Published in final edited form as:
Soc Dev. 2013 May ; 22(2): 340–362. doi:10.1111/sode.12025.

The Interaction between Negative Emotionality and Effortful Control in Early Social-emotional Development

Lyndsey R. Moran, **Liliana J. Lengua**, and **Maureen Zalewski**
University of Washington

Abstract

Interactions between reactive and regulatory dimensions of temperament may be particularly relevant to children's adjustment but are examined infrequently. This study investigated these interactions by examining effortful control as a moderator of the relations of fear and frustration reactivity to children's social competence, internalizing, and externalizing problems. Participants included 306 three-year-old children and their mothers. Children's effortful control was measured using observational measures, and reactivity was assessed with both observational and mother-reported measures. Mothers reported on children's adjustment. Significant interactions indicated that children with higher mother-reported fear or higher observed frustration and lower executive control showed higher externalizing problems whereas children with higher observed fear and higher delay ability demonstrated lower externalizing problems. These results highlight effortful control as a moderator of the relation between reactivity and adjustment, and may inform the development of interventions geared toward the management of specific negative affects.

Keywords

temperament; self-regulation; social competence; internalizing/externalizing

Introduction

Children's temperament is often studied in relation to their adjustment. Individual differences in temperament predict children's risk for social-emotional problems through several mechanisms including increasing problems directly, through transactional relations with other risk factors, or by moderating or exacerbating the effects of other risk factors (Nigg, 2006; Rothbart & Bates, 2006). Although combinations of temperament characteristics, particularly the interaction between reactive and regulatory dimensions, have been hypothesized to be relevant to children's adjustment, these interactions are rarely investigated (Rothbart & Bates, 2006). In this study, we examined the interactions between temperamental reactivity and regulation to predict social competence and adjustment problems of preschool children.

Correspondence should be addressed to Liliana Lengua, Department of Psychology, University of Washington, Box 351525, Seattle, WA 98195, USA. liliana@uw.edu.

Temperament

Temperament is defined as biologically based individual differences in reactivity and self-regulation that remain relatively stable over time, but may be influenced by heredity, maturation, and contextual and socialization experiences (Rothbart, Ahadi, & Hershey, 1994). Reactivity refers to arousability of affect and excitability of motor responses whereas self-regulation refers to processes that serve to alter this reactivity through mechanisms such as attentional focusing and inhibitory control (Rothbart & Derryberry, 1981). Both reactivity and regulation are important predictors of children's adjustment (e.g., Liew, Eisenberg, & Reiser, 2004; Muris & Ollendick, 2005). Examination of the interactions between the propensity for emotional reactivity and the ability to regulate this reactivity is important in understanding children's adjustment, as problem behaviors are associated with increased negative emotionality and uncontrolled behaviors (Eisenberg et al., 1996).

Negative Emotionality

Negative emotionality, one aspect of reactivity, describes individual differences in children's predisposition to experience negative emotions, and includes the threshold, intensity, and duration of emotions (Rettew & McKee, 2005). Greater negative emotionality broadly relates to a range of emotional and behavioral problems (e.g., Eisenberg et al., 1996; Muris, 2006; Rothbart & Bates, 2006). Although negative emotionality is frequently studied as one general factor, evidence suggests that, despite underlying commonalities, components of negative emotionality may have differential effects on adjustment (Rothbart et al., 1994). Two commonly studied components of negative emotionality are fear and frustration.

Fear—Fear reactivity can be described as a propensity to experience negative affect, inhibition, or withdrawal in response to novel or challenging situations, signals of punishment, or aversive stimuli (Rothbart & Jones, 1998). Research examining direct relations between fear and adjustment in older children have found that higher fear related specifically to higher internalizing as opposed to externalizing problems (Hill-Soderlund & Braungart-Rieker, 2008; Ormel et al., 2005; Rothbart, 2007). Infant fear also relates to positive adjustment, such as later empathy, guilt, and shame, as well as less aggression (Rothbart et al., 1994). These results suggest that fear reactivity may have differential relations with symptoms of psychopathology, and specifically may relate to greater internalizing problems and potentially fewer externalizing problems.

Frustration—Frustration reactivity, also described as anger or irritability, refers to distress to limitations, and represents an affective response to experiences of failure, having a goal blocked, or the interruption of an ongoing task (Rothbart et al., 1994). Specifically, frustration is seen as a response to unconditioned aversive stimuli resulting in the production of defensive or aggressive behaviors, as opposed to inhibition or escape seen in fear responses (Gray & McNaughton, 2000). Research demonstrates significant relations between children's anger, frustration, and hostility, and the tendency toward externalizing problems (e.g., Eisenberg et al., 2001; Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002; Lemery, Essex, & Smider, 2002; Lengua, 2003). Unlike fear, however, frustration seems to have a more pervasive effect on children's outcomes, with evidence of frustration predicting children's internalizing problems (Eisenberg et al., 2001; Lengua, 2003). For example, in

middle childhood, frustration predicted both later internalizing and externalizing problems (Ormel et al., 2005). Although associations between frustration and externalizing problems are more consistent, these results suggest that frustration may be a predictor of severity of maladjustment in general, serving as a risk factor across problem types.

Effortful Control

Effortful control reflects the self-regulatory aspect of temperament, and describes the ability to purposefully regulate behavior, to resist interference, or to suppress a dominant response in favor of a subdominant response (Bjorklund & Kipp, 1996; Murray & Kochanska, 2002). Effortful control has been linked to lower externalizing and internalizing problems, and better social competence (e.g., Eisenberg, Fabes, Guthrie, & Reiser, 2000; Eisenberg et al., 2004; Rothbart et al., 1994). The ability to effortfully inhibit a prepotent behavioral or emotional response and subsequently engage in an adapted or entirely different response requires the recruitment of multiple self-regulatory skills, making effortful control a multifaceted construct, and unique components of effortful control may differentially relate to children's adjustment (Davis, Bruce, & Gunnar, 2002). Specifically, effortful control is composed of both a 'cool', cognitive component (executive control) and a 'hot', emotional component (delay of gratification; Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009). Whereas the 'cool' component involves complex cognitive processes that occur in emotionally neutral contexts, the 'hot' component specializes in emotional processing and is engaged when children must navigate their emotions to successfully solve a problem (Zhou, Chen, & Main, 2012). Although these components are related and normally work as an integrated system, evidence suggests that these components differ in their developmental course, predictors, and relations with social and emotional outcomes (King, Lengua & Monahan, 2013; Li-Grining, 2007). As these components appear to develop and function in unique ways, it may be beneficial to investigate their individual effects on child adjustment.

Executive Control—Executive control is the 'cool', cognitive component of effortful control associated with voluntary regulation, particularly in the context of abstract concepts and higher order thinking when emotional consequences are not present (Brock et al., 2009). Executive control involves executive attention systems that influence experience and behavior by facilitating the shifting and focusing of attention (attention control), as well as the conscious inhibition and activation of behavior (inhibitory control; Liew et al., 2004).

Greater executive control has consistently predicted lower rates of children's externalizing and internalizing problems (Rettew & McKee, 2005; Valiente et al., 2003). Additionally, children with comorbid externalizing and internalizing problems were found to have lower executive control than children without problem behaviors whereas children with only internalizing problems had higher executive control than children with externalizing problems (Eisenberg et al., 2001). Relations to aspects of positive adjustment, such as social competence, empathy, less aggression, and less negative emotionality, suggest that executive control may be an important protective factor in child development (Eisenberg et al., 2001).

Delay Ability—Delay ability is the 'hot', emotional component of self-regulation and reflects the capacity to tolerate delaying immediate gratification. The ability to delay an immediate reward in the service of more long-term goals requires many of the skills encompassed by executive control, but has an additional requisite of regulating affect and motivation that are relevant in emotionally evocative contexts (Hongwanishkul, Happaney, Lee, & Zelazo, 2005).

