Easily Frustrated Infants: Implications for Emotion Regulation Strategies and Cognitive Functioning

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We identified easily frustrated (n=9) and less easily frustrated (n=15) infants from a cohort (n=54) of 10-month-olds with and without a family history of ADHD. Categorization into frustration groups was made on the basis of both parents' report and a laboratory assessment in which they were denied an attractive toy. Easily frustrated infants: 1) showed no significant relationship to having a family history of ADHD; 2) showed differences in frequency of emotion regulation strategies; and 3) showed significant group differences on assessments of cognitive functioning. Results indicate that easily frustrated infants are not regulating attention well and that better measures of cognitive functioning in relation to effortful control may better show group differences.

Introduction

Much of the research conducted on early personality, or temperament, has focused on early patterns of negative affect. Researchers have identified two patterns of negative affect, one being fearful reactivity and the other being frustrated reactivity. Fearful reactivity is marked by inhibition, vocal and facial indicators of fear and low heart rate variability (Calkins et al. 1996). The second pattern is characterized by anger and low tolerance for frustration (Braungart-Rieker & Stifter, 1996). Nigg, Goldsmith and Sachek (2004) identify distinctions within the negative domain between fearful (withdrawing) and hostile-angry (approaching) negative affect, as well as between approaching and non-approaching positive affect.

Table 1. *A Simplified Framework for Conceptualizing Temperament Reactivity, With Some Exemplary Traits.*

	Hedonic Valence	
Motivation	**Positive**	**Negative**
Approach	Exuberance	**** Anger proneness****
Withdrawal or non-approach	Contentment	Fear, sadness, or disgust

(Nigg, Goldsmith & Sachek, 2004)

Considerable research has been conducted to investigate the origins, correlates and physiology of fearful reactivity, however, there has been less research on frustrated reactivity. The aim of this study was to follow work done by Calkins et al. (2002) and examine early infant frustration in relation to the use of emotional regulation strategies. We also looked to do so in a group of infants at elevated risk for cognitive delay because of their high approach negative reactivity.

Nigg and colleagues (2002) have suggested that the negative approach temperament that is identified as frustrated reactivity, may constrain the development of appropriate regulatory behaviors. Calkins & Johnson (1998) demonstrated a negative relationship between the tendency to show distress during frustrating situations and certain regulatory behaviors. Similarly, Buss and Goldsmith (1998) observed that infants displayed a variety of emotion regulation behaviors during frustrating situations in an attempt to reduce negative affect.

In 2002, Calkins and colleagues measured frustration during three separate tasks and also assessed previously identified emotion regulation strategies (Calkins, 1996; Calkins & Johnson, 1998; Stifter & Braungart, 1995). She classified infants as easily and less easily frustrated. These classifications were made when there was agreement that participants were above or below average on both the laboratory and maternal report of frustration. Calkins et al (2002) found that easily frustrated infants did use different emotion regulation strategies, but found that the magnitude of differences found between the two groups, was in most cases, small. Calkins and colleagues speculated that these small effect sizes could be due to the somewhat low variability in SES and low risk within the cohort. This is problematic because the elicited distress targeted in the study is fairly infrequent in typically developing infants, despite their frustration group classification.

The regulation strategies that Calkins et al. (2002) investigated included behaviors such as self-comforting, distraction, mother orientation, etc. Nigg et al. (2004) believes that some of these regulatory behaviors rely on attention, as captured in the regulatory construct of effortful control. Kochanska, Tjebkes, & Forman (1998) suggested that easily frustrated infants are more likely to have shorter attention spans and **longer latencies to organize a response requiring focused attention**. Calkins et al. (2002) concludes that difficulties in the control of

attention and the ability to sustain attention may be related to frustration reactivity.

