



Maternal sensitivity and infant response to frustration: The moderating role of EEG asymmetry



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ABSTRACT

Two hundred and thirty-three 5-month-old infants and their mothers participated in a study designed to examine the influence of maternal sensitivity and infant neurophysiology, as well as interactions between these, on infants' regulatory behavior and reactivity to emotional challenge. Maternal sensitivity was measured during two mother–child free-play episodes prior to the challenge task. Infant neurophysiology was derived from a measure of resting EEG asymmetry collected during a baseline episode. Infant regulatory behaviors (mother orienting and distraction) and reactivity to challenge (negative affect) were assessed during an arm restraint procedure. Maternal sensitivity predicted mother-orienting behavior for all infants, regardless of baseline EEG asymmetry. Maternal sensitivity also predicted more distraction behaviors for infants with left frontal EEG asymmetry at baseline. In contrast, maternal sensitivity predicted more negative affect for infants with right frontal EEG asymmetry at baseline. These findings lend support for the hypothesis that maternal sensitivity and infant neurophysiological functioning interact to predict regulatory behavior and reactivity and are discussed in terms of the significance for understanding infant regulatory development in the first year of life.

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1. Introduction

Although infants acquire a wide range of skills in the first year of life that will continue to develop over the course of early childhood, emotional reactivity to the environment and an ability to regulate emotional responses are considered two of the most important predictors of later adaptive social-emotional and psychological functioning (Fox & Calkins, 2003; Propper & Moore, 2006). Research has demonstrated that the expression and regulation of emotion in infancy and early childhood are powerful mediators of interpersonal relationships and socioemotional adjustment, including behavioral self-control (Calkins, 1994; Cicchetti, Ganiban, & Barnett, 1991; Malatesta, Culver, Tesman, & Shephard, 1989; Rothbart, 1989; Thompson, 1994), and are associated with behavioral outcomes such as compliance, effortful control, and inhibitory behavior in later childhood (Fox & Calkins, 2003; Henderson, Fox, & Rubin, 2001; Stifter, Spinrad, & Braungart-Rieker, 1999). Thus, understanding the factors that influence the development of emotion regulation and reactivity in the first year of life is important for predicting both concurrent and future child functioning. Separate lines of research have demonstrated that environmental factors such

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as parenting, and intrinsic factors such as infant neurophysiology, predict emotional reactivity and regulatory behavior in infancy and early childhood. However, relatively little work has considered parenting and neurophysiology in combination, despite the fact that theoretical approaches suggest that intrinsic and extrinsic influences likely interact to influence child development (e.g. Fox & Calkins, 2003). To address this gap in the literature, the current study examines the influence of maternal sensitivity and infant neurophysiology, as well as interactions between these, on infants' regulatory behavior and reactivity to emotional challenge.

1.1. *The development of regulatory behavior in the first year*

From very early, infants show individual differences in a predisposition for when and how they respond to cues in their environment; this reactivity style is thought to be present at birth and reflect a relatively stable characteristic of the infant (Calkins, Fox, & Marshall, 1996; Rothbart, Derryberry, & Hershey, 2000). By three months of age, primitive and rapidly developing attentional self-regulatory mechanisms begin to assist in simple control of behavioral state and emotional reactivity (Eisenberg, Smith, Sadovsky, & Spinrad, 2004) perhaps because of the solidification of biologically based processes (e.g. sleep–wake cycles and eating and elimination) into more predictable and stable patterns and an increasing ability to voluntarily control arousal (Calkins, 2008). This depends largely on attentional control mechanisms and the development of simple motor skills (Rothbart, Ziaie, & O'Boyle, 1992; Ruff & Rothbart, 1996), and leads to coordinated use of attention engagement and disengagement to regulate the infant, particularly in contexts that evoke negative affect.

Rothbart, Posner, and Boylan (1990) were among the first to observe that attentional control, and particularly voluntarily control of visual attention, was related to decreases in negative affect in infants. These authors also demonstrated that by six months of age infants are capable of engaging in self-initiated distraction, and of moving attention away from the source of negative arousal to more neutral stimuli as a means of regulating their own arousal (Posner & Rothbart, 1998). Others have also found that distraction strategies may assist the child in managing early frustration and fear responses in situations where the control of negative emotions is required (Calkins, Smith, Gill, & Johnson, 1998; Stifter & Braungart, 1995). However, there are considerable individual differences in the development of these abilities that have been shown to have important implications for psychosocial adaptation and the acquisition of important developmental achievements (Calkins, 1994, 2008; Calkins et al., 1998; Posner & Rothbart, 1998; Rothbart & Derryberry, 1981; Sroufe, 1996).

Intrinsic child factors and extrinsic environmental factors may account for some of the individual differences in the development of young children's emotion regulation capabilities over time (Calkins, 2004; Cicchetti & Rogosh, 1996). For example, both neurophysiological functioning and experience with a sensitive caregiver have been found to be powerful predictors of regulatory development in the first year of life (e.g., Condradt & Ablow, 2010; Dawson, Panagiotides, Klinger, & Hill, 1992). Theories of emotion regulation suggest that although each of these may have an independent contribution to the development of regulatory behavior, they also likely interact with one another to influence patterns of behavior that emerge with development (e.g. Fox & Calkins, 2003; Posner & Rothbart, 1998).

1.2. *Maternal influences on development of regulatory behavior in infancy*

The rapid development of regulatory skills and abilities during the infant and toddler years has been described as a process in which the infant progresses from predominately relying on caregivers for regulation to increasingly more and more independent self-regulation (Calkins, 1994; Kopp, 1982; Sroufe, 1996). In infancy, success at regulation depends heavily on the parent's awareness, flexibility, and responsiveness to the infant's emotional expression and need for intervention (Calkins, 2008). Indeed, infants' state control in the first few months of life is considerably aided by caregivers' social interactions and routines and it is in the context of these interactions that infants first learn about regulating their own emotions (Kopp, 1982, 1989).

According to current models of caregiving, sensitive caregivers, who recognize infant coping signals (e.g., looking away or protesting), and who respond to them in an appropriate manner, have infants who develop a sense that they can help to regulate the dyadic exchange and, eventually, themselves (Gianino & Tronick, 1988; Tronick, 2007). The ultimate goal of early mother–infant face-to-face interactions is to achieve mutual regulation, or a state of reciprocity, which acts as an important foundation for the infant's development of effective self-regulation. That is, when infants are able to elicit caregiver interaction through the use of affective signals, and experience appropriate and sensitive responding to these signals, they begin to develop self-regulatory skills needed to cope with longer periods of frustrating or emotionally challenging episodes (Gianino & Tronick, 1988; Tronick, 2007).

Empirical evidence has demonstrated that regulatory behaviors observed in infants and toddlers during a challenge episode are related to sensitive maternal responses in previous interactive episodes (Kogan & Carter, 1996; Rosenblum, McDonough, Muzik, Miller, & Sameroff, 2002). For instance, mothers who were more sensitive in interactions that took place prior to a still-face episode had infants who showed more attention seeking behaviors (e.g., looking to her, smiling, reaching) and greater positive affect during a still-face episode (Kogan & Carter, 1996; Mesman, van Ijzendoorn, & Bakermans-Kranenburg, 2009). Negative maternal behavior, over-control and intrusiveness across a variety of contexts have been found to be negatively related to the use of distraction and sustained attention in a sample of toddlers (Calkins et al., 1998). Together, these data suggest that the infants of more sensitive mothers may display more mother orienting behaviors in an attempt to use her as an external source of regulation during times of challenge and threat. Because sensitive caregiving is

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