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Associations of Anger and Fear to Later Self-Regulation and Problem Behavior Symptoms

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Abstract

The mediating and moderating roles of self-regulation in the associations of dispositional anger and fear to later conduct and anxiety symptoms were tested. Mothers and teachers rated children's anger and fear at 54 months ($N = 191$), and mothers reported on children's symptoms of anxiety and conduct disorders at 72 and 84 months ($Ns = 169$ and 144). Children's self-regulatory ability was assessed using the Tower of Hanoi task at 72 months. Children's self-regulation mediated the association between early dispositional fear and 84-month mother-reported anxiety disorder symptoms above and beyond the effects of earlier generalized anxiety symptoms. Children's anger directly predicted relatively high mother-reported conduct and anxiety disorder symptoms. Findings are discussed in terms of the importance of considering self-regulation as potential mechanism relating early childhood dispositional reactivity to later psychopathology symptoms.

Keywords

dispositional anger; dispositional fear; self-regulation; general anxiety; conduct disorder

Emotion-related self-regulation has been defined as “the process of initiating, avoiding, inhibiting, maintaining, or modulating the occurrence, form, intensity, or duration of internal feeling states, emotion-related physiological, attentional processes, motivational states, and/or the behavioral concomitants of emotion” required to accomplish and guide goal-oriented behaviors (Eisenberg & Spinrad, 2004, p. 338), henceforth labeled self-regulation. The importance of self-regulatory behaviors for children's social-cognitive competence, school success, and academic achievement has been highlighted by previous researchers (e.g., Meltzer, 2007, Valiente et al., 2011). Poor self-regulation also appears to be a risk for the development of internalizing and externalizing behavior problems, including anxiety and conduct disorders (Eisenberg, Spinrad & Eggum, 2010, Riggs, Blair, Greenberg, 2003; Webster-Stratton, Reid, & Hammond, 2001). Despite the well-established link between

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negative reactivity and poor self-regulation, relatively few attempts have been made to distinguish between distinct negative emotions and their longitudinal relations to self-regulatory abilities across early childhood (e.g., Cuevas, Hubble, & Bell, 2012; Hongwanishkul, Happaney, Lee, & Zelazo, 2005). Thus, the first goal of the current study was to examine the longitudinal relations of children's temperamental negative affectivity, specifically proneness to anger and fear, to children's self-regulation during the transition to elementary school. Next, we examined the mediating and moderating role of self-regulation in the association of dispositional anger and fear to children's symptoms of conduct and anxiety disorders.

Self-Regulation

Research on two overlapping, and related constructs can be used to inform the potential relations between emotionality, self-regulation and children's problem behavior symptoms: executive function and effortful control. Effortful control (EC) is 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). Similarly, executive function (EF) has been conceptualized as the 'higher order, self-regulatory, cognitive processes that aid in the monitoring and control of thought and action' (Carlson, 2005, p. 595). It should be noted that in both EF and EC constructs, the regulation/control of cognitive processes and behaviors is voluntary and goal-directed rather than reactive and involuntary (Diamond, 2006; Ursache, Blair, Stifter, & Voegtline, 2013). Thus, both EF and EC constructs overlap considerably with the construct of effortful self-regulation (Esienberg & Zhou, in press).

A few researchers to date have empirically tested the overlap between EF and EC measures, and their components (Blair & Razza, 2007; Hongwanishkul et al., 2005). The results of these studies have demonstrated that, despite slight distinctions between EF and EC (i.e., working memory as an important indicator of EF but not EC), these two constructs are positively related, or at least have common/overlapping components (e.g., Blair & Razza, 2007; Bridgett et al., 2013). For example, Blair and Razza (2007) found positive relations of inhibitory control and attentional shifting components of EF to parent- and teacher-reported EC. Given considerable similarities between these two major regulatory constructs (i.e., EC and EF; Bridgett, Oddi, Laake, Murdock, & Bachmann, 2013; Zhou, Chen, & Main, 2012), the literature reviewed below includes work focusing on both EF and EC.

The Relation of Negative Reactivity to Self-Regulation

The theoretical and empirical evidence suggests that over-arousal or negative emotional reactivity, both situational and trait-like, may impair individuals' performance on tasks that require regulation of cognitive processes (e.g., attentional processes) and related behaviors (e.g., Philips, Bull, Adams, & Fraser, 2002). From a theoretical stance, the cue utilization and the processing efficiency theories (Easterbrooke, 1959; Eysenck & Calvo, 1992) posit that arousal or reactivity, either transient or trait-like, interferes with cognitive resources (e.g., attention, working memory) that are needed for efficient information processing. An abundance of empirical evidence in animals and humans (both adults and children) has

supported these theories (Bell & Fox, 2003; Blair & Dennis, 2010; Burbridge, Larsen, & Barch, 2005; van der Staay, Schuurman, van Reenen, & Korte, 2009). For example, in a recent study, Ursache et al. (2013) found that 15-month-old infants who displayed high levels of fear reactivity in response to viewing frightening masks had relatively poor EF skills at 48 months of age; however, this relation was stronger for children who had low levels of fear regulation during the task.

