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Developmental Precursors of Young School-Age Children's Hostile Attribution Bias

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This prospective longitudinal study provides evidence of preschool-age precursors of hostile attribution bias in young school-age children, a topic that has received little empirical attention. We examined multiple risk domains, including laboratory and observational assessments of children's social-cognition, general cognitive functioning, effortful control, and peer aggression. Preschoolers ($N = 231$) with a more advanced theory-of-mind, better emotion understanding, and higher IQ made fewer hostile attributions of intent in the early school years. Further exploration of these significant predictors revealed that only certain components of these capacities (i.e., nonstereotypical emotion understanding, false-belief explanation, and verbal IQ) were robust predictors of a hostile attribution bias in young school-age children and were especially strong predictors among children with more advanced effortful control. These relations were prospective in nature—the effects of preschool variables persisted after accounting for similar variables at school age. We conclude by discussing the implications of our findings for future research and prevention.

Keywords: hostile attribution, theory-of-mind, emotion, effortful control, social-cognition

Suppose a child has a soda spilled on her by a peer at a lunch table; was it an accident, or did her peer intentionally spill the drink on her? If the child tends to interpret her peer's behavior as intentional, when intent is ambiguous, she is demonstrating a *hostile attribution bias* (HAB). A HAB is typically identified during the school-age years and is linked with higher levels of aggressive peer interaction (Crick & Dodge, 1994; Dodge, 2006; Dodge, Laird, Lochman, Zelli, & the Conduct Problems Prevention Research Group, 2002; Dodge, Pettit, Bates, & Valiente, l995; Weiss, Dodge, Bates, & Pettit, l992). Yet, questions concerning the nature and antecedents of HAB in early childhood have received little empirical attention. Identifying factors that increase young children's risk for developing a HAB, as well as factors that protect against its development is of practical and theoretical importance.

There are compelling reasons for examining preschool-age precursors of children's HAB. According to Dodge (2006), HAB is common among young children who confront situations like the one described above, but most learn to attribute *benign* intent (or no intent) to others in those contexts. Indeed, during the preschool years children increasingly understand that the outcomes of others' actions do not always match their intentions (Feinfield, Lee, Flavell, Green, & Flavell, 1999). Because most children outgrow this bias during early childhood, the preschool years may be an important time to identify other competencies that develop simultaneously and support a decline in hostile attributions. Moreover, this may be an important period in which to intervene. In what follows, we propose that early advances in understanding others' mental and emotional states, as well as aspects of more general cognitive functioning, protect children from over-attributing hostile intent in ambiguous social situations. Based on experimental work with adults, we also hypothesize that these early cognitive advances combine with self-regulatory competencies to lower children's risk for a HAB. Finally, we account for peer aggression and assess whether aggressive children (who may have general cognitive and social-cognitive deficits) provoke aggressive responses from peers, thereby evoking hostile attributions.

Social-Cognitive Understanding

During the preschool period, most children develop an increased awareness that mental states are internal, subjective experiences

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related to, but distinct from, the behaviors and contexts associated with them (Wellman, 1990, 2011). This developing "theory of mind" (ToM) is proposed to play an important role in early social adjustment (Astington, 2003; Denham, Blair, Schmidt, & DeMulder, 2002; Lemerise & Arsenio, 2000). Indeed, preschoolers and young school-age children with a more advanced ToM (often gauged with false-belief tasks) demonstrate more advanced social skills and experience greater peer acceptance (Baird & Astington, 2004; Peterson & Siegal, 2002; Watson, Nixon, Wilson, & Capage, 1999). Conversely, preschoolers and young school-age children with a poorer ToM exhibit more aggressive and disruptive behavior (Astington, 2003; Baird & Astington, 2004; Hughes, Dunn, & White, 1998; Hughes & Ensor, 2006). As we discuss next, relations between social-cognition and externalizing behavior may exist, in part, because fundamental deficits in interpreting others' mental states may lead to hostile attributions of intent, which children then act upon.

One important aspect of ToM development is the progressive appreciation that people are fallible: they have misperceptions, lack information, and make mistakes (Harris, 2006; Wellman, 1990, 2011). Indeed, this is central to many components of ToM, including understandings of ignorance, false beliefs, and intentionality. One common mistake young children make is basing their judgments of others' intentions (as good or bad) on the outcomes of their actions (e.g., bad outcomes are the product of bad intentions) when in fact, intent and outcome do not always match in real life (Feinfield et al., 1999). During early and middle childhood, children's understanding of intentionality becomes more refined, and they progressively realize that some behaviors are unintentional, products of ignorance, misperceptions, or non-conscious processes (Mills & Keil, 2005). This developing understanding of intentionality is related to another fundamental component of ToM—an understanding of false-beliefs (Killen, Mulvey, Richardson, Jampol, & Woodward, 2011; Mull & Evans, 2010). Thus, one hypothesis is that the typical age-graded decrease in hostile attributions is, in part, a product of concurrent advances in children's ToM development; after all, incorrect hostile attributions are incorrect mental inferences. However, this relation has yet to be examined. Here, we assessed relations between HAB and ToM using false-belief tasks that require children to explain and predict others' actions based on their mental states (Bartsch & Wellman, 1989).

Hostile attributions may arise for reasons other than problems considering states like intentions and beliefs (which are gauged with ToM tasks); they may also arise from limitations in *emotion* understanding and perspective-taking. Children's understanding of the meaning of different emotional states is rooted in toddlerhood (Brown & Dunn, 1996; Pons, Harris, & de Rosnay, 2004). By 3 years of age, children understand that others' emotional reactions to situations may differ from their own, though significant individual differences remain at this age (Denham, 1986). Importantly, preschool-age children with higher levels of emotion understanding are perceived by peers as more likeable (Denham et al., 2003) and, as young school-age children, show advanced levels of moral understanding (Dunn, Brown, & Maguire, 1995), higher levels of social competence (Denham et al., 2003) and lower levels of disruptive behavior (Denham, Blair, Schmidt, & DeMulder, 2002).

