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Differential Components of Reactivity and Attentional Control Predicting Externalizing Behavior

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Externalizing behavior is characterized by conduct problems, aggressive or disruptive actions, and antisocial behaviors; these behaviors represent a pervasive problem that negatively impacts current functioning and reliably predicts later psychopathology in adulthood, including antisocial behavior (Zhou et al., 2007). Early deficits in self-regulation have been implicated in externalizing outcomes; however, greater specificity is needed to understand the role of individual components of self-regulation in the development of externalizing behaviors. For example, Rothbart and colleagues' temperament model (2000) suggests that self-regulation is best conceptualized as a dynamic interplay between biological reactivity and regulatory skill development. However, the specific components of reactivity and regulation, and their subcomponents, have not been thoroughly investigated in most research. Establishing the presence of an essential and unique interplay between subcomponents would assist in the identification of those children most at risk for developing externalizing problems in preadolescence. The present study adopts a developmental psychopathology perspective which emphasizes the importance of developmental tasks, as well as context, in the shaping of adaptive and maladaptive behavior (Cicchetti, 1984). Furthermore, we sought to examine the contribution of reactivity and one specific aspect of regulation (i.e. attentional control) at age 4 to the development of externalizing behaviors at age 10. Interactions between subcomponents were examined to determine which specific combination of reactivity and attentional control predicts of externalizing behavior in preadolescence. Research questions were guided by Eisenberg and Fabes' (1992) heuristic model, which suggests that externalizing behavior is associated with low levels of regulation, particularly for those children who experience negative emotions intensely.

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Reactivity is defined as the arousability of motor, affective, and sensory response systems; more explicitly, it is the propensity to display emotions, either positive or negative (Rothbart, 1989). Negative reactivity consists of two primary components, one characteristic of hostile emotion (i.e. anger) and one of non-hostile emotion (i.e. sadness). Anger reactivity has been consistently linked to aggression and externalizing behavior (Betts, Gullone, & Allen, 2009; Eisenberg et al., 2001; Janson & Mathiesen, 2008). For example, Eisenberg and colleagues (2009) reported that both boys and girls who were high in anger reactivity were prone to later externalizing behavior from ages 6 to 10. There is less conclusive evidence for linkage of sadness reactivity to externalizing behavior, as many studies have linked this component to internalizing behavior (Clark, Watson, & Mineka, 1994; Janson & Mathiesen, 2008). Berkowitz (1990) has discussed the connection between different negative emotions and proposed that any negative emotion (i.e. sadness or anger) could give rise to aggressive inclinations. However, studies in support of this claim are inconclusive and have shown either no relation between sadness reactivity and externalizing behavior (Kim, Walden, Harris, Karrass, & Catron, 2006) or a marginal positive relation (Eisenberg et al., 2009). Zeman, Shipman, and Suveg (2002), in fact, have found sadness reactivity to be negatively associated with externalizing behavior, noting that behaviors such as crying and whining are not likely to be endorsed as the emotional communication style used by aggressive children. Taken together, anger reactivity appears to be strongly related to externalizing behavior, while the link between sadness reactivity and externalizing behavior is much less clear. Few studies, however, simultaneously consider anger and sadness reactivity as predictors of problem behavior (Kim et al., 2007). Thus, a noteworthy aim of the current study is to clarify the association between negative reactivity and externalizing behavior by examining both anger and sadness reactivity.

