infants that utilizes multiple assessments and multiple types of measures. The study clearly contributes to our understanding of the emotional, behavioral, and physiological functioning of easily frustrated infants, and in particular, addresses the source of their regulatory behaviors. However, it is clear that this study cannot address the question of the long-term implications of frustration in infancy. An important unknown factor, addressed by both Diener, Mangelsdorf, McHale, and Frosch (this issue) and Stifter and Spinrad (this issue), is the extent to which the child’s environment provides the necessary support to help the child manage frustration. If it does, then the outcome for the easily frustrated infant may well be positive. If it does not, then the child may be faced with challenges in learning adaptive emotion-regulation skills (Braungart-Rieker & Stifter, 1996) crucial for social competence. It has been demonstrated that the ability to manage distress and anger when frustrated is likely to be critical for later adaptation. In addition, it is apparent that such skills begin to develop in infancy and become consolidated during toddlerhood so that by the time child enters preschool these skills may play an important role in the development of self-control (Kopp, 1982) and social competence (Rubin, Coplan, Fox, & Calkins, 1995). Styles of emotion regulation evident in infancy and toddlerhood may come to play an important role in children’s interactions with others (Rubin et al., 1995).

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