Difficulty delaying gratification, often described as impulsivity, has been linked to a variety of negative outcomes, but particularly to externalizing problems (Krueger, Caspi, Moffitt, White, & Stouthamer-Loeber, 1996). Additionally, impulsivity was a direct and unique predictor of later externalizing problems over and above the effect of executive control, suggesting that these components of effortful control may have differential effects on adjustment (Eisenberg et al., 2004).

Negative Emotionality and Effortful Control Interactions

Direct relations of negative emotionality and effortful control with children's adjustment have been more thoroughly investigated than the possible interactive effects of temperament on outcomes. In fact, very few studies have tested interactions between temperament characteristics despite particularly likely interactions between reactive and control systems (Rothbart & Bates, 2006). Specifically, greater emotionality has been theorized to put children at risk for maladjustment, but self-regulatory abilities may moderate this trajectory. Greater effortful control may provide children with the capability to modulate and cope with emotionality. By contrast, children with less effortful control may be less flexible or competent in their ability to deal with stressors that provoke negative emotion, leading to less effective strategies such as avoidance, aggression, or depression (Muris & Ollendick, 2005).

Externalizing—Externalizing problems are characterized by aggression, conduct problems, hostile behaviors, and hyperactivity, suggesting that children exhibiting externalizing behaviors may have deficits in regulating anger and controlling behaviors. Tests of additive effects of temperament dimensions have shown the presence of greater anger, impulsivity, and less regulation, particularly inhibitory control, in children with externalizing problems compared with those with internalizing problems (e.g., Eisenberg et al., 2001).

Significant interactions between negative emotionality and effortful control (including parent and teacher reports of children's attention control and ego control) have been reported, with high levels of regulation acting as a buffer on the effects of both moderate and high negative emotionality (Eisenberg et al., 1996). Specific examination of executive control (self-reported attention shifting, attention focusing, and inhibitory control) as a moderator of the effect of neuroticism (similar to negative emotionality) on symptoms of psychopathology found that high neuroticism was less strongly associated with externalizing problems at higher levels of executive control (Muris, 2006).

Internalizing—Internalizing problems include anxiety or despair, less adaptive emotion regulation, and maladaptive behavioral inhibition. Subsequently, internalizing problems may

result from interactions among greater negative emotionality (specifically fear), less executive control (particularly attention), and low impulsivity, which additive models have supported (Eisenberg et al., 1996, 2001). Limited research examining interactions among these temperament characteristics found that greater executive control resulted in fewer internalizing problems in children demonstrating high neuroticism (Muris, 2006). Additionally, for highly neurotic children, having high, compared with low, attention control resulted in lower anxiety (Meesters, Muris, & van Rooijen, 2007).

Social Competence—Social competence relies, in part, on understanding and complying with culturally derived conventions and customs. Socially competent children are able to effectively regulate emotionality to comply with conventions for the appropriate expression of emotion whereas violation of these conventions can lead to social rejection or punishment. Preschoolers who expressed less disappointment when given an undesirable prize were rated by parents, teachers, and peers as being more socially competent, and were also rated higher on executive control and lower on negative emotionality (Liew et al., 2004). Additionally, children's display of disappointment mediated the effect of executive control on ratings of social competence, suggesting that greater executive control may allow children to mask negative emotionality or inhibit inappropriate behaviors in response to negative emotions, resulting in better social competence. Similarly, among infants who demonstrated greater negative emotionality, those with greater attention were perceived as more socially competent 16 months later (Belsky, Friedman, & Hsieh, 2001).

This Study

Previous research has suggested that higher frustration, lower ability to delay gratification, and lower executive control predict more externalizing problems whereas greater fear and delay ability, and lower attention control are related to internalizing problems. Additionally, executive control was shown to moderate the relations of negative emotionality to both internalizing and externalizing problems. Better social competence was predicted by higher executive control and lower negative emotionality. Thus, although there is initial support for interactions between negative emotionality and effortful control, additional research investigating specific aspects of reactivity and regulation, particularly in young children, is needed.

This study sought to add to the existing literature by examining the interactive effects of negative emotionality and effortful control on children's adjustment during preschool, a time when regulatory abilities are rapidly maturing, problem behaviors emerge, and social competence becomes apparent. Individual aspects of both negative emotionality and effortful control, commonly examined as direct predictors of adjustment, were tested for interactive effects. Executive control and delay ability were tested as moderators of the relations of fear and frustration to later levels of externalizing problems, internalizing problems, and social competence. Specifically, we hypothesized that externalizing problems would result from higher frustration, and both lower delay ability and executive control. Internalizing problems would result from higher fear reactivity, lower executive control, and potentially higher delay ability. Finally, poor social competence would be predicted by less specific interactions between higher negative reactivity and lower effortful control.

Method

Participants

Participants were a community sample of 306 preschool-aged children and their mothers who were followed across four time points, each separated by 9 months. The first two assessments (T1 and T2) were used in this study. T1 assessments occurred when children were 36–40 months (M = 36.75, SD = 1.31), and T2 assessments occurred 9 months later (M = 45.94 months, SD = 1.57). Families were recruited from preschools, co-ops, and day cares, and were selected to represent the demographic characteristics of the urban area where the study was conducted. One child in the target age range per family participated. Children with developmental disabilities and families not proficient in English were excluded from the study to ensure adequate comprehension of the procedures. A female primary caregiver was required to participate. All study procedures were approved by the institutional review board at the university conducting this study.

Of the original 306 families, 97.4 percent participated at T2. Participants with missing data on any variable were compared with those with complete data on all T1 variables: demographics (child gender and family income), negative emotionality (observed and mother-reported fear and frustration reactivity), effortful control (executive control and delay ability), and outcomes (externalizing, internalizing, and social competence). The t tests indicated that participants with any missing data (N = 79) differed from those with no missing data (N = 227) on income (missing, M = 3.36, SD = 1.85; no missing, M = 4.25, SD = 2.06), $t(303) = -3.38$, $p < .01$; and executive control (missing, M = 0.24, SD = 0.16; no missing, M = .30, SD = .14), $t(304) = -2.98$, $p < .01$. However, the relations of income and executive control to missingness were small effects (r = .19 and r = .17, respectively) and did not reach previously cited thresholds for introducing substantial bias (e.g., $r > .40$; Collins, Schafer, & Kam, 2001). Analyses were based on the entire sample of 306 families, and the full information maximum likelihood estimation (FIMLE) was used to handle missing data.

Children included 50 percent girls, 9 percent African-Americans, 3 percent Asian-Americans, 2 percent Native Americans, 10 percent Latino or Hispanic, 64 percent European-Americans, and 12 percent children with other or multiple ethnic or racial backgrounds. The sample was evenly distributed across income levels, with 29 percent of the sample at- or near-poverty (at or below 150 percent of the federal poverty threshold), 28 percent low income (below the local median income of $58K), 25 percent middle income (above the median income to $100K), and 18 percent upper income (above $100K). Mothers' educational attainment included 3 percent with less than a high school degree, 6 percent high school graduates, 35 percent with some college experience, 30 percent college graduates, and 36 percent with some or completed graduate degree. Families consisting of two-parent households made up 81 percent of the sample.

Procedure

At both time points, mothers and children came to the university for 2-hour sessions to complete questionnaire measures and observational assessments. Children were

administered the effortful control and emotion-eliciting tasks described below. Tasks taken from the developmental neuropsychological assessment (NEPSY) were administered first, followed by day–night, bear-dragon, dimensional change card sort (DCCS), the fear and frustration eliciting tasks, gift delay, and finally head, toes, knees, shoulders (HTKS). Simultaneously, mothers completed questionnaires about family demographics, and children's temperament and adjustment, in a separate room. Families were compensated $70 at T1 and $90 at T2.

