Understanding the Victimization–Aggression Link in Childhood: The Roles of Sympathy and Resting Respiratory Sinus Arrhythmia

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Abstract

With a sample of 4- and 8-year-olds (N = 131), we tested the extent to which more frequent experiences of victimization were associated with heightened aggression towards others, and how sympathetic concern and resting respiratory sinus arrhythmia (RSA) factored into this relationship. Caregivers reported their children's aggression and sympathy. Children reported their victimization and their resting RSA was calculated from electrocardiogram data in response to a nondescript video. Findings revealed that children who reported more frequent victimization were rated as less sympathetic and, in turn, more aggressive. However, resting RSA moderated this path, such that children with high levels were rated as more versus less sympathetic when they reported less versus more victimization, respectively. Results suggest that considering children's sympathetic tendencies and physiology is important to gain a nuanced understanding of their victimization-related aggression.

Keywords: aggression, victimization, sympathy, respiratory sinus arrhythmia, childhood

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Introduction

Children with elevated levels of aggressive behavior—defined as behavior that intentionally causes physical and/or psychological harm to others (Krahé, 2013)—are more likely to experience a myriad of concurrent and prospective negative outcomes, including peer rejection (Ladd, Ettekal, Kochenderfer-Ladd, Rudolph, & Andrews, 2014), mental health problems, and the development of antisocial personality disorder (Eisner & Malti 2015; Wolke, Copeland, Angold, & Costello, 2013). These severe potential consequences have spurred the investigation of early social and emotional correlates of aggression that can be targeted by child-level interventions to reduce such behavior (Malti, Chaparro, Zuffianò, & Colasante, 2016). Specifically, frequent victimization from peers and deficits in sympathy have been repeatedly linked to more frequent and intense aggression (Reijntjes et al., 2011; Van Noorden, Haselager, Cillessen, & Bukowski, 2015). Evidence for the heritability of aggression (Rhee & Waldman, 2002) has prompted a separate line of research on the biological processes that may serve as reliable correlates of aggression and/or play a role in its manifestation from an early age. Resting respiratory sinus arrhythmia (RSA), which is thought to reflect temperamental regulatory capacities and sensitivity to environmental stressors (Porges, 2011), has emerged as a promising physiological correlate of children's sympathetic concern (Taylor, Eisenberg, & Spinrad, 2015) and aggressive behavior (Beauchaine, 2001).

Although the combination of social, emotional, and biological factors accounts for more variance in children's aggression than either factor alone, we still know relatively little about how these components interrelate to account for differences in such behavior (Portnoy &

Farrington, 2015). We therefore adopted an integrative approach to propose and assess how sympathy and resting RSA factor into the well-established link between victimization and aggression. We tested a sample of 4- and 8-year-olds because these developmental periods represent an important window for the development of social, emotional, and regulatory skills (Eisenberg, Spinrad, & Eggum, 2010) endemic to sympathy and aggression (Eisner & Malti, 2015; Kienbaum, 2014). Children also experience increased contact with peers and corresponding increases in the likelihood of victimization into middle childhood (Rubin, Bukowski, & Laursen, 2011).

Children's Aggression, Victimization, and Sympathy

A significant portion of childhood aggression research has focused on the victims of such behavior. For example, frequent victims of aggression experience more internalizing symptoms (e.g., anxiety, loneliness) and lower quality peer relationships (Perren & Alsaker, 2006; Perren, Ettekal, & Ladd, 2013). Being a target of aggression may also lead to externalizing symptoms: peer victimization in middle childhood was positively associated with externalizing behavior two years later after controlling for initial levels of the latter (Perren et al., 2013). Highly victimized children also tend to engage in more reactive aggression (i.e., hot-headed, impulsive harm in response to provocation; Camodeca, Goosens, Terwogt, & Schuengel, 2002). Victimization and aggression are probably interwoven in a cyclical manner, such that other children victimize aggressive children out of retaliation, which triggers further aggression as the cycle repeats (Malti, Perren, & Buchmann, 2010). This idea draws parallels to the notion of bully-victims—children who are victimized *and* bully others (Perren & Alsaker, 2006). However, the psychological mechanisms that link victimization to aggression remain unclear. Repeatedly victimized children may become less sympathetic or sensitive to the needs of others (Malti et al.,

2010) and, as a result, lack the other-oriented concern that would otherwise impede their aggression.

