

Emotional reactivity, self-control and children's hostile attributions over middle childhood

Jackie A. Nelson¹ and Nicole B. Perry²

¹School of Behavioral and Brain Sciences, University of Texas at Dallas, Richardson, TX, USA

²Human Development and Family Studies, University of North Carolina at Greensboro, Greensboro, NC, USA

Hostile attribution bias, a child's tendency to interpret ambiguous social information as threatening or hostile, has been discussed as an important point in which social, emotional and cognitive information intersect. This study explores the natural changes that occur in children's hostile attributions across three grades during middle childhood and examines how emotional reactivity and self-control at third, fourth and fifth grade independently and interactively relate to these trajectories. Participants included 919 children whose mothers reported on their emotional reactivity, whose teachers reported on their self-control and who completed an attribution bias interview, all at grades 3, 4 and 5. Results revealed that among children with a greater tendency to make hostile attributions at third grade, lower self-control at third grade was associated with greater initial hostile attribution bias and less decline in biases over time. Additionally, greater emotional reactivity at fourth grade was associated with declines in these children's hostile attributions, but only when self-control was also higher at fourth grade.

Keywords: Social information processing; Hostile attribution bias; Emotional reactivity; Self-control; Middle childhood.

More than a decade ago, Lemerise and Arsenio (2000) hypothesised that social information processing (SIP) was an important context in which to explore the intersection of emotion, cognition and control. Although much work has been devoted to SIP and to the association between

emotional reactivity and regulation (e.g., Crick & Dodge, 1994; Eisenberg & Fabes, 1992), little empirical research has tested the intersection of these three social processes. The purpose of the current study was to examine how emotional reactivity and self-control interact to predict

Correspondence should be addressed to: Jackie A. Nelson, School of Behavioral and Brain Sciences, University of Texas at Dallas, 800 W. Campbell Road, GR41, Richardson, TX 75080, USA. Email: Jackie.Nelson@utdallas.edu

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changes in children's interpretation of social information, specifically their hostile attribution bias, across middle childhood.

Social information processing

How children process and interpret information affects their behaviour in social situations. The SIP model describes six steps involved in processing and responding to social cues: attending to and encoding information, interpreting and making meaning of cues, clarifying goals, identifying possible responses to the situation, deciding on a response after considering the expected outcome and enacting the behaviour while monitoring environmental feedback (Crick & Dodge, 1994; Dodge, 1986). Researchers have often focused on specific steps in the model, with most attention paid to children's initial processing and interpretation of social cues. The interpretation of ambiguous social information as threatening or hostile has been termed a hostile attribution bias (Nasby, Hayden, & DePaulo, 1980). Children with a tendency to attribute a hostile intent to others' actions are more likely to behave aggressively (Crick & Dodge, 1994; de Castro, Veerman, Koops, Bosch, & Monshouwer, 2002; Dodge, 1980). This association has been so well-established in past research that an understanding of hostile attributions has contributed to the knowledge of the development of chronic behavioural problems in children and subsequent intervention efforts (Conduct Problems Prevention Research Group [CPPRG], 1992; Dodge & Pettit, 2003).

What has been less well-understood is how hostile attributions develop and change over time. Dodge (2006) proposes that all young children acquire hostile attribution biases due to limited emotional and cognitive understanding of others' perspectives. For example, a child whose toy is stepped on by a peer is unlikely to evaluate whether or not the action was accidental when he/she does not have the ability to understand another's intent. Over time with increasing social-cognitive awareness, most children learn to correct this bias and begin to use a benign attributional style during the preschool years (Dodge, 2006).

This is due to an understanding that some provocations are unintentional. However, some children have more difficulty interpreting provocations as benign and continue to infer hostile intent in response to ambiguous social situations. Dodge (2006) posits that in these children, this style becomes part of their personality as hostile schemas during social interaction are stored into their memory. Although this style is likely to endure as children receive negative feedback from others in response to their hostile impulses, life experiences and increasing social skills can alter these patterns (Dodge, 2006).

Empirical tests of the natural stability and change of hostile attributions have not been addressed in the literature despite the established importance of this characteristic. It is reasonable to assume that as children enter middle childhood there is variability in whether they have incorporated a benign attribution style in response to ambiguous social situations. Further, as the social demands and centrality of peers in children's lives increase over middle childhood (Berndt, 2004), there is also likely to be variation in how hostile attributions change over time. On the other hand, intervention research has emphasised the difficulty in changing attributional styles during the school-aged years and beyond (CPPRG, 2002; Guerra & Slaby, 1990). Thus, this research question warrants empirical tests.

