Infants’ responses to arm restraint at 2 and 6 months: A longitudinal study

Ughetta Moscardino*, Giovanna Axia

Department of Developmental and Social Psychology, University of Padova, Via Venezia 8, 35111 Padova, Italy

Received 26 January 2005; received in revised form 18 July 2005; accepted 18 July 2005

Abstract

This study examined the continuity, stability, and change of infants’ responses to a frustrating event (i.e., arm restraint) between 2 and 6 months in terms of both negative reactivity and its regulation. Fifty-two healthy, full-term infants and their mothers participated in an arm restraint procedure. Infant behaviors were observed and coded at 3-s intervals. The results showed that infants’ reactivity to frustration and their ability to regulate such reactivity significantly changed in level over time. Individual differences in frustration reactivity were stable across the two ages; two regulatory behaviors (i.e., orientation to mother and avoidance) could be observed in the same percentage of babies at both 2 and 6 months. At 6 months, several significant associations between frustration reactivity and infant regulatory behaviors emerged. These findings suggest that the arm restraint procedure may be usefully employed to study individual differences in infants as young as 2 months of age.

© 2005 Elsevier Inc. All rights reserved.

Keywords: Infancy; Frustration reactivity; Regulatory behaviors; Arm restraint

In the past decade, the issues of temperamental reactivity and the regulatory processes involved in modulating such reactivity have received increased attention from developmentalists. In Rothbart’s model (Rothbart & Derryberry, 1981), reactivity is defined as the excitability, responsivity, or arousability of the behavioral and physiological systems of the individual, and can be measured in terms of several parameters (i.e., latency of response, rise time, peak intensity, and recovery from a peak excitation); regulation refers to the internal processes involved in coping with reactivity and includes attention, approach/withdrawal, and self-soothing or self-comforting behaviors (Rothbart & Derryberry, 1981). Rothbart (1989) also distinguished between positive and negative reactivity. In recent studies, infants’ negative reactivity has been observed in the context of specific frustration tasks, such as pacifier withdrawal (Fish, Stifter, & Belsky, 1991), arm restraint (Stifter & Spinrad, 2002), and toy removal (Stifter & Jain, 1996). Among these, the arm restraint procedure appears to be the preferred assessment strategy when studying infant frustration in the second-half of the first year of life (see Braungart-Rieker & Stifter, 1996; Stifter & Fox, 1999). However, to date there are virtually no studies documenting the effectiveness of this procedure with infants younger than 5 months. The present study aimed at examining the continuity, stability, and change of reactivity to frustration and its regulation between 2 and 6 months via administration of an arm restraint procedure. In addition, we were interested in analyzing the relations among these behaviors at both ages. The general purpose was to determine whether arm restraint may be considered
as a valid tool to measure early individual differences in frustration reactivity and regulation, and to assess its heuristic value in the first months of life.

Research on the stability, continuity, and change of negative reactivity across the first 6 months of life has focused on reactivity to novelty (Calkins, Fox, & Marshall, 1996; Fox, Henderson, Rubin, Calkins, & Schmidt, 2001; Kagan, 1995a, 1995b, 1999a, 1999b; Kagan & Snidman, 1991), stress reactivity (Axia & Weisner, 2002; Gunnar, Brodersen, Nachmias, Buss, & Reganso, 1996; Lewis & Ramsay, 1995a, 1995b, 1999a, 1999b; Ramsay & Lewis, 2003), or frustration reactivity (Lewis, Alessandri, & Sullivan, 1990; Shapiro, Fagen, Prigot, Carroll, & Shalan, 1998; Stifter & Fox, 1990; Stifter & Spinrad, 2002; Sullivan, Lewis, & Alessandri, 1992). Infant response to frustration deserves particular attention not only because it has been recognized as a major temperamental difference (Rothbart, 1981), but also because it has important implications for the later development of personality and social behavior (Rubin, Caplan, Fox, & Calkins, 1995). Frustration has been defined as an increase in behavioral responding that occurs when goal-directed behavior is blocked (Amsel, 1958; Brown & Farber, 1951; Lawrence & Festinger, 1962), and can be observed in both animals and young infants. For example, in a series of studies conducted by Sherman and Sherman (1925) and Sherman, Sherman, & Flory (1936), the authors observed that when infants younger that 6 months were blocked in their movements through arm and leg restraint, they initially responded with increased tension, breath holding, and increased movement of the arms and legs. These and other studies suggested that infants' reactions to frustration were expressed by increased motor activity and the occurrence of negative vocalizations. However, to date there are not many studies on the development of frustration reactivity in the first half-year of life.