Conceivably, children with a less sophisticated understanding of emotion—particularly those who have difficulty differentiating others' emotions from their own—may be more prone to making hostile attributions, and this may partially account for why poorer emotion understanding is related to negative peer interaction. Consider the situation where a peer accidentally spills juice on a child. If the child has difficulty differentiating what she feels from what others feel, she may conclude that because she feels bad, the peer's intent must be bad. Thus far, relations between emotion understanding and hostile attributions have yet to be examined in early childhood. To explore these potential relations in the current study, we included a measure of emotion understanding that gauged children's ability to identify emotions and to distinguish their own versus others' emotional reactions to various situations.

General Cognitive Functioning

Sophisticated understanding of the mind and emotion alone do not always guard against misattributions of intent (Knobe, 2005; Leslie, Knobe, & Cohen, 2006); other capacities must also be at work. Low levels of general cognitive functioning—assessed with the Woodcock–Johnson Psychoeducational Battery-Revised—are linked to more hostile attributions of intent both concurrently and prospectively among first graders (Runions & Keating, 2007). Yet little is known about whether *preschoolers'* general cognitive functioning is predictive of their tendency to make hostile attributions (Orobio de Castro, Veerman, Koops, Bosch, & Monshouwer, 2002).

To examine the influence of preschoolers' general cognitive functioning on their school-age HAB, we included standard measures of children's verbal and non-verbal IQ. Because verbal ability has been hypothesized to play a critical role in the development of social-cognition and social competence (see Astington, 2003), we were particularly interested in assessing the relation between preschool-age verbal aptitude and an early school-age HAB–itself a social-cognitive deficit that plays an important role in children's social competence (Dodge, 2006).

Because individual differences in IQ are highly correlated with children's emerging social-cognitive skills (e.g., Carlson & Moses, 2001), and because language deficits in particular are predictive of a less advanced ToM (Farrant, Fletcher, & Maybery, 2006), it is important that we also account for IQ when considering relations between our social-cognitive predictors and HAB outcome. This serves as an important control also because children with less advanced verbal abilities may underperform on all laboratory tasks that entail verbal comprehension or production, and this may produce spurious relations between children's performance on our various tasks.

Self-Regulatory Competence

Another candidate in the etiology of hostile attributions is effortful control (EC)— one's ability to organize attention and modulate emotional and behavioral impulses in socially appropriate ways (Rothbart & Bates, 1998). Toddlers and preschoolers with low EC show elevated levels of disruptive and aggressive behavior (Murray & Kochanska, 2002; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005), and deficits in EC are key precursors of school-age children's adjustment problems (Olson, Sameroff, Kerr, & Lunkenheimer, 2009). Young children with suboptimal levels of EC may be less able to inhibit initial attributions of hostile intent in ambiguous social situations with negative outcomes. As discussed next, early deficits or delayed development in EC coupled with poor social-cognitive abilities may account for some children's tendency to attribute hostile intent to others.

EC may work in conjunction with ToM and emotion understanding to help individuals arrive at proper inferences about intent, thus reducing the risk of making incorrect hostile attributions. Indeed, Rosset (2008) found that adults have an initial tendency to incorrectly interpret certain behaviors as intentional and must override that tendency (a process that requires EC) in order to arrive at correct inferences that certain behaviors are unintentional. Thus, perhaps relations between ToM and emotion understanding on the one hand and hostile attributions on the other are strongest among children with robust EC, who can inhibit their initial inferences about others' negative intent, and then apply their social-cognitive capacities to arrive at more accurate mental inferences. The interplay of children's preschool-age EC with social-cognition and with general cognitive functioning was examined in the present study to determine whether their interactions predict fewer early school-age hostile attributions.

Covariates of Hostile Attribution Bias

Given that preschoolers with deficits in ToM, emotion understanding, IQ, and EC exhibit more aggressive and disruptive behavior (Denham et al., 2002; Hughes et al., 1998; Hughes & Ensor, 2006; Olson et al., 2005), we accounted for early peer aggression when predicting children's HAB. Children's tendency to make hostile attributions of intent has been linked to their concurrent and future aggressive behavior (Orobio de Castro et al., 2002; Dodge, 2006). Equally probable, children's aggressive behavior may increase their tendency to make hostile attributions, yet few studies account for children's peer aggression when predicting their later HAB. We included a measure of early peer aggression based on naturalistic observations and teacher reports. Because of the rapid growth in social-cognitive, general cognitive, and self-regulatory capacities during the preschool period, it was important to account for variability in children's age when they were assessed in the laboratory. Because boys tend to make more hostile attributions than girls (Runions & Keating, 2007), we also included gender as a covariate.

Goals of the Current Study

The main goal of our prospective longitudinal study was to identify early developmental pathways to children's later tendencies to attribute hostile intent to others under ambiguous circumstances. Our main research goals and hypotheses were as follows:

1. Based on previous research and theory (Dodge, 2006; Runions & Keating, 2007), we expected that early advances in children's social-cognition, general cognitive functioning (i.e., IQ), and self-regulation would place them at lower risk for misinterpreting others' behavior as intentionally hostile. We expected that higher levels of preschool-age ToM, emotion understanding, IQ, and EC would directly predict fewer hostile attributions in the early school-age years. Furthermore, we planned to examine the constituents of significant social-cognitive and general cognitive predictors to enhance the specificity of our findings.

2. We examined how factors in separate domains combine to increase (or to decrease) children's tendency to exhibit a HAB. Current conceptualizations underscore the need for simultaneous assessments of emotion and social-cognitive risk factors to elucidate developmental processes underlying aggressive behavior (Arsenio & Lemerise, 2004; Crick & Dodge, 1994). Especially in aggressive children, strong negative affect can impair the ability to make effective and adaptive interpretations of challenging social situations (Dodge & Somberg, l987). Izard, Fine, Mostow, Trentacosta, and Campbell (2002) hypothesized that associations between emotion and cognition synergize across development, fostering stable affective–cognitive "structures." Here, we considered whether early social-cognitive and general cognitive vulnerabilities and self-regulatory deficits interact to predispose children to a later HAB. Given that measures of early developmental risk tend to correlate, a unique advantage of our data was that we could determine the relative direct and interactive contributions of these factors to children's HAB.