Consistent with findings for the negative relations between context-specific negative reactivity and self-regulation, there is some evidence to suggest that children's temperamental negative reactivity (trait-like characteristic) is also related to low self-regulation (e.g., Golan & Neufeld, 1996; Lawson & Ruff, 2004; Perez & Gauvain, 2005; Valiente, Swanson, & Eisenberg, 2012). For example, Hongwanishkul et al. (2005) found that preschoolers' performance on two EF tasks (i.e., card sorting and self-ordered pointing) was negatively related to parents' reports of children's dispositional negative reactivity. Furthermore, Perez and Gauvain (2005) found that mother-reported dispositional emotional intensity (both positive and negative emotions) predicted second-graders' poor performance on a problem solving task that required planning and use of working memory. The negative association between dispositional negative reactivity and children's aspects of self-regulation is not surprising given that situational and dispositional negative emotionality measures often are found to be positively correlated (Murphy & Eisenberg, 2002; Rothbart & Ahadi, 1994).

There is also evidence for the relation between specific negative emotions, including anger and fear, and children's self-regulation. For instance, anger proneness during early childhood has been found to negatively predict children's inhibitory control (a component of self-regulation; Rothbart, Ahadi, Hershey, & Fisher, 2001). Furthermore, findings from several studies have demonstrated that children's dispositional anger and fear were negatively related to children's EC (Derryberry & Rothbart, 1988; Hanish, Eisenberg, Fabes, Spinrad, Ryan, & Schmidt, 2004; Kochanska & Knaak, 2003). Similar results also have been found in non-Western samples (e.g., Chinese and Indonesian children, Zhou, Eisenberg, Wang, & Reiser, 2004; Eisenberg, Liew, & Pidada, 2004). In the current research, we examined the associations of two distinct temperamental negative emotions (anger and fear) to children's later self-regulation. Anger and fear reactivity were expected to predict children's lower self-regulation skills.

The Relation of Self-Regulation to Psychopathology

There is a wealth of evidence demonstrating that poor self-regulatory abilities pose a risk for the development of externalizing behavior problems, perhaps because children with poor self-regulation abilities have difficulty modulating their impulses, as well as emotions such as anger that can lead to externalizing behaviors (Giancola, Roth, & Parrott, 2006; Schoemaker, Mulder, Dekovic, & Matthys, 2013; see Eisenberg et al., 2010, for a review). For example, Hughes and Ensor (2008) found that high levels of EF and engagement in goal-directed behaviors at age 3 predicted lower problem behaviors (e.g., disruptive behaviors) at 4 years of age after controlling for problem behaviors at age 3. Deficits in self-regulation also have been observed in samples of children with clinical levels of

externalizing symptoms (Eiden, Colder, Edwards, Leonard, 2009; Giancola, Martin, Tarter, Pelham, & Moss, 1996; Silk, Steinberg, & Morris, 2003).

Individuals with poor regulatory abilities may ruminate and remain in anxious states following stressful situations—which over time could contribute to the development of anxiety disorders (especially generalized anxiety disorder; see Cisler, Olatunji, Feldner, & Forsyth, 2010, for a review). Indeed, empirical evidence supports a negative relation between self-regulation and internalizing behavior problems (e.g., Eisenberg et al., 2001; Riggs et al., 2003). For example, Riggs et al. (2003) found that sequencing ability (the ability to order, remember, and reconstruct information to achieve a goal -- a core aspect of EF) during 1st and 2nd grade -- predicted declines in internalizing behavior problems. Similarly, Emerson, Mollet, and Harrison (2005) found that among 9 to 11-year-old boys, those with high anxiety and depression scored lower on tasks that required maintaining and/or shifting attention, hypothesis testing, and problem-solving skills compared to a control group.

It should be mentioned that researchers often have tested the relations of regulation to either externalizing or internalizing behavior problems, rather than both types of behavior problems, and often initial levels of problem behaviors have not been taken into account when predicting problem behaviors over time. Based on aforementioned evidence, in the current study, we expected children with poor regulation skills to display higher levels of internalizing (i.e., anxiety symptoms) and externalizing problem behaviors (i.e., conduct problems) a year later, even after controlling for earlier symptoms. The association of self-regulation skills to symptoms of psychopathology (i.e., anxiety and conduct disorders) was examined across the early school years. Understanding such relations during the early school years has obvious relevance to applied issues given the stability of behavior problems during this developmental period (Bufferd, Dougherty, Carlosn, Rose, & Klein, 2012; Heller, Baker, Henker, & Hinshaw, 1996).

The Mediating and Moderating Role of Self-Regulation in the Relation of Negative Emotionality to Psychopathology

The results of a number of studies indicate that temperamental differences during early childhood, including differences in negative emotional reactivity and modulation of negative emotions, relate to the development of internalizing and externalizing behavior problems (e.g., conduct and anxiety disorders; Eisenberg et al., 2001; Eisenberg et al., 2009; Frick & Morris, 2004; Rothbart & Bates, 2006; Turner et al., 1996). Specifically, irritability and the predisposition to anger during early childhood have been found to put children at risk for the development of conduct disorders (e.g., Frick & Morris, 2004; Holmes et al., 2001). Furthermore, high behavioral inhibition, shyness, and fearfulness in the early years have been viewed as developmental precursors or predictors of various anxiety symptoms (e.g., Biederman et al., 2001; Eisenberg et al., 2009; Muris, 2007). Anger and fear proneness often have been examined in relation to different behavior problems, with anger predicting relatively high externalizing problems and fear predicting internalizing problems. Evidence for the relation between anger and internalizing behavior problems has been inconsistent.

Whereas some researchers have found anger to be a risk for the development of internalizing behavior problems (e.g., Eisenberg et al., 2005; Morris et al., 2002), others have reported no or weak associations between anger and internalizing behavior problems (e.g., Lemery, Essex, & Smider, 2002; Muris, Meesters, & Blijlevens, 2007; Rydell, Berlin, & Bohlin, 2003).

