ELSEVIER

Effortful control, executive attention, and emotional regulation in 7–10-year-old children

Jennifer Simonds [a,*], Jessica E. Kieras [b],
M. Rosario Rueda [b,c], Mary K. Rothbart [b]

[a] *Department of Psychology, Westminster College, Salt Lake City, UT, United States*
[b] *Department of Psychology, University of Oregon, Eugene, OR, United States*
[c] *Dpto. de Psicología Experimental, Universidad de Granada, Granada, Spain*

Abstract

In this study, self-regulation was investigated in 7- to 10-year-old children using three different measures: (1) parent and child report questionnaires measuring temperamental effortful control, (2) a conflict task assessing efficiency of executive attention, and (3) the mistaken gift paradigm assessing social smiling in response to an undesirable gift. Both efficiency in executive attention and smiling to the undesired gift increased over age. Executive attention was related to both parent-reported temperamental effortful control and smiling, suggesting links between attentional capacities, broad temperament measures, and social situations requiring attentional control.
© 2007 Elsevier Inc. All rights reserved.

Keywords: Temperament; Effortful control; Executive attention; Attention; Emotional regulation; Self-regulation; Middle childhood; Elementary school students; Display rules; Emotional development

One of the major challenges in research on child development is understanding the development of self-regulation (Baumeister & Vohs, 2004). Self-regulation has been studied at multiple levels, including: (1) observed regulation of social behavior, (2) parent or self-reports of temperamental effortful control, and (3) executive attention as assessed on cognitive tasks. Effortful control is defined as the ability to inhibit a dominant response in order to perform a sub-dominant response, to detect errors, and to engage in planning (Rothbart & Rueda, 2005). The executive attention network is seen to underlie effortful control, and both are expected to predict children's emotional regulation in a social situation. Eisenberg, Smith, Sadovsky, and Spinrad (2004), for example,

* Corresponding author at: Department of Psychology, Westminster College, 1840 South 1300 East, Salt Lake City, UT 84105, United States. Tel.: +1 801 832 2414.
E-mail address: jsimonds@westminstercollege.edu (J. Simonds).

view effortful control as a key component of emotion-related regulation. In the current study, we examined relations among three measures of self-regulation: temperamental effortful control, executive attention, and smiling in a social situation to an undesired gift.

1. Temperamental effortful control

We define temperament as constitutionally based individual differences in emotional, motor, and attentional reactivity and self-regulation (Derryberry & Rothbart, 2001; Rothbart & Derryberry, 1981). Reactivity describes motor, emotional, and attentional responses to internal and external stimuli. Regulation describes processes that function to modulate those responses (Putnam, Ellis & Rothbart, 2001; Rothbart & Bates, 2006). Constitutional refers to the biological basis of temperament, influenced by genes, environment, and experience over time. Temperament has been shown to be relatively consistent across situations and stable over time, although changes in temperament related to development have also been reported (Rothbart & Bates, 2006). As children develop, self-regulatory capacities increase for better modulation of reactive responses (Rothbart & Rueda, 2005). Temperamental effortful control is measured as a higher-order trait of temperament. In factor analytic studies, this broad factor includes subscales measuring attentional and inhibitory control, as well as low intensity pleasure and perceptual sensitivity.

2. Executive attention

In neuro-cognitive models, attention is related to three separate brain networks (Posner & Petersen, 1990). Alerting refers to the establishment and maintenance of a vigilant state, and orienting to the ability to attend to a given location. The executive attention network is activated in situations requiring attentional control, as when there is conflict between responses suggested by different stimuli or dimensions of the same stimulus. Conflict tasks have been shown to activate a common neural network including the anterior cingulate cortex (ACC) and lateral prefrontal areas (Fan, Flombaum, McCandliss, Thomas, & Posner, 2003); conflict tasks thus serve as model tasks for assessing the efficiency of the executive attention network. Executive attention has also been identified as a neural substrate of developing temperamental effortful control (Posner & Rothbart, 2007; Rothbart, Posner, & Kieras, 2006; Rothbart & Rueda, 2005).

Efficiency of executive attention shows improvement from ages 2 to 7. Gerardi-Caulton (2000) and Rothbart, Ellis, Rueda, and Posner (2003) found that between 24 and 36 months, young children were increasingly able to perform a spatial conflict task requiring a response based on the identity of a stimulus while inhibiting its location. A strong positive relationship was also found between age and executive attention in children aged 3–5 years (Chang & Burns, 2005). Rueda et al. (2004) found that conflict scores did not improve from age 8 to adulthood. Using an age-appropriate version of the Attentional Network Test (ANT; Rueda et al., 2004) to measure conflict efficiency, we expected to replicate this finding in a sample of children 7–10 years of age.

3. Temperament and executive attention

Positive relations have been found between parent-reported temperamental effortful control and performance on executive attention tasks in children from ages 2 to 7 (Chang & Burns, 2005; Gerardi-Caulton, 2000; Gonzalez, Fuentes, Carranza, & Estevez, 2001; Rothbart et al., 2003) and adolescents aged 16–17 years (Ellis, 2002). Gerardi-Caulton (2000) found posi-