Method

Participants

Participants were 239 3.5-year-old children (118 girls; age range = 32 to 45 months, M = 41.40 months, SD = 2.09 months) who were part of an ongoing longitudinal study (Olson et al., 2005). Children represented the full range of externalizing symptom severity on the Child Behavior Checklist/2–3 (CBCL; Achenbach, 1992), with an oversampling of toddlers in the medium-high to high range of the Externalizing Problems scale ($T > 60$; 44%). Most families (95%) were recruited from newspaper announcements and fliers sent to day care centers and preschools; others were referred by preschool teachers and pediatricians. To recruit children with a range of behavioral adjustment levels, two ads were placed in local and regional newspapers and child care centers, one focusing on hard-to-manage toddlers, and the other on typically developing toddlers. Children with serious chronic health problems, mental retardation, and/or pervasive developmental disorders were not included in the current study.

Most children (91%) were of European American heritage. Others were of African American (5.5%), Hispanic American (2.5%), or Asian American (1%) backgrounds. The majority (87.9%) resided in two-parent families; of the remaining households, 5.3% of parents identified themselves as single (never married), and 6.8% identified themselves as divorced. Fifty-five percent of mothers worked full-time outside of the home. Nineteen percent of mothers and 24% of fathers received high school educations with no further educational attainment; 46% of mothers and 34% of fathers completed 4 years of college with no further training; and 35% of mothers and 42% of fathers completed some additional graduate or professional training. The median annual family income was $52,000, ranging from $20,000 to over $100,000.

Of the 239 consenting families, 88% participated in all aspects of data collection and 96% provided partial data. The second assessment occurred when participants were between 5- and 6-years-old (age range = 60 to 80 months, M = 68.90 months, SD = 3.85 months). Twenty families moved out of the state but continued to provide questionnaire data. Of the 10 families no longer in the study, only two refused participation (too busy). The other eight withdrew due to family or child illness. The final sample for the present study included 231 families. Attrition and missing data were nonselective based on comparisons of sociodemographic and study measures.

Overview of Procedures

At the age 3.5 assessment, or Wave 1 (W1), children participated in Saturday morning laboratory sessions at a local preschool. Following 20–30 min of rapport building, measures of social-cognitive functioning, general cognitive functioning, and EC were individually administered. Preschool teachers were asked to contribute ratings of children's behavioral adjustment. Children's peer interactions were videotaped in preschool settings. At the age 5–6 assessment, or Wave 2 (W2), children were administered a measure of HAB and age-appropriate measures of social-cognition, general cognitive functioning, and EC during a laboratory visit.

Social-Cognitive Functioning

At W1 and W2, children's ToM was measured using standard false-belief explanation and prediction tasks (Bartsch & Wellman, 1989). At W1, children's ability to identify basic emotions and to infer other's emotional reactions that are similar to those of the child (stereotypical) and opposite those of the child (non-stereotypical) was assessed with Denham's (1986) emotion understanding tasks. At W2, children were given more advanced appearance-reality emotion understanding tasks (Harris, Donnelly, Guz, & Pitt-Watson, 1986), which gauged their understanding that people can experience emotions that are distinct from what they physically express. Social-cognitive tasks are described in detail in the Appendix.

General Cognitive Functioning

Children's general cognitive functioning was operationalized as their IQ scores at W1 and W2, which were created by aggregating scaled scores on the Block Design and Vocabulary subtests of Wechsler's Preschool and Primary Scale of Intelligence-Revised (WPPSI-R; Wechsler, 1989). The Vocabulary and Block Design subtests are reported by Wechsler (1989) to have good reliability (reliability coefficients of .84 and .85, respectively), as well as sufficient construct and concurrent validity. With this measure, we considered direct relations between children's IQ and HAB alongside social-cognitive and self-regulatory predictors of HAB.

Effortful Control

At W1, individual differences in EC were assessed during laboratory visits with six tasks from Kochanska et al.'s (1996) toddler-age behavioral battery: Turtle and Rabbit, Tower Task, Snack Delay, Whisper Task, Tongue Task, and Lab Gift, administered in that order. Each task was designed to tap Rothbart's (1989) general construct of EC (suppressing a dominant response and initiating a subdominant response according to varying task demands). All tasks were introduced as "games," and children were reminded of the rules midway through each. To check the accuracy of recordings, 15 test administrations were videotaped and independently scored. Reliability was excellent, $\kappa = .95$. As recommended by Kochanska and colleagues (1996), a total behavioral score was computed by summing subtest scores ($\alpha = .70$). Comparable tasks and an aggregate score for EC at W2 were also included. Tasks for W1 and W2 have been described in detail elsewhere (Kochanska, Murray, & Coy, 1997; Olson et al., 2005).

Peer Aggression

Observational measures and teacher ratings of children's peer aggression (described in the Appendix) were aggregated into composite variables of peer aggression at W1 and W2. Both teacher ratings and observational indices of child aggression were highly positively skewed. The following steps were taken to derive statistically sound weighted composite measures of peer aggression. The observation scores were treated as upward adjustments to teacher ratings, which may be more reliable and of greater frequency than discrete observations over a limited time period (McEvoy, Estrem, Rodriguez, & Olson, 2003). The observation scores were weighted .5 in relation to the "1" values assigned to teacher scores. Next, the resulting *Z*-score composite was corrected for skewness (Afifi, Kotlerman, Ettner, & Cowan, 2007). A constant was added, and a logarithmic transformation of the new variable was created. These procedures yielded robust, normally distributed measures of peer aggression (skewness = .12, SE = .17).

Hostile Attribution Bias

During a separate laboratory session at W2, a child assessment of hostile attribution bias (HAB) was administered (Webster-Stratton & Lindsay, 1999). Children were asked to respond to four hypothetical scenarios. The instructions to the child were, "Now we're going to play detective. I want you to pretend." In each story, the identification figure (matched to child's gender) experiences adverse outcomes while in the presence of same-sex peers. In one story, children were told, "Pretend you were eating your snack quietly (child is shown plastic cup). Jane, a girl in your class, was drinking grape juice. She spilled grape juice all over you. What do you think happened?" Children were asked follow-up questions to elicit attributions of intent. For example, "Did Jane want to get you all wet and spill it on purpose? Or did Jane spill the grape juice on you by accident?" The order of the latter two questions varied for participants. The child's total score was the number of intentional (hostile) attributions made (range: 0–4).