In the past few decades, there has been increased interest in identifying the mechanisms involved in the relations of early temperamental differences in children's emotionality to their maladjustment. Recent evidence has highlighted the significance of self-regulation (or components thereof) in the relations between temperamental emotionality and behavior problems (e.g., Garon et al., 2008; Ursache, Blair, Raver, 2012; Luria, 1980). As argued by Urschae, Blair, and Raver (2011), although self-regulation involved in EF or EC encompasses more volitional rather than automatic aspect of regulation (top-down regulatory processes), it is also a consequence of lower order, more automatic, responses in reaction to the environment (e.g., emotion, attention, and stress response systems; bottom up regulatory processes). Indeed, there is some evidence, albeit limited, to support the mediating role of self-regulation (particularly EF) in the relation between emotionality and subsequent behavior problems (Giancola et al., 2006; White, Jarrett, & Ollendick, 2013). Giancola et al. (2006) found that self-regulation (measured using an EF task) mediated the relation between a global measure of difficult temperament (defined by negative reactivity, distractibility, low persistence) and aggressive behaviors among adults between the ages of 21 and 35 years of age. White et al. (2013) also found that parents' reports of children's EF skills mediated the relations between children's reactive aggression and subsequent aggressive behaviors among children between 6 and 16 years old. In addition, recent evaluation work points to the mediating role of effortful self-regulation in reducing behavior problems in children who are temperamentally at-risk for developing conduct and anxiety problems (e.g., Piehler et al., 2013; Webster-Stratton et al., 2001).

It should be noted that self-regulation skills or its components often have been tested as moderator of the association between negative emotionality and behavior problems (Eisenberg et al., 1996; Moran, Lengua, Zalewski, 2013; Oldehinkel, Hartman, Ferdinand, Verhulst, & Ormel, 2007). The result of this line of research has shown that, children who are prone to experience high levels of negative emotions may be at high risk for developing behavior problems, particularly if they lack the ability to regulate their attention and emotional arousal (e.g., shift their attention away from and focus on non-arousing arousing event/stimuli). For example, Moran et al. (2013) found that three-year old children with higher mother-reported fear or observed anger displayed high externalizing behavior problems, but only under conditions of low attentional control. Given evidence for both mediating and moderating roles of self-regulation in the links between temperamental negative reactivity and behavior problems, children's self-regulation at age 6 was tested as both mediating and moderating factor in the relations of children's dispositional fear/anger at age 4.5 years to anxiety/conduct disorder symptoms at age 7.

In the current study, we controlled for children's language abilities (receptive and expressive language) because children with low language ability or IQ scores have found to have poor cognitive and self-regulation skills and to be particularly at risk for expressing negative

emotions and developing psychopathology (Cook, Greenberg, & Kusche, 1994; Emerson, 2003; Jacobs et al., 2002; Manikam, Matson, & Hillman, 1995). Children's self-regulation in the current study was assessed the Tower of Hanoi (TOH) task. TOH is a complex cognitive task that involves several regulatory sub-functions, including working memory and cognitive planning skills (Friedman & Scholnick, 1997; Scholnick & Friedman, 1993; Welsh & Huizinga, 2005).

The present study addressed several gaps in existing literature. First, unlike previous studies, we distinguished between children's proneness to anger and fear as well as between externalizing and internalizing behavior problems when examining their relations with self-regulation. Next, we tested both the mediating and moderating role of self-regulation in the relation between temperamental negative reactivity during childhood and later symptoms of conduct and anxiety disorders, while controlling for earlier levels of children's problem behaviors. Understanding the role that self-regulation plays in the relation between early temperament and subsequent behavior problems is particularly important during early childhood, a period with pronounced advances in regulation skills and associated brain regions (Romine & Reynolds, 2005).

Method

Participants

The families who participated in the current study were part of a larger longitudinal study of toddlers' emotional and social development. Mothers and their infants were recruited at birth from three local hospitals in the southwest, United States. At the first laboratory assessment (18 months of age), 247 families participated in person, and mothers and their children came to the laboratory again when children were approximately 30, 42, and 54 months of age. At 72 months, a home visit (rather than a laboratory assessment) was conducted, and at 84 months, follow-up questionnaires were mailed to parents. About 2 weeks prior to each assessment, parents were sent a packet of questionnaires including a questionnaire about children's temperament. Mothers were asked to complete the questionnaires and return them through mail or bring them to the laboratory/home visit. At the end of the laboratory/home visit, parents provided permission and contact information for teachers; teachers received and returned questionnaires through the mail. The current study only included data from 54, 72, and 84 months (called T1, T2, and T3, respectively). There were 191 participants at T1 (107 boys and 84 girls; age range = 52.97 to 57.20 months, $M = 53.89$, $SD = .80$), 169 participants at T2 (94 boys and 75 girls; age range = 68.39 to 80.50 months, $M = 78.16$, $SD = 1.49$), and 144 participants at T3 (81 boys and 63 girls; age range = 79.57 to 92.93, $M = 84.86$, $SD = 2.80$).