Measures

Income—At T1, mothers reported on household income from all sources on a 14-point scale that provided a fine-grained breakdown of income, facilitating identification of families at the federal poverty cutoff (e.g., 1 = $14 570 or less, 2 = $14 571–$18 310, 3 = $18 311–$22 050, and so on). The 14-point variable representing the full range of income was used in this study. The mean income was 8.75 (*SD* = 3.93, range = 1.00–14.00).

Negative Emotionality—Multimethod measures of negative emotionality, including mother report on questionnaires and observation of children's reactivity to emotion-eliciting tasks, were used to capture differing perspectives on children's behavior. Both approaches provide valuable information (Rothbart & Bates, 2006). Laboratory observations capture individual differences across children within the same context, but constitute only one observation that may not reflect the child's typical behaviors in a natural setting. Maternal reports capture consistencies in behaviors within a child across different contexts, but may be biased by maternal perceptions or characteristics (e.g., depression). Comparing results across these methods may capture both variability between individual children (behavioral observations) and more consistent temperamental characteristics within the child (maternal report).

Mothers reported on their child's negative emotionality using the fear and frustration subscales of the child behavior questionnaire, which was developed for use with children 3–6 years, and has demonstrated adequate internal consistency and validity (Goldsmith & Rothbart, 1991; Rothbart, Ahadi, Hershey, & Fisher, 2001). Mothers responded to items on a scale ranging from 1 (*very false*) to 7 (*very true*). Sample fear and frustration items include 'My child is afraid of burglars or the boogie man' and 'My child gets frustrated when prevented from doing something s/he wants to do', respectively. Subscale scores for fear and frustration were calculated as the mean weighted sum of the items on a subscale. Internal consistency reliabilities for mother-reported fear and frustration were .66 and .74, respectively.

Child fear and frustration were also assessed using laboratory emotion-eliciting tasks administered by an experimenter while the child's mother was not present. These tasks were adapted from the laboratory temperament assessment battery, which is a standardized instrument for assessment of temperament in children 3–5 years of age (Goldsmith, Reilly, Lemery, Longley, & Prescott, 1995). Emotional and behavioral responses to the tasks were later rated by coders unfamiliar with the children and hypotheses of the study.

Fear reactivity was assessed by observed fear expressions and behaviors to a scary object. Children were prompted to touch a toy spider triggered to jump when the child approached it. Child behaviors were coded for intensity of a fear response, ranging from 0 (*no observed response*) to 2 (*obvious, strong response*). Coded behaviors included body motions (e.g., jumping/withdrawing, shaking/fluttering), facial expressions (e.g., widened eyes, tensing face), and vocalizations (e.g., non-language noises, verbal refusals). An overall fear score for each prompt was assigned based on the number of behaviors coded. In addition, latency to touch the spider after the prompt was given was assessed, with potential latencies ranging from 0 to 5 seconds. Total scores were the average overall rated fear across three prompts that also took into account the latency for the child to touch the spider. Internal consistency of the fear scale was .89, and the inter-rater intraclass correlation coefficient (ICC), based on double coding of 20 percent of cases, was .97.

Frustration was assessed by observed distress to a blocked goal, in this case obstructed access to a desirable toy. A desirable prize was locked inside a translucent, plastic box. Children were instructed to try to get the prize out, but were given keys that would not open the box. Each child was required to work on the box for 2 min without interaction with the experimenter. Child behaviors were coded over four 30-second epochs for intensity of frustration, ranging from 0 (*no observed response*) to 2 (*obvious, strong response*). Coded behaviors included body motions (e.g., frustrated hand movements, slamming the keys), facial expressions (e.g., furrowed brow, pursed lips), vocalizations (e.g., sighs, grunts), and annoyance directed toward the experimenter (e.g., glancing at experimenter, questions/ statements posed to experimenter). Appropriately asking the experimenter for help was not included in scores of frustration. An overall frustration score for each 30-second epoch was assigned based on the number of behaviors coded. Total scores were the average overall rated frustration across all four epochs. Internal consistency of the frustration scale was .72, and the inter-rater ICC was .79.

Effortful Control—Effortful control was assessed using behavioral measures of executive control and delay ability. As these measures have been extensively used in prior research, and in order to limit the number of analyses conducted, only behavioral measures of children's effortful control were used (e.g., Kochanska, Murray, & Harlan, 2000; Li-Grining, 2007).

Executive control was assessed using six tasks. The inhibition and auditory attention subscales of the NEPSY were designed for use with children 5 and older (Korkman, Kirk, & Kemp, 1998). However, the scales were administered to allow the use of identical measures of effortful control over time. Thus, these tasks were understandably difficult for children in this sample. The inhibition subtest assesses a child's ability to inhibit a dominant response in order to enact a novel response. Specifically, children are shown an array of circles and squares, and asked to label each shape in an opposite manner (e.g., say circle when they see square) while being timed. The auditory attention subtest is a continuous performance test that assesses the ability to be vigilant, and to maintain and shift selective auditory set. Children are required to listen to a series of words and respond only when they hear a specific target word, while refraining from response to all other words. Total scores were calculated as the proportion of correct responses to the total possible score, with a potential

range of 0–1. Average scores at T1 were .09 (*SD* = .24, range = .00–.93) and .18 (*SD* = .32, range = .00–1.00) for auditory attention and inhibition, respectively.

Cognitive inhibitory control was assessed using the day–night task, which requires the child to say 'day' when shown a picture of moon and stars, and 'night' when shown a picture of the sun (Gerstadt, Hong, & Diamond, 1994). Children's actions were scored 1 for correctly providing the non-dominant response, or 0 for providing the dominant response. Total scores were the proportion of correct responses (*M* = .44, *SD* = .33, range = .00–1.00).

Behavioral inhibitory control was assessed using the bear-dragon task, which requires the child to perform actions when a directive is given by a bear puppet, but not when given by a dragon puppet (Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996). Children's actions were scored as performing no movement, a wrong movement, a partial movement, or a complete movement, with scores ranging from 0 to 3. Total scores were the proportion of the score across both bear and dragon items to the total possible score (*M* = .62, *SD* = .20, range = .33–1.00).

The DCCS assesses cognitive inhibitory control, attention focusing, and set shifting (Zelazo, Müller, Frye, & Marcovitch, 2003). In this task, children were introduced to two black boxes with slots cut in the top. Target cards, consisting of a silhouetted figure on a colored background (star on blue background and truck on red background), were attached to the front of each box. Children were instructed to sort cards according to first the shape (six trials) and then color (six trials) properties on the target cards. The experimenter stated the sorting rule before each trial, and presented a card and labeled it according to the current dimension (e.g., on a shape trial, 'Here's a truck. Where does it go?'). If children correctly sorted ≥50 percent of the cards, they advanced to the next level in which the target cards integrated the sorting properties. Target cards consisted of a colored figure on a white background (blue star and red truck), and children were again instructed to sort according to shape (six trials) and then color (six trials). If they correctly sorted ≥50 percent of the cards, children advanced to the next level in which they were instructed to sort by one dimension (color) if the card had a border on it and by the other dimension (shape) if the card lacked the border (12 trials). The score was the proportion of correct trials out of the total possible of 36 trials (*M* = .42, *SD* = .20, range = .00–.89).

The HTKS integrates attention and inhibitory control (Ponitz et al., 2008). Children are asked to follow the instructions of the experimenter, but to enact the opposite of what the experimenter directs (e.g., touch toes when asked to touch head). Behaviors were coded as 0 (*touched directed body part*), 1 (*self-corrected his/her behavior*), and 2 (*only touched opposite body part*). Total scores were the proportion of the score across items to the total possible score (*M* = .01, *SD* = .07, range = .00–.65). Twenty percent of all executive control tasks were independently rescored. ICCs on all tasks ranged from .72 to .98.