Data Analysis Overview

Preliminary analyses examined descriptive properties of measures and their bivariate relations. Structural equation modeling (SEM) was used to examine preschool-age social-cognitive, general cognitive, and self-regulatory predictors of an early school-age HAB, while accounting for early peer aggression, age, and gender. A series of SEM models were tested using Mplus 6.1 with maximum likelihood with robust standard errors (Muthén & Muthén, 2010), which is robust to non-normal data and allowed us to estimate missing data while simultaneously regressing our measure of HAB on multiple predictors (Yuan & Bentler, 2000). Following recommendations by Boomsma (2000), SEM results include model chi-square (χ^2), comparative fit index (CFI), root-mean-square error of approximation (RMSEA), and its 90% confidence interval (CI). Fit indexes greater than .90 and χ^2 values close to zero reflect reasonably good fit. RMSEA values ≤ .05 indicate a close approximate fit. Standardized values are reported.

Results

Descriptive Statistics and Correlations

Means, standard deviations, and correlations are shown in Table 1. Focal to our research questions, W2 HAB was negatively related to W1 ToM, emotion understanding, IQ, and EC. These four W1 variables were all positively intercorrelated. Point-biserial correlations indicated that girls had more advanced W1 ToM and EC and demonstrated less peer aggression than boys.

Structural Equation Modeling

We expected that advanced levels of preschool-age ToM, emotion understanding, IQ, and self-regulation would lower children's risk for an early school-age HAB. We accounted for peer aggression, gender, and age in all SEM models. Covariances were added between measures at W1 to account for their similar time of measurement.

A preliminary SEM model was tested that included the composite measures of ToM, emotion understanding, IQ, EC, and peer-aggression at W1, as well as age-appropriate versions of these measures at W2 to ensure that early effects of W1 measures on W2 HAB were not reflecting their concurrent relations at ages 5 to 6. The model produced an adequate fit (see Model 1 in Table 2). W1 ToM ($\beta = -.13$, $p = .043$), W1 emotion understanding ($\beta = -.16$, $p = .043$), and W1 IQ ($\beta = -.13$, $p = .087$) predicted lower levels of W2 HAB. None of the W2 measures, W1 EC, or W1 peer aggression predicted W2 HAB. Given our modest sample size, W2 predictors were removed from the next model to increase power in detecting effects of W1 predictors on W2 HAB.

A SEM model with each measure at W1 predicting W2 HAB and accounting for peer-aggression, gender, and age produced a close approximate fit (see Model 2 in Table 2). This model accounted for 17% of the variance in W2 HAB. Consistent with our predictions and previous model, W1 ToM ($\beta = -.13$, $p = .048$), W1 emotion understanding ($\beta = -.18$, $p = .022$), and W1 IQ ($\beta = -.17$, $p = .031$) predicted lower levels of W2 HAB. W1 EC, W1 peer aggression, gender, and W2 age were not related to W2 HAB. In sum, preschoolers with a more advanced understanding of others' mental and emotional states and a higher IQ were less likely to demonstrate an early school-age HAB.

Constituent Predictors of Social-Cognitive and General Cognitive Variables

Each of the three significant W1 predictors in the previous model was composed of two constituents: for ToM, false-belief prediction and explanation scores; for emotion understanding, stereotypical and non-stereotypical emotion understanding scores; and for IQ, vocabulary and block design scaled scores. Some of these constituents may be more predictive of a school-age HAB than others, thus assessing the predictive value of each constituent might enhance the specificity of our model. In the case of ToM, children's performance on false-belief *explanation* tasks may be especially predictive of their performance on HAB tasks, as both tasks require children to explain others' behaviors in terms of underlying mental states. Likewise, non-stereotypical emotion understanding may be more predictive of a HAB than stereotypical emotion understanding, as both the non-stereotypical and HAB tasks require children to consider that different people may experience different emotions within the same social context. As for IQ, verbal ability in particular has been proposed to play a central role in children's developing social-cognition (Astington, 2003) and thus may be especially predictive of children's HAB.

Table 1
Study Variables: Correlations and Descriptive Statistics

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age 5–6 hostile attributions	—													
2. Gender (0 = boys, 1 = girls)	$-.12^{\dagger}$	—												
Age 3.5 (W1) predictors														
3. Theory of mind	$-.28^{***}$	$.17^{*}$	—											
4. Emotion understanding	$-.31^{***}$	.03	$.32^{***}$	—										
5. IQ	$-.32^{***}$	.06	$.30^{***}$	$.44^{***}$	—									
6. Peer aggression	.07	$-.14^{\dagger}$	$-.20^{**}$	−.02	$-.15^{*}$	—								
7. Effortful control	$-.24^{**}$	$.24^{***}$	$.29^{***}$	$.35^{***}$	$.35^{***}$	$-.24^{**}$	—							
Age 5–6 (W2) predictors														
8. Theory of mind	−.09	.06	.11	$.17^{*}$	.06	−.01	.12	—						
9. Emotion understanding	−.06	.05	$.25^{**}$	$.25^{**}$	$.29^{***}$	−.08	$.25^{**}$	.06	—					
10. IQ	$-.20^{**}$	.01	.09	$.26^{**}$	$.36^{***}$	−.13	$.20^{**}$	.09	$.30^{***}$	—				
11. Peer aggression	.10	$-.17^{*}$	−.08	−.07	−.01	$.43^{***}$	$-.19^{**}$	$-.13^{\dagger}$	.07	.00	—			
12. Effortful control	$-.29^{***}$	.08	$.32^{***}$	$.33^{***}$	$.39^{***}$	$-.18^{*}$	$.31^{***}$	$.28^{***}$	$.20^{*}$	$.33^{***}$	$-.15^{*}$	—		
Age covariates														
13. Age at W1 in months	−.05	.03	$.15^{*}$	$.20^{**}$	.08	.05	$.21^{**}$	$.13^{\dagger}$	.03	.01	.05	.03	—	
14. Age at W2 in months	.03	$-.24^{**}$	−.07	.03	−.09	.07	$-.16^{*}$	$.20^{**}$	.04	−.05	.08	$.31^{***}$	−.03	—
M	1.27		1.55	27.22	22.02	.80	−.01	4.11	5.96	24.72	.04	−.01	41.40	68.90
SD	1.36		2.00	6.39	5.44	1.03	.54	1.75	2.49	4.30	1.02	.52	2.09	3.85