If indeed there is variation in hostile attributions over middle childhood, there may be characteristics of children that explain some of the variability. Lemerise and Arsenio (2000) propose that the intersection of emotional reactivity and regulation is likely a central predictor of children's SIP. Emotional reactivity, an aspect of emotionality, has generally been considered a temperamental or personality characteristic that can be described as the tendency to respond frequently and intensely when experiencing both positive and negative emotions (Larsen & Diener, 1987; Thomas & Chess, 1977). The regulation or control of emotion encompasses processes that serve to modulate, inhibit or maintain the occurrence, intensity and expression of these emotional experiences (Calkins & Hill, 2007; Gross & Thompson,

2007). Thus, emotion regulation serves to modulate or control emotional reactivity. Although both emotional reactivity and emotional control are conceptually related, they are only moderately correlated over time (Eisenberg et al., 1993, 1997) and argued to be separate dimensions of emotional functioning (Calkins, Gill, Johnson, & Smith, 1999; Derryberry & Rothbart, 1997). Thus, varying combinations may exist such that children may be high in reactivity and control, low in both or high in one dimension and low in another (Laible, Carlo, Panfile, Eye, & Parker, 2010; Rydell, Berlin, & Bohlin, 2003). Children enter social situations with emotional predispositions that influence the intensity of their reactions (Eisenberg & Fabes, 1992; Rothbart & Derryberry, 1981), and they differ in how well they are able to regulate or control these emotional impulses (Eisenberg et al., 1997). Therefore, children who are highly emotionally reactive and are poor emotional regulators are likely to have difficulties encoding and interpreting information during emotionally arousing social encounters. Although Lemerise and Arsenio's (2000) hypothesis has not been tested previously, research on how children's emotional reactivity and control interact to predict social competence in general can inform our predictions about how they might predict children's hostile attribution bias.

Emotional reactivity, self-control and social competence

In the last several decades, a considerable amount of research has examined the role of emotion and regulation in the development of children's social competence (e.g., Rothbart & Bates, 1998), and the joint contribution of emotional reactivity and self-control has been recognised as highly influential for children's social behaviour (e.g., Eisenberg & Fabes, 1992; Eisenberg et al., 1996). Researchers have proposed that the implication of children's emotional reactivity for their social functioning depends on their ability to cognitively and behaviourally control intense emotional experiences such that emotion regulation should moderate the influence of emotional reactivity on

social behaviour (Bengtsson & Arvidsson, 2011; Eisenberg & Fabes, 1992). In particular, Eisenberg and Fabes (1995) posited that individuals who are unable to maintain their emotional reactions within a manageable range would be more likely to behave in ways that do not facilitate positive social interactions. In contrast, individuals who respond to other's negative emotions, while also regulating their own emotions, are more likely to behave in socially acceptable ways. Therefore, high emotional reactivity is hypothesised to only be problematic when children are low in regulatory abilities. Children with high emotional reactivity who do not possess adequate regulatory skills are hypothesised to have problems with angry and aggressive outbursts, be more likely to experience self-focused emotion and therefore be less likely to engage in prosocial behaviours (Eisenberg, Fabes, & Spinrad, 2006; Laible et al., 2010). Researchers have argued that children who are high or moderate in reactivity might be socially well-adjusted and display socially appropriate positive and expressive behaviour (Eisenberg & Fabes, 1992). It is less clear how individuals with low negative reactivity and varying levels of regulation perform socially. One possibility is that children low in negative emotional reactivity may be less socially competent if negative emotionality is needed to experience social emotions such as empathy and guilt (Laible et al., 2010). Eisenberg and Fabes (1992) argued that children high in regulation and low in emotional reactivity may appear socially withdrawn and lack affect, whereas children with low emotional reactivity and low regulation may exhibit more manipulative and less prosocial behaviour.

Empirical evidence has supported the predictive power of the joint examination of regulation and reactivity for school-aged children's social functioning over time. For example, Eisenberg et al. (1997) found that teachers' reports of high negative emotionality and low regulation collected at ages 4–6, 6–8 and 8–10 predicted consistently low school social competence or declines in functioning over time. Similarly, Murphy, Shepard, Eisenberg, and Fabes (2004) reported that 10- to 12-year-olds who were consistently low in social

functioning across time were higher on negative emotionality and lower on regulation than children who were consistently high on social functioning over time.