The majority of children in the current sample were Caucasian (85.9%, 87.0%, and 88.9% for T1, T2, and T3, respectively). However, African-American (3.7%, 3.0%, and 2.1%, for T1, T2, and T3, respectively), Asian American (1.0%, 1.2%, and 1.4%, for T1, T2, and T3, respectively) and Native American (3.1%, 2.4%, and 2.1%, for T1, T2, and T3, respectively) children also were represented, with some additional participants rated as other race/ethnicity (6.3%, 6.5%, and 5.6%, for T1, T2, and T3, respectively). In terms of children's ethnicity, most of children were non-Hispanic (88.4%, 88.7%, and 90.2%, for T1, T2, and

T3, respectively); children of Hispanic origin included 11.6%, 11.3%, and 9.8% of the sample, for T1, T2, and T3, respectively. For all time points, the median level of annual family income (1 = *less than \$15,000*; 2 = *\$15,000–30,000*; 3 = *\$30,000–45,000*; 4 = *\$45,000–60,000*; 5 = *\$60,000–75,000*; 6 = *\$75,000–100,000*; 7 = *over \$100,000*) reported by mothers was 5.0, and the median level of parents' education (1 = *grade school completion*, 2 = *some high school*, 3 = *high school graduate*, 4 = *some college*, 5 = *4 year college graduate*, 6 = *Master's degree*, and 7 = *Ph.D., J.D., or M.D.*) was 4.0 for both mothers and fathers.

Attrition

Families in our analytic sample ($N = 199$) --which included those participants who had data for at least one data point across T1 and T3 — were compared on demographic variables to the 62 families who were lost due to attrition from 18 months (the first data collection time point for the larger study). Specifically, for child's sex, ethnicity and race, chi-square statistics were computed, and for child's age, maternal education, and family income, t -tests were computed to test the between-group differences. No differences were found between families in our analytic sample and those who were lost due to attrition from 18 months.

Procedure

Mothers and teachers rated children's temperamental negative emotional reactivity at T1 ($ns = 189$ and 142 , for mothers and teachers, respectively), and mothers rated children's symptoms of conduct and anxiety disorders at T2 and T3. At T2, the Tower of Hanoi task was administered during a home visit to assess children's self-regulation. The home assessments were videotaped for later coding. The mothers were asked to remain uninvolved during the home visits. Children received a toy and a t-shirt, and mothers and teachers were paid for their participation.

Measures

Children's proneness to fear and anger—The intensity and frequency (combined) of children's fear and anger expressions were measured using mothers' and teachers' reports on the Child Behavior Questionnaire (CBQ; Rothbart, 2000; 1 = *never* and 7 = *always*) at T1. Mothers and teachers rated 13 and 11 items about children's dispositional anger, respectively, and 13 items about children's dispositional fear ($\alpha s = .80$ and $.87$ for mother- and teacher-reported dispositional anger, and $.77$ and $.65$, for mother- and teacher-reported dispositional fear, respectively). Sample items were "When you mildly criticized or corrected her/his behavior, how often did your child get mad?," and "While watching TV or hearing a story, how often did your child seem frightened by 'monster' characters?," for anger and fear, respectively. Composites of mother- and teacher-reported dispositional anger and fear were calculated by averaging the items within subscale and reporter (reversing items as needed). We then created adult-reported anger and fear composites by standardizing and averaging mothers' and teachers' reports of dispositional anger and fear, which were positively correlated, $r s(142, 134) = .35$ and $.18$, $p s < .01$ and $.04$, for anger and fear, respectively.

Children's self-regulatory skills—Children's performance on the Tower of Hanoi Task (Welsh, 1991), which is a measure frequently used to assess young children's executive function and regulatory skills (e.g., Kopecky, Chang, Klorman, Thatcher, & Borgstedt, 2005; Sullivan, Riccio, & Castillo, 2009; Welsh, 1991), was assessed at T2. The tools that were used in the Tower of Hanoi Task included a $4 \times 45.7 \times 3.8$ cm wooden platform with three pegs (left, center, and right), and three rings of different sizes (small, medium, and large). The three rings were placed on the left peg of the platform; the largest ring was placed on bottom, the medium ring in-between the other two rings, and the smallest ring on top of the medium ring. The child's goal was to move the rings from the left peg to the right peg of the platform. The rings were to end up on the right peg in their initial order (the largest ring on bottom, then the medium ring, and the smallest ring on top). Furthermore, only one ring was allowed to be moved from one peg to another peg at a time. The instructions about how to play the game were given to children by a trained experimenter. Children also were presented with a photograph of the final goal; the photograph remained visible to children during the task.

Before starting the task, the experimenter played a practice game with the child which was a simpler version of the actual task. The final goal was the same, but the rings' initial positions were such that only 2 moves were required to reaching the final goal if the child used the most efficient moves. In the 2-move game, the large ring was placed on the right peg, the medium ring was placed on the center peg, and the small ring was placed on the left peg. After the practice game, the experimenter set up the actual task, which was a 5-move game. Five moves were required to reach the goal if the child used the most efficient solution. The initial placement of the rings was such that the large ring was placed on the left peg, the medium ring was placed on the center peg, and the smallest ring was placed on the right peg. The child was given 2 minutes to accomplish the goal; if the solution was not reached after 2 minutes, the experimenter set up a 4-move game. The initial placement of the rings was such that the large ring was on the left peg, and the medium and small rings were on the center peg with the small ring on top of the medium ring. The child was given 2 minutes to reach the final goal state. If no solution was reached by the end of the 2-minute period, the experimenter helped the child complete the task.