Sympathy is a feeling of concern for another that often, but not always, stems from a shared (i.e., empathic) experience of their distress or emotional state (Eisenberg, 2000). We focused on sympathy in the present analysis because it necessitates other-oriented concern. Other-oriented concern likely motivates children to reconcile and later avoid aggressive acts (rather than empathy alone; see Zuffianò, Colasante, Buchmann, & Malti, 2017). Specifically, sympathetic children are more likely to attend to others in distress and feel concern for their well-being. Children who lack this tendency may be less sensitive to the negative consequences of aggressive acts and more likely to carry through with and repeat such behavior (Hoffman, 2000). A substantial body of research supports this negative relation between sympathy and aggression in childhood and adolescence (Van Noorden et al., 2015; for notable cross-sectional evidence in early and middle childhood, respectively, see Schultz, Izard, & Bear, 2004 and Strayer & Roberts, 2004). Sympathy and aggression even appear to codevelop, as decreases in children's sympathy from age 6 to 12 were systematically linked to increases in their aggression over the same period (Zuffianò et al., 2017).

Regarding victimization and its relation to sympathy, it is likely that the isolation and lack of social support that victimized children endure negatively affect their ability to feel and express sympathy. However, surprisingly little research has tested the viability of this notion. Malti and colleagues (2010) found that Swiss 6-year-olds who experienced more peer victimization expressed less sympathy. They argued that victims become less sympathetic towards others in distress as their own welfare is repeatedly compromised by aggressive acts. We attempted to build on this nascent research by testing the extent to which children's experiences

of peer victimization were related to their aggression—both directly and indirectly through lapses in sympathy.

Children's Aggression, Victimization, and Sympathy: The Role of Resting RSA

RSA is a widely used, noninvasive physiological measure. It represents the coupling of one's respiratory cycle and heart rate. This coupling is influenced by the activity of the parasympathetic nervous system via the vagus nerve. According to polyvagal theory (Porges, 2011), the activity of the vagus nerve is systematically related to the self-regulation of attention, emotion, and behavior. When RSA is measured at rest, it is thought to represent the individual's temperamental, trait-like ability to regulate their physiological arousal and engage with their environment in a socially sensitive manner (Beauchaine, 2001; Porges, 2011).

Resting RSA has rarely, if ever, been linked to peer victimization in childhood and past findings linking it to children's aggression and sympathy/empathy, respectively, have been relatively inconsistent. For example, children diagnosed with externalizing problems had significantly lower levels of resting RSA than matched controls (Beauchaine, 2001). However, other studies on resting RSA and aggression/externalizing behavior have reported null (e.g., Calkins, Graziano, & Keane, 2007; Hastings et al., 2008) or mixed associations dependent on the consideration of HR as a mediator (Xu et al., 2014). Still, children with high resting RSA tend to show greater other-oriented sympathetic and empathic tendencies (Liew et al., 2011; Taylor et al., 2015; for a notable exception, see Morales, Beekman, Blandon, Stifter, & Buss, 2015), which is consistent with studies linking low resting RSA to aggression.

While these findings suggest that high resting RSA reflects a well-regulated and socially adaptive predisposition, their inconsistent nature has led to the argument that relations between physiology, social emotions, and behavior are complex and context dependent (Obradović, Bush,

Stamperdahl, Adler, & Boyce, 2010). The diathesis–stress model suggests that negative social experiences are most likely to impact the development of children with vulnerability factors, or diatheses, such as difficult temperamental traits (Roisman et al., 2012). The theory of differential susceptibility takes this notion one step further: some vulnerability factors are better conceptualized as plasticity agents because they not only amplify the risks of negative social experiences (as the diathesis–stress model suggests), but also increase the probability of benefitting from the absence of such experiences (i.e., they operate for worse or for better depending on the context; Belsky & Pluess, 2009). For example, infants who exhibited higher resting RSA at 1 month had *higher levels of problem behaviors at 3 years if they were reared in a disorganized environment* (e.g., exposed to high levels of caregiver stress), but *lower levels of such behavior if they were reared in a secure environment* (e.g., in the presence of a safe, responsive caregiver; Conradt et al., 2016).