Two different approaches have been used to investigate the developmental course of infant reactions to frustration. The first includes work by Lewis and colleagues (Lewis et al., 1990; Lewis, Sullivan, Ramsay, & Alessandri, 1992; Sullivan et al., 1992; Sullivan & Lewis, 1989), who conducted an extensive series of investigations to describe 2- to 8-month-old infants' emotional reactions (facial expressions) to the violation of expectancy that occurs in extinction of operant conditioning. Infants in these studies received a brief audiovisual stimulus contingent upon arm pulling. Sullivan et al. (1992) reported a high concordance between arm pulling and the expression of anger during extinction, indicating that a brief exposure to extinction produces frustration-like changes in emotional reactivity. The authors found stability in the expression of anger during extinction across 2-month periods between 2 and 4 months of age, 4 and 6 months of age, and 6 and 8 months of age. Moreover, they found a significant increase in interest and anger expressions from 2 to 4 months of age, but no differences from 4 to 6 or 6 to 8 months of age. However, it is not clear whether these reactions may be generalized to other conditions (Sullivan et al., 1992). A different approach was adopted by Stifter and Fox (1990). In a longitudinal study of infants from birth to 5 months of age, these authors assessed reactivity to frustration using pacifier-withdrawal (McGrade, 1968) at age 2 days, and an arm restraint procedure (Provost & Gouin-Decarie, 1979) at age 5 months. Findings of this study showed that newborn negative reactivity was stable across the 5-month period. More specifically, infants who cried to pacifier withdrawal were more likely to cry to arm restraint, and those who did not respond during the newborn period did not cry at 5 months. Braungart-Rieker and Stifter (1996) examined continuity, stability, and change in behaviors reflecting infant reactivity on a sample of infants observed in laboratory situations designed to elicit frustration (i.e., arm restraint, toy removal) when they were 5 and 10 months of age. In this study, behaviors indicative of reactivity included objective ratings of average intensity cry, peak intensity cry, and latency to cry. Results showed that 10-month-old infants exhibited significantly higher peak intensities in crying than 5-month-olds; no stability was found for the negative reactivity composite. A limitation of these studies concerns the use of two laboratory situations that were not exactly equivalent. Considering the general lack of studies on the early development of infants' frustration reactivity in response to arm restraint, our study aimed at investigating its continuity, stability, and change between 2 and 6 months of age using equivalent procedures in order to obtain comparable results.

The development of infant regulatory behaviors across the first half-year of life has been addressed using different experimental paradigms. For example, Lewis and Ramsay (1995a, 1999) longitudinally observed infants' time for quieting after inoculation; Rothbart, Ziaie, and O'Boyle (1992) studied infants' regulatory behaviors in the laboratory through presentation of different emotion-eliciting stimuli; Shapiro et al. (1998) examined infants' regulatory behaviors longitudinally in the context of two violation of expectancy tasks. However, there are virtually no studies investigating infants' regulation of distress during arm restraint in the first 6 months of life. The only empirical data available focus on infants starting from 5 months of age, and have been collected in a series of studies conducted by Stifter and co-workers (Braungart-Rieker & Stifter, 1996; Stifter & Jain, 1996; Stifter & Spinrad, 2002) to address—among other aspects—the issue of continuity, stability, and change of infant regulatory behaviors exhibited during frustrating situations in the
laboratory (i.e., arm restraint). These behaviors included object orientation, mother orientation, scanning, avoidant behaviors, and communication. Braungart-Rieker and Stifter (1996) reported no significant stability of their regulation composite from 5 to 10 months, and found that infants showed significantly lower levels of orienting and avoidance behaviors and greater levels of communication at 10 months than at 5 months. In a recent paper, Stifter and Spinrad (2002) classified the same sample into excessive criers and typical criers based upon 24-h cry diaries completed by parents when their infants were 6 weeks of age. Infant reorienting, self-comforting, avoidance, looks to the experimenter, and non-negative vocalizations were used as indexes of regulation and later combined to form a regulation composite score. Comparison between cry groups revealed that excessive criers showed lower levels of self-regulation during frustration tasks at both 5 and 10 months, but this effect was only present for boys. In addition, by 10 months of age all infants showed significantly lower levels of self-regulation than at 5 months; this decrease appeared to be primarily a function of boys in the typical criers group. The authors suggest that this finding may be due to the potency of the arm restraint procedure for older infants (Camras, Oster, Campos, Miyake, & Bradshaw, 1992). Stifter and Jain (1996) examined the stability of infant regulatory behaviors during frustration tasks when infants were 5, 10, and 18 months of age. Their regulation factor, which included infant attentional strategies, avoidance, self-comforting, and communication behaviors, was not stable across the three ages. Since little is known about the regulatory behaviors exhibited by infants in response to arm restraint as early as 2 months of age, one of the goals of the present study was to examine the preferred use of different regulatory strategies at different developmental stages in an attempt to provide new data on the expression and development of these behaviors.