Another primary individual factor related to prediction of externalizing behavior is regulation, defined as “those behaviors, skills, and strategies, whether conscious or unconscious, automatic or effortful, that serve to modulate, inhibit, and enhance emotional experiences and expressions” (Calkins & Hill, 2007, p. 229). A specific regulation strategy that is present early in development and has been found to relate to externalizing behavior in preadolescence is attentional control. Attentional control is defined as the ability to shift and sustain attention, and it is one of the first regulation strategies that children can effectively manage (Derryberry & Rothbart, 1997). Attention networks become more organized and sophisticated as infants age (Rothbart & Rueda, 2005), and individual differences in attentional ability become more detectable throughout the toddler and preschool years (Kochanska, Murray, & Harlan, 2000). Since attentional control involves properly organizing incoming stimuli and focusing attention away from distressing stimuli, this strategy is often used to maintain a calm state (Rothbart, Ellis, & Posner, 2004). Furthermore, normative levels of attentional control allow one to tolerate change and delay gratification (Rothbart et al., 2004), which may contribute to creating an appropriate cognitive and behavioral response, as opposed to acting out. Thus, poor attentional control has been associated with externalizing behavior, conduct disorder, and aggression (Derryberry & Rothbart, 1988; Eisenberg, Fabes & Guthrie, 1996; Hart, Keller, Edelstein, & Hofman, 1998; Moffitt, 1993; Muris, Mayer, van Lint, & Hofman, 2008).

Previous literature has underscored the importance of regulation and reactivity when predicting behavioral outcomes. In addition to their individual contributions, researchers have also postulated that these factors operate in concert (Blair, Denham, Kochanoff, & Whipple, 2004; Eisenberg et al., 2000). This idea was prominent in Eisenberg and Fabes' (1992) heuristic model, which stated that individual differences in reactivity and regulation often have multiplicative effects. In reference to externalizing behavior, children who are prone to intense negative emotion and who are also low in regulation would be expected to be especially high in externalizing behavior (Eisenberg & Fabes, 1992). While such theorized interactive effects are intuitive, these findings have not always been demonstrated in the literature or when found, have been dependent on factors such as reporter or regulation strategy (Eisenberg et al., 1996; Eisenberg et al., 1997). Rydell and colleagues (2003) examined relations between reactivity, emotion regulation, and children's behavioral adaptation and concluded that, most consistently, reactivity and regulation did not interact in their sample. The researchers, however, supported the theoretical argument for interactive effects and encouraged future research to examine the combined contribution of reactivity and regulation (Rydell, Berlin, & Bohlin, 2003). Attentional control is the regulation strategy that has most consistently been found to interact with measures of reactivity to predict behavioral outcomes. For example, Eisenberg and colleagues (2000) revealed that attentional control predicted externalizing behavior only for those children with high anger reactivity; this association was true for both sexes. Thus, there is theoretical and empirical support to examine interactive effects between attentional control and reactivity. Moreover, replication of previous findings would provide stronger evidence for multiplicative effects.

Increased specificity of the attentional control variable is also important. Attentional control consists of two components (attention shifting and attention focusing); however, most consistently, they have not been analyzed separately. This is surprising since attention focusing and attention shifting represent two distinct cognitive tasks (Posner, Walker, Friedrich, & Rafal, 1987). Furthermore, different underlying neural mechanisms for focusing and shifting attention have been suggested (Derryberry & Rothbart, 1988). FMRI studies show that shifts in attention are mediated by superior regions, and sustained attention is mediated by more lateral regions (Thakral & Slotnick, 2009). These differentiating processes have also been referred to as "top-down" cognitive control processes, which are responsible for focusing attention and "bottom-up" stimulus-driven processes, which are responsible for rapid attentional shifts (Miller, Miller, Healey, Marshall, & Halperin, 2013). Indeed, measures used to assess attentional control consistently produce two correlated, yet separate, factors that correspond to attention focusing and attention shifting [see the Attentional Control Scale (ACS; Derryberry & Reed, 2002) and Child Behavior Questionnaires (CBQ; Rothbart, Ahadi, & Hershey, 1994)].

One reason for lack of differential analyses of the two components of attentional control may be because early work assessing focusing and shifting found similar associations with outcomes, particularly shyness (Eisenberg, Shepard, Fabes, Murphy, & Guthrie, 1998). More recently, however, differential associations have been noted. For example, Gilliom and colleagues (2002) found that shifting attention away from frustrating sources was associated with low externalizing problems, and focusing attention on sources of frustration was associated with high externalizing problems over time from ages 3 to 6. Furthermore,

Ólafsson and colleagues (2011) found attention focusing and attention shifting differentially related to anxiety and depression. Additionally, these processes have been differentially linked to symptoms of AD/HD (Miller, Miller, Healey, Marshall, & Halperin, 2013).