Part of the explanation for positive links between resting RSA and other-oriented emotions and behavior is the ability to sensitively attend to one's social surroundings (Porges, 2011). Interestingly, the outcomes of this ability may be less desirable under conditions of frequent victimization and more desirable under conditions of infrequent victimization. In support of this idea, adults with higher versus lower resting RSA reported more shame and engaged in less sociable behavior after receiving negative social feedback, but more sociable behavior after receiving positive social feedback (Muhtadie, Akinola, Koslov, & Mendes, 2015). A related study examined whether physiological arousal—assessed via salivary alpha amylase and cortisol—moderated the victimization–aggression link in 9-year-old children. High levels of victimization were associated with high levels of aggression in children with higher but not lower levels of physiological arousal. For children with lower levels of peer victimization,

heightened biological sensitivity actually protected against frustration in response to a challenging interaction with an unfamiliar peer (Rudolph, Troop-Gordon, & Granger, 2010). These studies suggest that links between victimization and aggression/related social functioning are moderated by the expression of major biological components. Moreover, heightened biological sensitivity operates for better or for worse depending on the child's exposure to victimization. Similarly, children with high resting RSA in the present study may be particularly sensitive to the presence *and* absence of peer victimization, thus influencing their likelihood of sympathy and aggression.

The Present Study

We adopted an integrative approach to assess the roles of sympathy and resting RSA in 4- and 8-year-olds' victimization-related aggression (i.e., we tested the indirect link between victimization and aggression through sympathy at high and low levels of resting RSA). Given our focus on children's biological and emotional sensitivity to *incoming* social information, we focused on peer victimization as an independent variable subject to moderation and mediation en route to influencing aggression.

We hypothesized differential susceptibility, such that children high in resting RSA would be more sensitive to the risks of high victimization and more sensitive to the benefits of low victimization. Specifically, we expected children with high resting RSA who rated themselves as highly victimized to be rated by their caregivers as less sympathetic and, in turn, more aggressive. Alternatively, we expected children with high resting RSA who rated themselves as less victimized to be rated as more sympathetic and, in turn, less aggressive. We expected those with low resting RSA to have relatively moderate levels of sympathy and aggression regardless of their exposure to victimization. Finally, we considered age (both direct and interactive effects)

and gender in our model in light of previously established developmental and gender differences in our study variables (see Eisenberg, 2000; Eisner & Malti, 2015).

Method

Participants

A sample of 131 Canadian 4- (n = 65; M_{age} = 4.68 years, SD = 0.44; 59% girls) and 8-year-olds (n = 66; M_{age} = 7.96 years, SD = 0.38; 47% girls) participated alongside their primary caregivers (M_{age} = 39.60 years, SD = 4.72; 76% female, 18% male, 6% missing or chose not to report). Both were fluent in English. Participants were recruited from various community centers and events (e.g., festivals, summer camps, etc.) throughout a major city. Interested families provided their contact information, which was then entered into a pre-existing database of potential participants from similar past events. Families within the database were screened for children matching the age cutoffs of the present study and this subset was recruited by telephone until the required sample size was reached. The sole exclusion criterion was the presence of autism spectrum disorder (ASD). We chose this criterion because children with ASD experience social deficits (i.e., in social attention and communication) that would likely make it difficult for them to engage in our social-emotional tasks. The sample was ethnically diverse, hailing from Western European (30%), Asian (19%), Eastern European (11%), Central and South American (10%), and African (2%) backgrounds (23% reported other/multiple origins and 5% chose not to report). Caregivers reported their highest level of education as follows: university (39%), postgraduate (32%), college (16%), and high school (7%; 6% missing or chose not to report). These distributions were representative of the community from which the sample was drawn (Statistics Canada, 2013).

Procedure

The study was granted ethical approval by the researchers' institution. Informed written consent and oral assent were obtained from caregivers and children, respectively. Families visited the research laboratory, at which point children were outfitted with physiological equipment. Children then watched a nondescript video and were interviewed by a trained research assistant for approximately 30 minutes. Meanwhile, caregivers completed a questionnaire in a waiting area.