A final issue concerns the relations between infant reactivity to frustration and its regulation. Although there is evidence that reactivity and regulation are two separate and independent parameters of infant behavioral response to stress (Lewis & Ramsay, 1995a; Lewis & Thomas, 1990; Worobey & Lewis, 1989), there are few longitudinal data available on the early coordination between the infants’ level of distress and the evolving ability to modulate negative affect in response to a frustrating event. In their studies on infant frustration during arm restraint, Braungart-Rieker and Stifter (1996) examined structural continuity and discontinuity of infant reactivity and regulation from 5 to 10 months. Using confirmatory factor analysis, the authors found that behaviors were organized into two similar factors at 5 and 10 months (reactivity and regulation), but the relation between these factors became increasingly independent over time: reactivity and regulation were negatively correlated at 5 months, but were uncorrelated at 10 months. Interestingly, model-fitting revealed cross-dimension but not within-dimension stability (5-month reactivity predicted 10-month regulation). In a related study, Stifter and Jain (1996) reported only a modest correlation between their reactivity and regulation composites at infants’ age 5 months (r = −.19), which disappeared at 10 months; however, at 18 months this association became highly significant (r = −.41). These studies seem to show that by the age of 5/6 months, negative reactivity and regulation may be considered as two interdependent constructs, and that highly reactive infants have more difficulties in regulating their negative arousal. However, the antecedents of this relationship need to be further explored.

To summarize, several studies have investigated the development of frustration reactivity and regulation in infancy using different experimental paradigms, but virtually no information is available on infants’ responses to arm restraint between 2 and 6 months in terms of continuity, stability, and change. In this paper, continuity was conceptualized as the “consistency in average group score on some dimension over time” (Lamb, Bornstein, & Teti, 2002, p. 15), and was assessed empirically by examining group means; specifically, we measured absolute continuity, defined as the constancy in the amount of a particular characteristic over time within a single individual (see Caspi, 1998). Stability refers to the “consistency over time in ranking of individuals in a group on some dimension or aspect of development” (Lamb et al., 2002, p. 15), and was indexed by correlation coefficients. We assessed infants at 2 and 6 months, as these ages represent important developmental milestones involving a reorganization in the biological, behavioral, and social domain (Erde, Gaensbauer, & Harmon, 1976). In addition, previous research has demonstrated that by 2 months infants express anger/frustration (Lewis et al., 1990), and that at 5/6 months arm restraint is an effective elicitor of frustration reactivity (Camras et al., 1992). Our study addressed the following issues:

1. Do frustration reactivity and the behaviors used to modulate such reactivity change according to the babies’ age?

We expected that infants would show higher levels of frustration reactivity at 6 months than at 2 months due to the significant developmental changes occurring in this age span (Cole & Cole, 2001). Moreover, since past research has shown that across the first 6 months of life infants increasingly tend to orient their attention to objects and
less towards their mothers in moderately stressful situations (Gianino & Tronick, 1988; Rothbart et al., 1992), we expected to find a similar pattern.

2. Are reactivity to frustration and regulation stable or do they change across the age span considered in our study? Considering the lack of literature on infants’ responses to arm restraint between 2 and 6 months, no a priori hypothesis was formulated.

3. Is the infants’ level of distress during arm restraint related to their regulatory behaviors? If so, which are the strategies predominantly used by the infants at both ages? Since there is a general consensus among researchers that negative reactivity and regulation become increasingly coordinated as infants learn to refer to their caregivers as a means to regulate distress (Kopp, 1989, 2002; Thompson, 1990, 1994), we expected to find some association between infant frustration reactivity and regulatory behaviors at 6 months. In addition, we tested whether the preferred regulatory strategies used by infants in response to arm restraint differed according to the babies’ age.