For externalizing behavior, previous literature has theoretically and empirically underscored the importance of attention shifting. For example, Crick and Dodge's (1994) social information-processing model outlines how children cognitively process information in the context of social interactions, and an initial step in this process is selective attention. Selective attention is a related construct to attention shifting, as both allow for appropriate filtering of environmental cues. Wilson (2003) states that shifting attention is an especially difficult task for children who display aggressive behavior. This is because aggressive children are more likely to focus on environmental cues, particularly ones that are hostile, and less likely to shift their attention to other cues (Gouze, 1987). In fact, Wilson (2003) found that aggressive children had significantly more difficulty on the Children's Attentional Shifting Task compared to their nonaggressive peers. Such difficulty may be foundational for the development of hostile attributional bias, defined as the tendency to attribute hostile intent in ambiguous situations (Gouze, 1987). It has also been argued that attention shifting represents attempts to control intake of stimuli (Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002), which is the foundation of distraction as a regulatory skill. Thus, deficits in attention shifting, particularly in the context of social interactions, may serve as a unique risk factor for later attentional biases and may impede the development of more adaptive regulation strategies.

Previous literature has also established that attentional deficits become more pronounced in the presence of negative affect (Dodge & Somberg, 1987). In fact, Lemerise and Arsenio (2000) articulated an integrated model of emotion processes and cognition in social information processing to extend Crick and Dodge's (1994) model and highlight the importance of cognitive processes in the context of negative reactivity. Indeed, the propensity to display negative emotions may exacerbate the relation between poor attention shifting and externalizing behavior. This may be especially true for children with high anger reactivity, given the strong link between anger and externalizing behavior. However, no work to date has examined if the interplay between anger reactivity and poor attention shifting is essential and unique.

In summary, components of reactivity and regulation have emerged in the literature as predictors of behavioral outcomes, with anger reactivity and attentional control (as a composite) most consistently predicting externalizing behavior (Betts et al., 2009; Derryberry & Rothbart, 1988; Eisenberg et al., 2001; Hart et al., 1998; Janson & Mathiesen, 2008; Moffitt, 1993; Muris et al., 2008). Considering the importance of both reactivity and regulation on development, Eisenberg and Fabes (1992) have theorized interactive effects; however, empirical findings are inconsistent (Rydell, Berlin, & Bohlin, 2003). Specifying a particular regulation strategy could be an avenue to clarify this question. In this vein, attentional control has emerged as a regulation strategy that most often interacts with reactivity to predict behavior problems. However, the separate components of attentional control have not been thoroughly investigated for possible interactive effects, despite theoretical and empirical evidence suggesting that attention shifting and attention focusing

represent distinct cognitive processes. Furthermore, attentional control components have not been examined in concert with the specific components of reactivity. Previous literature suggests that attention shifting may be particularly linked to externalizing behavior (Wilson, 2003), underscoring the importance of the examining this component, in concert with reactivity, as a predictor of externalizing behavior.

The developmental psychopathology perspective asserts that behavior problems result from individuals' inability to adapt to the environment during critical time points (Sroufe, 2009). Thus, the current study examined early regulation strategies and reactivity in children at age 4, as during this age, stable differences in regulation and reactivity begin to emerge (Kochanska et al., 2000). These individual factors were used to predict externalizing behavior in the same children 6 years later, at age 10. During preadolescence, most children exhibit a normative decline in externalizing behavior (Forehand, Neighbors, & Wiersen, 1991); therefore, it may be particularly beneficial to identify early predictors for those children who show an increase rather than a decrease in these problem behaviors. It is also possible that deficits in self-regulation, along with large displays of negative emotion, become more atypical and problematic at this developmental stage, further emphasizing the importance of investigating this period. Sex was not investigated in the current study due to power limitations. Moreover, sex differences have not been reliably demonstrated in the literature in regard the question of interest during this developmental period (Eisenberg et al., 2000, 2009; Janson & Mathiesen, 2008). Teachers reported on externalizing behavior, while parents reported on reactivity and attentional control using questionnaires. While cognitive tasks in a laboratory setting are likely an ideal method for directly assessing attention, Kim and Deater-Deckard (2011) assert that such tasks are probably not necessary to determine the effect of attention regulation at the level of behavior. Furthermore, task-based and questionnaire-based measures of attention regulation are correlated (Rothbart, 2007).