Because children did not have a score for both games, using a 5-point scale, a variable was computed based on children's overall efficiency of problem-solving (4 = *solved 5-move game without extra moves* ($n = 17$), 3 = *solved 5-move game with extra moves* ($n = 32$), 2 = *solved 4-move game without extra moves* ($n = 61$), 1 = *solved 4-move game with extra moves* ($n = 8$), or 0 = *did not solve either 5- or 4-move game* ($n = 32$)). Reliability was assessed on 20% of the data. For both 4- and 5-move games, the intra-class correlation (ICCs) was .98.

Children's symptoms of conduct and anxiety disorders—At T2 and T3, mothers rated items about children's symptoms of conduct and anxiety disorders using two subscales of the Child Symptom Inventory-4 (CSI-4; Gadow & Sprafkin, 2002): conduct disorder (10 items; e.g., "Compared with other children the same age, bullies, threatens, or intimidates others."), and general anxiety disorder (8 items; e.g., "Compared with other children the same age, has nightmares about being separated from parent."). The items of CSI

correspond to disorder symptoms as defined by the Diagnostic and Statistical Manual of Mental Disorders (4th ed. [DSM-IV]; American Psychiatric Association, 1994). Thus, CSI subscales are used for identifying and screening for behavioral symptoms of disorders.

There are two ways to score the items: the categorical scoring, which computes the count of symptoms (0 = *never* and 1 = *often*), and the dimensional scoring, which uses a 4-point scale (0=*never* to 3=*very often*) for item ratings. For categorical scoring, if the number of items that were rated 1 is equal or greater than the number of disorder symptoms (as identified by DSM-IV), the child receives a score of *yes* for having the disorder. Because our sample did not have many children whose behavior warranted diagnosis, we used the symptom severity scoring (dimensional scoring). The symptom severity scores do not signify a clinical diagnosis.

The CSI has been shown to have satisfactory internal consistency and test-retest reliability; mothers' and teachers' reports of CSI subscales also have exhibited stability across 4 years among 6- to 10-year-old children (Sprafkin, Gadow, Salisbury, Schneider, & Loney, 2002). The measure also has shown good construct validity as relations have been found between scores obtained from this scale and those obtained from the Child Behavior Checklist (CBCL; Achenbach, 1991), and the Diagnostic Interview for Children and Adolescents-Revised-Parent Version (DICA-P; Reich, Shayka, & Taibleson, 1991). The composites of conduct disorder and general anxiety symptoms were calculated by summing the items within subscale (α s = .66 and .68 for conduct disorder symptoms at T2 and T3, respectively, and .66 and .70 for mothers' reports of anxiety disorder symptoms at T2 and T3, respectively).

Children's receptive and expressive language—Children's receptive and expressive language was assessed at T1 using the third edition of Wechsler Preschool and Primary Scale of Intelligence (WPPSI; Wechsler, 2002). To assess children's receptive language, children were presented with 38 pictures (four pictures per page) and were asked to point to the picture that matched to the word that was spoken by experimenter (1 = *pass*, 0 = *fail*). The obtained raw scores (possible raw score range = 0–38 points) were standardized using the WPPSI manual (possible scale score range = 1–19). To assess children's expressive language, children were asked to name a series of items, 5 pictures and 20 verbal items). The raw scores (possible raw score range = 0–43 points) were scaled based on the instructions provided in the WPPSI manual (possible scale score range = 1–19). A composite score was computed by standardizing and then averaging children's expressive and receptive language skills, $r(167) = .49, p < .01$.

Results

Descriptive Statistics

Means and standard deviations of the study variables are reported in Table 1. Although T3 conduct disorder symptoms were skewed, the variable was not transformed because the final analyses were computed using a bootstrapping procedure that is robust to non-normality. Sex differences were examined for all demographic and study variables; girls had higher scores on language ability (average of expressive and receptive language) than did boys (M s

= 11.95 and 10.81, $SDs = 3.60$ and 3.23 , for girls and boys, respectively; see Table 1 for the results of t -tests). No other significant sex differences were observed.

Correlations Among Study Variables

Correlations between study variables within and across time are presented in Table 2. Children's dispositional anger and fear were positively related to each other within time, although this correlation was fairly weak. Children's dispositional fear, but not anger, at T1 was negatively related to T2 regulation. Children's T1 language was negatively related to children's T1 dispositional anger and was positively related to T2 self-regulation. No associations were found between children's language ability and dispositional fear or psychopathology symptoms.

Children who were reported to have high levels of T1 anger were reported to have relatively high levels of T2 and T3 conduct disorder and general anxiety disorder symptoms. In addition, children with lower T2 self-regulation also had higher general anxiety disorder symptoms at T3. Children's symptoms of conduct problems at T2 and T3 were unrelated to their T2 regulation. Children's conduct disorder and general anxiety symptoms showed stability over time and were positively related to each other both within and across time.