Note. $N = 231$. W1 = Wave 1; W2 = Wave 2.
$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 2
Overall Fit of Structural Equation Models and Estimates of Their Significant Effects

Model tested	χ^2	*df*	*p*	CFI	RMSEA [90% CI]	Significant effects (β) on W2 hostile attribution bias
1. Model with W1 and W2 predictors	17.21	10	.070	.98	.06 [.00, .10]	W1 ToM (−.13*), W1 emotion understanding (−.16*) and W1 IQ (−.13†)
2. Model with W1 predictors	16.92	10	.076	.97	.06 [.00, .10]	W1 ToM (−.13*), W1 emotion understanding (−.18*), and W1 IQ (−.17*)
3. Model with constituents of W1 predictors	17.17	13	.192	.99	.04 [.00, .08]	W1 false-belief explanation (−.13†), non-stereotypical emotion understanding (−.22*), and W1 vocabulary (−.21**)
4. Model with W1 interaction terms	59.42	55	.318	.99	.02 [.00, .05]	W1 nonstereotypical emotion understanding (−.24*) and W1 vocabulary (−.20**)
5. Unconstrained multiple-group model for EC	40.40	26	.036	.95	.07 [.02, .11]	W1 nonstereotypical emotion understanding (−.27**) and W1 vocabulary (−.22**)
6. Best-fitting multiple-group model for EC with two equality constraints	41.89	33	.138	.97	.05 [.00, .09]	Same as above and W1 false-belief explanation for high EC group only (−.32***)
7. Best-fitting multiple-group model for IQ with no equality constraints	39.84	35	.264	.98	.04 [.00, .08]	W1 false-belief explanation (−.17*) and W1 nonstereotypical emotion understanding (−.24*)

Note. W1 = Wave 1; W2 = Wave 2; CFI = comparative fit index; RMSEA = root-mean-square-error of approximation; EC = effortful control; ToM = theory-of-mind; CI = confidence interval.
† $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

A model regressing W2 HAB on W1 predictors' constituents and the other independent variables produced a close fit (see Model 3 in Table 2), accounting for 18% of the variance in W2 HAB. For W1 ToM, false-belief prediction scores were not related to W2 HAB (β = –.05, *p* = .460), but false-belief explanation scores marginally predicted lower levels of W2 HAB (β = –.13, *p* = .073). For W1 emotion understanding, stereotypical emotion understanding scores were not related to W2 HAB (β = .06, *p* = .572), but more advanced non-stereotypical emotion understanding scores predicted lower levels of W2 HAB (β = –.22, *p* = .022). Finally, for W1 IQ, block design scores were not related to W2 HAB (β = .00, *p* = .951), but higher W1 vocabulary scores predicted lower levels of W2 HAB (β = –.21, *p* = .005).

Interactions of Preschool-Age Self-Regulation and Social-Cognitive Variables

Although we found no evidence of EC having a direct effect on HAB, we speculated that preschool-age self-regulation might moderate relations between preschool social-cognition and a school-age HAB. We tested for such moderation with two approaches: (a) including interaction terms in our models and (b) comparing separate models for participants who were high versus low in EC. We created interaction terms by combining a continuous measure of EC with constituent variables from the previous model. Interaction terms were included in our model along with the individual predictors and covariates. This model produced a close approximate fit (see Model 4 in Table 2), accounting for 18% of the variance in W2 HAB. As in the previous model, W1 non-stereotypical emotion understanding (β = –.24, *p* = .013) and W1 vocabulary (β = –.20, *p* = .009) predicted lower levels of W2 HAB. Interaction terms and other predictors were not significant.

To further examine a potential moderating role of EC, we conducted multiple-group SEM with the constituent model comparing children with high and low levels of W1 EC, which required that we dichotomize EC by median split. Although this technique has been criticized for contributing to a loss of statistical power and negatively biasing standard errors and R^2 estimates (Fürst & Ghisletta, 2009), considering jointly extreme observations among predictor and moderator variables is pivotal to detecting statistical interactions in studies that do not include experimental conditions, such as the current study (McClelland & Judd, 1993). A median split allowed us to compare children who scored better than average on EC tasks to those who performed worse with adequate power to detect modest statistical interactions. Children scoring below the median (n = 114) will be referred to as the *poorly-regulated* group, and children scoring above the median (n = 112) will be considered the *well-regulated* group.

The unconstrained multiple-group model produced a reasonable fit (see Model 5 in Table 2), accounting for 11% and 32% of the variability in W2 HAB for the *poorly-regulated* group and the *well-regulated* group, respectively. Chi-square difference tests and an iterative approach of adding equality constraints were used to determine which paths from W1 measures to W2 HAB significantly differed between groups. The best fitting multiple-group model produced a close fit (see Model 6 in Table 2). Results indicated that for both the *poorly-* and *well-regulated* groups, W1 non-stereotypical emotion understanding (mean β = –.27, *p*s < .01) and vocabulary scores (mean β = –.22, *p*s = .001) predicted lower levels of W2 HAB. Two predictors of W2 HAB significantly differed between groups: W1 EC [$\Delta\chi^2(1) = 7.04$, $p = .008$] and W1 false-belief explanation [$\Delta\chi^2(1) = 5.87$, $p = .015$]. Neither W1 predictor had a significant effect on W2 HAB for the *poorly-regulated* group (W1 false-belief explanation β = .11, *p* = .376; W1 EC β = –.12, *p* = .172). For *well-regulated* children, W1 false-belief explanation scores strongly predicted lower levels of W2 HAB (β = –.32, *p* < .001), but W1 EC was not significant (β = .17, *p* = .084). Thus, regardless of self-regulation, preschoolers with a more flexible understanding of others' emotions and better verbal ability were less likely to demonstrate an early school-age HAB. Advanced false-belief understanding during the preschool years predicted fewer hostile attributions in the early school years only among children with greater self-regulation.