The current study expanded on the known associations between reactivity, regulation, and externalizing behavior by providing greater specificity as to which individual factors interact to predict behavior over time. Based upon previous literature (Betts, Gullone, & Allen, 2009; Derryberry & Rothbart, 1988; Eisenberg et al., 2001; Eisenberg, Fabes & Guthrie, 1996; Hart et al., 1998; Janson & Mathiesen, 2008; Moffitt, 1993; Muris et al., 2008), attention focusing and attention shifting are hypothesized to be negatively associated with externalizing behavior, while anger reactivity is hypothesized to be positively associated with the outcome. Previous literature has provided inconclusive results regarding the association between sadness reactivity and externalizing behavior (Berkowitz, 1990; Eisenberg et al., 2009; Kim et al., 2006; Zeman, Shipman, & Suveg, 2002); therefore, no directional hypothesis is provided for the association between these constructs. Consistent with the developmental psychopathology perspective and Eisenberg and Fabes' (1992) heuristic model, interactive effects between reactivity and regulation will be investigated. Given the paucity of research regarding which specific combinations of reactivity and attentional control predict externalizing behavior; all possible combinations will be entered into a model to compete for explained variance. However, based upon Lemerise and Arsenio's (2000) integrated model of emotion processes and cognition, as well as previous empirical findings (Gilliom et al., 2002; Wilson, 2003), it is hypothesized that the interaction

between anger reactivity and attention shifting will uniquely contribute to the outcome, with children who display high levels of anger reactivity and low levels of attention shifting at age 4 displaying the most elevated levels of externalizing behavior at age 10. Furthermore, it is expected that this specific interaction will be a significant predictor of externalizing behavior even after controlling for all other combinations of attentional control and reactivity components.

Method

Recruitment and Attrition

The current study utilized data from three cohorts of children who are part of an ongoing longitudinal study of social and emotional development. The goal for recruitment was to obtain a sample of children who were at risk for developing future externalizing behavior problems, and who were representative of the surrounding community in terms of race and socioeconomic status (SES). All cohorts were recruited through child day care centers, the County Health Department, and the local Women, Infants, and Children (WIC) program. Potential participants for cohorts 1 and 2 were recruited at two-years of age (cohort 1: 1994–1996 and cohort 2: 2000–2001) and screened using the Child Behavior Checklist (CBCL 2–3; Achenbach, 1992), completed by the mother, in order to over-sample for externalizing behavior problems. Children were identified as being at-risk for future externalizing behaviors if they received an externalizing T-score of 60 or above. Efforts were made to obtain approximately equal numbers of males and females. This recruitment effort resulted in a total of 307 selected children. Cohort 3 was initially recruited when infants were six-months of age (in 1998) for their level of frustration, based on laboratory observation and parent report, and were followed through the toddler period (see *deleted for blind review*, for more information). Children whose mothers completed the CBCL at two-years of age were included in the current study ($N = 140$). Of the entire sample ($N = 447$), 37% of the children were identified as being at risk for future externalizing problems and 15% ($N = 447$) were identified as being at risk for future internalizing problems. There were no significant demographic differences between cohorts with regard to gender, $\chi^2(2, N = 447) = .63, p = .73$, race, $\chi^2(2, N = 447) = 1.13, p = .57$, or two-year SES, $F(2, 444) = .53, p = .59$.