1. Method

1.1. Participants

The sample consisted of 52 infants (25 girls, 27 boys) assessed longitudinally at 2 and 6 months of age (±2 weeks at each age). Infants and their mothers were recruited through a local unit of the National Health System in Padova, Italy. The Unit staff was informed about the study and, with the help of several staff members, mothers were contacted both personally and via telephone by the first author about volunteering for a larger, cross-cultural research project on the early socialization of state, attention, and affect. Interested mothers gave their permission for subsequent telephone contact in order to schedule the home visits; informed consent was obtained from both parents on the first home visit. Selection criteria for participation were: (1) both parents living in the home; (2) both parents of Italian origin; (3) no significant medical or psychiatric diseases in the family. Infants were full-term and healthy; mean gestational age was 39.8 weeks (S.D. = .89, range = 37–42); mean birth weight was 3335 g (S.D. = 391, range = 2390–4240), and mean Apgar score at 5 min was 9.8 (S.D. = .67, range = 7–10). Birth order was distributed as follows: 61% first born, 35% second born, and 4% third born. Most families were middle-class; mothers’ mean age was 33 (S.D. = 4.5, range = 22–42) and mean education 13 years (S.D. = 3.2, range = 8–23). Of the 52 original participants, 45 (23 girls, 24 boys) were available for the second assessment. Infants who did not participate at the 6-month assessment did not systematically differ on any demographic variable from those who remained in the investigation.

1.2. Procedures

At 2 months postpartum, mothers and their infants were visited at their homes twice. On the first visit, the first author got acquainted with the participating families, obtained informed consent and asked mothers to complete a demographics questionnaire. After about a week, a home session was scheduled during which infants were observed in an arm restraint procedure designed to elicit frustration reactivity and regulatory behaviors. At 6 months postpartum, another home session was conducted to assess infant frustration and its regulation (see above). Home sessions were always scheduled at the same time of day (i.e., morning), when babies were alert and not too hungry, sleepy or tired. If the infants became fatigued or distressed, the sessions were terminated and rescheduled on another day. All observations were videotaped using a camcorder for later coding.

Arm restraint at 2 and 6 months. To elicit frustration reactivity, an arm restraint procedure was administered at both ages (Braungart-Rieker & Stifter, 1996; Stifter & Fox, 1990; Stifter & Jain, 1996). Mothers were asked to place their babies in a reclining infant seat situated across from them and to gently restrain their infants’ arms down to their sides. Mothers were also instructed to maintain a neutral expression and to refrain from verbally interacting with their babies. After 2 min of arm restraint or 10 s of hard crying, mothers were cued to release their infants’ arms and told that they could soothe him/her if necessary, using whatever method they considered appropriate (see Braungart-Rieker & Stifter, 1996, Stifter & Braungart, 1995). The entire procedure was videotaped for later coding. The 2 min of arm restraint were completed by 67 and 54% of the infants at 2 and 6 months, respectively. For these infants, the mean length of arm restraint was 102.2 s at 2 months (S.D. = 25.7, range = 30–120) and 99.7 s at 6 months (S.D. = 27.3, range = 12–120). The remaining infants followed the procedure for an average of 87.7 s (S.D. = 29.9, range = 20–120) at 2 months, and 82.1 s (S.D. = 30, range = 12–120) at 6 months.
Table 1
Description of behavioral codes for infant regulatory behaviors at 2 and 6 months

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orientation to mother</td>
<td>Looks at mother</td>
</tr>
<tr>
<td>Orientation to object</td>
<td>Looks at object (e.g., infant seat, camera, own body)</td>
</tr>
<tr>
<td>Scan</td>
<td>Looks around the room, without focusing on any specific object</td>
</tr>
<tr>
<td>Avoid</td>
<td>Body arches; baby tries to get out of infant seat</td>
</tr>
<tr>
<td>Self-soothe</td>
<td>Mouthing; sucks on mother’s hand/arm</td>
</tr>
</tbody>
</table>