Consistent with previous research, an overall executive control score that integrated attention shifting and focusing (auditory attention, DCCS), cognitive inhibitory control (inhibition, day–night), and behavioral inhibitory control (bear-dragon, HTKS) was computed as the mean of the proportion scores of the six tasks (Carlson & Moses, 2001;

Kochanska et al., 1996; Lengua, Honorado, & Bush, 2007). Executive control scores were considered missing if >50 percent of the component scores were missing. Internal consistency of the composite executive control measure was .67, and the inter-rater ICC was .83.

Delay ability was assessed using a gift delay task (Kochanska et al., 1996). In this task, the child was told that s/he would receive a present, but that the experimenter wanted to wrap it. The child was instructed to sit facing the opposite direction and to not peek while the experimenter noisily wrapped the gift. Children's peeking behavior (frequency, degree, latency to peek, latency to turn around) and difficulty with the delay (e.g., fidgeting, tensing, facial grimaces) were rated. Latencies and behavior scores were converted to proportions of total possible times/scores and were averaged. Internal consistency of the composite delay ability measure was .77, and the inter-rater reliability was .91.

Confirmatory factor analyses were used to test the acceptability of a two-factor model that specified executive control and delay factors. The executive control factor loaded on inhibition, auditory attention, bear-dragon, day–night, DCCS, and HTKS whereas delay ability loaded on peeking frequency, latency to peek, latency to turn around, and difficulty with delay observed scores. The model demonstrated acceptable fit to the data, root mean square error of approximation = .04, confirmatory fit index = .97, $\chi^2(42) = 64.95$, $p = .01$. All standardized loadings were significant, ≥.36, and the correlation of the latent factors was .37, supporting the examination of a two-factor model of effortful control. Further, the two-factor model was compared with a one-factor model in which a single factor loaded on all of the executive control and delay ability indicators. The two-factor model demonstrated a significantly better fit, $\chi^2_{\text{difference}}(1) = 133.30$, $p < .001$. These results support recent calls for research to examine individual components of effortful control rather than use aggregate measures that, due to low intercorrelations across components, may introduce measurement error (McClelland & Cameron, 2012).

Child Adjustment—Mothers reported on children's externalizing and internalizing problems using the child behavior checklist (CBCL), rating items on a 3-point scale (0 = *not true* to 2 = *very/often true*; Achenbach, 1991). The scales were augmented with problem behavior items from the preschool version (ages of 2 to 3; 11 items) that do not overlap with the 4–18 version (34 items) to allow for administration of identical measures across all time points. Additionally, an alternate scoring system for the CBCL was used, providing better sensitivity, positive predictive power, and discriminate validity above the original scales (Lengua, Sadowski, Friedrich, & Fisher, 2001). Internalizing symptoms were assessed by summing maternal responses on the anxiety (12 items) and depression (12 items) scales, and externalizing included the aggression and delinquency scales (21 items). Alphas for externalizing were .74 and .77 at T1 and T2, respectively, and .69 and .74 at T1 and T2, respectively, for internalizing problems. Mothers also reported on their children's social competence using the 34-item social skills rating scale (SSRS; Gresham & Elliot, 1990). Construct validity of the SSRS was demonstrated by consistent associations with other similar measures (e.g., CBCL; Gresham & Elliot, 1990). An overall score of children's social competence was computed as the mean of items on the cooperation (nine items),

assertiveness (nine items), responsibility (10 items), and self-control (10 items) subscales. Alpha was .83 at T1 and .82 at T2.

Analytic Plan

Families were included if they had available data from at least one time point. Data analyses were conducted using FIMLE, which has been found to be less biased and more efficient than other techniques for missing data (Arbuckle, 1996). Our examination of bias in missing data (above) suggested that the pattern of missing data introduced minimal bias and aligned with the assumptions of FIMLE. Data were analyzed using hierarchical linear regressions in Mplus Version 4.2 (Muthén & Muthén, 1998–2006).

Results

Correlations

Table 1 presents descriptive statistics for all variables; correlations are reported in Table 2. Gender (0 = female, 1 = male) was significantly related to both delay ability and externalizing behavior problems at T1 and T2, with boys demonstrating lower delay ability and more externalizing problems. Lower family income was related to lower effortful control, higher frustration, higher T2 externalizing and internalizing problems, and lower T2 social competence. Gender and income were, therefore, included as covariates in all analyses.

Fear and frustration had different relations to each other depending on measurement method. Mother-reported fear and frustration were significantly correlated whereas the observed measures were not. Additionally, observed fear was unrelated to mother-reported negative emotionality whereas observed frustration was significantly correlated with both mother-reported fear and frustration. It appears that mother-reported negative emotionality may be more similar to observed frustration than fear, supporting the importance of investigating fear and frustration reactivity separately rather than as an aggregate construct. As expected, executive control and delay ability were modestly, positively correlated, demonstrating their relation to each other as components of effortful control and also suggesting some independence between them.

Significant correlations among adjustment measures suggest that children demonstrating one type of problem (externalizing or internalizing) are more likely to also demonstrate other problems and be less socially competent. Mother-reported fear and frustration were related to higher internalizing and externalizing problems and lower social competence at T2. In addition, observed fear and delay ability related to lower externalizing problems whereas executive control related to higher social competence. Thus, both reactivity and effortful control variables were plausible predictors of adjustment. Child adjustment was moderately to highly stable from T1 to T2, indicating that there was a modest to moderate degree of change over time to be accounted for by the predictors.

Regression Analyses

To examine whether effortful control moderated the relation of negative emotionality to children's adjustment, hierarchical regressions were tested in which both components of negative emotionality (fear, frustration), both components of effortful control (executive control, delay ability), and the multiplicative of these variables were entered as simultaneous predictors. Regressions were conducted including only one measurement method of reactivity, either observed or mother-reported, resulting in six regression equations in total. Following the recommendation by Curran, Bauer, and Willoughby (2004), components of both negative emotionality and effortful control were mean-centered. The centered values were then used to create the multiplicative terms, as well as entered as direct predictors in the regression equations. Each equation included the corresponding T1 adjustment measure to control for initial levels of problems. Child gender and family income were included as covariates. The results of the three regression equations, including observed negative emotionality, are summarized in Table 3. Table 4 summarizes results including mother-reported negative emotionality. Two interactions emerged as significant, with a third demonstrating a trend toward significance. Each of these was examined further by testing the simple intercepts and slopes at values ±1*SD* from the mean for negative emotionality and effortful control.

Both of the significant and the trend interaction effects predicted externalizing problems. For fear, the interaction between executive control and observed fear was non-significant; however, the interaction between executive control and mother-reported fear was significant (Figure 1). Mother-reported fear was positively related to externalizing problems for children low ($b = .75$, $t = 3.43$, $p < .01$) and moderate ($b = .31$, $t = 2.07$, $p = .04$) in executive control, but not for children high in executive control ($b = -.13$, $t = -.62$, $p = .53$). Children seen as highly fearful by their mothers had significantly more externalizing problems if they also had low to average executive control, but not high executive control. A significant interaction emerged between delay ability and observed fear reactivity (Figure 2). For children with high delay ability, fear was significantly, negatively related to externalizing problems ($b = -1.76$, $t = -2.22$, $p = .03$). Fear was unrelated to externalizing for children with moderate ($b = -.60$, $t = -1.02$, $p = .31$) or low ($b = .57$, $t = .64$, $p = .52$) delay ability. Children with high fear reactivity who also had higher delay ability had lower externalizing problems compared with children who had high fear but only average to low delay ability. The interaction between delay ability and mother-reported fear was not significant.