The Mediating Role of Self-Regulation

A path analysis panel model was conducted using *Mplus* version 6.0 (Muthén, & Muthén, 1998–2010) to examine the mediating role of self-regulation in the relation between dispositional anger and fear to conduct and anxiety symptoms. The direct paths in the model included paths from the following: 1) T1 dispositional anger and fear to T2 self-regulation, and to T2 and T3 symptoms of conduct and general anxiety symptoms, respectively, and 2) T2 self-regulation skills and T2 conduct and anxiety disorder symptoms to T3 conduct and general anxiety symptoms. Children's language at T1 was used as a covariate predicting T2 self-regulation and T2 symptoms of general anxiety and conduct disorders.¹ Within-time correlations among language, dispositional anger, and dispositional fear at T1, as well as among disturbances of T2 self-regulation skills, and T2 anxiety and conduct symptoms, also were specified in the model. Full Information Maximum Likelihood (FIML) estimation was used for handling missing data under the assumption that the data were *missing at random* (MAR; Acock, 2005).²

In addition to testing the direct effects, the indirect effects of children's dispositional fear on anxiety disorder symptoms and of children's dispositional anger on conduct disorder symptoms through self-regulation skills were tested. The indirect effects were assessed using the bias-corrected confidence interval method using the bootstrapping procedure (5000 draws and 10,000 iterations), which is robust to non-normality and small sample size (MacKinnon, 2008; MacKinnon, Lockwood, & Williams, 2004). Mediation is considered to

¹A model was also computed in which children's sex was controlled; however, consistent with the correlations, paths from sex to the study variables were not significant. Thus, sex was not used as control variable.

²Little's test was performed to examine the null hypothesis that the data were not missing completely at random (MCAR). The results were not significant, suggesting that the data were missing completely at random, $X^2(80) = 99.37, p = .07$.

be significant if the bias-corrected confidence intervals (CIs) do not include zero (MacKinnon, 2008; MacKinnon, Lockwood, & Williams, 2004).

The resulting model converged without error and fit the data well, $\chi^2 (df = 4) = 7.63, p = .11$ (nonsignificant chi-squares indicate good fit), CFI = .98 (values greater than .95 indicate good fit; Kline, 2010), RMSEA = .07, and SRMR = .03 (values less than .05 indicate good fit; Hu & Bentler, 1999; see Figure 1). As expected, children who were reported to have higher dispositional fear at T1 had lower self-regulation skills. Furthermore, children who were observed to have higher self-regulation were reported to have lower T3 general anxiety disorder symptoms. There were no direct relations between children's earlier dispositional fear and children's T2 or T3 anxiety disorder symptoms. The estimated indirect effect of children's T1 dispositional fear to T3 general anxiety disorder symptoms through T2 self-regulation was .16 and significant with 95% CI [.04, .37]. This result indicated that children's T1 dispositional fear and T3 general anxiety disorder symptoms were indirectly related to each other through children's T2 self-regulation, even after controlling for earlier symptoms of general anxiety (percentage of total effect that was mediated by T2 problem-solving skills = 69).

Children's dispositional anger was unrelated to children's self-regulation and self-regulation scores were unrelated to children's T3 symptoms of conduct disorder. Children's dispositional anger positively predicted children's T2 and T3 conduct disorder symptoms and T2 general anxiety disorder symptoms. Children's T1 language ability positively predicted T2 self-regulation but was unrelated to children's conduct and general anxiety symptoms. In addition, the anxiety and conduct disorder symptoms showed stability from T2 to T3.

In terms of within-time correlations and disturbance correlations, children's anger reactivity was positively related to fear and was negatively related to children's language skills at T1. No relation was found between T1 fear and language. At T2, children's conduct and anxiety symptoms were positively related to each other, and children's anxiety symptoms were negatively related to self-regulation; however, conduct disorder symptoms were unrelated to T2 regulation skills. Children's conduct and anxiety disorder symptoms at T3 also were unrelated to each other.

The Moderating Role of Self-Regulation

To explore the moderating role of regulation in the associations between negative emotionality and later behavior problem symptoms, a model was run in *Mplus* using FIML estimation. The direct paths in this model included paths from T1 anger and fear to T2 and T3 conduct and anxiety disorder symptoms, and paths from T2 to T3 conduct and anxiety disorder symptoms. Children's language at T1 was used as a covariate, predicting T2 symptoms of general anxiety and conduct disorders and within-time correlations among language, dispositional anger, and dispositional fear at T1 also were specified in the model. To model the interaction effects, first anger, fear and self-regulation were centered and then interaction terms were computed. Next, the following paths were included to the model: 1) paths from T2 self-regulation and the interaction of anger and regulation to T2 and T3 conduct problem symptoms, and 2) paths from T2 self-regulation and the interaction of fear

and regulation to T2 and T3 anxiety problem symptoms. The resulting model fit the data adequately, $\chi^2(6) = 11.03$, $p = .09$, CFI = .97, RMSEA = .07, and SRMR = .03. Similar to the previous model, 1) the conduct and general disorder symptoms showed stability over time, $bs = .53$ and $.40$, $ps < .05$, respectively; 2) T3 conduct disorder symptoms were only directly and positively predicted by T1 anger proneness, and 3) T3 anxiety symptoms were negatively predicted by self-regulation. However, the interaction effects were not significant, $bs = -.10$ and $.11$, for anger by self-regulation and fear by self-regulation interactions, respectively.

Discussion

The role of temperamental negative emotionality in children's externalizing and internalizing behavioral problems has been highlighted by researchers (e.g., Dougherty, Klein, Durbin, Hayden, & Olino, 2010; Lipscomb et al., 2012). Given that understanding the mechanisms or protective factors that might contribute to these relations are important, the primary goal of this study was to examine the mediating or moderating role of self-regulation in the relations of early childhood dispositional negative reactivity to children's later behavior problems (i.e., conduct and generalized anxiety symptoms). Unlike previous studies, we differentiated between children's proneness to distinct negative emotions of anger and fear, and their relations to children self-regulation as well as externalizing and internalizing behavior problems. The results of the current study supported a mediational process for the relation of children's fear to internalizing symptoms. No evidence was found for the mediating role of self-regulation in the relation between dispositional anger and later conduct disorder symptoms, although a direct relation was found. Further, no evidence was found for the moderating role of self-regulation in the relations of anger and fear reactivity to subsequent related behaviors problems.