1.3. Behavioral rating/coding

1.3.1. Frustration reactivity
At 2 and 6 months, infant reactivity to frustration was rated during the 2-min arm restraint episode. Two separate behaviors were coded every 3 s on a five-point scale as indexes of frustration reactivity: distress vocalizations (0 = no negative vocalizations; 1 = single moans, no protest; 2 = prolonged moaning, protest; 3 = whimpering or fussing; and 4 = crying), and motor activity (0 = no movement; 1 = movement of one body part; 2 = movement of two body parts; 3 = movement of three body parts; 4 = movement of four body parts). The latter scale included specific types of body movements in response to arm restraint (e.g., movement of head, shoulders, and limbs). Previous research indicates that distress vocalizations (or crying) may be considered as a valid measure of negative affect and arousal in response to a frustrating event (Calkins et al., 1996; Stifter & Braungart, 1995), whereas motor activity is thought to be a component of early temperamental reactivity (Kagan & Snidman, 1991; Kagan, Snidman, & Arcus, 1998) which has been used to code infants’ bodily responses to arm restraint (Camras et al., 1992). Two independent coders were trained until acceptable agreement (Cohen’s kappa > .75) was achieved. Twenty percent of all infant reactivity observations were coded to assess coder drift reliability. Inter-rater reliability resulted in a mean Cohen’s kappa of .95 for distress vocalizations, .82 for motor activity at 2 months, and .92 for distress vocalizations, .88 for motor activity at 6 months. These behaviors were averaged across epochs and due to their significant intercorrelations at both 2 months (r = .51, p < .0001) and 6 months (r = .41, p < .01), the scores were summed to yield a global distress score for each age. Following Rothbart and Derryberry (1981), two other measures of distress were derived: peak intensity distress, defined as the total number of consecutive intervals in which the babies scored their highest ratings on the distress measure, and latency to maximum distress, defined as the total number of intervals before the babies showed their most intense negative reaction (see Braungart-Rieker & Stifter, 1996). These variables were used in subsequent analyses.

1.3.2. Regulatory behaviors
As reported in other studies (Calkins, Dedmon, Gill, Lomax, & Johnson, 2002; Stifter & Spinrad, 2002), infants’ regulatory behaviors were coded during the 2-min arm restraint episode at both ages. The selection of relevant behaviors was based on previous research (see Buss & Goldsmith, 1998; Crockenberg & Leerkes, 2003; Stifter & Braungart, 1995) and included orientation to mother, orientation to object, scanning, avoidance behaviors, and self-soothing (i.e., mouthing). A brief description of the behaviors can be found in Table 1. The presence/absence of infant regulatory behaviors was coded at 3-s epochs. Two independent coders were trained until acceptable agreement (Cohen’s kappa > .75) was achieved, and overlapped on 20% of the sample. Inter-rater reliabilities for the 2-month behaviors averaged .93 by Cohen’s kappa (range = .81–.99). At 6 months, inter-rater reliabilities averaged .92 by Cohen’s kappa (range = .81–.99). The total amount a regulatory behavior was exhibited was divided by the total number of intervals of the arm restraint episode for each subject. These proportions were used in subsequent analyses.

Self-soothing (i.e., sucking on mother’s hand) was dropped from further analyses because it only occurred at 6 months (in 5 infants), and therefore would have prevented comparison with the 2-month regulatory behaviors.

2. Results
The main issue addressed in this study concerned the developmental course of infant reactivity to frustration and its regulation between 2 and 6 months. First, age changes in frustration reactivity and regulatory behaviors were analyzed,
second, stability of infant behaviors was examined; third, intercorrelations between frustration reactivity and regulation at 2 and 6 months were considered.

Preliminary analyses focused on the influence of several sociodemographic variables to determine whether they should be included in subsequent analyses or as covariates in the analyses. Three types of measures were examined: parity, maternal age, and maternal years of education. Simple correlations revealed that neither maternal age, nor years of education were significantly associated with infants’ reactivity to frustration; similarly, independent samples t-tests showed that parity did not have any influence on infant frustration reactivity. As for regulatory behaviors, non-parametric tests were used due to skewness of the 2-month variables (see next paragraph). Spearman correlations and Mann–Whitney tests revealed that the selected sociodemographic variables were not significantly related to infant regulatory behaviors at neither 2 months nor at 6 months. Hence, these variables were not included in subsequent analyses.

2.1. Age changes

2.1.1. Frustration reactivity

Our first goal was to test whether infants differed in their level of frustration reactivity across the two ages. Kolmogorov–Smirnov tests indicated that all distress variables were normally distributed. Therefore, age and gender differences were examined for each of the distress measures by means of a 2 (gender) × 2 (age) repeated-measures ANOVA, with gender as the between-subjects factor and age as the within-subject factor. All main and interaction effects involving gender were non-significant. However, the ANOVAs revealed a significant age effect for two of the three variables examined. Table 2 presents the means, standard deviations, F-tests, and effect-sizes for the three ANOVAs. The analyses showed that at 6 months, infants exhibited higher levels of distress and peak distress than at 2 months, whereas no significant difference in latency to reach maximum distress was found between the two ages.