For frustration, there was a trend toward an interaction between executive control and observed frustration reactivity (Figure 3). Specifically, frustration was positively related to externalizing for children low in executive control ($b = .96$, $t = 2.11$, $p = .04$) but unrelated to externalizing for children high ($b = -.32$, $t = -.79$, $p = .43$) or moderate ($b = .32$, $t = 1.05$, $p = .30$) in executive control. Children demonstrating high frustration and low executive control had more externalizing problems than children with average or high executive control. However, neither the interaction of executive control and mother-reported frustration nor the interaction of delay ability with either measure of frustration reactivity was significantly related to relative changes in externalizing problems.

Contrary to the proposed hypotheses, neither of the components of effortful control interacted with fear or frustration to predict rank-order changes in internalizing problems or social competence. In looking at direct effects, across all three outcomes, initial levels of the corresponding outcome predicted later adjustment, suggesting some continuity in symptoms over time. Low family income prospectively predicted higher symptoms and lower social competence. Except for mother-reported fear, which predicted higher externalizing problems, the direct effects of fear, frustration, executive control, and delay did not predict relative change in adjustment over the effects of initial symptoms or family income.

Discussion

Although previous research has shown direct, additive effects of temperament dimensions on a variety of adjustment indicators, few studies have examined their interactive effects, and those that have often test broad measures of emotionality and regulation. In this study, executive control and delay ability were tested as moderators of the relations of fear and frustration to relative changes in adjustment across 9 months in preschool-aged children.

Hypotheses that effortful control might moderate the relation of negative emotionality to children's adjustment were partially supported, specifically for externalizing problems. Three interaction effects emerged when predicting externalizing problems, even when controlling for initial levels of externalizing. Two of these three interactions involved children's fear reactivity. In the zero-order correlations, higher fear was related to lower externalizing problems, consistent with previous research in which fear related to less aggression, potentially acting as a control system by inhibiting behavior (Rothbart et al., 1994, 2001). In this study, the protective effect of fear on externalizing problems did not exist for children with less developed effortful control abilities. Children perceived by their mothers as highly fearful actually showed increases in externalizing problems if they demonstrated lower executive control. Additionally, fearful children who had difficulty delaying gratification demonstrated higher externalizing problems than those with strong delay ability. Only highly fearful children who also had higher delay ability demonstrated reductions in externalizing problems over time. It may be that the inhibitory tendencies conferred by greater fear can only serve to reduce externalizing problems when not overwhelmed by difficulty delaying gratification. Thus, fear reactivity may be a protective factor for the development of externalizing problems only when specifically in combination with strong delay ability. In combination with deficits in effortful control, children's fearfulness may result in emotionally driven reactions to situations that are then difficult to modulate or inhibit, and may prevent adaptive responding and result in externalizing problems.

Additionally, executive control moderated the relation of observed frustration to externalizing problems. Children rated as high in frustration and low in executive control demonstrated greater relative increases in externalizing problems. These results are consistent with previous research on the interactive effects of negative emotionality and executive control (Eisenberg, Guthrie et al., 2000; Valiente et al., 2003). Together these interaction effects suggest that greater negative emotionality in and of itself may not be a risk factor for externalizing problems when executive control abilities are sufficiently strong

to modulate or regulate the reactivity, and allow for flexible, adaptive, and socially acceptable behavioral responses to the negative emotion. However, greater reactivity in the absence of sufficient executive control appears to confer risk for the development of externalizing behavior problems. It appears that the ability to effectively use adaptive regulation strategies that rely on executive control abilities, such as attention regulation and inhibitory control, is more crucial for children who are prone to experiencing more intense negative emotion than for those who are less reactive.

It is also interesting to see fairly parallel results of executive control moderating mother-reported fear and observed frustration, particularly considering the significant zero-order correlations between these measures. This may suggest that, within this study, maternal report of child fearfulness better captures behavioral features that are more similar to observed frustration (e.g., irritability, agitation) as opposed to features of fear, which may be more internalized, and therefore more difficult for mothers to observe. Conversely, it is possible that children's agitation during the frustration-eliciting task could reflect greater fearfulness in a novel setting. However, this is unlikely given its positive association with mother-reported frustration as well.

Despite significant zero-order correlations of negative emotionality and effortful control with internalizing problems and social competence, there was minimal prediction of relative change in these outcomes. In particular, the expected relation between fear and internalizing problems was not replicated in this study (Belsky et al., 2001; Calkins, Gill, Johnson, & Smith, 1999; Liew et al., 2004). It is possible that the validity of mother-reported internalizing problems in this age group (i.e., 36–49 months) is lower than for externalizing problems, as it may be difficult to detect internalized symptoms in such young children. By contrast, externalizing problems are overt and easily identifiable even at a young age. In addition, there may be a developmental course to fearfulness, such that fear reactivity early in development might be related to more mild problems, like diminished sociability or inhibition in novel situations, which may later develop into internalizing problems by the grade school years (Kagan, Snidman, Zentner, & Peterson, 1999). Thus, it is possible that at later ages, these predicted relations would emerge. As this study is part of a larger longitudinal study, it will be interesting to continue to investigate these reactivity-by-regulation interactions as these children develop from early into middle childhood.

Strengths and Limitations

The use of longitudinal data and a developmental framework supports conclusions about direction of effects, and is a strength of the study. However, it is possible that the time frame of the analyses (i.e., 9 months) was too short to capture developmental changes in children's adjustment given the moderate to high stability of the adjustment measures. It is also possible that some indicators of adjustment at this age reflect children's temperamental difficulties to a greater degree than at older ages, and thus are more characterological than symptomatic. Additionally, the age of the participants was specifically chosen for a larger study examining the emergence and development of effortful control. Although this age range allowed us to examine the effect of temperamental regulation as it first matures, children's effortful control abilities at this age may not have matured enough for the

expected relations to children's adjustment to emerge. Further, executive control was assessed by a variety of measures, including two subscales of the NEPSY, which were normed for children older than those in this study. However, other developmentally appropriate measures were included to capture current levels of executive control. This measurement approach will allow the continued developmental assessment of effortful control in this sample over time.

A further strength of the study is the use of multiple assessment methods, which help minimize the effects of reporter bias and shared method variance. These results demonstrate that examining child behavior from varying perspectives may reveal distinct relations. Observational measures of reactivity may identify individual differences across children exposed to the same context whereas maternal report of reactivity and outcomes may be capturing more general patterns of children's behavior and personality varying across time and contexts. However, it is sometimes difficult to achieve significant associations across differing methods. Finally, the use of a community rather than clinical sample limited the rates at which problem behaviors were exhibited, but also improved generalizability and allowed for the examination of both normative levels of behaviors and the emergence of problems.

Conclusions

Children's effortful control moderates the effects of negative emotionality on the development of externalizing problems, with specific aspects of effortful control having differential effects depending on the type of negative emotionality. Delay ability in combination with greater fear resulted in fewer externalizing behaviors whereas deficits in executive control in combination with greater fear or frustration related to more externalizing problems. These findings highlight the importance of effortful control as a moderator of reactivity. However, many anticipated associations did not emerge. It may be that, within this age group, effortful control has not developed fully enough to demonstrate a significant effect on child outcomes, or that adjustment problems at this age may actually reflect temperamental difficulties as opposed to symptoms of psychopathology. Nonetheless, these findings support the need for continued research on temperament-by-temperament interactions, particularly research that investigates specific as opposed to broad dimensions of temperament. A better understanding of the interactions between regulatory and reactive components of temperament may lead to more efficient and effective intervention efforts that target the strengthening of components of children's self-regulation geared toward the management of specific negative emotions.

References

Achenbach, TM. Manual for the child behavior check-list/4-18 and 1991 profile. Burlington, VT: University of Vermont Department of Psychiatry; 1991.