Of the 447 original screened participants, 6 were dropped because they did not participate in any two-year data collection. At 4 years of age, 399 families participated. There were no significant differences between families who did and did not participate at age 4 in terms of gender, $\chi^2(1, N = 447) = 3.27, p = .07$, race, $\chi^2(1, N = 447) = .70, p = .40$, two-year SES, $t(432) = .81, p = .42$, or 2 year externalizing T score, $t(445) = -.36, p = .72$. At age ten, 357 families participated, including some families that did not participate in data collection at age 4. No significant differences were noted between families who did and did not participate in the ten-year assessment in terms of child gender, $\chi^2(1, N = 447) = 3.31, p = .07$; race, $\chi^2(3, N = 447) = 5.78, p = .12$; 2 year SES, $t(432) = -.02, p = .98$; or 2 year externalizing T score, $t(445) = 0.11, p = .91$. Families lost to attrition included those who could not be located, moved out of the area, declined participation, or did not respond to phone and letter requests to participate.

Participants

The sample for the current study included 404 children (216 girls, 188 boys) who participated in the 4 and 10 year assessments. Children were included in the current study if they had any data at either time point. In addition, 4 participants were dropped from the current study due to developmental delays. 67% of the sample was European American, 27% African American, 4% biracial, and 2% “other.” Families were economically diverse based on Hollingshead (1975) scores at the 4 year assessment, with a range from 14 to 66 ($M = 42.48$, $SD = 10.27$), thus representing families from each level of social strata typically captured by this scale. Hollingshead scores that range from 40 to 54 reflect minor professional and technical occupations considered to be representative of middle class.

Procedures

4 year Assessment—When the children were 4 years old, they were asked to come to the laboratory with their mothers for a 2-hour visit examining children’s frustration tolerance, emotional regulation, compliance, impulsivity, as well as several tasks involving mother-child interactions. During this visit mothers were also asked to complete several questionnaires. Maternal report of regulation and reactivity were utilized in the current study.

10 year Assessment—Questionnaires were completed by fifth grade teachers assessing child functioning in the classroom, school adjustment and peer relationships. Teacher report of externalizing symptoms was used from this data collection point.

Measures

Reactivity—Reactivity was assessed through maternal report on the Child Behavior Questionnaire at age 4 (CBQ; Rothbart, Ahadi, Hershey, & Fisher, item questionnaire, requiring mothers to rate their child’s behavior on a 7-point Likert scale 2001). The CBQ is a 195 ranging from extremely untrue to extremely true. The subscales of anger (12 items) and sadness (12 items) were utilized. Sample items from the anger and sadness subscales include the following: “Has temper tantrums when s/he doesn’t get what s/he wants,” and “Cries sadly when a favorite toy gets lost or broken,” respectively. Cronbach’s alpha for the current sample on the anger and the sadness subscales were $\alpha = .88$ and $\alpha = .65$, respectively.

Regulation—To assess children’s behavioral display of regulation the CBQ was also utilized; specifically the attention focus and attention shifting subscales. The attention focus subscale consisted of 9 items. A sample item is “My child, when drawing or coloring in a book shows strong concentration.” The attention shifting scale consisted of 5 items; a sample item is “My child can easily shift from one activity to another.” Rothbart and colleagues (2001) indicated that the CBQ is a valid reliable measure and have reported acceptable reliability for the attentional control subscale. Cronbach’s alpha for the current sample $\alpha = .71$ for attention focusing, and $\alpha = .60$ for attention shifting. The lower Cronbach’s alpha for the attention shifting subscale is consistent with previous reports of reliability for this subscale (see Murphy, Eisenberg, Fabes, Shepard, & Guthrie, 1999).

Externalizing Behavior—Teacher report on the aggression and conduct problem subscales of the Behavior Assessment Scale for Children (BASC-TRS; Reynolds & Kamphaus, 1992) was utilized as a measure of externalizing behavior at age 10. Teachers rated the frequency of problem behaviors that are focused outward and are highly disruptive using a likert-type rating ranging from 1 (never) to 4 (almost always). Example items include the following: “Lies”, “Breaks the rules”, and “Bullies others.” A composite measure was computed for the externalizing variable by averaging the general T scores on the aggression and conduct problem subscales of the BASC; the externalizing subscale was purposefully not used, as to not include AD/HD as an outcome. The BASC is widely used across research domains and exhibits well established internal consistency, reliability, and validity. Cronbach’s alpha for the current sample was $\alpha = .84$.