2.1.2. Regulatory behaviors

Since the analysis of age change assumes normal distribution patterns among the variables, their skewness was examined at both 2 and 6 months. Kolmogorov–Smirnov tests for normality of distribution revealed that the four regulatory behaviors were all skewed at 2 months, with D-values ranging from .22 to .28 (p < .05); in contrast, all variables were normally distributed at 6 months, with D-values ranging from .13 to .19 (p < .05). As a consequence, level changes in infant regulatory behaviors were analyzed using non-parametric tests. Since preliminary Mann–Whitney tests showed that there were no significant differences between girls and boys on the four regulatory behaviors, subsequent analyses were performed on the pooled sample. Wilcoxon-tests revealed that between 2 and 6 months, there was a significant increase in infants’ object orientation and scanning behaviors, whereas mother orientation and avoidance behaviors significantly decreased. Table 3 describes the mean proportions, standard deviations, and Wilcoxon-tests for each of the regulatory behaviors exhibited by the infants in our sample in response to arm restraint.

2.2. Stability

2.2.1. Frustration reactivity

In order to address the issue of stability, Pearson correlations were computed among measures of infant frustration reactivity assessed at 2 and 6 months. Results indicated that distress and peak distress were moderately stable over time:
Table 3

Mean proportions, standard deviations, and age effects on infant regulatory behaviors at 2 and 6 months

<table>
<thead>
<tr>
<th>Behavior</th>
<th>2 months M</th>
<th>2 months S.D.</th>
<th>6 months M</th>
<th>6 months S.D.</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother orient</td>
<td>.65</td>
<td>.37</td>
<td>.41</td>
<td>.26</td>
<td>−3.20***</td>
</tr>
<tr>
<td>Object orient</td>
<td>.42</td>
<td>.39</td>
<td>.78</td>
<td>.22</td>
<td>−4.17****</td>
</tr>
<tr>
<td>Scanning</td>
<td>.08</td>
<td>.14</td>
<td>.14</td>
<td>.13</td>
<td>−2.62**</td>
</tr>
<tr>
<td>Avoidance</td>
<td>.16</td>
<td>.19</td>
<td>.09</td>
<td>.09</td>
<td>−2.28*</td>
</tr>
</tbody>
</table>

Note. N=45.

* p < .05.
** p < .01.
*** p < .001.
**** p < .0001.

Infants showing high levels of distress and peak distress during arm restraint at 2 months were more likely to exhibit the same intensity of reaction 4 months later in the same situation, r(45) = .36; p = .016; and r(45) = .34, p = .021, respectively. In contrast, latency to show maximum distress was not stable across the two ages, r(45) = .02, p = .904.

2.2.2. Regulatory behaviors

Next, we examined the stability of regulatory behaviors used by infants to modulate their level of negative arousal. This issue was addressed following two different analytic strategies. First, Spearman correlations among the four variables measured at 2 and 6 months were computed. Results showed that mother orientation, object orientation, scanning, and avoidance behaviors were not stable across the two ages, with r ranging from −.01 to .24. Second, McNemar tests on the presence/absence of each regulatory behavior were performed in order to determine whether the percentage of infants exhibiting a certain behavior at 2 months significantly changed (instability) or remained constant (stability) between 2 and 6 months (see Fig. 1). Findings revealed that infants’ use of mother orientation and avoidance were stable over time, p = .250 and .210, respectively, whereas object orientation and scanning did not show such stability (p = .002 and .019, respectively).