Interactions of Preschool-Age General Cognitive and Social-Cognitive Variables

Arguably, children in our well-regulated group may simply be better test takers with cleaner data, allowing us to find stronger predictive relations between HAB and our other measures; on this hypothesis stronger relations should also be found among children who performed better (vs. worse) on other general cognitive measures. To test this possibility, we conducted a multiple-group analysis comparing children with high versus low IQ composite scores (based on median split). The best fitting model produced a close fit (see Model 7 in Table 2). For both groups, W1 false-belief explanation (mean $\beta = -.17$, *p*s = .02) and non-stereotypical emotion understanding (mean $\beta = -.24$, *p*s = .01) predicted lower levels of W2 HAB. In contrast to our findings for EC, no differences were found between children with higher IQ scores ($n = 114$) and children with lower IQ scores ($n = 103$) when estimates of effects of false-belief explanation and non-stereotypical emotion understanding on HAB were fixed to be of equal value between the IQ groups [$\Delta\chi^2(2) = 1.63$, $p = .442$].

Discussion

This prospective longitudinal study contributes evidence of preschool-age precursors of HAB in young school-age children, a topic that has received almost no empirical attention. We integrated the study of multiple domains, including children's social-cognition, general cognitive functioning, and self-regulation. Preschoolers with advanced ToM, emotion understanding, and IQ made fewer hostile attributions of intent in the early school years. Further exploration of these significant predictors revealed that components of these capacities (*non-stereotypical* emotion understanding, false-belief *explanations*, and *verbal* IQ) were robust predictors of an early school-age HAB and supported our hypothesis that preschool-age levels of EC would interact with some factors to predict hostile attributions. Relations were prospective in nature—effects of preschool variables persisted after accounting for their school-age variance.

Drawing upon recent theory on HAB development (Dodge, 2006) and empirical work on ToM development (Killen et al., 2011; Mull & Evans, 2010), we hypothesized that preschoolers with more advanced social-cognitive skills would be less likely to make hostile attributions during the early school years. Largely supporting expectations, preschoolers with more sophisticated understanding of false beliefs and emotions demonstrated lower levels of HAB during the school-age years, even after controlling for school-age social cognition. To our knowledge, this is the first evidence of predictive relations between preschool-age social-cognition and early school-age HAB. Also, consistent with prior work (Runions & Keating, 2007), aspects of preschoolers' general cognitive functioning predicted fewer hostile attributions of intent during the early school years. Early school-age levels of ToM, emotion understanding, and IQ were unrelated to concurrent levels of a HAB.

To clarify these effects, we deconstructed significant predictor variables—ToM, emotion understanding, and IQ—into their constituents to identify specific capacities that predict an early school-age HAB. We found that preschoolers who were better able to *explain* others' behavior in terms of underlying false beliefs, those who were better at identifying others' emotional states that were *inconsistent* with their own, and those with greater verbal aptitude made fewer hostile attributions 2 to 3 years later. While accounts of relations between cognitive capacities and HAB have been broad and speculative, these results provide evidence of specific social-cognitive and general cognitive capacities that are indeed related to young children's HAB. Collectively, these results extend developmental accounts of HAB to the preschool years and suggest that the preschool years may be a sensitive period of social-cognitive and general cognitive development, potentially having long-term implications for the formation of children's social schemas.

Children typically demonstrate critical social-cognitive gains during the preschool period (Harris, 2006; Wellman, 1990, 2011), paralleling a normative decrease in the frequency of hostile attributions (Dodge, 2006). Developing an understanding that the mind is representational—prone to ignorance, mistakes, and accidents—enables children to correctly attribute intent or non-intent to actors in various contexts, thus reducing attributions of negative intent that arise from accidental social mishaps (Killen et al., 2011; Mull & Evans, 2010). Similarly, emotion understanding develops rapidly during early childhood, beginning with children's recognition of core emotions to a more sophisticated understanding that other peoples' emotions may differ from their own (Brown & Dunn, 1996; Denham, 1986; Pons et al., 2004). Strong negative affect can impair children's ability to accurately interpret complicated social situations (Dodge & Somberg, 1987). Children who have difficulty decoupling their own negative emotions and the emotional reactions of others' more often interpret others' intent as hostile when their actions produce negative consequences.

Orobio de Castro and colleagues (2002) demonstrated that studies of children's HAB that control for intelligence produce smaller effect sizes for other variables. Our analyses included IQ to ensure that relations between social-cognitive measures and HAB were not confounded by individual differences in general cognitive functioning. Finding effects of preschool-age social-cognition while accounting for general cognitive functioning indicates how robustly these specific forms of social-cognition predict hostile attributions during the early school years. Moreover, regardless of children's IQ, more advanced non-stereotypical emotion understanding and false-belief explanations predicted fewer hostile attributions in the early school years.

In their meta-analysis, Orobio de Castro and colleagues (2002) concluded that individual differences in intelligence should be considered as an independent predictor of children's hostile attributions rather than solely as a control variable. In the present study, preschoolers with better verbal ability made fewer hostile attributions several years later. To the best of our knowledge no other study has identified verbal ability as a specific predictor of HAB. Verbal ability is believed to play an important role in the development of children's social-cognition, especially their ToM (Astington, 2003; Farrant et al., 2006). The current findings suggest that the influence of language on social-cognitive development may be even broader than previously conceptualized.