Results

The data were first imputed to account for missing values using the missing value analysis (MVA) technique in SPSS version 20. Little’s (Little & Rubin, 2002) missing completely at random (MCAR) yielded a Chi-square = 2425.12 ($p = 0.91$; $df = 2520$), indicating that the data were not systematically missing. An expectation-maximization (EM) algorithm was then used to generate values to fill in all the missing data. Preliminary analyses were conducted, and the scales were normally distributed based upon values of skewness (< 2) and kurtosis (< 4). Variables were centered prior to creating interaction terms. Table 1 lists the descriptive information for all study variables; Table 2 displays correlations among all study variables. Anger reactivity was correlated modestly with the outcome. There was no correlation between sadness reactivity and externalizing behavior. Both subcomponents of attentional control were negatively correlated with the outcome. The subcomponents of reactivity correlated moderately with each other, and the components of attentional control were also significantly correlated.

Components of reactivity and attentional control as predictors of externalizing behavior

To test for main effects for the variables of interest, a hierarchical regression analysis was conducted. At the first step, early externalizing behavior was entered as a control variable and to assess for change in this behavior over time. At the second step, the main effects for reactivity components were entered separately, and at the third step, the main effects for the regulation components were entered. Table 3 presents the beta weights and significance levels for all steps. Main effects for anger reactivity and sadness reactivity were found, indicating that children with high levels of anger reactivity, as well as children with low levels of sadness reactivity display increases in externalizing behavior from ages 4–10. There was also a main effect for attention focusing, where children with low abilities to focus their attention at age 4 display increased levels of externalizing behavior at age 10.

Interactions between components of reactivity and attentional control as predictors of externalizing behavior

We hypothesized that children who display high levels of anger reactivity and low levels of attention shifting at age 4 would display the most elevated levels of externalizing behavior at age 10, with this interaction being significant above and beyond the other possible

combination of components. Thus, at the fourth step all 2 way interactions were entered (see Table 3). As hypothesized, the interaction variable of anger $\times$ attention shifting was significant, where children with high levels of anger reactivity and low levels of attention shifting had elevated levels of externalizing behavior. Table 3 shows the beta weights and significance levels for all interactions, and Figure 1 displays the anger $\times$ attention shifting interaction. The simple slopes analysis revealed that the lines representing children who had low levels of attention shifting ($\beta = 4.80, p = .00$) and children who had high levels of attention shifting ($\beta = 2.59, p = .00$) were significantly different from zero. No other significant interactions were found.

Discussion

The current study sought to clarify the role of reactivity and regulation on externalizing behavior by examining specific individual factors and establishing the presence of a unique interactive effect between attention shifting and anger reactivity. We investigated the interplay between cognitive and affective processes based upon the developmental psychopathology perspective, which highlights how converging processes initiate maladaptive pathways (Sroufe, 2009). More specifically, Eisenberg and Fabes' (1992) heuristic model provided the theoretical rationale for predicting multiplicative effects between negative reactivity and attentional control on externalizing behavior. Consistent with our hypotheses, there was a main effect for anger reactivity, indicating that children who were prone to display high levels of anger had high levels of acting out behavior over time. Moreover, children who had difficulty focusing their attention effectively had high levels of acting out behavior over time.