Arbuckle, JT. Full information estimation in the presence of incomplete data. In: Marcoulides, GA.; Schumacker, RE., editors. Advanced structural equation modeling: Issues and techniques. Hillsdale, NJ: Erlbaum; 1996. p. 243-277.

Belsky J, Friedman SL, Hsieh KH. Testing a core emotion-regulation prediction: Does early attentional persistence moderate the effect of infant negative emotionality on later development? Child Development. 2001; 72:123–133. [PubMed: 11280474]

Bjorklund DF, Kipp K. Parental investment theory and gender differences in the evolution of inhibition mechanisms. Psychological Bulletin. 1996; 120:163–188. [PubMed: 8831295]

Brock LL, Rimm-Kaufman SE, Nathanson L, Grimm KJ. The contributions of 'hot' and 'cool' executive function to children's academic achievement, learning-related behaviors, and engagement in kindergarten. Early Childhood Research Quarterly. 2009; 24:337–349.

Calkins SD, Gill KL, Johnson MC, Smith CL. Emotional reactivity and emotional regulation strategies as predictors of social behavior with peers during toddlerhood. Social Development. 1999; 8:310–334.

Carlson SM, Moses LJ. Individual differences in inhibitory control and children's theory of mind. Child Development. 2001; 72:1032–1053. [PubMed: 11480933]

Collins LM, Schafer JL, Kam CM. A comparison of inclusive and restrictive strategies in modern missing-data procedures. Psychological Methods. 2001; 6:330–351. [PubMed: 11778676]

Curran PJ, Bauer DJ, Willoughby MT. Testing main effects and interaction in latent curve analysis. Psychological Methods. 2004; 9:220–237. [PubMed: 15137890]

Davis EP, Bruce J, Gunnar MR. The anterior attention network: Associations with temperament and neuroendocrine activity in 6-year-old children. Developmental Psychobiology. 2002; 40:43–56. [PubMed: 11835150]

Eisenberg N, Cumberland A, Spinrad TL, Fabes RA, Shepard SA, Reiser M, et al. The relations of regulation and emotionality to children's externalizing and internalizing problem behavior. Child Development. 2001; 72:1112–1134. [PubMed: 11480937]

Eisenberg N, Fabes RA, Guthrie IK, Murphy BC, Maszk P, Holmgren R, et al. The relations of regulation and emotionality to problem behavior in elementary school children. Development and Psychopathology. 1996; 8:141–162.

Eisenberg N, Fabes RA, Guthrie IK, Reiser M. Dispositional emotionality and regulation: Their role in predicting quality of social functioning. Journal of Personality and Social Psychology. 2000; 78:136–157. [PubMed: 10653511]

Eisenberg N, Guthrie IK, Fabes RA, Shepard S, Losoya S, Murphy BC, et al. Prediction of elementary school children's externalizing problem behaviors from attentional and behavioral regulation and negative emotionality. Child Development. 2000; 71:1367–1382. [PubMed: 11108101]

Eisenberg N, Spinrad TL, Fabes RA, Reiser M, Cumberland A, Shepard SA, et al. The relations of effortful control and impulsivity to children's resiliency and adjustment. Child Development. 2004; 75:25–46. [PubMed: 15015673]

Gerstadt CL, Hong YJ, Diamond A. The relationship between cognition and action: Performance of children 3.5–7 years old on a Stroop-like day-night test. Cognition. 1994; 53:129–153. [PubMed: 7805351]

Gilliom M, Shaw DS, Beck JE, Schonberg MA, Lukon JL. Anger regulation in disadvantaged preschool boys: Strategies, antecedents, and the development of self-control. Developmental Psychology. 2002; 38:222–235. [PubMed: 11881758]

Goldsmith HH, Reilly J, Lemery KS, Longley S, Prescott A. The laboratory temperament assessment battery: Description of procedures. 1995 Unpublished manual.

Goldsmith, HH.; Rothbart, MK. Contemporary instruments for assessing early temperament by questionnaire and in the laboratory. In: Strelau, J.; Angleitner, A., editors. Explorations in temperament: International perspectives on theory and measurement. New York: Plenum; 1991. p. 249-272.

Gray, JA.; McNaughton, N. The neuropsychology of anxiety. 2. London: Oxford University Press; 2000.

Gresham, FM.; Elliot, SN. Social skills rating system. Circle Pines, MN: American Guidance Service; 1990.

Hill-Soderlund AL, Braungart-Rieker JM. Early individual differences in temperamental reactivity and regulation: Implications for effortful control in early childhood. Infant Behavior & Development. 2008; 31:386–397. [PubMed: 18279967]

Hongwanishkul D, Happaney KR, Lee WSC, Zelazo PD. Assessment of hot and cool executive function in young children: Age-related changes and individual differences. Developmental Neuropsychology. 2005; 28:617–644. [PubMed: 16144430]

Kagan J, Snidman N, Zentner M, Peterson E. Infant temperament and anxious symptoms in school age children. Development and Psychopathology. 1999; 11:209–224. [PubMed: 16506531]

King KM, Lengua LJ, Monahan KC. Differentiating executive and motivational components of self-regulation: Differences in trajectories, predictors and adjustment. Journal of Abnormal Child Psychology. 2013; 41:57–69.10.1007/s10802-012-9665-0 [PubMed: 22865096]

Kochanska G, Murray K, Jacques TY, Koenig AL, Vandegeest KA. Inhibitory control in young children and its role in emerging internalization. Child Development. 1996; 67:490–507. [PubMed: 8625724]

Kochanska G, Murray KT, Harlan ET. Effortful control in early childhood: Continuity and change, antecedents, and implications for social development. Developmental Psychology. 2000; 36:220–232. [PubMed: 10749079]

Korkman, M.; Kirk, U.; Kemp, S. NEPSY: A developmental neuropsychological assessment, manual. San Antonio, TX: Psychological Corporation; 1998.

Krueger RF, Caspi A, Moffitt TE, White J, Stouthamer-Loeber M. Delay of gratification, psychopathology, and personality: Is low self-control specific to externalizing problems? Journal of Personality. 1996; 64:107–129. [PubMed: 8656312]

Lemery KS, Essex MJ, Smider NA. Revealing the relation between temperament and behavior problem symptoms by eliminating measurement confounding: Expert ratings and factor analyses. Child Development. 2002; 73:867–882. [PubMed: 12038557]

Lengua LJ. Associations among emotionality, self-regulation, adjustment problems and positive adjustment in middle childhood. Journal of Applied Developmental Psychology. 2003; 24:595–618.

Lengua LJ, Honorado E, Bush NR. Contextual risk and parenting as predictors of effortful control and social competence in preschool children. Journal of Applied Developmental Psychology. 2007; 28:40–55. [PubMed: 21687825]

Lengua LJ, Sadowski CA, Friedrich WN, Fisher J. Rationally and empirically derived dimensions of children's symptomatology: Expert ratings and confirmatory factor analyses of the CBCL. Journal of Consulting and Clinical Psychology. 2001; 69:683–698. [PubMed: 11550734]

Liew J, Eisenberg N, Reiser M. Preschoolers' effortful control and negative emotionality, immediate reactions to disappointment, and quality of social functioning. Journal of Experimental Child Psychology. 2004; 89:298–319. [PubMed: 15560876]

Li-Grining CP. Effortful control among low-income preschoolers in three cities: Stability, change, and individual differences. Developmental Psychology. 2007; 43:208–221. [PubMed: 17201520]

McClelland MM, Cameron CE. Self-regulation in early childhood: Improving conceptual clarity and developing ecologically valid measures. Child Development Perspectives. 2012; 6:136–142.

Meesters C, Muris P, van Rooijen B. Relations of neuroticism and attentional control with symptoms of anxiety and aggression in non-clinical children. Journal of Psychopathology and Behavioral Assessment. 2007; 29:149–158.

