Relational Aggression and Hostile Attribution Biases: Testing Multiple Statistical Methods and Models

Stephanie A. Godleski · Jamie M. Ostrov

Abstract The present study used both categorical and dimensional approaches to test the association between relational and physical aggression and hostile intent attributions for both relational and instrumental provocation situations using the National Institute of Child Health and Human Development longitudinal Study of Early Child Care and Youth Development (M=8.3 years-old, SD=0.19, N=840). A one standard deviation threshold was used to create categorical aggression status groups. In categorical analyses, children who were both relationally and physically aggressive were found to attribute more hostile intent attributions in relationally provocative situations. Results from the dimensional analyses indicated that female gender, physical aggression, and hostile attribution biases for instrumental provocations each predicted increases in relational aggression over time. Further, relational aggression was not predictive of hostile attribution biases for relational provocations, and instead physical aggression was predictive. Implications for the fields of developmental psychology and psychopathology are discussed.

Keywords Relational aggression · Physical aggression · Hostile attribution biases · Gender

The Social Information Processing (SIP) model gives a theoretical framework for how aggressive children per-

ceive, interpret, and make decisions about social stimuli and situations that increase their likelihood of engaging in aggressive behavior in the future (Crick and Dodge 1994). In this model, behavioral responses to social situations are based on a set of processing steps that are believed to be outside of consciousness (Crick and Dodge 1994; Quiggle et al. 1992). Hostile attribution biases occur at the second step of this model following the encoding of internal and external cues, or the interpretation processing step.

Hostile Attribution Biases: Overview

In general, attributions in social events allow individuals to make judgments regarding the motivations of others and provide the individual with information regarding how he or she should react (Crick and Dodge 1994). Hostile attribution biases may be operationally defined as over-attributing hostile intent to peers' behaviors, even in situations where hostile attribution is not warranted such as when the actual intent is benign in nature or the situation is ambiguous (Dodge 1980; Dodge and Frame 1982; Dodge et al. 1984). In children, hostile attribution biases are most frequently assessed through asking them to imagine being a character faced with a peer-caused problem or provocation to which there are a variety of possible responses with varied causal intentions such as benign, accidental, ambiguous, or clearly hostile (Crick and Dodge 1994). Ambiguous intent depictions elicit individual differences at several social cognitive processing steps in the SIP model (Crick and Dodge 1994, 1996).

Children's perceptions and feelings about social situations develop gradually over time and are impacted by interactions in different contexts as children attempt to understand their social worlds (Crick and Ladd 1993).

S. A. Godleski (✉) · J. M. Ostrov
Department of Psychology, University at Buffalo,
The State University of New York,
226 Park Hall,
Buffalo, NY 14260-4110, USA
e-mail: sg72@buffalo.edu

Hostile attribution biases are most frequently investigated within the realm of ambiguous situations which are related to physical aggression, or the intent to hurt another individual using physical force or the threat of physical harm (Dodge et al. 2006). Hostile attribution biases for instrumental provocation situations and physical aggression have been demonstrated to be most salient for boys (Crick et al. 2002; Dodge and Frame 1982; Dodge and Somberg 1987). Aggressive boys who demonstrate hostile attribution biases enact more aggressive behavior than they receive from peers (Dodge and Frame 1982) and have less peer competence (Dodge et al. 1986).

Hostile Attribution Biases for Relational Provocations

The past emphasis on instrumental scenarios and focus on physical aggression does not include other developmentally salient situations that may be more relevant for the display of relationally aggressive behaviors (i.e., the removal or the threat of the removal of relationships as the means of harm; Crick and Grotpeter 1995), such as friendship withdrawal and gossiping. Crick and colleagues (Crick 1995; Crick et al. 2002) have conducted studies investigating hostile attribution biases for ambiguous relational provocations. These authors (Crick 1995; Crick et al. 2002) demonstrated that relationally aggressive children find provocation events that involve ambiguous relationship conflicts, such as situations involving social exclusion and manipulations (e.g., not having received an invitation for a party that the character overhears other children talking about; Crick 1995), more distressing than those who were non-aggressive.

According to the SIP model, hostile intent attributions increase the likelihood that a child will behave aggressively (Crick 1995). It is hypothesized in this theoretical framework that aggression may be a defense against the hostility the peer was exhibiting as this may help the child to cope with his or her feelings of distress through retaliation (Crick 1995). It has also been posited that hostile attribution biases temporally precede the development of aggressive behavior problems for physical aggression (Rabiner and Coie 1989). Within the physical aggression literature, intent biases often do precede an aggressive response (Dodge and Frame 1982) or predict later development of aggressive behavior (Dodge et al. 1990). Hostile attribution biases have thus been demonstrated to be important in the development and maintenance of physical aggression (Orobio de Castro et al. 2002). However, it is unclear whether the direction of the effect between hostile attribution biases and aggressive behavior is from cognition to behavior or vice versa, especially for relational aggression (Crain et al. 2005; Crick 1995; Crick et al. 2002). Therefore, both directions of effect will be investigated.

Hostile attribution biases for relational provocation situations also seem to be impacted by gender, as girls find the ambiguous relational conflict situations significantly more distressing than boys (Crick 1995; Crick et al. 2002). This is most likely due to the importance and focus girls place on social interaction and relationships (Crick and Grotpeter 1995; Cross and Madsen 1997; Rose and Rudolph 2006). However, the association between gender and hostile attribution biases is largely understudied. Gender differences in hostile attribution biases for relational and instrumental provocations may help to explain differences in aggression and psychopathology. Thus, interactions between gender and hostile attribution biases will be explored.