Attention-deficit/hyperactivity disorder (ADHD) is diagnosed by behavioral disruptions, most notably, hyperactivity, impulsivity and inattention (APA, 2003). Nigg, Goldsmith & Sachek (2004) have provided preliminary evidence that high negative approach temperament in preschool is associated with later development of ADHD. Observational studies conducted by Rothbart & Ahadi (1994) indicated that the reactive processes can be observed to begin altering the direction of attention in late infancy perhaps as early as 6 to 8 months of age. With typical development, even very young children can be observed to shift their attention from a worrisome stimulus to sooth themselves. Nigg et al. (2004) identified a pathway for ADHD in which those with a temperamental high negative approach (high anger) were to be considered as having an elevated risk of developing ADHD. This pathway is supported by evidence in which the influence of early hostility on later ADHD symptoms was mediated by weak effortful control (Goldsmith et al., 2004).

The heritability of ADHD is extremely high, with the risk of occurrence of ADHD estimated to be 15-20% given an affected sibling and 57% given an affected parent (Nigg, Goldsmith & Sachek, 2004; Nigg et al., 2004). Julia Noland, Ph.D., in the Infant Health and Cognition Laboratory at Vanderbilt University is currently conducting research to compare infants at-risk (via family history) for ADHD with non-risk controls. She is looking at differences in regards to executive functioning deficits and high approach temperament as precursors to the development of ADHD. This study referred to henceforth as the BSTART study, for the mechanism of NIMH funding.

Given the relationship between attention, effortful control and frustration, as well as the relationship between these functional difficulties and ADHD, we anticipated that overall our cohort would be at a broadly higher risk for disrupted development than Calkins' normative sample. In the current secondary coding of the BSTART participant's behavior, our aim is to reproduce Calkins' frustration classification within a group of infants that may be more extreme in frustration and lack of attention control and who will therefore show some greater group differences in effortful control and executive functioning.

While the aim of Calkins et al. (2002) study was to look at the behavioral implications of frustration status, our review of the literature leads us to believe there would be cognitive differences between the two frustration groups. The weak effortful control Goldsmith et al. (2004) associated with high anger ratings in infancy leads us to expect differences in executive functioning within the two frustration groups in our high-risk cohort. Within this ADHD pathway, Nigg and colleagues propose that infants who show high levels of negative approach as early as 6-12 months experience disruptions in later effortful control development and thus suffer secondary executive functioning deficits. Specifically, they argue this early temperament style leads to later notable hostility and the ADHD profile that includes the combined-type ADHD classification with and without a comorbid oppositional defiant or conduct disorder. Given the support for this temperament structure and the cognitive outcomes, we chose to separate the infants who we could classify as having a "double-risk" for executive functioning deficits both in the easily frustrated group and the family-risk for ADHD group and compare them to the no-risk group on executive functioning.

As a secondary analysis of the BSTART study that is currently being conducted in Vanderbilt's Infant Health & Cognition lab, we sought to identify these frustration groups based on a procedure similar to Calkins by including coding of behavior during a frustration task and reports from parents in a questionnaire. We hypothesize that we would 1) find a positive relationship between being at family risk for ADHD and being classified as an easily frustrated infant, 2) see differences between frustration groups in the emotional regulation strategies employed and 3) see differences in cognitive measures between the double-risk infants and non-risk controls.

Method

Participants

The funded BSTART study included n=25 infants with a family history of ADHD and n=29 infants without a family history of ADHD. The infants were scheduled to come in at 10 months (+/- 14 days). For the purposes of the current study we used a procedure described in detail below to post-hoc code the behavior during a frustration task to identify 24 infants as easily or less easily frustrated. Infants were classified into the easily frustrated group by scoring above the mean on the measures of distress both on the frustration task and the maternal report of distress

to limitations on the Infant Behavior Questionnaire-Revised (IBQ-R; Gartstein & Rothbart, 2003**)**. Less easily frustrated infants fell below the mean on both. From the BSTART cohort, 56% did not fall into either group. The two frustration groups did not differ in age or gender. Easily frustrated infants averaged around 9.99 months with 44% of group members being male. Less easily frustrated infants averaged around 9.94 months with 60% of group members being male.