2.3. Relations among frustration reactivity and regulatory behaviors

Another aspect investigated in this study concerned the relation of frustration reactivity with the strategies infants exhibit to regulate negative affect during arm restraint. As a first step, we sought to reduce the number of variables in order to yield more interpretable results. Hence, separate exploratory factor analyses on the three distress variables (i.e., global distress, peak intensity distress, and latency to maximum distress) were performed at 2 and 6 months. A one-factor solution emerged at each age, with factor loadings of the three measures (in absolute values) ranging from .57 to .93 and from .54 to .90, respectively; the standardized factor scores within each age group were used to create composite measures of frustration reactivity. At 2 months, the frustration reactivity composite explained 68%
of the total variance; at 6 months, 61%. A composite measure of regulation could not be created due to the skewness of these behaviors at 2 months. As a second step, Spearman correlations were used at both ages in order to obtain comparable results. At 2 months, no significant associations among the infant frustration reactivity composite and the four regulatory behaviors at 2 months were found. In contrast, a new pattern emerged at 6 months: infants displaying higher levels of frustration reactivity were more likely to orient their attention towards their mothers and less likely to look at objects in the environment during arm restraint. At 2 months, no significant associations among the infant frustration reactivity composite and the four regulatory behaviors at 2 months were found. In contrast, a new pattern emerged at 6 months: infants displaying higher levels of distress were more likely to orient their attention towards their mothers and less likely to look at objects in the environment.

2.4. Discussion

The major purpose of this investigation was to analyze the continuity, stability, and change of infant reactivity to frustration and its regulation from 2 to 6 months via administration of an arm restraint procedure. In addition, we were interested in analyzing the interdependence among these behaviors at both ages. Our study showed that negative reactivity in response to arm restraint significantly increased between 2 and 6 months, and that infants displayed significantly higher levels of object orientation and scanning behaviors and lower levels of mother orientation and avoidance at 6 months than at 2 months. Infant frustration reactivity was moderately stable from 2 to 6 months; in addition, the percentage of infants exhibiting mother orientation and avoidance behaviors at 2 months did not significantly differ from the percentage of infants using those behaviors at 6 months, suggesting that some regulatory strategies may be stable in early infancy. Our findings also revealed that, while at 2 months there was no significant relation among infant frustration reactivity and regulatory behaviors, a new pattern seemed to emerge at 6 months: infants exhibiting higher levels of distress were more likely to orient their attention towards their mothers and less likely to look at objects in the environment during arm restraint.

The first issue addressed in this paper concerned the continuity and/or discontinuity of infants’ responses to a frustrating event between 2 and 6 months. The significant increase in frustration reactivity exhibited by the infants in our sample at 6 months confirms the results of other studies, which have shown that anger/frustration expressions significantly increase from 2 to 4 months (Lewis et al., 1990, 1992). Moreover, the rapid developmental changes of motor, cognitive, and social competencies occurring in this age span may exacerbate infants’ reactions to being limited in their bodily movements, especially as by 5/6 months of age infants have learned to control their arms (Braungart-Rieker & Stifter, 1996; Camras et al., 1992). In accordance with the results of other studies (see Braungart-Rieker & Stifter, 1996), no significant age effect was found for the latency to cry measure. Infant regulatory behaviors showed discontinuity across the two ages. Specifically, there was a significant increase in infants’ orientation towards objects, and a significant decrease in orientation towards their mothers during the arm restraint procedure. The qualitative shift in attention occurring at around 4–6 months of age (Kopp, 2002; Ruff & Rothbart, 1996) may be related to these infants’ heightened interest in other aspects of the environment and has been found in other studies on early emotion regulation. For example, Gianino and Tronick (1988) reported that infants’ tendency to attend to objects as a coping strategy increased from 3 to 6 months; Calkins et al. (2002) and Stifter and Spinrad (2002) found that attentional strategies such as distraction and reorienting are relatively common responses to frustrating situations at 5 and 6 months. Our results concerning infants’ orientation to mother during arm restraint could also be explained in terms of this developmental shift; during the arm restraint procedure at 2 months, infants show relatively little flexibility in attention and thus are predominantly focused on their mother, who is standing in front of them, whereas at 6 months, infants have better attentional control (Colombo, 2001), and show greater ability to disengage their attention from negative stimuli (Rothbart & Bates, 1998; Ruff & Rothbart, 1996). These results confirm that infants’ attentional functioning is strongly influenced by chronological age (see Colombo, 2001). The higher levels of scanning behavior displayed by infants at 6 months of age support the idea that the maturation of the posterior attentional system (Johnson, Posner, & Rothbart, 1991) fosters infants’ ability to disengage attention from one stimulus and to redirect it to another in a more flexible way, that is, attention is no longer “obligatory”. At 6 months, infants also exhibited significantly lower levels of avoidance behaviors than at 2 months; one interpretation of this finding is that avoidance may represent...
a relatively primitive regulatory strategy (Braungart-Rieker & Stifter, 1996), which becomes secondary as soon as more “sophisticated” mechanisms, such as attentional shifting, begin to develop.