Statistical Methods and Models

Overall, there has been limited research into the role of social information processing and hostile attribution biases for relational provocations within the field. In addition, there is a lack of consensus both in finding an association between relational aggression and hostile attribution biases for relational provocations, as well as the methods through which this information is analyzed. Both categorical and dimensional approaches are used. A categorical approach would designate individuals as being relational or physical aggressors if they are above a specific point on a scale, whereas a dimensional approach would result in individuals being along a continuum where a participant would be higher or lower on a construct such as relational aggression. There are problems, as well as benefits, with each approach. A limitation to using the categorical approach in researching the forms of aggression is that often relational and physical aggression are at least moderately correlated (Crain et al. 2005; Crick 1996; Grotpeter and Crick 1996). In addition, often the boundaries between constructs (e.g., between aggressive and non-aggressive) are arbitrarily determined based on subjective judgment (Dwyer 1996; Meehl 1995) and may not resemble underlying latent classes if they do actually exist (MacCallum et al. 2002). Further, there may not be clear cut boundaries between those who are just above and just below the threshold (Dwyer 1996; Meehl 1995; Widiger and Trull 2007). It may also be problematic if differing criteria are used across studies, as is the case with relational aggression and hostile attribution biases for relational provocations (Crick 1995; Crick et al. 2002). Additionally, there are statistical limitations to categorical approaches (e.g., loss of power; Cohen 1983; MacCallum et al. 2002). Yet, the categorical approach may offer benefits as well, especially within psychopathology research. For example, being able to create specific categories across studies could offer stan-

dardization and ease communication between researchers and clinicians (Maughan 2005; Widiger and Trull 2007). In addition, practical utility that may be afforded by categorical approaches could be important for translational research.

The dimensional model seems to fit more appropriately with a developmental psychopathology framework rather than a categorical medical model (Sroufe 1997). The dimensional model, which is more frequently utilized in personality research (Clark 1993, 1999), may increase the validity and reliability of assessment (Widiger 1992). This may be the case as the approach eliminates the arbitrary cut scores and potentially non-existent specific categories (Widiger and Samuel 2005). Measurement and analyses on a continuum could allow for more detailed information on children and adolescents and assist in the creation of aggressive profiles, particularly for youth just below the cut score in a categorical approach. This detailed information may be more helpful in considering developmental trajectories and the heterogeneity of children both between and within levels and forms of aggression.

There has been limited research using a dimensional approach to investigate relational aggression and hostile attribution biases for relational provocation. Based on our literature review, only one study has been published to date on this topic. Crain et al. (2005) used a dimensional approach to assess fourth through sixth grade girls and used multiple regression analyses to avoid creating categorical aggression groups. They investigated whether hostile attribution biases for situations involving friends would predict peer nominated relational aggression. In their sample, hostile attribution biases were not related to peer-nominated relational aggression ($r=0.06$, $p=0.49$) and they did not find that hostile attribution biases were predictors of relational aggression. In a second study, Crain et al. (2005) found a significant but negative association between relational aggression and hostile attribution biases for relational provocations. Further, Crain et al. (2005) followed up their novel dimensional analyses with a categorical approach, with a one standard deviation threshold. The authors compared only the highly relationally aggressive girls with the non-relationally aggressive girls and did not find any significant differences. Importantly, Crain et al. (2005) had lower power than the original categorical investigations (i.e., Crick 1995; Crick et al. 2002). Although this was a pioneering study in analyzing hostile attribution through a continuous approach, there are limitations. Crain et al. (2005) used a measure of hostile attribution biases that specifically taps ambiguous situations in friendships which may make comparisons with original studies, using ambiguous peer situations, difficult. Crain and colleagues also used a sample of only girls with vignettes that solely included female characters which may limit the ability to generalize as well as the comparisons that can be done with past studies. Importantly, the measures used by Crain et al. (2005)

demonstrated low internal consistency (Cronbach's $\alpha=0.58$ in Study 1 and 0.68 in Study 2). Crain et al. (2005) also did not control for physical aggression. In sum, despite the important contributions of this study, additional research is needed to replicate and extend the findings.

There is clearly a need within the literature to gain a greater understanding of the construct of hostile attribution biases for relational provocations, given the especially mixed and to some degree inconclusive findings as hostile attribution biases have been demonstrated to be an important construct in predicting aggression and for intervention purposes (Orobio de Castro et al. 2002). Therefore, it is important to understand the impact that the statistical methods, models, and approaches used in the past may have in the association between the key constructs.

Present Study

Despite the potential problems with the associations between hostile attribution biases for relational provocation situations and aggression, as well as the difficulties with methods of assessment for hostile attribution biases, there does seem to be importance in investigating social cognition (Crick and Dodge 1994; Leff et al. 2006). The current study was designed to investigate the differences between categorical and dimensional approaches with these constructs. A large-scale investigation into the association between relational aggression and hostile attribution biases was conducted using a national data set. The majority of past work often presents comparisons between relational aggression and hostile attribution biases for relational provocation situations with instrumental provocation situations and physical aggression. To replicate and extend past studies, we make such comparisons in both the categorical and dimensional analyses.

We hypothesize that relational aggression will be associated with hostile attribution biases for relational provocation situations across dimensional and categorical approaches.

Within the categorical analyses, we expect that the relational aggressors will exhibit significantly more hostile attribution biases for relational provocation situations than other aggressor groups and non-aggressive children and the physical aggressors will exhibit significantly more hostile attribution biases for instrumental situations than all other children.

Within the dimensional analyses, we expect that hostile attribution biases for relational provocations will predict relational aggression in the sixth grade and that hostile attribution biases for instrumental provocations will be uniquely predictive of physical aggression in the sixth grade. We will also explore the reverse direction with aggression predicting hostile attribution biases and we expect that relational aggression will predict hostile attribution biases for relational provocations above and beyond physical

aggression, and that physical aggression will uniquely predict hostile attribution biases for instrumental provocations.

In addition, as gender effects have been found in previous work on distress associated with hostile attribution biases (Crick et al. 2002), we expect that gender will moderate the associations between the forms of aggression and hostile attribution biases, such that for girls hostile attribution biases for relational situations will be significantly greater than for boys. With boys, similar effects are expected with instrumental situations.