We hypothesized that children's self-regulation would moderate relations between their social-cognitive competencies in the preschool years and an early school-age HAB. Our key finding here was that preschool levels of EC moderated the effect of early ToM on a later HAB. When comparing children who scored relatively high versus low on EC, we found that preschoolers who were better able to explain others' mental states made fewer hostile attributions several years later, but this was true only among well-regulated preschoolers. Among children with poorer self-regulation, there was no predictive relation between ToM and HAB. Our interpretation of this finding is that preschoolers with more self-regulatory competence are better able to apply their understanding of others' mental states in a manner that overrides their initial tendency to make hostile attributions to ambiguous social mishaps. Preschoolers with poorer self-regulation may have difficulty inhibiting their initial impulse to attribute hostile intent to other people whose actions have negative consequences (a tendency that both children and adults are prone to; Rosset, 2008), so that more sophisticated social-information processing can take place. The interactive effect of early ToM and EC on later hostile attributions suggests that poor self-regulation in the preschool years reduces children's ability to effectively apply their social-cognitive competencies in certain social contexts, increasing the frequency of hostile attributions of intent. Importantly, the relation between ToM and HAB for well-regulated children did not emerge simply because well-regulated children were relatively better study participants and thus had less noisy data. If that were the case, we would have found stronger relations between all of our predictors and HAB for well-regulated children (compared to poorly-regulated children), or we would have found differences in predictive relations between preschoolers with high versus low scores on other measures, such as IQ. But, EC (not IQ) played a moderating role, and this moderation was specific to ToM, not the other predictors.

Caveats and Future Directions

There are several ways in which future studies can extend and further clarify the current findings. First, we included peer aggression to account for its associations with focal study variables, but contrary to previous research (e.g., Dodge, 2006), children's HAB scores were unrelated to peer aggression. Although associations between children's hostile attributions and aggressive behavior have been found in many other studies, effect sizes vary by study characteristics (Orobio de Castro et al., 2002). For example, studies of boys and clinically referred children reveal larger relations between hostile attributions and aggression than studies, such as the present investigation, that included both boys and girls or studies of nonreferred children. Mean levels of aggression were lower in our community sample compared to samples of children with identified aggression problems. It is possible that levels of HAB in our sample were not severe enough to be associated with children's aggressive behavior; however, we cannot formally test this hypothesis as past studies vary widely in their measurement of children's HAB and there are no established norms to compare our results against. More research with non-referred boys and girls may be useful in delineating how variability at the low end of the hostile attribution continuum is related to physical aggression. Nevertheless, our results suggest that early school-age HAB is not simply the sequelae of pre-existing aggression but rather a consequence of suboptimal levels of perspective taking, expressive vocabulary, and self-regulation, important precursors of HAB that can inform future research.

Another explanation for finding no association between HAB and aggressive behavior is related to our measure of HAB. Some researchers who have used vignettes similar to those in the present study have additionally asked children whether they would physically retaliate against provocateurs (Dodge et al., 1995; Halligan, Cooper, Healy, & Murray, 2007; Schultz & Shaw, 2003). Studies that aggregate children's responses to questions about physical retaliation and intent attribution may find stronger relations between these aggregates and aggressive behavior than studies (like ours) that measure only intent attributions. Thus, children who both infer hostile intent and who forecast their own aggressive responses may be at greatest risk for actual physical aggression. Our use of a measure not including children's forecasted behavior likely reduced the strength of relations we might find between HAB and aggression. Unified criteria for how to operationalize and measure children's HAB are needed, as well as studies that examine how children's tendency to attribute hostile intent and forecasting of hostile behavior contribute to peer aggression. Nonetheless, our measure of HAB seems most appropriate for addressing the issues at hand—preschool-age precursors of children's hostile attributions, not their hostile behavior forecasting.

Although our findings support a social-cognitive model of HAB, we find that general cognitive and self-regulatory capacities also play a role, and we acknowledge that social processes are important as well. Frequent negative social interactions may reinforce young children's tendency to over-attribute hostile intent to others, thereby contributing to the development of a hostile attributional style that persists into the school years and beyond (Dodge, 2006). Indeed, physical abuse, mothers' authoritative parenting attitudes, and fathers' aversive parenting are predictive of children's greater hostile attributions (Dodge et al., 1995; Nelson & Coyne, 2009; Runions & Keating, 2007). Adverse caregiving experiences may also indirectly contribute to the development of a HAB by hindering critical gains in children's self-regulatory abilities (Olson et al., 2005), which we have shown are associated with a HAB. Likewise, negative peer interactions are a prime situation in which children may attribute hostile intent, and the more they occur, the more skewed children's social-information schemas may become. More work on HAB development is needed accounting for children's cognitive capacities as they function within various social contexts.

As noted previously, lack of associations between W2 measures and HAB may suggest that the early preschool years are an especially critical time for development of ToM and emotion understanding. However, we also acknowledge that tasks tapped different capacities at different ages. Specifically, children's more rudimentary emotion understanding, measured at 3.5 years, was prospectively related to HAB at 5–6 years, whereas their more advanced understanding of real versus apparent emotion, measured at 5–6 years, was unrelated to concurrent HAB. Thus, it is possible that the more rudimentary components of emotion understanding play a more important role in dampening hostile attributions. Our findings extend Dodge's (2006) model of HAB development by specifying preschool-age components of emotion understanding, ToM, IQ, and self-regulation that may help foster a benign attributional style in children.

Lastly, the generalizability of our findings is limited to mostly White families of medium to high socioeconomic status. Although children ranged in externalizing behavior (to provide enough variability to investigate the early etiology of behavioral problems), our sample was characterized by few environmental risk factors, which enabled us to examine children's social-cognitive, general cognitive, and self-regulatory functioning with limited confounds of poverty and other environmental stressors. Thus, results suggest that even normative variation in early cognitive abilities predicts young school-age children's HAB. Future work can extend our findings by sampling families that are more representative of the U.S. population, and therefore, provide more external validity to evidence of early precursors to HAB. Studies conducted in different cultures are also necessary to understand the full generalizability of our findings.

Conclusions

We identified early pathways to children's later tendency to over-attribute hostile intent to others. Poorer understandings of others' mental and emotional states and poorer verbal ability in the preschool years predicted a greater tendency for children to make hostile attributions in the early school years. The combination of early deficits in self-regulation and understanding of others' mental states increased children's vulnerability to making hostile attributions of intent. These prospective relations remained after controlling for school-age social-cognitive, general cognitive, and self-regulatory competencies, which themselves were not concurrently related to hostile attributions. Thus, the preschool years may be a sensitive period for the development of a HAB. Given the rapid development in preschoolers' cognitive and self-regulatory functioning, the preschool years may be an important time to intervene with at-risk children. Interventions targeting multiple domains of cognitive and behavioral functioning may be most effective.

