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Infant frontal electroencephalogram asymmetry and negative emotional reactivity as predictors of toddlerhood effortful control



Cynthia L. Smith^{a,*}, Anjolie Diaz^{b,1}, Kimberly L. Day^{a,2}, Martha Ann Bell^b

^a Department of Human Development, Virginia Tech, Blacksburg, VA 24061, USA

^b Department of Psychology, Virginia Tech, Blacksburg, VA 24061, USA

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ABSTRACT

Given the importance of children's self-regulation, relations were examined between two fundamental components of self-regulation, specifically temperamentally based reactivity and regulation. Infant negative emotional reactivity and regulation, measured via frontal electroencephalogram (EEG) asymmetry, were examined as potential precursors to understanding toddlerhood regulation, conceptualized as effortful control. Our longitudinal design allowed for examination of two perspectives on the interplay of reactivity and regulation, namely that (a) early negative affectivity interferes with the development of later regulation and (b) regulation is necessary to modulate negative affectivity and, thus, would buffer the effects of negative affectivity on later regulation. Mother–child dyads participated in a three-wave longitudinal study. Baseline frontal EEG asymmetry was assessed at 10 months (T1). Mothers rated children's negative reactivity at both 10 and 24 months (T2). Children's effortful control, measured at 30–36 months (T3), was a composite score of maternal ratings and observed behavior during a snack delay. Negative affectivity was related to effortful control; however, significant interactions between negative affect and frontal EEG asymmetry were found. Higher levels of negative affectivity at both T1 and T2 were associated with lower levels of effortful control at T3, but only for toddlers who also had right frontal EEG asymmetry. Negative

* Corresponding author. Tel.: +1 540 231 4793; fax: +1 540 231 7012.

E-mail address: smithcl@vt.edu (C.L. Smith).

¹ Current address: Department of Psychological Sciences, Ball State University, Muncie, IN 47306, USA.

² Current address: Department of Psychiatry and Behavioral Neurosciences, McMaster University, Hamilton, ON L8S 4K1, Canada.

affectivity was not associated with effortful control for the left frontal EEG asymmetry group. Our moderation findings highlight the complex relations of negative affect and frontal EEG asymmetry in understanding children's development of self-regulation, specifically effortful control. The interaction between early reactivity and physiological regulation indicates that both may be important precursors of effortful control.

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Introduction

Self-regulation is a hallmark of children's development (Shonkoff & Phillips, 2000) because children who can regulate their emotions and behaviors are more socially competent, display fewer behavior problems, make successful transitions to school, and have higher academic achievement (for reviews, see Blair, 2002; Blair & Diamond, 2008; McClelland & Cameron, 2012). Because self-regulation is a broad encompassing term, we chose to examine effortful control, which is a component of children's self-regulation. Effortful control, defined as "the efficiency of executive attention—including the ability to inhibit a dominant response and/or to activate a subdominant response, to plan, and to detect errors" (Rothbart & Bates, 2006, p. 129), has also been associated with many optimal developmental outcomes (Eisenberg, Hofer, Sulik, & Spinrad, 2014; Eisenberg et al., 2005, 2009; Ponitz, McClelland, Matthews, & Morrison, 2009; Spinrad et al., 2007). Given the role that effortful control can play in children's development, it is important to understand how early factors in children's lives relate to individual differences in effortful control. The current study examined two factors, negative emotional reactivity and early brain electrophysiology (i.e., the electroencephalogram, EEG), as early predictors of children's effortful control. We proposed that early indicators of regulation reflected in frontal EEG asymmetry will interact with negative affectivity to predict later regulation as measured through children's effortful control.

Relations between emotional reactivity and regulation are complex, especially when considering the developmental course of each and the interaction of the two. In Rothbart's (1989) framework, children's effortful self-regulation was proposed to be influenced by both components of reactivity (positive and negative affect) and modulation of that reactivity, which in very young infants involves approach and withdrawal behaviors (e.g., turning attention away from something that is overly

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