Method

Participants

Data used in this study included the third phase, or grades two through six, of the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development (SECCYD) which was conducted by a network of investigators, the Early Child Care Research Network (ECCRN). In this longitudinal data collection, participants were recruited beginning in January 1991 through November 1991 from hospitals in ten urban and suburban collection sites throughout the United States. Mothers were originally screened in the hospital at the birth of their child (N=8,986) and of those screened, 5,416 (60%) were eligible and agreed to a follow-up phone call when their child was 2 weeks old. A conditionally random sampling plan was employed, such that there was a mixture of mothers returning to work and those not and that there was demographic diversity, as both single and two parent homes were included (for details see NICHD ECCRN 2001, 2005; NICHD ECCRN and Duncan 2003) reducing the sample to 3,015 (56%) . Families were excluded if they could not be contacted after 3 attempts or if at the 2 week phone call there was an expected move within 3 years or the infant had remained in the hospital for more than 7 days after birth leaving a sample of 1526 (51%). A sample of 1,364 women and their newborn children then completed the 1-month interview and became study participants. It is important to note that the sample is not statistically representative of a specific population; however, it is demographically diverse (Dearing et al. 2006). In Phase III, 1077 families (N= 507 boys) remained in the study, indicating a high rate of retention from birth (79%). After this attrition, the ethnicity of the remaining sample was comprised of: American Indian, Eskimo, Aleutian, Asian or Pacific Islander (1%), Black/African-American (12%), other race (5%), or White/Caucasian (82%). Instead of being based on age, the data collected during these grades was collected on a year-in-school basis. However, the average age was 100 months (SD=2.40) or 8 years and

4 months at the third grade. Families and children that stayed in the study from birth through third grade were more likely to be White/Caucasian and to have a higher income to needs ratio (NICHD ECCRN 2004). The subset of participants used within this study were those who had child-report data and teacher-report data on the variables of interest which restricted the sample to 840 participants (422 girls). These participants did not significantly differ from the original sample on ethnicity representation, mother-reported relational and physical aggression, hostile attribution biases for relational or instrumental provocations, or measures of academic performance. The subset did have significantly higher family income than the original sample.

Procedure

The aggression measures were completed by teachers in the third and sixth grade in the spring semester after having been given questionnaire packets by research personnel during a school observation. Teachers were compensated $50 for their completion of the questionnaire packet. Children came to the laboratory in third through fifth grades to complete the Assessment of Intent Attributions (Crick 1995). The timing of lab visits each year varied, but the lab visit primarily occurred during the spring/early summer for most children and on average occurred during the months of March–May of each year. This measure was presented to the children as an interview with a trained interviewer while the children were able to read along in their own copy of the questionnaire and mark their own answers. Both informed consent from adults and assent from the target children were obtained. For more information see NICHD ECCRN (2004).

Measures

Relational Aggression Teacher- and parent-report of relational aggression was derived from the measure referred to as "Child's Behavior with Peers," used by the NICHD, designed to assess the study children's peer-oriented behaviors. The measure consists of 43 items including six relational aggression items (e.g., "ignoring another child when s/he is mad at him or her" or "telling friends that s/he will not like them if they don't do what s/he says") from the Children's Social Behavior Scale-Teacher Report (CSBS-TR: Crick 1996; Crick et al. 1996). Teachers rated these items on a 3-point scale (0=Not True, 1=Sometimes True, and 2=Often True) which varies from the original 5-point scale (Crick 1996). The teacher- report of child behavior with the CSBS-TR has demonstrated Cronbach's α's ranging from 0.90 to 0.96 in previous samples (Casas et al. 2006; Crick et al. 1996) and the relational aggression scale specifically has demonstrated a Cronbach's α of 0.89 (Crick et al. 1996). In

the present study, the measure was reliable (Cronbach's α> 0.83 for teacher-report in third and sixth grade).

Physical Aggression Teacher-report of physically aggressive behavior for the study children were derived from the Aggressive Behavior Subscale of the Teacher Report Form (TRF) (Achenbach 1991). This self administered checklist is a widely used measure to assess the social competence and problem behavior of children 4 to 18 years old. From the TRF, a series of behaviors (118 items) are rated on 3-point scales from 0 (not true of the child) to 2 (very true of the child) (Achenbach 1991). There are extensive validity data indicating that clinically referred children receive elevated scores on this measure and that elevated scores are predictive of the onset and continuation of problems (Collett et al. 2003). Five items reflecting overt physical aggression were selected (see NICHD ECCRN 2004): (a) destroys own things, (b) destroys others' things, (c) gets in many fights, (d) cruel, bully, mean to others, and (e) physically attacks people. Raw scores for the relevant items were summed for the third grade. This modified scale showed adequate internal consistency (Cronbach's α=0.79 in third grade and α=0.76 in sixth grade). The subset of physical aggression items was moderately correlated with the Aggressive Behavior subscale (r=0.78, p<0.001 for third grade and r=0.80, p<0.001 for sixth grade). This subset of items was selected for use in subsequent analyses.

Hostile Attribution Biases The child's self-report of relational and instrumental intent attributions in response to socially ambiguous situations were assessed in grades three through five using a measure of intent attributions, Assessment of Intent Attributions (Crick 1995), referred to as "Why Kids Do Things" in the NICHD dataset. Based on Crick (1995), this measure involves hypothetical-situation vignettes of socially ambiguous relational and instrumental provocation situations. Children were asked to imagine that the events in the stories were happening to them. Two stories depicted relational provocation focusing on potential rejection (e.g., discovering that a friend is playing with someone else), however; in grade five only one story of relational provocation was included. For each story, the child indicated a reason for the provocation with two options indicating hostile intent, such as "Your friend was mad at you," and two indicating benign intent, such as "Your friend didn't see you on the playground." Three stories depicted instrumental provocation focusing on ambiguous intent property destruction (e.g., another child getting your new sneakers muddy) and for each story the child indicated a reason for the provocation with two options indicating hostile or benign intent. The next question asked the child whether the provocative behavior was intended to be mean (1="Trying to be mean") or not mean (2="Not trying to be mean"). In three independent samples and studies, Crick

(1995), Crick et al. (2002), and Leff et al. (2006) demonstrated Cronbach's α levels ranging from 0.65 to 0.78 for the items assessing hostile intent attributions for relational provocation situations and Cronbach's α levels ranging from 0.77 to 0.86 for items assessing hostile intent attributions for instrumental provocation. Despite past concerns about internal consistency, Leff et al. (2006) reported a 2 week test-retest reliability of 0.79 for relational situation items and 0.82 for the instrumental situation items.