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(*Appendix follows*)

Appendix

Detailed Procedure for Social Cognition Tasks and Peer Aggression Measures

Social-Cognition Tasks

Theory of mind. Theory of mind (ToM) at W1 and W2 was assessed using *false-belief prediction and explanation tasks* (Bartsch & Wellman, 1989), which index children's ability to predict and explain the actions of hypothetical children who have erroneous information about the location of everyday objects. In four *prediction* tasks, children predicted where a doll character will look for a desired object based on what that character believes about that object's location. For example, in one false-belief prediction task, the experimenter showed the child a crayon box and a plain box. The experimenter then suggested that they play a "trick" on the story character and proceeded to take the crayons out of the crayon box and put them in the plain box, emphasizing to the child that the story character cannot see them play this trick. The child was then asked to predict where the story character will look for the crayons. A *false-belief prediction* score was calculated as the total number of stories (range: 0–4) where children correctly predicted the protagonist's behavior. Four *explanation* tasks followed the same format, where the desired objects were moved in order to "trick" the story character. For example, raisins were moved from a raisin box to a plain box. The explanation tasks differ in that the experimenter then proceeded to have the story character look for the desired object in the original location (raisin box). The child was then asked to explain why the story character looked for the raisins in that location. In order to respond correctly, the child must refer to the story character's mental state, such as "he thinks the raisins are in the raisin box." If the child did not spontaneously provide this sort of explanation, he or she is explicitly asked, "What does (the character) think?" A *false-belief explanation* score was calculated as the total number of stories (0–4) where the child correctly explained the protagonist's behavior as stemming from a false belief. A *false-belief* composite was computed as the total number of stories for which the child correctly predicted or explained the protagonist's false belief, for a maximum score of 8 ($\alpha = .80$). Prospective relations between ToM and HAB were focal here, but to account for concurrent relations between ToM and HAB at W2, children were administered a similar set of six false-belief prediction and explanation tasks, yielding a false-belief-understanding composite with moderate variance among 6-year-olds.

Emotion understanding. At W1, children received emotion understanding tasks that reliably assess 2- to 3-year-old children's ability to label and infer the causes of emotional states in others (Denham, l986). Understanding of emotion was assessed using puppets with detachable faces that depict basic emotional states (happy, sad, mad, and afraid). Initially, the child was asked to identify each of the four emotions expressively and receptively. Children received 2 points for identifying the correct emotion, 1 point for correctly identifying the emotion as good/bad, and 0 points for incorrect or no response, for a maximum of 16 points. Next, the examiner made stereotypical facial and vocal expressions of emotion while enacting four vignettes that depicted a situation likely to cause each emotional state; children were asked to choose the face that showed how the puppet would feel in each situation. Scoring was the same as for the emotion labeling task, yielding a *stereotypical emotion understanding* score ranging from 0–8. The child's ability to understand that others feel *differently* than oneself (*non-stereotypical emotion understanding*) was also assessed. Six vignettes were enacted involving a target puppet that "felt" an emotion that was different from how the child was expected to respond in a similar situation. Information about the child's likely reactions were obtained in a prior phone interview during which the child's mother was asked how the child might respond if she or he were to experience each situation. For example, if the parent indicated that her child's favorite food was pizza and the puppet proclaimed his or her anger over being served pizza for dinner, the child was correct if he or she identified the puppet's emotion as "mad." Scoring was the same as for emotion labeling and stereotypical tasks, producing a *non-stereotypical emotion understanding* score ranging from 0–12. Following Denham (1986), a composite *emotion understanding* score was created by summing scores for the labeling, stereotypical emotion understanding, and non-stereotypical emotion understanding tasks ($\alpha = .70$). Based on a random sample of 15 protocols, reliability of scoring was 100%.

Prospective relations between emotion understanding and HAB were focal to our study, but to account for concurrent relations between emotion understanding and HAB at W2, children were administered more advanced and age-appropriate appearance-reality emotion understanding tasks (Harris, Donnelly, Guz, & Pitt-Watson, 1986). These required children to differentiate between the emotions that people express and the emotions that they experience internally. For these tasks children were read two stories in which a protagonist hid an emotion from another story character. Using line-drawn faces, children identified how the protagonist tried to look and why; and what emotion the protagonist really felt and why. For each story, children earned as many as 2 points for identifying how the protagonist really felt, 2 points for correctly explaining why the protagonist felt that way, 3 points for identifying how the protagonist tried to look, and 2 points for correctly explaining why the protagonist tried to look that way, for a maximum of 18 points.

(*Appendix continues*)

Peer Aggression

School observations. Target children were videotaped during free play in classrooms at W1 and W2. There were two 30-min observation sessions scheduled 2–3 weeks apart. The observer was unknown to the target child and was introduced as "a visitor to our classroom who's taking pictures of our school." A 10–15 min warm-up period occurred during which the observer videotaped multiple targets in the classroom so that children could adapt to the observer's presence. Following warm-up, the observer continuously videotaped the target child for 30 min, moving the camera away only when the child looked directly at it. Subsequently, videotapes were written to CD-ROM. Aggressive interactions between the target and his/her peers were coded sequentially, with the presence or absence of the following behaviors recorded at 15-s intervals (adapted from Olson, 1992): Verbal Aggression (taunts; threatens physical harm; insults); Object Aggression (smashes or bangs peer's toys or possessions); and Physical Aggression (hits, kicks, bites, scratches, pinches, spits on, and/or pulls hair of peer). Reliability was established based on 40 paired observations independently analyzed (κ = .89, range = .79–.97). For the present study, a total Peer-Directed Aggression score was derived, based on a composite of verbal aggression, physical aggression, and object aggression directed toward peers. Because different observations varied slightly in length, proportional scores were used indicating the number of intervals in which the target engaged in aggressive behaviors toward peers.

Teacher ratings. At W1, preschool teachers completed the Caregiver/Teacher Report Form, Ages 2-5 (CTRF/2-5; Achenbach, 1997). The Aggressive Behavior subscale, a measure of aggressive, destructive behavior in preschool settings, was extracted for use in the current study (α = .94). At W2, teachers completed the Aggressive Behavior (α = .93) subscale of the Teacher Report Form for Ages 6–18 (TRF; Achenbach & Rescorla, 2001).

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