BSTART Design and Procedure

Families were recruited through phone-call and they were screened to see if they met criteria for either the ADHD family history or the control group. In order to be included in the Family-ADHD group the interviewee had to report a family member (a parent of a sibling of the infant) who had a clinical diagnosis in childhood or as currently having ADHD symptoms. The symptoms had to 1) be endorsed in the interview as currently disrupting functioning and 2) meet criterion on a follow-up questionnaire. To meet the criteria for the non-ADHD control group, the infant had to 1) have no first- or second-degree relative with a clinical history of ADHD and 2) have no first-degree relative with current ADHD symptoms reported on the questionnaires.

After qualifying as either a family-risk infant or a control, families were then contacted by telephone and were asked to schedule a laboratory assessment. Once scheduled, the parents were mailed an IBQ-R and asked to complete it and bring it with them to the assessment. The IBQ-R was primarily filled out by the infant's mother (96%), but 1 infant had a paternal report.

The infants were assessed in the laboratory playroom and participated in multiple tasks measuring executive functioning and working memory ability. Although participants were assessed in a number of procedures, the focus of this investigation is on the plexi-glass frustration task and data from the cognitive tasks was only looked at as a secondary analysis.

Frustration Tasks: Plexi-glass task

The infant sat facing the examiner in a highchair or, if fussy, on the parent's lap. There was a short warm-up procedure and then two consecutive 30-second trials, between which the child had the opportunity to play with the toy. At the start of the trial the experimenter would place a clear plastic box (top, 11.4 cm by 11.4 cm, and three 6.35 cm high sides) on the testing table so that the infant was presented with solid sides and the only opening faced the experimenter. The experimenter then placed a small toy in the box. The toy was a small yellow plastic duck, but other toys of similar size were substituted as needed. The experimenter would then place both hands on the back of the box and hold it in place for the 30-second duration of the test trial.

Executive Functioning Tasks:

Delayed Response Task

The delayed response task measures the duration for which information can be held in working memory. During this task an object is hidden at one of two locations. After a variable delay infants visually search for the object. Based on prior finding with the task, we inferred working memory accuracy when the infant directs his or her gaze to the location where the toy had last appeared.

A-not-B

The A-not-B task is an object search delayed response task. During this task, a toy is hidden and there is a delay between the completion of the hiding event and the time at which the child is able to search for the toy. After two successful finds, the toy is moved to a new location and the infant has to overcome a bias to reach to the prior correct location.

Object Retrieval

In this reaching task, after the infant demonstrates interest in the toy, it is placed inside a clear plastic box. The toy is accessible through a single open side, or not at all. The location of the opening is then changed across six 20-second trials in order of increasing difficulty.

Towel

The towel task is a means end task in which the infant in placed in front of a wooden board with three towels (one long, two short) laying vertically down the board. Pulling the long towel results in a toy ball rolling down the board to the child. Like A-not-B, after two successes the correct ball is moved to a different location.

Measures

Behavioral Ratings of Distress:

1) Infant Behavior Questionnaire- Revised

The IBQ-R (Gartstein & Rothbart, 2003) was used to provide measures of parental perception of frustration. The IBQ-R is a 94-item questionnaire and questions are answered using a 7-point likert scale. The questions are asked in regards to the infant's behavioral and emotional responses to normal, everyday conditions over the last two weeks. The mothers' responses to IBQ-R questions are reduced to

six subscales. Following Calkins' for the frustration analysis, our focus was on the distress to limitations subscale. Questions that fell into this category included ones like, "when something the baby was playing with had to be removed, how often did s/he: cry or show distress for a time? Seem not bothered?"

2) Laboratory Assessment of Frustration

A plexi-glass task was conducted as part of the BSTART study to determine the developmental challenge presented by clear barriers (Noland & Rodrigues, under review). As a secondary analysis a new code file was developed in Procoder to determine frustration and emotional regulation strategies during this task. The coding and resultant variables were modeled as closely as possible on Calkin et al. 2002.