Within the current data set, a composite score was created from child self-report hostile attribution biases from grades three, four, and five by summing the items across these years. A composite was created due to the fact that the measure of relational provocation had been truncated from its original format of five items to two thus creating low internal consistency (Cronbach's α=0.62). The correlations between the years ranged from 0.27 to 0.30 (pś<0.001) and the final composite had a Cronbach's α of 0.76. The inter-item correlations did not suggest that the composite merely had greater internal consistency due to item overlap across the years (mean r=0.21). For instrumental provocation, the measure had also been truncated from five to three items, however, the internal consistency in third through fifth grade was adequate (Cronbach's α's=0.77–0.80). Therefore, to allow comparison and consistency, a composite was created from the three grades for hostile attribution biases for instrumental provocation situations as well. With the composite, the internal consistency was increased (Cronbach's α= 0.86) and the inter-item correlations were of similar magnitude to those represented by the relational items (mean r=0.24). Further, within this data set the correlation between relational and instrumental hostile attribution biases was moderate (r= 0.40, p<0.001), similar to the moderate correlations found in previous work (e.g., r=0.51, p<0.001, Leff et al. 2006).

Results

All analyses presented are based on teacher-report.[1] Descriptive statistics and correlations are presented in

---

Table 1. Important to note, relational and physical aggression were each moderately stable from third to sixth grade ($r=0.31$, $p<0.001$ and $r=0.37$, $p<0.001$, respectively). Correlations were also examined to investigate associations separately for gender and racial status (i.e., racial minority vs. non-minority status). Fisher r to Z correlation tests were run to compare the magnitude of correlations between males and females and between racial status groups, and it was found that the only significant differences were between boys and girls for the association between physical aggression in Grade 3 and hostile attribution biases for instrumental provocations ($r=0.27$, $p<0.001$ for girls and $r=0.11$, $p=0.021$ for boys, $Z=-2.42$, $p<0.05$) and for the correlation between physical aggression and relational aggression in Grade 6 ($r=0.47$, $p<0.001$ for girls and $r=0.64$, $p<0.05$ for boys, $Z=3.56$, $p<0.001$). It is important to note that the physical aggression variables had relatively higher level of skew (3.82 and 4.28, in Grades 3 and 6 respectively); however, all other variables had acceptable levels of skew (Kline 2005). The correlations between the constructs ranged from low to moderate (r's ranging from 0.05 to 0.53). The relational and physical aggression variables were moderately correlated with each other ($r=0.44$, $p<0.001$ in Grade 3 and $r=0.53$, $p<0.001$ in Grade 6), as were the hostile attribution biases variables for relational and physical provocations ($r=0.40$, $p<0.001$). However, the relational aggression variable in Grade 3 and the hostile attribution biases for relational provocation composite were only slightly correlated ($r=0.09$, $p<0.01$), as were physical aggression in Grade 3 and hostile attribution biases for instrumental situations composite ($r=0.19$, $p<0.001$).

Categorical Approach

Aggression status groups were created using teacher-report of relational aggression when the study child was in the third grade. Analyses were run using a one standard deviation criterion (Crick et al. 2002). Therefore, the relational aggressor group was one standard deviation above the mean for relational aggression, but not for physical aggression; the physical aggressor group was one standard deviation above the mean for physical aggression but not relational aggression. Those who were over one standard deviation above the mean for both physical and relational aggression formed the comorbid group, and finally those who were neither high on relational nor physical aggression formed the non-aggressive group (see Table 2).

Relational Provocation A 4 (Aggression status: relational, physical, comorbid, non-aggressive) x 2 (Gender) ANOVA was conducted with child-reported hostile attribution biases

for relational provocations as the dependent variable.[2] There was a main effect of aggression status [$F(3, 833)=6.30$, $p<0.001$, $\eta_p^2=0.02$]. The Bonferroni post hoc tests for aggression status indicated that the comorbid aggressor group ($M=5.23$, $SE=0.33$) was significantly ($p=0.026$) higher than the non-aggressive group ($M=4.12$, $SE=0.08$). There was also a main effect of gender [$F(1, 833)=3.94$, $p=0.048$, $\eta_p^2=0.01$]. Girls ($M=5.14$, $SD=0.24$) were significantly higher in self-reported hostile intent for relational provocations than boys ($M=4.45$, $SD=0.17$). No other significant effects were found.

Instrumental/Physical Provocation A 4 (Aggression status: relational, physical, comorbid, non-aggressive) x 2 (Gender) ANOVA was conducted with child-reported hostile attribution biases for instrumental provocation as the dependent variable. There was an interaction between gender and aggression status [$F(3, 832)=6.02$, $p<0.001$, $\eta^2=0.02$]. The simple effects were explored, using the Bonferroni correction, and it was found that for girls there were significant differences between the physical aggressors ($M=10.38$, $SE=1.64$, $p=0.003$) and the relational aggressors ($M=4.85$, $SE=0.45$), such that the physical aggressors reported significantly higher hostile intent for instrumentally provocative situations. In addition, it was also found that for girls there were significant differences between the relational aggressors ($M=4.85$, $SE=0.45$, $p=0.003$), physical aggressors ($M=10.38$, $SE=1.64$, $p<0.001$), and the comorbid group ($M=6.56$, $SE=1.01$, $p=0.003$) and non-aggressive groups, such that the aggressive groups were each significantly higher in reported hostile intent than the non-aggressive group ($M=3.18$, $SE=0.21$). For boys, only the comorbid group ($M=6.89$, $SE=0.86$, $p=0.014$) was significantly higher than the non-aggressive group ($M=4.39$, $SE=0.23$).

Dimensional Approach

In the dimensional analyses, both the theorized direction of effect (i.e., from hostile attribution biases to aggression) and the reverse direction of effect will be explored as the direction of this association has yet to be empirically determined for relational aggression, as it has been with

_____

[2] Two 4 (Aggression status: Relational, physical, comorbid, non-aggressive) x 2 (Racial Status: Minority and non-minority status) x 2 (Gender) ANOVA's were conducted with either child-reported hostile attribution biases for relational provocations or instrumental provocations as the dependent variable. There were no significant main effects of racial status [$F(1, 840)=1.66$, $p=0.20$, $\eta_p^2=0.002$ for relational provocations and $F(1, 840)=2.05$, $p=0.15$, $\eta_p^2=0.002$ for instrumental provocations] and no significant interactions with racial status.