Measures

Aggression. Caregivers rated 18 items from the narrow-band Aggressive Behavior Syndrome scales of the Child Behavior Checklists (CBCL) for 1.5- to 5- and 6- to 18-year-olds (Achenbach & Rescorla, 2000, 2001; e.g., "My child hits others") on a 6-point scale from 1 = *not at all true* to 6 = *always true* (αs = .91). We scaled the aggression items up from the original 3-point scale of the CBCL to maintain consistency with other assessments in our questionnaire and allow parents to utilize similar points to anchor their judgments across various scales. Importantly, this expanded aggression scale was reliable (both in the present study and in past studies of ours).

Victimization. In light of previous studies on the cyclical nature of the victimization–aggression link and the notion of bully-victims (e.g., Malti et al., 2010; Perren & Alsaker, 2006), we focused on victimization related to being aggressive (aggression may be a less frequent/relevant response in children victimized for other reasons [e.g., looks, atypical personality characteristics]). Children reported how often they were victimized due to their aggressive behavior using two items adapted from Perren and Alsaker (2006; i.e., "Have you ever been picked on because you push other kids?" and "Have you not been allowed to join a

group because you push other kids?") on a 3-point scale from 0 = *rarely* to 2 = *always*, $r = .49$, $p < .001$.

Sympathy. Caregivers rated five items (e.g., "My child gets upset when he/she sees another child being hurt") from a well-validated sympathy measure (Eisenberg et al., 1996[1]) on a 6-point scale from 1= *not at all true* to 6 = *always true* ($\alpha = .86$).

Resting RSA. Three-lead electrocardiogram data were recorded from children using a Biopac MP150 data acquisition system and BioNomadix modules (Biopac Systems, Goleta, CA, USA) at a sampling rate of 2 kHz while they viewed a 120-second video depicting aquatic scenery. Resting physiological measures are often measured in the absence of stimuli for adults because verbal instructions are sufficient to reduce their movement (and associated artifacts in the data). Children, however, find it relatively difficult to stay still, so developmental researchers have opted to use calming stories or videos to reduce the risk of motion-related artifacts (Gavin & Davies, 2007; for a comparison of a video baseline to traditional resting baselines, see Piferi, Kline, Younger, & Lawler, 2000). Monitoring electrodes were secured slightly below the right clavicle and below the ribs on both sides. Leads from each electrode were connected to a module fastened around the midsection that communicated wirelessly via the MP150 with a computer in an adjacent room running AcqKnowledge 4.2 data acquisition software. Data during the video were imported to Mindware HRV 3.0.21 (Mindware Technologies, Gahanna, OH, USA) for visual inspection, cleaning, and RSA calculation. They were cleaned in 30-second intervals to facilitate ease of processing. If more than 20% of an interval required editing, it was excluded from further analysis (overall rejection rate = 31%). RSA was calculated in line with the

[1] In a previous pilot study, we dropped two reverse-coded items from the original seven-item scale due to low reliability for children. Since, we have used a five-item sympathy scale for caregiver informants, as the excluded items also did not significantly improve reliability for them (see Malti, Gummerum, Keller, & Buchmann, 2009).

recommendations of the Society for Psychophysiological Research committee on heart rate variability (Berntson et al., 1997).

Data Analytic Strategy

First, we ran descriptive statistics and zero-order correlations. Next, we tested our main hypotheses on the roles of sympathy and resting RSA in the victimization–aggression link with a path analysis in Mplus Version 5.1 (Muthén & Muthén, 2007) using full information maximum likelihood estimation to account for missing data (aggression = 5%, victimization = 15%, sympathy = 12%, and resting RSA = 31%). We included the interaction of Victimization x Resting RSA as a predictor of sympathy, which, in turn, we assumed would be associated with aggression. We also estimated direct links from (1) resting RSA to aggression and (2) victimization to aggression, and we investigated potential effects of gender/age. Finally, we tested a moderated mediation to determine if the hypothesized indirect effect from victimization to aggression through sympathy depended on children's level of resting RSA (i.e., high versus low). Upper and lower values for the 95% confidence intervals (CIs) of the indirect effect were computed using the RMediation package (Tofighi & MacKinnon, 2011). A comparative fit index (CFI) around .95, root mean square error of approximation (RMSEA) less than .08, and standardized root-mean-square residual (SRMR) less than .06 were considered indicative of good model fit (Kline, 2011).