Coders, blind to family status, rated frustration measures during the two consecutive 30-second plexi-glass frustration trials. Each 30-second trial was first broken down into three 10-second intervals. Three frustration measures were coded for during the task. First, the intensity of the infant's distress was rated from 0-5, with 0 indicating no distress and 5 indicating screaming or crying. Next, the frequency of distress as presence or absence was marked during each 10-second interval, and finally, the peak of distress was rated as 0-5 throughout both 30-second trials. All three were significantly related (range r=0.7964-0.9283). A z-score was assigned to each of the three measures, and then summed as the distress z-score

Following Calkins' classification, infants were characterized as easily frustrated versus less easily frustrated if they scored at or above the 50^{th} percentile on both the laboratory index of frustration (distress z-score) and the maternal report of distress to limitations. The infants classified as less easily frustrated scored below the mean on both. The correlation between the distress z-score n and the maternal report was 0.4535. Although this was not statistically significant it was similar in magnitude to that found in Calkins' study**.** Infants in the easily frustrated group scored at -0.02-or-above on the laboratory measure of frustration (mean -0.02, standard deviation 2.85), and at 3.87-or-above on the maternal report (mean 3.87, standard deviation 0.80). Of the BSTART sample, 9 infants made the criteria for the easily frustrated infant group and 15 made the less easily frustrated group. Thirty infants did not fall into either group.

Emotion regulation behaviors

In addition to the frustration measures, the two 30 second trials on the plexi-glass box task were coded for emotional regulation strategies. Each 10 second interval was also coded for previously identified behaviors established as indicators of emotion regulation (Calkins, 1996; Calkins & Johnson, 1998). These behaviors were coded for presence or absence in the 10-second intervals for both 30-second trials. These six measures were outlined by Calkins et al. but due to slight differences in our task, two had to be changed (numbers 5&6). These measures included:

1. *Self-comforting: thumb sucking, hair-twirling, or other auto-manipulative behavior.*
2. *Distraction: Attending to or manipulating an object other than the task object.*
3. *Physical: Banging, kicking, throwing, hitting the task object, or any of these directed towards mother or experimenter.*
4. *Scanning: Visually exploring the environment, with duration of orienting on a given object less than 2 seconds.* (Calkins et al., 2002)
5. Adult orientation: Looking at experimenter or mother, talking to experimenter or mother, touching or pulling on experimenter or mother.
6. Degree of task-object orientation (DTOO): interest in task object, latency to look away from task object, duration of manipulation

The adult orientation measure was an adaptation of Calkins' "mother orientation" emotional regulation strategy. During Calkins' frustration tasks, the infant's mother was always in view of the child and there was no experimenter present. During our trial, the mother was always seated behind the child and the experimenter was in direct view of the child. Because of this we had infants who oriented both to their mothers as well as to the experimenter as what we believe to be the same emotion regulation strategy. We coded both mother and experimenter orientation separately, but then combined them as presence or absence during the 10-second intervals and regarded it as adult orientation.

The degree of task-object orientation (DTOO) measure was also an adaptation of Calkins' work, but specifically we replaced her single emotional regulation strategy "orienting to task object" with a measure of attention to novel, accessible toys from the same paper. Since our infants were placed directly in front of the plexi-glass box, easily most infants

oriented to the task objects during every 10-second interval (xx). In Calkins study, orientation to test object was very rare. The toys were in front of the child but not easily in the infant's reach. We therefore came up with the DTOO measure that included 3 measures. The first of these was coded rating of interest during the 10-second intervals on a scale from 0-5, with 0 indicating no interest to 5 being intense engagement with the object. The second measure was the latency to look away from the object in trial 1 which was measured using frame-by-frame coding of the infant looking at the toy from the time it was placed in the plexi-glass box till the time he or she first looked away. Finally, the duration of manipulation in both trial 1 and trial 2 was measured using frame-by-frame coding in which infants engagement with the toy while both actively looking and touching the plexi-glass box was marked. These three measures were then combined into a summed z-score and used as the measure of degree of task-object orientation. The relationship between all of these three measures was significant (range r=0.27321-0.60252).

Executing Functioning Measures

Infants who were identified as both members of the easily frustrated group as well as having a family-history of ADHD were identified as double-risk infants (n=7). These infants were then compared on cognitive measures to their counterparts, the infants who were identified as both less easily frustrated and had no family-history of ADHD (n=18).

For the delayed response task, a score was assigned to each infant based on the number of accurate looks to the previous toys location once the toy was hidden and completion of the delay, out of the number of opportunities for a response.