Table 1 Descriptive Statistics and Correlations Between Aggression Constructs and Attribution Biases

	1.	2.	3.	4.	5.	6.
Teacher-reported Relational Aggression in Grade 3	x					
Teacher-reported Physical Aggression in Grade 3	0.44**	x				
Teacher-reported Relational Aggression in Grade 6	0.31**	0.20**	x			
Teacher-reported Physical Aggression in Grade 6	0.16**	0.37**	0.53**	x		
HAB Composite for Relational Situations	0.09*	0.14**	0.05	0.12*	x	
HAB Composite for Instrumental Situations	0.18**	0.19**	0.10*	0.18**	0.40**	x
M	2.10	0.45	1.69	0.35	4.26	4.19
SD	2.54	1.21	2.26	1.02	2.13	4.09
Range	0.00–12.00	0.00–10.00	0.00–12.00	0.00–9.00	0.00–10.00	0.00–18.00

HAB hostile attribution biases

$*p<0.01$, $**p<0.001$

physical aggression (Orobio de Castro et al. 2002). Although the design allows for a clean test of the temporal precedence in the theorized direction, the design is less ideal for the reverse direction of effect as the hostile attribution biases composite from third through fifth grade and the assessment of aggression in third grade overlap to some degree. Gender and interactions between both physical and relational aggression (or gender and the forms of hostile attribution biases) with gender were included in all models run. Further, the interaction between relational aggression and physical aggression (or between the forms of hostile attribution biases) was also included. For ease of communication only significant effects are shown (see Table 3).

Relational Aggression In this model predicting relational aggression in Grade 6 (Model I), physical aggression in Grade 3, relational aggression in Grade 3, and gender were entered at step 1 and hostile attribution biases for relational provocations and hostile attribution biases for instrumental provocations were entered at step 2 (Table 3). At step 1, relational aggression in Grade 3 and physical aggression in Grade 3 were each unique significant predictors of relational aggression in Grade 6 [$F(3, 685)=25.04$, $p<$

0.001]. At step 2, hostile attribution biases for relational provocations did not significantly predict relational aggression in Grade 6 [$\Delta F(2, 680)=2.89$, $p=0.056$] above and beyond the role of reported hostile attribution biases for

Table 3 Hierarchical Linear Regressions Predicting Hostile Attribution Biases for Relational and Instrumental Provocation Situations

Outcome, step & predictors	β	p	R^2	ΔR^2
Model I: RAGG G6				
1. RAGG G3	0.24	0.01	0.10	
PAGG G3	0.11	<0.001		
Gender	0.07	0.053		
2. IHAB	0.10	0.021		0.008
RHAB	−0.02	ns		
Model II: PAGG G6				
1. RAGG G3	0.01	ns	0.18	
PAGG G3	0.34	<0.001		
Gender	−0.14	<0.001		
2. IHAB	0.09	0.047		0.009
RHAB	0.03	ns		
Model III: RHAB				
1. RAGG G3	0.10	0.005	0.01	
Gender	0.02	ns		
2. PAGG G3	0.13	0.001		0.014
Model IV: IHAB				
1. PAGG G3	0.18	<0.001	0.05	
Gender	−0.09	0.006		
2. RAGG G3	0.14	<0.001		0.016
3. Gender x PAGG G3	0.31	0.020		0.008

All R^2 values are based on the unbiased adjusted R^2; Gender coded: 1=Male and 2=Female; RHAB = Hostile attribution biases for relational provocations Grades 3 through 5 Composite, IHAB = Hostile attribution biases for instrumental provocations Grades 3 through 5 Composite, RAGG = Relational aggression, PAGG = Physical Aggression; G3 = Grade 3; G6 = Grade 6

Table 2 Aggression Status by Gender

	N	Boys	Girls
Relational Aggressor Group	126	37	89
Physical Aggressor Group	45	35	10
Comorbid Aggressor Group	55	37	18
Non-aggressive Group	743	373	370

instrumental provocations, physical aggression, relational aggression, and gender (i.e., female).

Physical Aggression In this model predicting physical aggression in Grade 6 (Model II), physical aggression in Grade 3, relational aggression in Grade 3, and gender were entered at step 1 and hostile attribution biases for relational provocations and hostile attribution biases for instrumental provocations were entered at step 2. At step 1, physical aggression in Grade 3 and gender (i.e., male) were each unique significant predictors of physical aggression in Grade 6 [$F(3, 696)=46.39$, $p<0.001$]. At step 2, hostile attribution biases for instrumental provocations predicted physical aggression in Grade 6 [$\Delta F(3, 694)=3.69$, $p=0.025$] above and beyond the role of reported hostile attribution biases for relational provocations and relational aggression.

Relational Provocation In the first model predicting hostile attribution biases for relational provocations (Model III), relational aggression and gender were entered at step 1 and physical aggression was entered at step 2. At step 1, relational aggression was a significant predictor of level of hostile attribution biases for relational provocations [$F(2,835)=4.26$, $p=0.014$]. At step 2, physical aggression predicted hostile attribution biases for relational situations [$\Delta F(1, 834)=11.87$, $p=0.001$] controlling for relational aggression and gender.