Results

Descriptive Statistics and Zero-Order Correlations

Means and standard deviations by age group are presented in Table 1. A series of one-way ANOVAs revealed significant age group differences in victimization, $F(1, 109) = 10.88$, $p < .001$, $\eta p^2 = .09$, sympathy, $F(1, 113) = 11.41$, $p < .001$, $\eta p^2 = .09$, aggression, $F(1, 122) = 11.85$,

$p < .001$, $\eta p^2 = .09$, and resting RSA, $F(1, 88) = 5.59$, $p < .05$, $\eta p^2 = .06$. As expected, 4-year-olds had higher victimization and aggression, whereas 8-year-olds had higher sympathy and resting RSA. Table 2 shows the zero-order correlations among study variables. Children with lower sympathy had higher victimization and aggression, and boys had higher victimization than girls.

Moderated Mediation Model Testing the Roles of Sympathy and Resting RSA in the Victimization–Aggression Link

Overall, the path model fit the data well, S-B $\chi^2(1) = 0.237$, $c = 0.450$, $p = .63$, CFI = 1.00, RMSEA = .001 (90% CI [.001, .182]), $p = .68$, SRMR = .01. Sympathy was negatively related to aggression, whereas the direct effects from resting RSA and victimization to aggression were not significant. The hypothesized interaction of Victimization x Resting RSA was significantly associated with sympathy ($p < .001$; Figure 1).[2] Simple slopes analysis (Cohen, Cohen, West, & Aiken, 2003) indicated that the negative association between victimization and sympathy was only significant for children with high (+1 *SD*) levels of resting RSA, $b = -.66$, $p < .01$ (Figure 2). We followed recommendations outlined in Roisman et al. (2012) for probing interactions to distinguish differential susceptibility from diathesis-stress effects (i.e., to ascertain—beyond mere visual analysis—if our obtained interaction was truly crossed over). The regions of significance test with respect to victimization indicated that the slope of sympathy on resting RSA was significant, albeit marginally, for children at +2 SD of victimization ($\beta = -.36$, $p = .08$) and –2 SD of victimization ($\beta = .32$, $p = .07$; significance at both high and low levels [i.e., ±2 SD] of the independent variable is suggestive of differential susceptibility). The proportion of interaction (PoI) and proportion affected (PA) values with respect to victimization were .45 and

[2] Interactions between control (i.e., gender and age) and independent variables were not significant.

.46, respectively (PoI and PA values closer to .50 suggest strong evidence for differential susceptibility, whereas values closer to 0 [or 1] suggest strong evidence for diathesis–stress). Thus, children with high resting RSA were differentially susceptible to victimization, such that those who were highly victimized were rated as less sympathetic and those who were less victimized were rated as more sympathetic. Finally, as a formal test of moderated mediation, the indirect effect from victimization to aggression via sympathy was only significant for those with high levels of resting RSA (95% CI [.08, .51]). The overall model explained 25% of the variance in aggression.

Discussion

The complex interactive roles of social, emotional, and biological factors in aggression from early in development have received little attention to date (Portnoy & Farrington, 2015). We investigated how sympathy and resting RSA factored into the link between victimization experiences and aggression in a sample of 4- and 8-year-olds. From this novel integrative perspective, we aimed to disentangle the contributions of other-oriented concern and temperamental regulatory capacities to the well-established victimization–aggression link.

Regarding direct relations between victimization, sympathy, resting RSA, and aggression, we found hypothesized negative associations between sympathy and both aggression and victimization. The former link supports cross-sectional studies on early and middle childhood (e.g., Schultz et al., 2004; Strayer & Roberts, 2004). A negative relation between sympathy and aggression has also been observed in several longitudinal studies (e.g., Zuffianò et al., 2017). Children who lack sympathy for others in need may be less sensitive to and less deterred by the negative consequences of their aggression, thus increasing their likelihood of harming others (Hoffman, 2000). Indeed, social-emotional learning programs that include core

sympathetic skills (e.g., recognizing others' perspectives and needs) have documented reduced aggression and increased prosocial behavior in intervention groups (Malti et al., 2016).