The current study

For the current study, we will examine how school-aged children's emotional reactivity and self-control interact in relation to their hostile attribution bias from third grade to fifth grade. Consistent with previous research on social skills (e.g., Eisenberg et al., 2006), we predict that moderate to high emotional reactivity will be related to lower hostile attribution bias and decreases in bias over time when children have high self-control, but will be related to higher hostile attribution bias and increases in bias over time when children have low self-control.

METHOD

Participants

Participants were enrolled in the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development (SECCYD, Phase III 2000–2004), a prospective longitudinal study conducted at 10 research sites across the USA starting in 1991. This study includes 1364 families who participated in a home interview when infants were one-month-old and continued with 15 measurement waves during childhood and adolescence. The recruited sample consisted of 48% girls, 24% children of colour, 45% first-born children, 11% mothers not completing high school and 14% single-parent families. Additional details about recruitment procedures are available from the study website.

The sample was restricted to children who participated in the hostile attribution bias task and had teacher data available at the third grade assessment. This resulted in a subsample of 919 families. Of the 919 children, 51% were female ($n = 468$), 78% were European American ($n = 716$), 11% were African-American ($n = 103$) and

11% were of mixed or other ethnicities ($n = 100$). Additionally, 29% of families had income-to-needs ratios less than 2 ($n = 270$), indicating low income, 44% had ratios of 2–5 ($n = 401$), indicating middle income and 27% had ratios greater than 5 ($n = 248$), indicating high income. Families included in the subsample of 919 families were not significantly different than the 1364 families in the full recruited sample with regard to income-to-needs ratio or ethnicity. However, children included in the subsample were more likely to be female than those in the full sample, $\chi^2(1, n = 1364) = 7.69, p < .01$.

Procedure

Participating families reported demographic information during a home visit when the child was approximately one-month-old. Additional assessments at third ($M = 9.16$ years, $SD = 0.31$), fourth ($M = 10.10$ years, $SD = 0.32$) and fifth ($M = 11.12$ years, $SD = 0.32$) grade were spaced one year apart. Parents completed measures at home, teachers completed measures at school and children engaged in tasks with an experimenter in the laboratory.

Measures

Emotional reactivity

At third, fourth, and fifth grade, mothers reported on their perceptions of their child's emotional reactivity in response to events using the Parent Report of Children's Reactions Scale (PRCR; Eisenberg et al., 1995). Parents rated the frequency with which their child reacted emotionally on a 5-point scale: 1 = *Never*, 2 = *Occasionally*, 3 = *About Half the Time*, 4 = *Usually* and 5 = *Always*. The PRCR is comprised of 10 items such as "my child is calm and not easily aroused" and "when my child feels an emotion, either positive or negative, my child feels it strongly". The child emotional reactivity score was computed as the sum of the responses to items 1–10 with greater scores indicating higher emotional reactivity. This variable had an internal reliability (Cronbach's α)

of .76, .74 and .77 for third, fourth and fifth grade, respectively.

Self-control

At third, fourth and fifth grade, teachers reported on children's ability to demonstrate self-control using the Social Skills Rating System (SSRS; Gresham & Elliott, 1990). The SSRS provides a broad assessment of children's behaviours across two dimensions: social skills and problem behaviours. The social skills portion includes 38 items that document the perceived frequency of target behaviours that influence children's development of social competence and adaptive functioning. Specifically, the social skills scale identifies deficits in positive social behaviours, grouped under four subscales: cooperation, assertion, responsibility and self-control. The current study utilised only the self-control subscale. The self-control subscale is comprised of 10 items such as "responds appropriately when hit or pushed by a child" and "controls their temper when arguing with other children". The response levels for each item are 0 = *Never*, 1 = *Sometimes* and 2 = *Very Often*, and the possible range of scores is from 0 to 20. Raw scores were used in the analyses; higher scores indicate a stronger affinity to demonstrate self-control as perceived by the child's teacher. The items used to create this variable had an α of .89, .88 and .89 for third, fourth and fifth grade, respectively.