Instrumental/Physical Provocation In the model predicting hostile attribution biases for instrumental provocations (Model IV), physical aggression and gender were entered at step 1 and relational aggression was entered at step 2. At step 3, interactions between relational aggression and gender, physical aggression and gender, and between relational aggression and physical aggression were entered. At step 1, physical aggression was a significant predictor of hostile attribution biases for instrumental provocation situations [$F(2,834)=20.05$, $p<0.001$]. At step 2, relational aggression was also a significant predictor of hostile attribution biases for instrumental situations [$\Delta F(1, 833)=13.90$, $p<0.001$] and physical aggression and gender remained significant predictors even when further accounting for relational aggression. At step 3, the addition of interactions did not result in a significant change in the overall model [$\Delta F(3, 830)=2.33$, $p=0.073$]. However, there was a significant interaction between physical aggression and gender. When the simple effects of the interaction were explored, for girls, physical aggression was a significant predictor of hostile attribution biases for instrumental situations when controlling for the other constructs [$F(2,419)=21.61$, $p<0.001$]. For boys, physical aggression was only a significant predictor of hostile

attribution biases for instrumental situations when not controlling for the other constructs [$F(1,415)=5.41$, $p=0.021$].[3]

Discussion

The purpose of this study was to investigate both categorical and dimensional approaches for considering the prospective association between relational and physical aggression and hostile intent attributions for relational and instrumental provocation situations. Importantly, the effect sizes in the present study are rather small and require replication, but we did replicate some prior findings as well as introduce novel, and at times, surprising results.

With the categorical approach, only the comorbid aggressor group was significantly higher than the non-aggressive group in hostile intent attributions for relational provocation situations. However, previous studies (Crick 1995; Crick et al. 2002) found that the relational aggressors reported significantly more hostile intent attributions to relational provocations than did the non-aggressive group and this result was counter to our original hypotheses. Yet, the comorbid group has been predictive of hostile attribution biases for instrumental provocation situations in past research (Crick 1995). Therefore, there may be an important aspect of the comorbid group as a predictor of hostile intent attributions that deserves future research. In addition, girls reported significantly more hostile intent attributions for relational provocation situations than boys did as was hypothesized. Although Crick (1995) and Crick et al. (2002) did not find gender differences for hostile intent attributions, this result was anticipated as relational aggression may be more frequently displayed by girls during middle childhood (Crick 1997; Crick and Grotpeter 1995; c.f. David and Kistner 2000; Tomada and Schneider 1997). In addition, research and theory would suggest that girls find interpersonal situations in which a potential relationship threat occurs more distressing (Rose and Rudolph 2006; Rudolph et al. 2000).

Previous studies have found that hostile attribution biases for instrumental provocations are most salient for boys (Dodge and Frame 1982; Dodge and Somberg 1987) and are associated with being physically (Crick et al. 2002;

---

[3] Simple effects of the physical aggression by gender interaction predicting instrumental hostile attribution biases were also run considering physical aggression as dichotomous (i.e., either no reported aggression or reported aggression). Using this criterion physical aggression was a significant predictor of instrumental hostile attribution biases above and beyond relational aggression and gender when there was reported aggression [$F(3,156)=2.86$, $p=0.039$, $R^2=0.052$].

Dodge 1980; Dodge and Somberg 1987) or comorbidly aggressive (Crick 1995). With hostile attribution biases for instrumental situations, results from the current study differed from previous studies where children high in physical aggression (when a one standard deviation criterion was used; Crick et al. 2002) and children high in both relational and physical aggression (when a half standard deviation criterion was used; Crick 1995) reported significantly more hostile attribution biases. Within the current study, results were specific to gender and aggression status group for hostile attribution biases for instrumental situations when the categorical approach was used for analyses. We did find that for boys those categorized as both relational and physical aggressors reported more hostile attribution biases than the non-aggressive boys. Interestingly in considering the physical aggressor group, girls reported more hostile attribution biases for instrumental provocation situations than boys did; whereas, in the non-aggressive group boys reported more hostile attribution biases for instrumental provocation situations than girls. Further, aggressive girls, regardless of form, reported significantly more hostile attribution biases than did non-aggressive girls. In addition, physically aggressive girls reported more hostile attribution biases than physically aggressive boys and relationally aggressive girls. These results are interesting as aggressive girls of any form, but particularly physical aggressors, seem to be finding instrumental provocations significantly more hostile than non-aggressive girls. Although these results were not anticipated, it may be that boys in general are primed to find potential physical aggression threats as more hostile because physical aggression is more salient for boys. It may be that for girls being any type of aggressor increases sensitivity to hostile cues. However, caution is necessary in interpreting these results as the sample size for girls in the physical aggressor group was small.

In exploring the theoretical temporal precedence of hostile attribution biases using a dimensional approach such that hostile attribution biases were predicting future aggression, there appeared to be stability within forms of aggression from the third grade to the sixth grade. Further, the expected gender effects were also demonstrated, such that female gender tended to predict relational aggression in the sixth grade and male gender significantly predicted physical aggression in the sixth grade. However, hostile attribution biases for instrumental provocations significantly predicted both future relational and physical aggression in the sixth grade. Therefore, there does appear to be a predictive association between hostile attribution biases and future aggression, but it does not seem to be specific within form of aggression. This may be because the items used were primarily property destruction oriented instead of involving bodily physical harm or because some of the

items were ambiguous with relation to form (e.g., "fights," "bully, cruel and mean"). This subtype of "physical" aggression may thus lead to intent attributions that are germane to both forms of aggression. However, given the finding that hostile attributions and aggression are related, the hypothesis within the literature concerning specificity may need to be revised and explored in future research.

In the reverse direction of effect dimensional models which investigated the role of aggression in predicting hostile attribution biases, physical aggression was predictive of hostile attribution biases for relational situations above and beyond relational aggression. However, gender (i.e., boys), physical aggression, and relational aggression were each uniquely predictive of hostile attribution biases for instrumental situations. Although gender and physical aggression were hypothesized to predict hostile attribution biases for instrumental situations, relational aggression was not. This result is particularly interesting given that relational aggression was not predictive of hostile attribution biases for relational situations as we had hypothesized.

Based on the results, it seems that both the categorical and dimensional approaches offered important information to understanding hostile attribution biases for relational provocation situations. Therefore, it may be that using both categorical and dimensional approaches in a complementary manner yields the most interesting and detailed picture of hostile intent attributions. However, categorical approaches do have inherent limitations (e.g., statistical limitations; Cohen 1983; MacCallum et al. 2002) and as such a dimensional approach may be more appropriate particularly with smaller sample sizes or in cases when boundaries between categories are not empirically determined (Dwyer 1996; Meehl 1995). Further, there may be differential impacts in practice depending on which approach is used. Dimensional approaches may allow for understanding the unique roles of each form of aggression in association with hostile attribution biases. Understanding these unique roles may specifically impact intervention and preventions as such efforts may be more targeted if the specific, relevant behaviors (i.e., physical aggression) and thoughts (i.e., hostile attribution biases for relational provocations) can be addressed. Using a dimensional approach may also allow for the inclusion of more at-risk or subthreshold children who may not be above the categorical cut off but still may be experiencing significant impairment or dysfunction and be in need of services.