Children who reported more frequent experiences of victimization by peers as a result of their aggressive tendencies were rated as less sympathetic. Although links between victimization and other-oriented concern have been less studied, Malti et al. (2010) also found a negative association between these factors. They argued that victimized children perceive others as less sensitive to their own needs and are thus less willing to express concern for the needs of others. Given the importance of reciprocal relations with peers for the development of sympathy (Rubin et al., 2011), victimized children may also be less sympathetic as a result of being rejected more and having less opportunities to create social networks and engage in socially competent interactions (Sentse, Kretschmer, & Salmivalli, 2015).

We did not replicate previous research documenting a direct relation between victimization and aggression (which may be explained, in part, by our use of separate informants to assess them; see Reijntjes et al., 2011). Instead, our path model suggested a more complex association between these constructs that was mediated and moderated by emotional and biological functioning, respectively. Children who reported more frequent victimization were rated as less sensitive to others' well-being, and, in turn, higher in aggression. This is the first evidence to suggest that a lack of other-oriented sympathetic concern may be a mechanism through which more frequent victimization experiences are connected to more frequent aggressive conduct. It also builds on previous studies reporting the distinct paths of this model from victimization to sympathy (Malti et al., 2010) and sympathy to aggression (Schultz et al., 2004; Strayer & Roberts, 2004). Thus, sympathy may be an important target for interventionists

to disrupt the translation of victimization experiences into aggressive behavioral problems in childhood.

The mediated effect from victimization to aggression through sympathy was only significant for children with high resting RSA. Some previous research on the direct associations of resting RSA to sympathy and aggression suggests that high resting RSA reflects a more adaptive social-emotional and behavioral predisposition (Beauchaine, 2001; Taylor et al., 2015). However, studies accounting for social and environmental factors suggest that the effects of physiological tendencies are context dependent (Obradović et al., 2010). High resting RSA has been linked to more adaptive outcomes in safe and supportive environments, but less adaptive outcomes in threatening and impoverished contexts (Conradt, Measelle, & Ablow, 2013). Part of the reason why children with high resting RSA are relatively more susceptible to their surroundings may be their increased sensitivity to social stimuli and corresponding readiness to respond to environmental demands (Porges, 2011). For children in the current study with high resting RSA, this may have manifested in increased sensitivity to victimization, thus increasing the likelihood of such experiences triggering a negative cascade of sympathetic lapses and aggressive conduct. In line with the notion of differential susceptibility (Belsky & Pluess, 2009), the proposed adaptive side of RSA-related social sensitivity was also apparent, as high-resting-RSA children with relatively low exposure to victimization had the highest ratings of sympathy. In a related study, adults with higher resting RSA engaged in more sociable behavior after positive social feedback, but less sociable behavior after negative social feedback (Muhtadie et al., 2015). Similarly, 9-year-olds with higher levels of salivary alpha amylase and cortisol were more likely to be aggressive if they experienced higher levels of victimization and less likely to show social frustration if they were exposed to lower levels of victimization (Rudolph et al.,

2010). The current study extended this support for context dependent effects of biological sensitivity to children's RSA-related social sensitivity in the specific context of peer victimization.

Despite expected developmental differences in our core study variables (i.e., higher victimization/aggression and lower sympathy/resting RSA in 4- versus 8-year-olds), we did not find developmental differences in our hypothesized moderated mediation. Thus, despite these mean-level differences, it appears as though structural relations between victimization, sympathy, and aggression are similar in early and middle childhood, as are the environmentally contingent benefits and drawbacks of high resting RSA.

Although we utilized multiple methods and informants to consider the roles of social, emotional, and biological factors in explaining children's aggression, some limitations should be considered while interpreting our findings and devising related future studies. First, our data were cross-sectional; thus, causal inferences about associations between victimization, sympathy, resting RSA, and aggression cannot be made. Alternative models should be considered, as relations between victimization and aggression are likely bidirectional and cyclical (see Malti et al., 2010). For example, deficits in sympathy may foster aggressive behavior, and, in turn, aggressive children may be pegged as deserving targets of victimization. Future research should attempt to replicate the complex interrelations of these factors within a longitudinal framework. We also relied primarily on mother-reported sympathy and aggression, and literature suggests differential perceptions of children's social behavior in mothers versus fathers (e.g., 4- to 6-year-olds' externalizing problems were rated higher by fathers compared to mothers; Davé, Nazareth, Senior, & Sherr, 2008). While this could certainly affect the mean levels of aggression (and perhaps sympathy) in the current study, it is unclear to what extent the variability and structural