Specifically, our results indicated that children with high levels of dispositional fear had poor performance on the self-regulation task (that required goal setting, planning, and regulation of behaviors, emotions and attentional processes) a year later, which in turn was positively related to children's generalized anxiety disorder symptoms a year later. Vasey, Crnic, and Carter (1994) argued that the experience of worry and fear is the result of foreseeing and anticipating future negative events and ruminating about negative possibilities. These potentially overwhelming feelings in response to challenging and novel situations are more likely to become activated in children who are prone to fear and to impair regulation of cognitive resources such as executive attention, working memory, and cognitive flexibility required for carrying goal-oriented behaviors (Garon et al., 2008; Mesulam, 2002). These children over time also may be less likely to regulate anxious behaviors and related negative cognitions (e.g., anticipating negative possibilities) inherent in some internalizing problems. Because children's earlier levels of generalized anxiety disorder symptoms were controlled in the current study, this finding highlights the potential importance of children's poor self-regulation (particularly during anxiety-evoking tasks) in the emergence of, and increases in, later anxiety symptoms.

Whereas early childhood predisposition to fear was indirectly related to symptoms of anxiety problems through self-regulation, children's high dispositional anger during the

early years directly predicted high levels of conduct disorder symptoms at 72 and 84 months. This result replicated findings of previous studies indicating that children with high anger/frustration may be at higher risk for developing externalizing behaviors and/or conduct problems (Deater-Deckard, Petrill, & Thompson, 2007; Eisenberg et al., 2001, Eisenberg, Ma, Zhou, West, & Aiken, 2007; Frick & Morris, 2004); however, in many studies, initial level of externalizing problems were not controlled. It is possible that other mechanisms (that we did not measure in the current study), such as maladaptive social information processing or negative parenting behaviors/practices, play a mediating role in the relation between anger reactivity and later conduct problems. For example, children who are prone to anger may be more likely to interpret others' behavioral and facial cues as angry when they are not and show bias toward interpreting others' behaviors as angry. This maladaptive pattern of social information processing, in turn, may be related to children's aggressive reactions (Dodge, Pettit, Bates, Ernest, 1995). Children who are prone to anger have been found to elicit more negative parenting behaviors (i.e., negative control) from their parents, which in turn have been related to aggressive behaviors (Campbell, 1995; Putnam, Sanson, & Rothbart, 2002). Alternatively, it is possible that the relations between dispositional anger and conduct problems are direct and not mediated by regulatory variables.

Anger at 54 months also predicted relatively high levels of generalized anxiety symptoms when children were 72 months of age. Research evidence regarding the associations of anger and internalizing behavior problems are mixed. Whereas some researchers have found no or weak associations between anger and internalizing behavior problems (e.g., Lemery et al., 2002; Muris et al., 2007; Rydell et al., 2003), there is some evidence to show that anger reactivity predicts more serious types of internalizing behavior problems (e.g., anxiety symptoms), especially when children are older, rather than younger (Eisenberg et al., 2005; Morris et al., 2002). Our result regarding the prediction of children's generalized anxiety symptoms during the elementary school years from early dispositional anger was consistent with the latter findings. It is possible that these children had comorbid anxiety and conduct disorder symptoms. Thus, future research should examine the relations between anger and fear to self-regulation in children who are diagnosed with comorbid anxiety and conduct problems versus only one or the other.

Unexpectedly, we did not find any evidence for the relation between dispositional anger and self-regulation or for the relation between self-regulation and conduct disorder. The latter result is inconsistent with a body of research indicating that deficits in regulation, including EC and EF, plays a significant role in the emergence and development of aggressive behaviors. One possible explanation for this nonsignificant result may be due to the nature of the sample we used in the current investigation. Perhaps conduct disorder symptoms do not, for some children, become apparent (especially to the mothers who were reporters of conduct disorder symptoms in the current investigation) until the later school years when high levels of aggression might affect school adjustment and peer relationships. Indeed, the average levels of mother-reported conduct disorder symptoms in the current study were relatively low, suggesting that mothers perhaps underreported their children's conduct disorder symptoms.

A number of research studies have focused on examining the role of self-regulation skills, including EF and EC, as a moderator of the relations between negative reactivity and subsequent behavior problems (e.g., Lyndsey, Lengua, Zalewski, 2013; Oldehinkel, Hartman, Ferdinand, Verhulst, & Ormel, 2007). The results of these studies have demonstrated that, under conditions of poor regulation, reactive children who also have poor regulatory skills may be at higher risk for developing behavior problems later in life than reactive children with high regulatory abilities. In the current study, we did not find any evidence for the moderating role of self-regulation in the relation between fear reactivity and subsequent anxiety symptoms (or for the moderating role of self-regulation in the relation between anger and conduct problems). Rather, our results demonstrated that regulatory skills served as a mediating mechanism to explain the relations between temperamental characteristics and later behavior problems. One possible explanation for this result could be that the task that was used in the current study was more cognitive-based rather than emotion-based. Perhaps emotion-based regulation serves as a protective factor against development of behavior problems in children prone to negative emotions, whereas the regulation of cognitive resources (attention regulation) has direct effects to anxiety disorders. Thus, an important direction for future research is to test whether the regulation of negative emotions, measured using a task that focus more on the emotion-based rather than cognitive-based regulation, moderates the pathways found in the current study.