An index score was calculated for success on the A-not-B task. The score reflects both earning increasing levels of delay as well as succeeding on them. The index score ranges from 0, meaning no reversal trail was earned, to 10, which is succeeding at the longest delay.

An index score was also calculated for success on the Object Retrieval task. This measure was a fraction of the number of successful toy retrievals out of the six possible trials.

We did not compare infants of their means-end success on the towel task because that data was not yet available. For the purpose of the current study we designed an exploratory code to try and capture the process of cognitive reappraisal. This is where, as discussed in the literature, frustration may disrupt experiences where infants could learn the problem solving skills required in late executive functioning tasks. This new coding method was developed to determine if infants were able to recover from failure and make a correct second choice. Since the majority of infants failed on the first reversal of the towel means-end task, we specifically looked at their cognitive reappraisal time during this trial. The time between first failure and making the correct choice was then quantified and compared between groups.

Results

Frustration Group and ADHD-Family Risk Status

We first ran a frequency analysis to determine if there was a relationship between the BSTART family-history ADHD/control groups and our newly formulated frustration groups. Table 1 presents the number of subjects that fell into each group. As apparent, more less easily frustrated infants were included in the no family-history ADHD group, while frustration group was distributed evenly across the family history of ADHD and non-family history groups. This analysis revealed a difference in distribution frustration rating and family ADHD status that was in the expected direction, but not statistically significant.

TABLE 1

	Less Easily Frustrated	**Easily Frustrated**	**Total**
Control	10	4	14
Family History ADHD	4	5	9
Total	14	9	23

Chi-Square = 1.6747 p<0.1956

Group Differences in Emotion Regulation

To determine if there were group differences in emotional regulation behaviors, t-tests were conducted comparing emotional regulation strategies across the frustration groups. Table 2 presents the means, by group, for each regulation strategy as well as the significance test. As the table indicates there were differences in the means of the self-comforting and DTOO variables reflecting a moderate effect size (Cohen's D= 0.58 and 0.56 respectively). Easily frustrated infants engaged in less self-comforting and physical emotional regulation strategies, yet showed more degree of task object orientation. No relations

existed between frustration group membership and distraction, scanning, or adult orientation regulation strategies. The analysis revealed some differences between groups in use of emotional regulation strategies, but none were statistically significant.

TABLE 2
Emotion Regulation Measures for Easily Frustrated and Less Easily Frustrated Infants

	Less Easily Frustrated (n= 15)		Easily Frustrated (n=9)			
	M	**SD**	**M**	**SD**	**t**	**p<**
Self Comforting	0.2333	0.2423	0.1111	0.1443	1.55	**0.1358**
Distraction	0.3888	0.2999	0.2778	0.2357	1.01	0.3257
Physical	0.3893	0.4071	0.2222	0.2035	1.34	**0.**1955
Scanning	0.3444	0.2919	0.2778	0.2357	0.61	0.5472
Adult Orientation	0.8000	0.2377	0.7022	0.2166	1.03	0.3156
DTOO	-1.6579	3.7582	0.3585	3.3573	-1.36	**0.1897**

Cognitive Measures

To determine whether there were differences between our double-risk and control infants in regards to cognitive measures, t-tests were conducted on the four tasks. Significant differences were found between groups in the working memory and towel reappraisal tasks. The double-risk infants actually performed better on both the working memory and towel reappraisal task. The towel task had fewer participants due to the fact that it was one of the last tasks and many babies had already exhausted out, as well as the fact that some babies never earned reversals.