We did not propose a specific hypothesis for sadness reactivity predicting externalizing behavior due to the lack of conclusive evidence in the literature regarding their association (Berkowitz, 1990; Eisenberg et al., 2009; Kim et al., 2006; Zeman, Shipman, & Suveg, 2002). However, our results indicated that children with low levels of sadness had high levels of acting out behavior over time. It should be noted that correlation analyses indicated no relation between sadness reactivity at age 4 and externalizing behavior at age 10. However, low levels of sadness reactivity did predict change in externalizing behavior from ages 4–10. These results suggest that a lack of sadness early on can lead to a pattern of escalating problem behavior across development. This is consistent with the developmental psychopathology perspective, which recognizes that the cumulative developmental history of the individual is most important when predicting behavioral outcomes (Sroufe, 2009). Contrary to our hypothesis, the inability to shift attention was not directly related to externalizing behavior. However, attention shifting was important in the context of anger reactivity. A significant interaction was found indicating that children who cannot adequately regulate anger and have difficulty shifting their attention are most at risk for externalizing behavior.

The link between anger reactivity and externalizing behavior has been well established in the literature (Betts et al., 2009; Eisenberg et al., 2001; Janson & Mathiesen, 2008) and was supported in the current study. Our findings also indicate that sadness reactivity is inversely related to externalizing behavior. This is consistent with the work of Zeman and colleagues

(2002) and supports the argument that children who display externalizing behavior are less likely to display non-hostile emotion. This finding also highlights the importance of including measures of both facets of negative reactivity when predicting externalizing behavior over time. Given that attention focusing was negatively associated with the outcome in the current study, we interpret our findings as consistent with work indicating direct effects of poor attention regulation on externalizing behavior (Muris et al., 2008, Derryberry & Rothbart, 1988; Eisenberg et al., 1996). However, our findings suggest that it is the attention focusing aspect, rather than the attention shifting aspect of regulation, that is important to consider as an *independent* predictor of externalizing behavior.

Interpreting these findings through a developmental psychopathology lens highlights the importance of contextual factors. Given that there are environmental demands for sustained attention, particularly in the classroom, deficits in focusing may lead to more pronounced behavior problems as reported by teachers, as the child may be more disruptive. Moreover, while attention shifting does not independently predict externalizing behavior, it is a significant predictor in the context of anger. This finding is consistent with a more process-oriented approach, as suggested by the developmental psychopathology perspective, whereas cognitive and affective processes operate in concert. Our results further indicate that future work should continue to identify specific cognitive and affective processes, as well as their interplay when predicting outcomes. This should include replication of the current study's findings and possibly reexamining previous work that has linked reactivity and attentional control to behavioral outcomes.

Our results are consistent with Eisenberg and Fabes' (1992) heuristic model, which suggests that individual factors have multiplicative effects on behavioral outcomes. The significant anger X attention shifting interaction substantiates past research highlighting the link between attention shifting and aggression in the presence of negative affect (Dodge & Somberg, 1987). More explicitly, difficulties with shifting attention may only become problematic when the child is angry and unable to attend to a more positive stimulus. These data also provide some preliminary evidence that children with a particular combination of individual factors may be more at risk for conduct problems and aggression, which could be due to the development of attentional biases or the lack of development of a more adaptive regulation strategy, such as distraction. This is substantiated by the developmental psychopathology perspective, which considers developmental timing as a critical factor when analyzing behavior (Cicchetti & Toth, 2009). High levels of anger reactivity and low levels of attention shifting at age 4 may constrain the organization of other adaptive behaviors and regulatory capacities which typically develop between age 4 and 10. Given these findings, future work should identify mediating processes linking these individual factors to later externalizing behavior. For example, studies should test whether children with poor attention shifting abilities and high levels of anger are less likely to use distraction or more prone to exhibit hostile attribution biases and whether these difficulties lead to increases in externalizing behavior over time.

A limitation of the study was the sole reliance on maternal report of reactivity and regulation. Although this method has merit, future research should consider a multi-method approach to examining individual factors, such as utilizing parental report, behavioral