Hostile attribution bias

At third, fourth and fifth grade, children were asked to complete a laboratory task designed to assess their intent attributions in response to socially ambiguous situations (Crick, 1995). Stories were used that describe provocation situations in which the intent of the provocateur is ambiguous. Three of the stories depicted instrumental provocation focusing on acts of potential overt aggression (e.g., one's radio is broken by a peer). Relational provocation stories were also administered, but given that the number and content of these stories varied across the three grades, only the instrumental provocation vignettes were

included in the current analyses. For each story, the child indicated a reason for the provocation based on four choices (e.g., the radio wasn't made well, breaking the radio was an accident, the kid who broke it was mad at you, the kid who broke it was jealous of you). The child's choice was then coded as hostile (1) or benign (0). Next, the child was asked about the intent of the behaviour (e.g., In this story, do you think the kid was trying to be mean or not trying to be mean?) which was coded as hostile (1) vs. benign (0). And finally, the child indicated whether the behaviour would upset him or her (1 = *not at all*, 2 = *a little* or 3 = *very much*).

A hostile intent score was computed as the mean of the six intermediate hostile intent-instrumental items (three stories). The possible scores range from 0 to 1, with higher scores indicating a higher likelihood to see the events as having hostile intent. The raw items used to create this score had an internal reliability (Cronbach's α) of .77, .80 and .80 for third, fourth and fifth grade, respectively. A distress score was computed as the mean of the three distress items, ranging from 1 to 3, with higher scores indicating more negative emotional reactions to the events. The sum of the hostile intent score and the distress score was used to measure Hostile Attributions in the current study. Correlations between these two scores at each age ranged from .37 to .48, all p 's < .01.

RESULTS

Analysis plan

The analyses proceeded in three steps. First, preliminary analyses were conducted in SPSS v.19 to examine the average growth pattern of children's hostile attributions using repeated measures analysis of variance (ANOVA). Second, a linear growth model was fit to the data using Mplus v.6 to examine children's hostile attributions over middle childhood. Third, we added time-varying and invariant predictors to our growth model to test whether the interaction between children's emotional reactivity and self-control was related to the intercept and slope of the hostile attribution trajectory. Full information

maximum likelihood (FIML) was used to account for missing data.

Child gender, child ethnicity and family income-to-needs ratio were examined as potential covariates. Child gender and family income-to-needs ratio were related to both the independent and dependent variables and were thus included as controls. Compared to males, female children had higher emotional reactivity at grade 4, $t(872) = 2.62, p < .01$, and grade 5, $t(869) = 2.28, p < .05$; greater self-control at grade 3, $t(917) = 4.27, p < .01$, grade 4, $t(806) = 5.55, p < .01$ and grade 5, $t(807) = 4.23, p < .01$; and less hostile attribution bias at grade 4, $t(881) = -2.27, p < .05$, and grade 5, $t(860) = -3.45, p < .01$. Children from families with higher incomes had lower emotional reactivity at grade 4, $r(815) = -.08, p < .05$, and grade 5, $r(810) = -.09, p < .05$; greater self-control at grade 3, $r(847) = .13, p < .01$, grade 4, $r(753) = .20, p < .01$ and grade 5, $r(755) = .19, p < .01$; and less hostile attribution bias at grade 4, $r(821) = -.08, p < .05$, and grade 5, $r(806) = -.13, p < .01$.

Preliminary analyses

Preliminary analyses were conducted to examine descriptive information for and correlations between study variables (see Table 1). A repeated-measures ANOVA revealed that hostile intent attribution means at grade 3 ($M = 2.62, SD = 0.65$), grade 4 ($M = 2.63, SD = 0.65$) and grade 5 ($M = 2.60, SD = 0.64$) were not significantly different, $F(2, 846) = 1.33, p = .27$. A visual examination of a random sample of individual growth patterns revealed that while some children's scores stayed the same, many more children either increased or decreased over time.

Trajectory analyses

Trajectories of children's hostile attributions at grades 3, 4 and 5 were examined. Despite the fact that no mean change was found in the preliminary analyses with the repeated-measures ANOVA, it was still of interest to examine variations in individual children's hostile attributions over time. Thus, a linear growth model was used,

which fit the data very well, Root Mean Square Error of Approximation (RMSEA) = .06 (90% CI = .02-.09), Confirmatory Fit Index (CFI) = .98, $\chi^2(3) = 11.53, p = .01$. This model was chosen over a model estimating no change in order to examine predictors of the variance in the intercept and slope.