Muris P. Unique and interactive effects of neuroticism and effortful control on psycho-pathological symptoms in non-clinical adolescents. Personality and Individual Differences. 2006; 40:1409–1419.

Muris P, Ollendick TH. The role of temperament in the etiology of child psycho-pathology. Clinical Child and Family Psychology Review. 2005; 8:271–289. [PubMed: 16362256]

Murray KT, Kochanska G. Effortful control: Factor structure and relation to externalizing and internalizing behaviors. Journal of Abnormal Child Psychology. 2002; 30:503–514. [PubMed: 12403153]

Muthén, LK.; Muthén, BO. Mplus user's guide. 4. Los Angeles, CA: Muthén & Muthén; 1998–2006.

Nigg JT. Temperament and developmental psychopathology. Journal of Child Psychology and Psychiatry. 2006; 47:395–422. [PubMed: 16492265]

Ormel AJ, Oldehinkel AJ, Ferdinand RF, Hartman CA, de Winter AF, Veenstra R. Internalizing and externalizing problems in adolescence: General and dimension-specific effects of familial loadings

and preadolescent temperament traits. Psychological Medicine. 2005; 35:1825–1835. [PubMed: 16300695]

Ponitz CE, McClelland MM, Jewkes AM, Connor CM, Farris CL, Morrison FJ. Touch your toes! Developing a direct measure of behavioral regulation in early childhood. Early Childhood Research Quarterly. 2008; 23:141–158.

Rettew D, McKee L. Temperament and its role in developmental psychopathology. Harvard Review of Psychiatry. 2005; 13:14–27. [PubMed: 15804931]

Rothbart MK. Temperament, development, and personality. Current Directions in Psychological Science. 2007; 16:207–212.

Rothbart MK, Ahadi SA, Hershey KL. Temperament and social behavior in childhood. Merrill-Palmer Quarterly: Journal of Developmental Psychology. 1994; 40:21–39.

Rothbart MK, Ahadi SA, Hershey KL, Fisher P. Investigations of temperament at three to seven years: The Children's Behavior Questionnaire. Child Development. 2001; 72:1394–1408. [PubMed: 11699677]

Rothbart, MK.; Bates, JE. Temperament. In: Damon, W.; Eisenberg, N., editors. Handbook of child psychology: Vol. 3. Social, emotional, and personality development. 6. New York: Wiley; 2006. p. 105-176.

Rothbart, MK.; Derryberry, D. Development of individual differences in temperament. In: Lamb, ME.; Brown, AL., editors. Advances in developmental psychology. Vol. 1. Hillsdale, NJ: Erlbaum; 1981. p. 37-86.

Rothbart MK, Jones LB. Temperament, self-regulation, and education. School Psychology Review. 1998; 27:479–491.

Valiente C, Eisenberg N, Smith CL, Reiser M, Fabes RA, Losoya S, et al. The relations of effortful control and reactive control to children's externalizing problems: A longitudinal assessment. Journal of Personality. 2003; 71:1171–1196. [PubMed: 14633062]

Zelazo PD, Müller U, Frye D, Marcovitch S. The development of executive function in early childhood. Monographs of the Society for Research in Child Development. 2003; 68:1–151.

Zhou Q, Chen SH, Main A. Commonalities and differences in the research on children's effortful control and executive function: A call for an integrated model of self-regulation. Child Development Perspectives. 2012; 6:112–121.

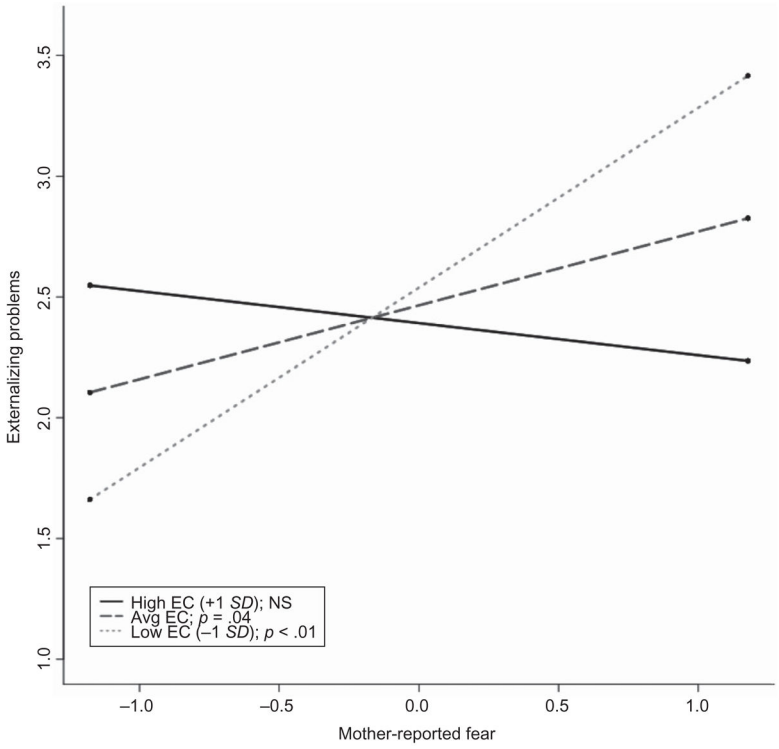

Figure 1.

Executive Control (EC) as a Moderator of the Relation of Mother-reported Fear Reactivity to Externalizing Problems With Simple Slopes Plotted at the Mean and ±1*SD* of Executive Control.

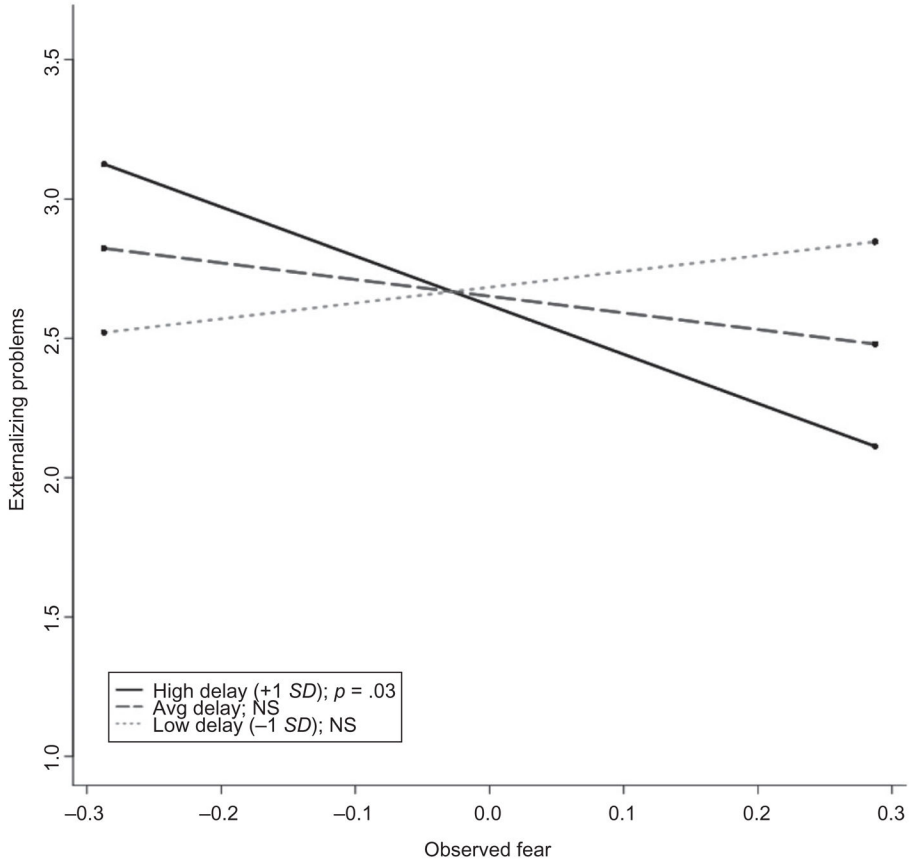

Figure 2.