relations we documented between our variables would have been different if our endogenous variables (i.e., sympathy and aggression) were primarily father- versus mother-reported. Nonetheless, we acknowledge that future studies should include both maternal and paternal perceptions of children's emotions and behavior to achieve a more comprehensive profile of their social-emotional development. The normative nature of our community sample should also be considered. For example, children with high versus low resting RSA had similar, high levels (i.e., high intercepts) of sympathy. We also did not collect data regarding relevant psychopathologies, such as oppositional defiant disorder, conduct disorder, and attention deficit hyperactivity disorder (see Crowell et al., 2006; Karalunas et al., 2014). This lack of information on potentially hidden clinical factors may limit the generalizability of our findings. In the future, it would be interesting to examine whether the current effects differ in clinical samples with less social-emotional acuity or in a model that includes dimensional clinical measures. Finally, we only considered children's victimization based on their aggressive behavior and with a limited set of items. Future studies in this vein should analyze the experiences of children who are victimized for other reasons, such as social withdrawal (e.g., shyness).

Despite these limitations, this study was the first to highlight the potential translational role of sympathy in the victimization–aggression link. It also underscores the importance of resting RSA for helping us understand which conditions of biological functioning and social context are most likely to perpetuate a maladaptive cycle of reduced sympathy and heightened aggression in childhood.

Summary

We tested the extent to which more frequent experiences of peer victimization were associated with heightened aggression towards others in 4- and 8-year-olds, and how

sympathetic concern and resting respiratory sinus arrhythmia (RSA) factored into this relationship. Path analyses revealed that children who reported more frequent victimization were rated as less sympathetic and, in turn, more aggressive. However, resting RSA moderated this path, such that children with high levels were rated as more versus less sympathetic when they reported less versus more victimization, respectively. High resting RSA signifies heightened biological sensitivity to one's environment. Broadly, these findings support differential susceptibility theory—that some vulnerability factors (e.g., high resting RSA) not only amplify the risks of negative social experiences (e.g., victimization), but also increase the probability of benefitting from the absence of such experiences (i.e., they operate for worse or for better depending on the context). These findings also meaningfully extend previous related work in adult populations linking high RSA to both positive and negative social behaviors depending on the harshness of social feedback, and work on salivary physiological indicators in middle childhood suggesting that high levels thereof are both harmful and protective depending on exposure to victimization. Given that links between victimization and aggression/related social functioning appear to be moderated by the expression of major biological components, efforts to understand and reduce victimization-related aggression should consider inter-child differences in biological sensitivity.

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Table 1

Descriptive Statistics by Age Group

Variables	4-year-olds	8-year-olds	Total Sample
	M (*SD*)	*M* (*SD*)	*M* (*SD*)
Aggression	2.53 (0.77)	2.06 (0.75)	2.28 (0.79)
Victimization	0.37 (0.56)	0.10 (0.29)	0.22 (0.45)
Sympathy	4.40 (0.73)	4.89 (0.81)	4.67 (0.80)
Resting RSA	6.48 (1.15)	7.06 (1.17)	6.77 (1.19)

Note. RSA = Respiratory Sinus Arrhythmia. Caregiver-reported sympathy and aggression (6-point scale). Child-reported victimization (3-point scale).

Table 2

Zero-Order Correlations

Variables	1	2	3	4	5
1. Aggression	–				
2. Victimization	.12	–			
3. Resting RSA	-.03	-.19	–		
4. Sympathy	-.47***	-.21*	-.02	–	
5. Gender	.02	.21*	-.01	-.10	–

Note. RSA = Respiratory Sinus Arrhythmia. Gender (0 = girls, 1 = boys).
*** $p < .001$. * $p < .05$.