The second issue investigated in this study was related to the stability and/or change of frustration reactivity and regulatory behaviors from 2 to 6 months. Our data revealed that individual differences in infants’ affective reactions to a mildly stressful event were moderately stable across the two ages. Similar results were reported by Stifter and Fox (1990) and by Lewis et al. (1990, 1992), albeit these authors used different research paradigms. We were not able to find stability for latency to cry. However, it should be noted that the variations in the strength with which different mothers held their babies’ wrists is not controlled in this procedure. We cannot exclude that these variations may affect the time needed to trigger the babies’ reactions; once the reaction has set in, it is more likely to occur according to the babies’ temperamental dispositions, which indeed remain relatively stable over time. Stability of infant’s use of regulatory strategies between 2 and 6 months presents a more complex picture. Although Spearman correlations did not highlight any significant differences across the two ages, McNemar tests on the percentage of infants using each regulatory behavior indicated that mother orientation and avoidance were displayed by approximately the same number of individuals at 2 and 6 months, therefore suggesting some kind of intraindividual stability. Previous research has demonstrated a general lack of stability of infant regulatory behaviors in the early months (Rothbart et al., 1992; Shapiro et al., 1998), supporting the more general view that individual differences in regulation are more slowly developing if compared to individual differences in negative reactivity (Eisenberg & Fabes, 1992a,b; Kopp, 1989; Thompson, 1994).

However, more studies are needed to investigate the stability of regulatory behaviors in response to arm restraint in the first half-year of life, because this procedure may elicit different regulatory strategies if compared to other procedures. The third issue concerned the concurrent and longitudinal relations between infant reactivity to frustration and its regulation. Our data showed that, while at 2 months there was no association between frustration reactivity and regulatory behaviors, 6-month high levels of distress were significantly positively correlated with infants’ orientation towards their mothers, and negatively correlated with orientation to objects during arm restraint. The developmental literature reports that between 6 and 9 months of age, secondary intersubjectivity emerges, in which infants and caregivers begin to share understandings and emotions that refer beyond themselves to objects and other people (Trevarthen, 1993, 1998). A corollary of this new type of interaction is social referencing, in which infants tend to look at their caregivers to search for some indication on how they should feel and act in unfamiliar and/or mildly stressful situations (Cole & Cole, 2001). As a consequence, one could hypothesize that the coordination of frustration reactivity and regulation observed at 6 months may partly be a product of this phenomenon, in that more reactive infants seem to have learned to refer to their mothers as a source of relief. However, this hypothesis needs to be further tested. In contrast, scanning and avoidance were not related to infants’ frustration reactivity at either age, suggesting that in response to a frustrating event such as arm restraint, these may not be the preferred strategies used by infants at the ages considered in our study. For example, Stifter and Braungart (1995) found that in 5-month-old infants, avoidance behaviors did not function as regulators of distress when the infants’ arms were restrained.

Finally, we would like to highlight some positive and negative aspects of the arm restraint procedure as it was used in our study. On the positive side, our data indicate that the arm restraint procedure may function as an effective elicitor of infant frustration and of different regulatory behaviors as early as 2 months of age. For example, 33% of the babies did not complete the procedure at 2 months because it had elicited too much distress. Another positive aspect is that it provides a structured stimulation, whereas more ecologically valid situations cannot control for type, length or intensity of stimuli. On the negative side, the arm restraint technique as it is used here—with the mother simultaneously being the source of distress and not being available for comfort—may have problems. Future research should control for mother–infant relationship, either assessing it also in a different situation, or providing the infant with a different social source of frustration (e.g., an experimenter) or both. In addition, further studies should also better investigate the effect of infants’ responses to arm restraint on maternal soothing strategies to cast light on the relations between sensitive caregiving and infant frustration reactivity and regulation, especially during early infancy (see Spinrad & Stifter, 2002; Stifter & Spinrad, 2002).

Acknowledgements

The work reported here was carried out as part of the International Baby Study, which was funded in part by the work reported here was carried out as part of the International Baby Study, which was funded in part by the National Institutes of Health (HD38357, to C. Super, S. Harkness, D. Granger, D. van den Boom, and P. Molenaar).
The authors would like to thank all the mothers and infants who participated in the study. We gratefully acknowledge Charles Super and Sara Harkness for their support and assistance, Francesco Benettolo, Anna Maria Tormene and her medical staff for their helpful cooperation, and Gianmarco Altoro for his statistical advice.

References


Galean’s prophecy.