Limitations and Future Directions

There are several limitations to this study which may have attenuated the effect sizes and should be addressed in future research. For instance, the sample is not particularly diverse or representative, and unfortunately has become more

homogenized over time. This may have lead to results which cannot be generalized easily to the rest of the population, despite the large sample size from communities across the US. Therefore, future research should investigate the role that race, ethnicity, and culture may play in social cognition and subsequent behavior with a more diverse sample, as there could be important group differences (Leff et al. 2006).

Methodologically, the measure of hostile attribution biases used in the NICHD study reduces the number of relationally provocative vignettes in half from the original version (Crick 1995), thus, information and consistency may be lost. Further, the hostile attribution biases composite limited the ability to be able to cleanly test the temporal precedence of aggression in the reverse direction of effect models. It has also been addressed by Leff et al. (2006) that many measures of hostile attribution biases in general, including the one used in the NICHD longitudinal study, are not culturally and ecologically sensitive. In addition, the measure of physical aggression may not assess pure physical aggression as not all of the items focus explicitly on physical force and some of the items could be interpreted relationally.

Future research should also include peer-reports in order to provide a more detailed and accurate picture of children's social behavior and interactions within the context of aggression (Leff et al. 1999). Future research may also benefit from extending this model beyond the forms to the functions of aggression (i.e., proactive and reactive) as well (Crick and Dodge 1996; Little et al. 2003; Orobio de Castro et al. 2002; Prinstein and Cillesson 2003; Schwartz et al. 1998).

Clinical Implications

Given the low effect sizes and association between relational and physical aggression and their respective hostile attribution biases, there still appears to be practical significance and utility to studying hostile attribution biases. This is especially the case due to the significance of relational aggression in predicting later psychological distress as it has been demonstrated to be predictive of concurrent and future social maladjustment for both sexes (e.g., Crick et al. 2006; Zalecki and Hinshaw 2004), as well as increases in maladjustment over time for girls (Crick 1996). Therefore, it may be of particular importance to understand the social cognitions associated with aggressive behavior, as well as the direction of the relation between behavior and attributions, in order to create appropriate assessment measures, intervention, and prevention efforts. More specifically, assessment may be greatly improved if both hostile attribution biases and aggression are measured across time in order to understand the particular associa-

tions between these variables and if attention is paid to the assessment measures used such that the forms of aggression and hostile attribution biases can be teased apart, if possible. When considering the recruitment of samples for intervention research, consistency in criteria for inclusion in studies is needed. Moreover, considering the clinical implications of using a specific statistical approach for inclusion in such research could be beneficial. Further, interventionists and school-based professionals could benefit from considering enacting change both through cognitive and behavioral pathways. For example, Leff et al. (2009) demonstrated that an intervention for relational aggression could be effective through targeting both hostile attribution biases and aggressive behavior. In addition, it may be critical to consider the importance of hostile-intent cognitions in a variety of situations for relational, physical, and comorbid aggressors in order for interventions and prevention efforts to be effective. Finally, it may be especially relevant for clinicians and school-personnel to investigate the function of behaviors and cognitions and to not make assumptions about specificity between subtypes of aggression and intent attributions.

References

Achenbach, T. M. (1991). *Manual for the child behavior checklist: 4-18 and profile*. Burlington: University of Vermont, Department of Psychiatry.

Casas, J. F., Weingel, S. M., Crick, N. R., Ostrov, J. M., Woods, K. E., Jansen Yeh, E. A., et al. (2006). Early parenting and children's relational and physical aggression in the preschool and home contexts. *Journal of Applied Developmental Psychology, 27*, 209–227.

Clark, L. A. (1993). Temperament as a unifying basis for personality and psychopathology. *Journal of Abnormal Psychology, 114*(4), 505–521.

Clark, L. A. (1999). Dimensional approaches to personality disorder assessment and diagnosis. In C. R. Cloninger (Ed.), *Personality and psychopathology* (pp. 219–244). Washington: American Psychiatric.

Cohen, J. (1983). The cost of dichotomization. *Applied Psychological Measurement, 7*(3), 249–253.

Collett, B., Ohan, J., & Myers, K. (2003). Ten-year review of the rating scales. VI: Scales assessing externalizing behaviors. *Journal of the American Academy of Child and Adolescent Psychiatry, 42*, 1143–1170.

Crain, M. M., Finch, C. L., & Foster, S. L. (2005). The relevance of the social information processing model for understanding relational aggression in girls. *Merrill-Palmer Quarterly, 51*(2), 213–249.

Crick, N. R. (1995). Relational aggression: the role of intent attributions, feelings of distress, and provocation type. *Development and Psychopathology, 7*, 313–322.

Crick, N. R. (1996). The role of overt aggression, relational aggression, and prosocial behavior in the prediction of children's future social adjustment. *Child Development, 67*, 2317–2327.

Crick, N. R. (1997). Engagement in gender normative versus non-normative forms of aggression: links to social-psychological adjustment. *Developmental Psychology, 33*, 610–617.

Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychological Bulletin, 115*, 74–101.

Crick, N. R., & Dodge, K. A. (1996). Social information-processing mechanisms in reactive and proactive aggression. *Child Development, 67*, 993–1002.

Crick, N. R., & Grotpeter, J. K. (1995). Relational aggression, gender, and social-psychological adjustment. *Child Development, 66*, 710–722.

Crick, N. R., & Ladd, G. W. (1993). Children's perceptions of their peer experiences: attributions, loneliness, social avoidance, and social anxiety. *Developmental Psychology, 29*, 244–254.

Crick, N. R., Bigbee, M. A., & Howes, C. (1996). Gender differences in children's normative beliefs about aggression: how do I hurt thee? Let me count the ways. *Child Development, 67*, 1003–1014.