Delay Ability as a Moderator of the Relation of Observed Fear Reactivity to Externalizing Problems With Simple Slopes Plotted at the Mean and ±1*SD* of Delay Ability.

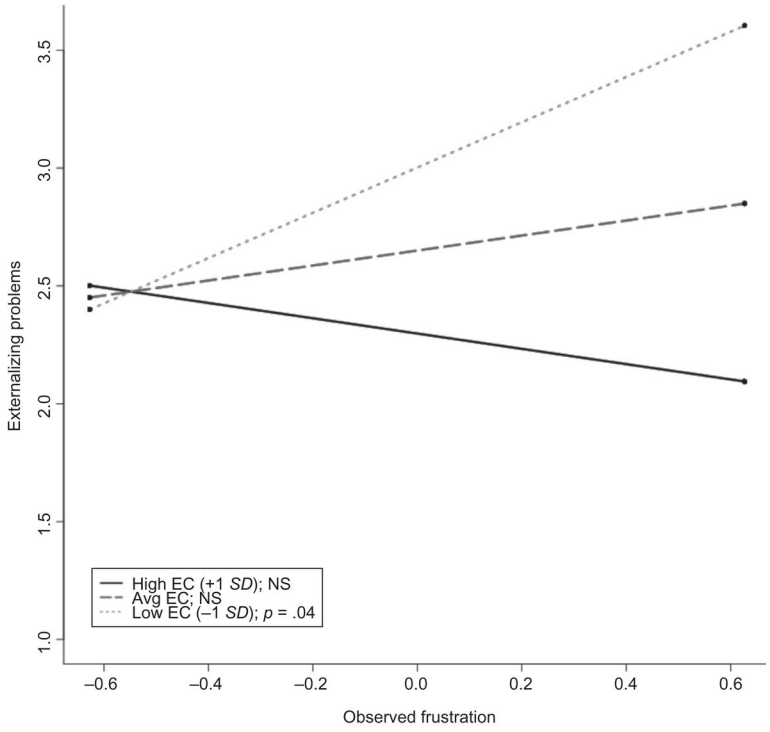

Figure 3.

Executive Control (EC) as a Moderator of the Relation of Observed Frustration Reactivity to Externalizing Problems With Simple Slopes Plotted at the Mean and ±1*SD* of Executive Control Ability.

Table 1

Descriptive Statistics for Study Variables

			Range		
Variable	***M***	***SD***	**Observed**	**Possible**	**Skewness**
Time 1					
Observed					
Fear	.36	.29	.00–.93	.00–1.00	.27
Frustration	1.28	.63	.00–3.00	.00–3.00	.40
Executive control	.29	.15	.00–.77	.00–1.00	.66
Delay ability	.63	.25	.09–1.00	.00–1.00	−.01
Mother-reported					
Fear	3.62	1.17	1.00–7.00	1.00–7.00	.17
Frustration	4.67	1.07	2.17–7.00	1.00–7.00	−.12
Internalizing	4.67	3.55	.00–20.57	.00–48.00	1.22
Externalizing	5.87	3.50	.00–19.00	.00–42.00	.95
Social competence	45.53	8.42	17.00–66.00	.00–76.00	−.03
Time 2					
Mother-reported					
Internalizing	4.87	3.78	.00–24.00	.00–48.00	1.42
Externalizing	5.91	3.78	.00–19.89	.00–42.00	.83
Social competence	47.17	7.86	24.00–68.00	.00–76.00	−.13

Table 2

Variables

er	Family income	Executive control	Delay	Observed fear	Observed frustration	Mom fear	Mom frustration	T1 Internalizing	T1 Externalizing	T1 Social competence	T2 Internalizing	T2 Externalizing
	—											
	.19**	—										
	.24**	.26**	—									
	−.03	−.01	.05	—								
	−.13*	−.03	−.11	.06	—							
	−.11	−.02	−.04	.06	.15*	—						
	−.13*	−.12*	−.04	−.07	.12*	.26**	—					
	.06	−.002	−.02	−.002	.06	.26**	.30**	—				
	−.02	−.08	−.15*	−.13*	.05	.04	.44**	.34**	—			
	.03	.11	.06	.09	−.12*	−.20**	−.29**	−.12*	−.23**	—		
	−.19**	.01	−.10	.04	.05	.20**	.18**	.58**	.22**	.02	—	
	−.16**	−.11	−.15*	−.15*	.06	.14*	.35**	.27**	.66**	−.20**	.39**	—
	.24**	.14*	.05	.11	−.03	−.21**	−.21**	−.11	−.19**	.65**	−.09	−.29**

Soc Dev. Author manuscript; available in PMC 2014 November 24.

Table 3

Hierarchical Linear Regressions: Effortful Control Moderating Observed Negative Emotionality

			Externalizing problems			Internalizing problems			Social competence		
			b	**SE**	**β**	***b***	**SE**	**β**	***b***	**SE**	**β**
Direct effects		Gender	.30	.33	.04	−.17	.36	−.02	−.09	.69	−.01
		Family income	**−.11****	.04	−.11	**−.19*****	.05	−.20	**.42*****	.09	.21
		Initial level	**.69*****	.05	.64	**.63*****	.05	.59	**.60*****	.04	.65
		Fear	−.60	.59	−.05	.74	.63	.06	1.23	1.21	.05
		Frustration	.16	.27	.03	.01	.29	.002	.53	.57	.04
		Executive control	−.99	1.18	−.04	1.90	1.27	.07	1.74	2.45	.03
		Delay	−.13	.72	−.01	−.58	.78	−.04	−1.03	1.50	−.03
Interaction effects	Executive control	Fear	−4.03	4.42	−.04	−6.06	4.80	−.06	−7.88	9.16	−.04
		Frustration	**−3.13***	1.87	−.08	−2.15	2.04	−.05	3.00	3.92	.04
	Delay ability	Fear	**−4.62****	2.40	−.09	−.21	2.62	−.004	6.70	5.00	.06
		Frustration	−.03	1.13	−.001	−.74	1.24	−.03	.34	2.37	.01

* $p = .09$,

** $p < .05$,

*** $p < .01$.

Table 4

Hierarchical Linear Regressions: Effortful Control Moderating Mother-reported Negative Emotionality

			Externalizing problems			Internalizing problems			Social competence		
			b	**SE**	**β**	***b***	**SE**	**β**	***b***	**SE**	**β**
Direct effects		Gender	.31	.33	.04	−.29	.36	−.04	−.37	.68	−.02
		Family income	**−.09***	.04	−.10	**−.20****	.05	−.21	**.41****	.09	.21
		Initial level	**.69****	.05	.64	**.63****	.05	.58	**.59****	.04	.63
		Fear	**.31***	.15	.10	.09	.16	.03	−.43	.31	−.06
		Frustration	.08	.18	.02	.03	.18	.01	.05	.35	.01
		Executive control	−.50	1.15	−.02	2.16	1.26	.08	1.72	2.40	.03
		Delay	−.25	.72	−.02	−.71	.78	−.05	−1.62	1.49	−.05
Interaction effects	Executive control	Fear	**−2.97****	1.05	−.13	−.73	1.12	−.03	−1.96	2.20	−.04
		Frustration	.17	1.19	.01	1.12	1.29	.05	−3.00	2.48	−.06
	Delay ability	Fear	.24	.61	.02	.96	.66	.08	1.98	1.29	.08
		Frustration	.35	.74	.02	−.48	.82	−.03	1.24	1.56	.04

* $p < .05$,

** $p < .01$.