observations, and/or physiological measures. Future research should also further examine the measurement of sadness and attention shifting, and studies should utilize questionnaires with a substantial number of items and those that have demonstrated higher reliability (>.70). Additionally, replication of the current study's findings would advance the field's knowledge of reactivity and regulation interacting to predicting behavioral outcomes. Identifying other essential and unique interactions, such as of anger X sadness and attention focusing X attention shifting, would also be a notable future direction. Although sex was not considered a construct of interest in the current study, significant mean differences were found consistent with previous literature (Eisenberg et al., 2000). Specifically, females were rated higher for sadness reactivity, attention shifting, and attention focusing, while males were rated higher for externalizing behavior. A lack of power prevented further exploration; therefore, future research should examine potential sex differences across development. Moreover, gender differences may become apparent later on when reactivity and regulation difficulties occur in the context of other biological and psychosocial factors. For example, Silverthorn and Frick's (1999) proposed that antisocial behavior is delayed in girls until adolescence when such factors (e.g. puberty, less parental monitoring and supervision, greater contact with deviant peers) exacerbate predisposing vulnerabilities.

Despite the limitations noted, the current study offers important contributions to the literature. It was established that components of reactivity and attentional control contribute singly to the development of externalizing behavior, with evidence for a differential, unique interaction between anger and attention shifting predicting externalizing behavior. Consistent with the developmental psychopathology perspective and Eisenberg and Fabes' (1992) heuristic model, this finding contributes to the conceptualization of individual factors as an interactive process, as well as to the understanding of the differential roles attentional and affective processes have in the development of externalizing behavior. These contributions are strengthened by the study's use of longitudinal data; thus, we were able to measure change in externalizing behavior across development periods. Finally, the use of an ethnically and socioeconomically diverse sample increases the generalizability of the results.

The ability to identify early maladaptive processes as risk factors for behavior problems provides important treatment and prevention implications. In light of these findings, the continued use of emotion centered interventions in early childhood that focus on both the expression of sadness and suppression of anger is warranted. The results of the current study also suggest that incorporating attention strategies in intervention and prevention efforts targeting children with externalizing behavior may be a fruitful next step. Such work should be done with the aim of fostering the ability to focus attention, as well as the ability shift attention when the child is angry.

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Highlights

- We examine specific, unique interplays of individual factors.
- Low sadness and high anger reactivity directly predict externalizing behavior.
- Low attention focusing directly predicts externalizing behavior.
- Anger reactivity and attention shifting interact to predict externalizing behavior.

Figure 1. Interaction of Anger Reactivity and Attention Shifting Predicting Externalizing Behavior

Note. Values on y-axis represent change in externalizing behavior from ages 4 to 10

Table 1

Descriptive Statistics for Independent and Dependent Composite Variables

Variable	Mean	SD	Min	Max
4 yr. Externalizing ^a	54.77	5.43	50.00	76.50
10 yr. Externalizing ^b	48.91	8.12	31.19	85.50
Anger	4.68	.84	1.92	6.58
Sadness	4.06	.67	1.33	5.70
Attention Shifting	3.81	.86	1.60	7.00
Attention Focusing	4.40	.81	1.89	7.00

Note.^a Composite variable from parent report of Delinquency and Aggression subscales of the CBCL (T scores);^b Composite variable from teacher report on the Aggression and Conduct Problem subscales of the BASC (T scores)

Table 2

Correlation Coefficients for Independent and Dependent Composite Variables

Variable	1	2	3	4
1. Externalizing	–			
2. Anger	.33 **	–		
3. Sadness	–.06	.51 **	–	
4. Attention Shifting	–.19 **	–.27 **	–.18 **	–
5. Attention Focusing	–.20 **	–.11 **	–.18 **	.23 **

*Note.***
 $p < .01$

Table 3

Early Externalizing Behavior, Components of Reactivity and Attentional Control, and Interactions Regressed onto Externalizing Behavior

Variable	β	R^2	R^2
Step 1			
Early Externalizing Behavior	.35 **	.12 **	
Step 2			.11 **
Anger	.38 **		
Sadness	-.32 **		
Step 3			.01
Attention Shifting	-.02		
Attention Focusing	-.10 *		
Step 4			.02 *
Sadness $\times$ Attention Shifting	.05		
Anger $\times$ Attention Shifting	-.13 *		
Sadness $\times$ Attention Focusing	.11		
Anger $\times$ Attention Focusing	.00		

Note.

*
p<.05

**
p<.01