Crick, N. R., Grotpeter, J. K., & Bigbee, M. A. (2002). Relationally and physically aggressive children's intent attributions and feelings of distress for relational and instrumental peer provocations. *Child Development, 73*, 1134–1142.

Crick, N. R., Ostrov, J. M., & Werner, N. E. (2006). A longitudinal study of relational aggression, physical aggression and children's social-psychological adjustment. *Journal of Abnormal Child Psychology, 34*, 131–142.

Crick, N. R., Ostrov, J. M., & Kawabata, Y. (2007). Relational aggression and gender: An overview. In D. J. Flannery, I. Waldman, & A. Vazsonyi (Eds.), *The Cambridge Handbook of Violent Behavior and Aggression* (245–259).

Cross, S. E., & Madsen, L. (1997). Models of the self: self-construals and gender. *Psychological Bulletin, 122*, 5–37.

David, C. F., & Kistner, J. A. (2000). Do positive self-perceptions have a "dark side"? Examination of the link between perceptual bias and aggression. *Journal of Abnormal Child Psychology, 28*, 327–337.

Dearing, E., McCartney, K., & Taylor, B. (2006). Within-child associations between family income and internalizing and externalizing problems. *Developmental Psychology, 37*, 230–252.

Dodge, K. A. (1980). Social cognition and children's aggressive behavior. *Child Development, 51*, 162–170.

Dodge, K. A., & Frame, C. L. (1982). Social cognitive biases and deficits in aggressive boys. *Child Development, 53*, 620–635.

Dodge, K. A., & Somberg, D. R. (1987). Hostile attributional biases among aggressive boys are exacerbated under conditions of threat to self. *Child Development, 58*, 213–224.

Dodge, K. A., Murphy, R. R., & Buchsbaum, K. (1984). The assessment of intention-cue detection skills in children: implications for developmental psychopathology. *Child Development, 55*, 163–173.

Dodge, K. A, Pettit, G. S., McClaskey, C. L., & Brown, J. (1986). Social competence in children. *Monographs of the Society for Research in Child Development, 44*(2).

Dodge, K. A., Bates, J. E., & Pettit, G. S. (1990). Mechanisms in the cycle of violence. *Science, 250*, 1678–1683.

Dodge, K. A., Coie, J. D., & Lynam, D. (2006). Aggression and antisocial behavior in youth. In W. Damon (Series Ed.) & N. Eisenberg (Vol. Ed.), *Handbook of child psychology: Vol. 3.*

Social, emotional, and personality development (6th ed., pp. 719–788). New York: Wiley.

Dwyer, C. A. (1996). Cut scores and testing: statistics, judgment, truth, and error. *Psychological Assessment, 8*, 360–362.

Grotpeter, J. F., & Crick, N. R. (1996). Relational aggression, overt aggression, and friendship. *Child Development, 67*, 2328–2338.

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York: Guilford.

Leff, S. S., Kupersmidt, J. B., Patterson, C. J., & Power, T. J. (1999). Factors influencing teacher identification of peer bullies and victims. *School Psychology Review, 28*(3), 505–517.

Leff, S. S., Crick, N. R., Angelucci, J., Haye, K., Jawad, A. F., Grossman, M., et al. (2006). Social cognition in context: validating a cartoon-based attributional measure for urban girls. *Child Development, 77*(5), 1351–1358.

Leff, S. S., Lakin Gullan, R., Paskewich, B. S., Abdul-Kabir, S., Jawad, A. F., Grossman, M., et al. (2009). An initial evaluation of a culturally adapted social problem-solving and relational aggression prevention program for urban African–American relationally aggressive girls. *Journal of Prevention & Intervention in the Community, 37*(4), 260–274.

Little, T. D., Jones, S. M., Henrich, C. C., & Hawley, P. H. (2003). Disentangling the "whys" from the "whats" of aggressive behavior. *International Journal of Behavior Development, 27*(2), 122–133.

MacCallum, R. C., Zhang, S., Preacher, K. J., & Rucker, D. D. (2002). On the practices of dichotomization of quantitative variables. *Psychological Methods, 7*(1), 19–40.

Maughan, B. (2005). Developmental trajectory modeling: a view from developmental psychopathology. *The Annals of the American Academy of Political and Social Science, 602*, 118–130.

Meehl, P. E. (1995). Bootstrap taxometrics: solving the classification problem in psychopathology. *American Psychologist, 50*(4), 266–275.

NICHD Early Child Care Research Network. (2001). Nonmaternal care and family factors in early development: an overview of the NICHD study of early child care. *Journal of Applied Developmental Psychology, 22*, 457–492.

NICHD Early Child Care Research Network. (2004).Trajectories of physical aggression from toddlerhood to middle childhood: Predictors, correlates, and outcomes. *Monographs of the Society for Research in Child Development, 69*(4).

NICHD Early Child Care Research Network. (2005). *Child care and child development: Results from the NICHD study of early child care and youth development*. New York: Guilford.

NICHD Early Child Care Research Network, NICHD, & Duncan, G. J. (2003). Modeling the impacts of child care quality on children's preschool cognitive development. *Child Development, 74*, 1485–1506.

Orobio de Castro, B., Veerman, J. W., Koops, W., Bosch, J. D., & Monsouwer, H. J. (2002). Hostile attribution of intent and aggressive behavior: a meta-analysis. *Child Development, 73*(3), 916–934.

Prinstein, M. J., & Cillessen, A. H. N. (2003). Forms and functions of adolescent peer aggression associated with high levels of peer status. *Merrill-Palmer Quarterly, 49*(3), 310–342.

Quiggle, N. L., Garber, J., Panak, W. F., & Dodge, K. A. (1992). Social information- processing in aggressive and depressed children. *Child Development, 63*, 1305–1320.

Rabiner, D. L., & Coie, J. D. (1989). The effect of expectancy inductions on rejected children's acceptance by unfamiliar peers. *Developmental Psychology, 25*, 450–457.

Rose, A. J., & Rudolph, K. D. (2006). A review of sex differences in peer relationship processes: potential trade-offs for the emotional and behavioral development of girls and boys. *Psychological Bulletin, 132*, 98–131.