The linear growth model revealed that there was no significant change, on average, in hostile attributions across middle childhood, $b = -.01, p = .35$. However, there was significant variation in where individual children's scores began at third grade (the intercept), $b = .22, p < .01$, and in whether children's scores were stable or changed across the three grades (the slope), $b = .03, p < .01$. Significant variability in the estimates provided justification for the next step of the analyses which involved adding predictors of this variance to the model. However, because no significant mean change was found, predictors of the slope would be interpreted as factors that predict the rate of change regardless of whether this refers to an increase or a decrease in hostile attributions. In order to remedy this interpretability problem, we split the sample into a group of children with third grade hostile attribution scores below the mean ($n = 419$) and a group of children with third grade hostile attribution scores above the mean ($n = 500$). Emotional reactivity and self-control predictors were added to a model for each sample separately.

Emotional reactivity, self-control and children's trajectories

The effects estimated in the models can be seen in Table 2. Child sex and family income-to-needs were controlled for in analyses predicting the intercept and the slope. Children's emotional reactivity, self-control and the interaction between the two (created after standardising each variable) at third grade were used to predict the intercept. The main effects and interactions at third, fourth and fifth grade were included as predictors of the slope.

For the group of low-risk children with initial hostile attribution scores below the mean, the

Table 1. Descriptive information and correlations for study variables

	Descriptives			Correlations								
	<i>M</i>	<i>SD</i>	<i>Range</i>	1	2	3	4	5	6	7	8	
1. Mother reported reactivity (third grade)	33.92	5.63	13–49									
2. Mother reported reactivity (fourth grade)	33.70	5.47	18–48	.71**								
3. Mother reported reactivity (fifth grade)	33.50	5.71	16–49	.69**	.72**							
4. Teacher reported control (third grade)	14.88	3.97	2–20	-.12**	-.08*	-.12**						
5. Teacher reported control (fourth grade)	14.99	3.89	2–20	-.12**	-.09*	-.14**	.50**					
6. Teacher reported control (fifth grade)	15.11	3.91	2–20	-.14**	-.11**	-.15**	.43**	.49**				
7. Hostile intent attributions (third grade)	2.62	0.65	1–4	.04	.03	.05	-.07*	-.08*	-.04			
8. Hostile intent attributions (fourth grade)	2.63	0.65	1–4	.07	.07*	.09**	-.16**	-.18**	-.15**	.45**		
9. Hostile intent attributions (fifth grade)	2.60	0.64	1–4	.05	.05	.06	-.20**	-.17**	-.17**	.37**	.51**	

Note: * $p < .05$, ** $p < .01$.

growth model including the predictors had marginal fit to the data, RMSEA = .07 (90% CI = .06–.08), CFI = .89, $\chi^2(64) = 191.06$, $p < .01$. There were no significant predictors of the intercept or the slope.

For the group of high-risk children with initial hostile attribution scores above the mean, the growth model including the predictors had acceptable fit to the data, RMSEA = .06 (90% CI = .05–.07), CFI = .92, $\chi^2(64) = 162.76$, $p < .01$. In predicting the intercept, higher self-control at third grade was significantly related to fewer hostile attributions at third grade, $b = -.20$, $p < .01$. In predicting the slope, higher self-control at third grade was related to declines in hostile attributions from third grade to fifth grade, $b = -.18$, $p < .01$. There was also a significant interaction between emotional reactivity and self-control at fourth grade in predicting the slope, $b = -.03$, $p < .05$. Among children with high self-control at fourth grade, higher fourth grade

emotional reactivity was associated with greater declines in hostile attributions from third grade to fifth grade, $b = -.24$, $p < .05$ (see Figure 1).

DISCUSSION

Research has indicated that a tendency to attribute hostile intentions to social scenarios is linked with children's aggression and behaviour problems (de Castro et al., 2002; Dodge & Pettit, 2003). However, little empirical work has examined the way in which hostile attribution biases naturally change over time; most previous longitudinal studies have focused on the effects of interventions aimed at changing attributional styles (e.g., Guerra & Slaby, 1990). Thus, the current study explored developmental changes in children's hostile attribution bias by examining trajectories across middle childhood, a time period during which children

Table 2. Emotional reactivity and self-control predicting children's hostile attribution trajectories

