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## Introduction

Recent developmental work has focused on emotions as organizers of behavior, modifying a child's thinking, learning, and action. The regulation of these emotions is essential for appropriate socially adaptive behavior (Cole et al., 2004). Much work in infancy has pointed to infant temperament as the basis for individual differences in emotion regulation strategies (Fox, Calkins, & Bell, 1994). Work with infants and young children has also included some environmental factors (Calkins, 2004).

Because this study was longitudinal in nature, we were able to examine infant-mother dyads at 5 months, before emotion regulation strategies are in place, and again at 10 months, when rudimentary emotion regulation strategies are beginning to develop. The study was designed to give insight into the complex nature of emotion regulation by examining how both environmental (maternal behaviors) and biological (infant temperament) factors are related to the development of these emotion regulation strategies during the first year of postnatal life.

## Participants

One hundred mothers and their infants were recruited from the New River Valley area of southwestern Virginia. All were healthy full-term infants with no known neurological problems. Mothers and infants participated in a variety of dyadic interactions when the infant was 5 and 10 months old. These data were collected as part of a larger longitudinal study focusing on the early development of self-regulation. EEG and ECG measures were also taken, but these data will not be discussed here.

## Infant Temperament



Temperament was assessed using Rothbart's IBQ. Mothers filled out these questionnaires when their infants were 5 and 10 months old.

## Maternal Behavior



Maternal behavior was assessed during two pleasant tasks, which each lasted two minutes. First, mothers were given two infant toys and were instructed to play with their infants. In the second task, mothers were asked to play peek-a-boo. These interactions were coded in 30-second epochs to give an index of maternal responsiveness, intrusiveness, and maternal positive affect.

These variables were rated on a 1 to 4 scale. Maternal responsiveness was defined as how well she facilitated the infant's attention to the task and included factors such as appropriateness of pace and responsiveness to her infant's cues. Intrusiveness ratings were based on behaviors such as taking the toy from the infant while he or she was still interested, forcing the infant to manipulate the toy, or interacting with the infant so exuberantly that the baby flinches or turns away (Calkins et al, 2004).

## Emotion Regulation

Infants' emotion regulation strategies were observed during two frustrating tasks. During the first task, the mother and infant played with a busy box toy; after about 45 seconds, the mothers were instructed to pull the toy away and keep a blank face. During the second task, mothers were asked to gently restrain the infant's arms while keeping a blank face. Emotion regulation strategies related to attention (orienting to mother, distracting, scanning, and orienting to toy) and self stimulation (physical, other physical, and self-comforting) were quantified by whether or not they occurred in a given 10 second interval (Stifter & Spinrad, 2002).



## Results

### Emotion Regulation and Temperament

Infants whose mothers rated them high on attention (orienting) used less self-stimulating regulatory behavior during the frustration tasks ( $r$ 's  $> .237$ ,  $p$ 's  $< .05$ ). There were many other correlations between IBQ scores and infant regulation, but these focused on scales describing infant emotional reactivity (i.e., smiling, fear, and cuddliness) rather than our focus on the regulatory aspects of behavior.

### Emotion Regulation and Maternal Behaviors

Emotion regulation strategies during the frustration tasks were correlated with maternal behaviors during mother-infant play. Specifically, maternal responsiveness was positively correlated with infant's tendency to orient to mom during the frustration tasks at 5 and 10 months ( $r = .367$ ,  $p < .01$ , and  $r = .308$ ,  $p < .01$ , respectively).

### Developmental Trends in Emotion Regulation

Whereas mother behaviors were relatively stable over time (i.e., they were significantly correlated at the 5 and 10 month visits;  $r$ 's  $> .26$ ,  $p$ 's  $< .05$ ), infant regulatory strategies changed considerably (i.e., they were not significantly correlated at 5 and 10 months;  $r$ 's  $< .13$ ,  $ns$ ; see also means presented below).

Proportion of epochs during which strategy occurred (toy removal)

	5 months	10 months
Self-comforting	.22	.12
Orienting to mother	.32	.60
Distracting	.37	.36
Physical	.02	.16
Orienting to toy	.62	.74
Scanning	.47	.36

Proportion of epochs during which strategy occurred (arm restraint)

	5 months	10 months
Orienting to mother	.37	.61
Distracting	.39	.28
Physical	.00	.08
Physical Other	.32	.47
Scanning	.49	.42

## Discussion

Both maternal report of temperament and maternal behavior during mother-infant interaction were correlated with infant emotion regulation at 5 and 10 months. Also, maternal behavior was fairly consistent whereas infant behavior changed over time. This is consistent with Rothbart's conceptualization of biologically based self-regulation, in which we expect to see regulatory strategies emerging at 10 months of age. These preliminary results suggest that there are at least two sources from which infants develop emotion regulation strategies: learning from maternal interactions and temperamentally-based differences in psychobiology.