TABLE 3
Cognitive Measures for Double Risk and Control Infants

	Double Risk (n = 5)		Control (n=10)			
	M	**SD**	**M**	**SD**	**t**	**p<**
A-not-B Task	4.0000	1.4142	3.7000	1.2517	-0.4	0.6992
Index					0	
Object Retrieval Index	3.6000	2.4083	4.5000	1.1785	0.79	0.4656
Working Memory Accuracy	0.4932	0.0956	0.3943	0.0910	-1.92	**0.0925**
	Double Risk (n=2)		**Control (n=7)**			
	M	**SD**	**M**	**SD**	**t**	**p<**
Towel Reappraisal	7.4550	0.5869	29.3343	20.7229	2.79	**0.0314**

Discussion

The goal of this study was to identify a group of infants who displayed higher ratings of frustration both by maternal report and by laboratory assessment. Once identified, we wanted to compare these infants to the control group in regards to their emotion regulation behaviors as well as to cognitive measures. We identified infants who could be classified as easily and less easily frustrated from a larger project. We then assessed them behaviorally during the frustration task and then in terms of cognitive outcomes based on our executive functioning tasks. The findings showed that the easily frustrated infants showed no significant difference within ADHD family-risk groups, used different emotion regulation strategies and showed some cognitive advantages.

Although we saw a slight tendency within the non-risk infants to be placed in the less easily frustrated group, we did not find the expected statistically significant relationship between frustration group membership and family-history status.

While we did not find significant differences between groups in use of emotional regulation strategies, we did see trends within two of the strategies. Calkins et al. (2000) found that easily frustrated infants were more likely to a display a physical response and to scan the environment during a frustrating task. In her study, less easily frustrated infants showed more distraction and mother orientation. She did not find any differences in self-comforting or focal object orientation. We found a different pattern. In our study, easily frustrated infants engaged in less self-comforting and self-comforting and in more degree of task-object orientation. We did

not find differences in scanning, distraction, physical or adult orientation.

In our study, the easily frustrated infants showed less self-comforting than the less easily frustrated infants. This emotional regulation strategy can be seen an effective coping behavior that could be denying them the ability to lessen their frustration levels. It is possible that the less easily frustrated infants learn this and engage in self-comforting, while the easily frustrated infants do not adapt their behavior.

Another regulation strategy difference was in regards to degree of task-object orientation during the frustrating task. Our easily frustrated group showed significantly more focused attention on the desired toy in the plexi-glass frustration task. As presented in the introduction, we hypothesized that the ability to control attention was related to the decrease in negative emotionality in infancy. Here we observed that infants who were able to control their attention away from the frustrating object during the plexi-glass trial were less likely to show frustration. The infants who showed latencies in looking away and continued to try and get the toy were more likely to get frustrated. Rothbart and Ahadi (1994) conducted a study and found that toddler's ability to influence the allocation of their attention helped them regulate their reactive responses. This allowed them to turn attention deliberately away from upsetting information and begin to soothe themselves. Our findings suggest, that easily frustrated infants become so focused on the thing that is frustrating them that they cannot focus on calming themselves down, which also supports why they are not engaging in as much self-comforting.

Finally, we saw some significant differences in our cognitive measures. Contrary to our hypothesis, the differences we saw between groups in regards to the working memory task and the towel reappraisal task showed that the double-risk group was actually doing better on the tasks. It is possible that based on the four approach types Nigg and colleagues outlined, there aren't actually such strict lines between groupings. It is possible that the anger prone infants with high negative approach actually also experience some of the benefits of the exuberance temperament. Specifically in regards to the Towel reappraisal task, it may be that once the infants have failed they are still so determined to get the toy that they make a second choice without much thought and succeed. These are all hypothetical ideas, but we cannot take any significant statements from our data unless they are repeated with larger sample sizes.

Weaknesses of our study include our small sample size and like Calkins, small magnitudes of effect within our emotional regulation differences. While our study showed some trends and gave hope for bigger findings, replication in a larger subject pool would help to highlight some of the proposed ideas.

One of the strengths of our study was that we were able to compare our frustration groups in a sample where we would expect to see larger group differences. We were also able to modify our measures and task to get a different look at degree of object orientation and how that attention control differs between frustration groups. Another strength of our study was our ability to explore the implications of these classifications by comparing our infants on cognitive functioning.

The implications of our findings would definitely be strengthened by replication in a larger population, but it may be helpful for parents of children who show characteristics of our easily frustrated group to try and teach their children some of the positive emotion regulation strategies that were outlined, specifically self-comforting because that seems to be where they are lacking. These skills while apparent in infancy can play an important role in development later in life and could benefit from early intervention.

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