Children with third grade hostile attributions	B (SE B)	
	Below the mean	Above the mean
<i>Intercept</i>	2.24 (.02)**	2.92 (.02)**
Emotional reactivity third grade	-.02 (.06)	.03 (.07)
Self-control third grade	-.04 (.06)	-.20 (.07)**
Reactivity × self-control third grade	.01 (.02)	-.01 (.02)
<i>Slope</i>	.19 (.02)**	-.17 (.02)**
Emotional reactivity third grade	-.01 (.08)	-.04 (.08)
Emotional reactivity fourth grade	.13 (.07)	-.05 (.08)
Emotional reactivity fifth grade	.06 (.07)	-.09 (.08)
Self-control third grade	-.08 (.06)	-.18 (.06)**
Self-control fourth grade	.01 (.05)	-.09 (.07)
Self-control fifth grade	-.10 (.06)	-.12 (.06)
Reactivity × self-control third grade	.01 (.01)	-.00 (.02)
Reactivity × self-control fourth grade	.00 (.01)	-.03 (.02)*
Reactivity × self-control fifth grade	-.00 (.01)	-.00 (.01)

Note: Covariate estimates are not presented.
* $p < .05$, ** $p < .01$.

continue to hone socioemotional skills in social contexts. Two salient emotional characteristics, emotional reactivity and regulation, have been found to influence behaviour in social situations and relate to changes in hostile attributions across development. Therefore, the current study aimed to examine how school-aged children's emotional reactivity and self-control assessed at third, fourth and fifth grade independently and interactively relate to their hostile attribution biases at third

grade and to changes in their biases from third grade to fifth grade.

On average across all children, a model estimating linear change in hostile attribution bias over middle childhood fit the data well, but showed that hostile attribution scores were consistent over time. Nonetheless, there was significant variability in individual children's third grade attributions and in whether and how these attributions changed over time. This suggested that many children's hostile attributions did change across middle childhood in various directions. However, this model did not allow us to interpret the nature of that change. Thus, we broke our sample into a high-risk and low-risk group to gain a better understanding of the ways in which children's hostile attributions changed over time. As Dodge (2006) observed, by middle childhood a distinct style of making negative attributions and lacking the regulatory abilities to control initial emotional responses and consider the nature of social situations is developing and putting children with higher biases at risk for long-term social consequences. Separating children into groups based on hostile attribution scores at the start of the middle childhood period examined in the current study

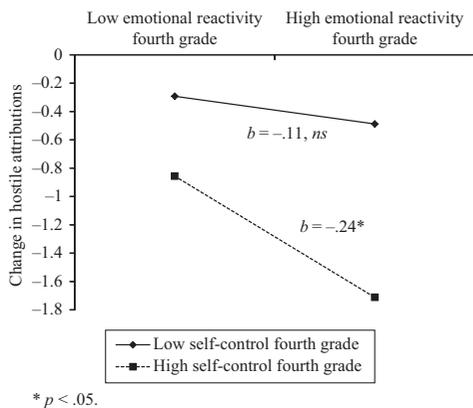


Figure 1. Interaction between emotional reactivity and self-control predicting change in children's hostile attributions.

was theoretically meaningful according to Dodge's (2006) work.

After breaking the sample into two groups based on whether third grade bias was low or high, it was clear why no average change was found with the full sample. Children with higher third grade biases decreased over time, whereas children with lower third grade biases increased over time. The fact that the low-risk group would experience increases in hostile attributions over middle childhood is surprising and contrary to previous research (Dodge, 2006). Although it is possible that children who initially make few hostile attributions at third grade tend to become more sceptical of others' intentions in social situations during middle childhood, it is also possible that this simply reflects a tendency to regress to the mean. We encourage readers to interpret the findings among the low-risk children with caution because the change model did not fit the data particularly well in this subsample. With model fit in mind, and considering none of the predictors explained variance in the intercept or slope for the low-risk group, the following discussion focuses on findings among the children with higher third grade bias.

Among children with higher third grade hostile attributions, the children who were particularly at risk were those with low self-control early in middle childhood. Low self-control at third grade was associated with the highest starting bias at third grade and little decline in these highly biased attributions from third grade to fifth grade. Past research has shown that children's ability to regulate themselves in early childhood is associated with greater social functioning in middle childhood (Eisenberg et al., 1997). Therefore, being able to display greater self-control at an earlier age may allow children to develop more advanced social skills and, in turn, give children an advantage when interacting with their peers. Main effects were not found for emotional reactivity, suggesting that having a strong emotional response in a situation is not a risk factor for children, but rather, not being able to control one's feelings or behaviours is what is most detrimental in social situations.