Examining how emotional processes (e.g., temperamental negative emotionality) relate to later regulatory abilities during early school years is especially important because of the rapid changes in children's brain structures and cognitive and emotional capacities during this period (Schore, 2001). Thus, the results of the current study contribute to the somewhat limited body of research on the role of mechanisms, particularly self-regulatory abilities, as a potential mediator linking children's negative emotionality and behavior problems during early school years. One strength of the current study was that we controlled for language abilities which has shown to play a role in development of self-regulation during early childhood (Remine, Care, & Brown, 2008; Vallotton & Ayoub, 2011). Indeed, larger vocabulary and better language skills may help children to better formulate questions, rules, or plans and to monitor and control their actions (Remine et al., 2008). In the future, researchers might utilize other measures of overall cognitive ability (e.g., non-verbal intelligence) to examine whether our results would be replicated.

Furthermore, we utilized longitudinal data when examining the associations among children's temperamental negative emotionality, self-regulation, and later behavior problem symptoms. Examining the longitudinal associations among aforementioned variables is particularly important because there may be a developmental lag between the acquisition of many cognitive and emotional components involved in self-regulation and the behavior difficulties associated with them (Riggs et al., 2003).

Despite its strengths, our study had several limitations that must be considered. First, although we used a behavioral measure of self-regulation, only mothers' reports of children's behavior problem symptoms were used. Thus, utilizing an even stronger methodological approach (i.e., multiple reporters to rate children's anxiety and conduct disorder symptoms) to reduce shared method bias (between emotionality and behavior

problem measures) would be desirable in future research. In addition, given that we did not have multiple reporters or methods to measure the majority of the constructs, we conducted a path analysis to test the longitudinal relations of temperament and self-regulation to the symptoms of conduct and anxiety disorders. In the future, researchers should consider testing similar models using latent variables to account for measurement errors.

Nevertheless, the results of this study highlight the significance of children's self-regulation as a potential mechanism through which high levels of fear during early childhood relate to later anxiety symptoms. Efforts to teach children self-regulation skills may be effective in helping to reduce children's potential internalizing symptoms. In addition, the direct links found between anger and conduct problems suggest that intervention programs should focus on reducing children's dispositional anger, which has been found to be modified by environmental factors (e.g., parenting; Putnam et al., 2002).

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Highlights

- Self-regulation mediated the longitudinal relation between fear reactivity and anxiety
- Toddler's fear reactivity negatively predicted their later self-regulation
- Toddlers' self-regulation in turn predicted later anxiety symptoms
- Toddlers' anger reactivity was unrelated to later self-regulation skills
- Anger reactivity positively predicted to later conduct and anxiety problems

Figure 1.

The mediating role of self-regulation in the associations of children's dispositional anger and fear to symptoms of conduct and general disorder symptoms.

Notes. * $p < .05$. ** $p < .01$. Standardized estimates are presented in parentheses. Dashed lines indicate nonsignificant relations; black bold lines indicate significant mediated pathways. T1 language was used as a control variable for all variables at T1 and T2.

Table 1

Descriptive Statistics of the Study Variables

Study Variables	N	M	SD	Skew	Kurtosis	Min	Max	T
T1 Mother dispositional fear	189	3.89	.93	.18	-.47	2.00	6.15	-.91
T1 Mother dispositional anger	189	4.60	.78	-.14	-.02	2.54	6.62	-1.07
T1 Teacher dispositional fear	134	3.85	.60	.21	1.18	1.77	5.62	-1.48
T1 Teacher dispositional anger	142	4.21	1.09	-.21	-.33	1.27	6.55	-.73
T1 dispositional fear	189	.01	.84	.07	-.61	-1.95	2.12	-.61
T1 dispositional anger	189	.01	.86	-.10	-.21	-2.25	2.19	-2.00
T1 expressive and receptive language	168	11.25	2.81	.08	-.83	5.00	17.00	-2.16*
T2 self-regulation	150	1.96	1.26	-.23	-.80	.00	4.00	-.36
T2 conduct disorder symptoms	158	1.28	1.61	1.46	1.96	.00	7.00	.84
T2 general anxiety disorder symptoms	157	3.36	2.48	1.22	2.10	.00	13.00	.43
T3 conduct disorder symptoms	134	.61	1.51	2.69	8.44 ^a	.00	9.00	.64
T3 general anxiety disorder symptoms	137	2.95	2.49	1.62	4.29	.00	15.00	.59

*Note.** $p < .05$.** $p < .01$; T = t -test results examining sex differences between males and females on study variables. T1 dispositional anger and fear are the average of mothers' and teachers' reports.

Table 2

Correlations Between Study Variables

Study Variables	1.	2.	3.	4.	5.	6.	7.	8.
1. T1 dispositional anger	---	.22**	-.31**	-.03	.16*	.22**	.24**	.18*
2. T1 dispositional fear		---	.01	-.20*	-.09	.13	-.01	.16
3. T1 language			---	.23**	.01	.00	-.02	.05
4. T2 self-regulation				---	-.02	-.15	.01	-.31**
5. T2 conduct disorder symptoms					---	.34**	.56**	.23**
6. T2 general anxiety disorder symptoms						---	.30**	.48**
7. T3 conduct disorder symptoms							---	.26**
8. T3 general anxiety disorder symptoms								---

Notes.

* $p < .05$.

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$p < .01$; N ranged between 119 to 205. T1 dispositional anger and fear are the average of mothers' and teachers' reports..