An interaction at fourth grade among the high-risk group showed that for at-risk children who do have better self-control, emotional reactivity can affect changes in hostile attributions over time. Significantly more decline in attribution bias from third grade to fifth grade was seen when fourth grade children had emotional reactions to social situations but were able to control their emotions and behaviour. Less change in hostile attribution was seen from third to fifth grade among these high-risk children when they experienced less emotional engagement at fourth grade.

The findings partially support our hypothesis that the combination of high emotional reactivity and high self-control is related to declines in hostile attribution bias over time. We suggest that partial support was found because a significant interaction was only found between fourth grade reactivity and fourth grade self-control in predicting change in hostile attribution bias from third grade to fifth grade; additional interactions between reactivity and self-control were not found at third grade or fifth grade. The interaction between emotional reactivity and self-control was also not associated with hostile attributions among the low-risk subsample, which referred to children with lower initial attribution bias at third grade; this suggests that higher emotional reactivity and higher self-control are particularly important for the change in hostile attributions of children who display greater negativity when they enter middle childhood. Because researchers have argued that high reactivity might allow children to recognise and react to social information in a way that is both positive and socially appropriate (Eisenberg & Fabes, 1992), and individuals who cannot control their own emotional reactions are thought to be less likely to facilitate positive social interactions (Eisenberg & Fabes, 1995), it is possible that the combination of high reactivity and emotional control allows children who are initially more negative greater opportunities to continue to engage in social interactions. Thus, continued engagement in socially complex interactions in an expressive and controlled way may allow for subsequent decreases in these biases over time.

Although the self-control and emotional reactivity findings among the high-risk subsample were significant after controlling for child sex, it is noteworthy that many gender differences were found in the study variables. Boys displayed lower emotional reactivity, lower self-control and higher hostile attribution bias across most time points compared to girls. Thus, boys were more likely to be categorised in the high-risk subsample than the low-risk subsample. Boys and girls are taught different messages about emotionality and regulation, with girls often encouraged to display and discuss sadness (Adams, Kuebli, Boyle, & Fivush, 1995; Fivush, Brotman, Buckner, & Goodman, 2000), yet hold back anger (Birnbaum & Croll, 1984; Radke-Yarrow & Kochanska, 1990). These emotion socialisation messages are particularly relevant to developmental changes in children's social cognition and emotion. Future research that investigates child sex differences in emotion socialisation and subsequent reactivity, control and hostile attributions is warranted.

The current study utilised behavioural indices of emotion regulation and reactivity; however, children's behavioural reactivity and regulation have been theorised to have physiological underpinnings (Calkins & Hill, 2007). It may be that how upset or aroused children get during emotionally charged contexts and how well they manage this arousal in socially appropriate ways is dependent upon underlying physiological mechanisms. Therefore, future work may want to examine the ways in which children's physiological arousal and regulation of arousal during provocation influence their ability to correctly interpret social situations.

The current study was a multi-method, multi-informant longitudinal design with a large nationally drawn sample of school-aged children. Nonetheless, this study is not without limitations. The hostile attribution bias measure only included stories that addressed instrumental provocations, such as one's possession being broken by another person. Relational provocations, such as being laughed at by peers, are also very relevant to school-aged children (Crick, 1995). Unfortunately, due to differences in the relational stories

across assessments in the current data-set, we were unable to examine these types of attributions in this longitudinal design. This is an important direction for future work. Additionally, separating the sample by the third grade hostile attribution mean may have resulted in somewhat artificial groups. Future research should utilise growth mixture modelling on a larger time frame to better examine naturally occurring patterns of change over an extended period.

In sum, results revealed that some children's hostile attributions continued to change over middle childhood and that socioemotional skills were related to attribution differences between children. Findings underscore the importance of children's regulatory abilities in social situations, particularly when they are emotionally reactive. Having emotional reactions in social situations can increase children's abilities to relate to peers, as long as they are able to control initial negative impulses in order to attend to important social information in their environment. A recent intervention study applied this idea to a small sample of early-adolescent boys finding that increasing self-regulated learning strategies decreased later negative attribution styles (Tavakolizadeh & Qavam, 2011). Increasing regulatory skills appears to be an important direction for future intervention efforts aimed at changing children's negative perceptions about others' intentions. And as we see in this study, these efforts may be particularly beneficial among children who are identified early as experiencing more difficulties with hostile attributions in social situations.

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