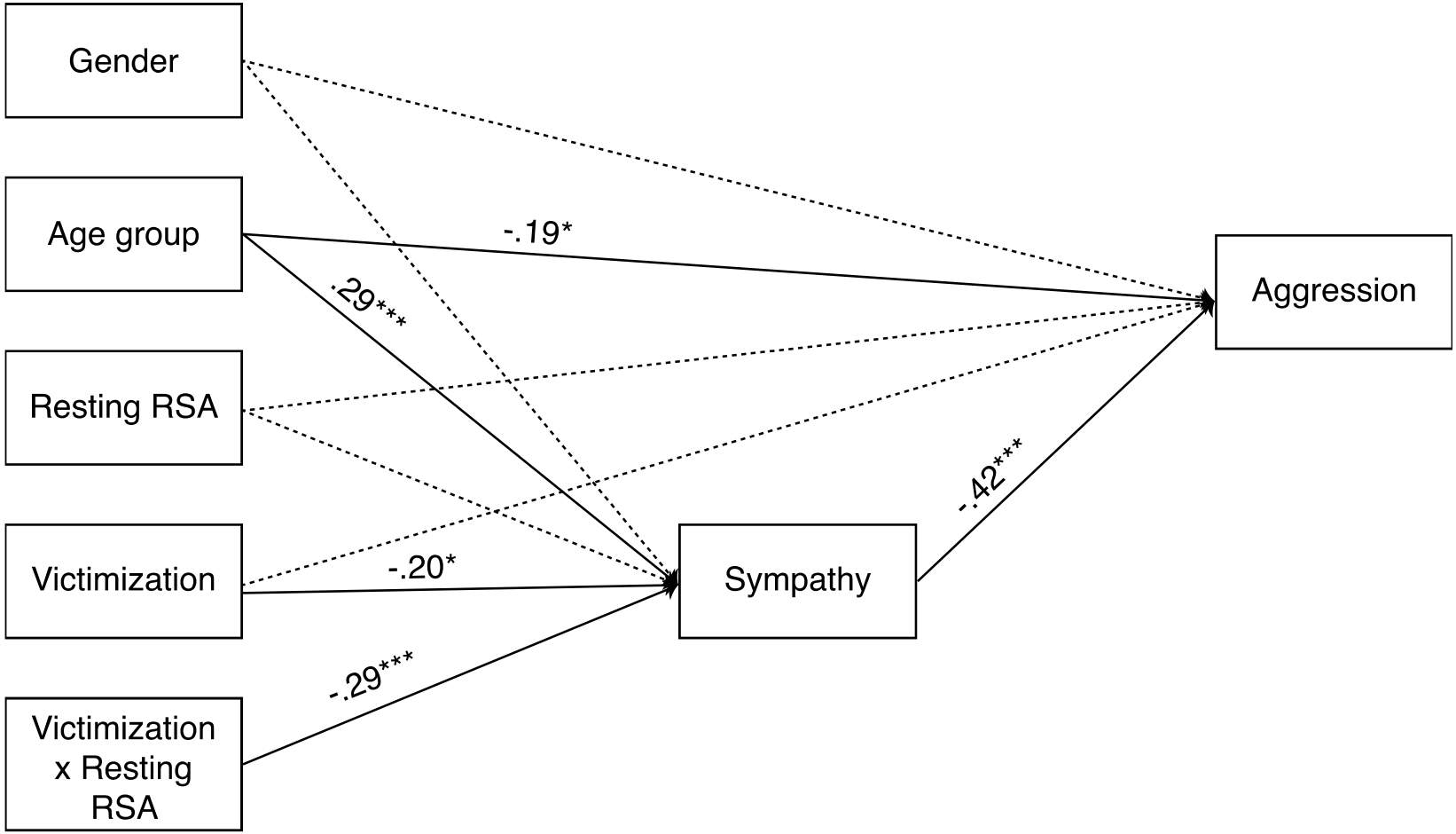

Figure 1. Relations between victimization, sympathy, resting RSA, and aggression.
Note. RSA = Respiratory Sinus Arrhythmia. Standardized path coefficients are depicted. Dashed lines represent nonsignificant paths. Gender (0 = girls, 1 = boys). Age group (0 = 4-year-olds, 1 = 8-year-olds). $^{***}p < .001$. $^{*}p < .05$. We tested interactions between control variables (i.e., gender and age) and independent variables, but they were not significant.

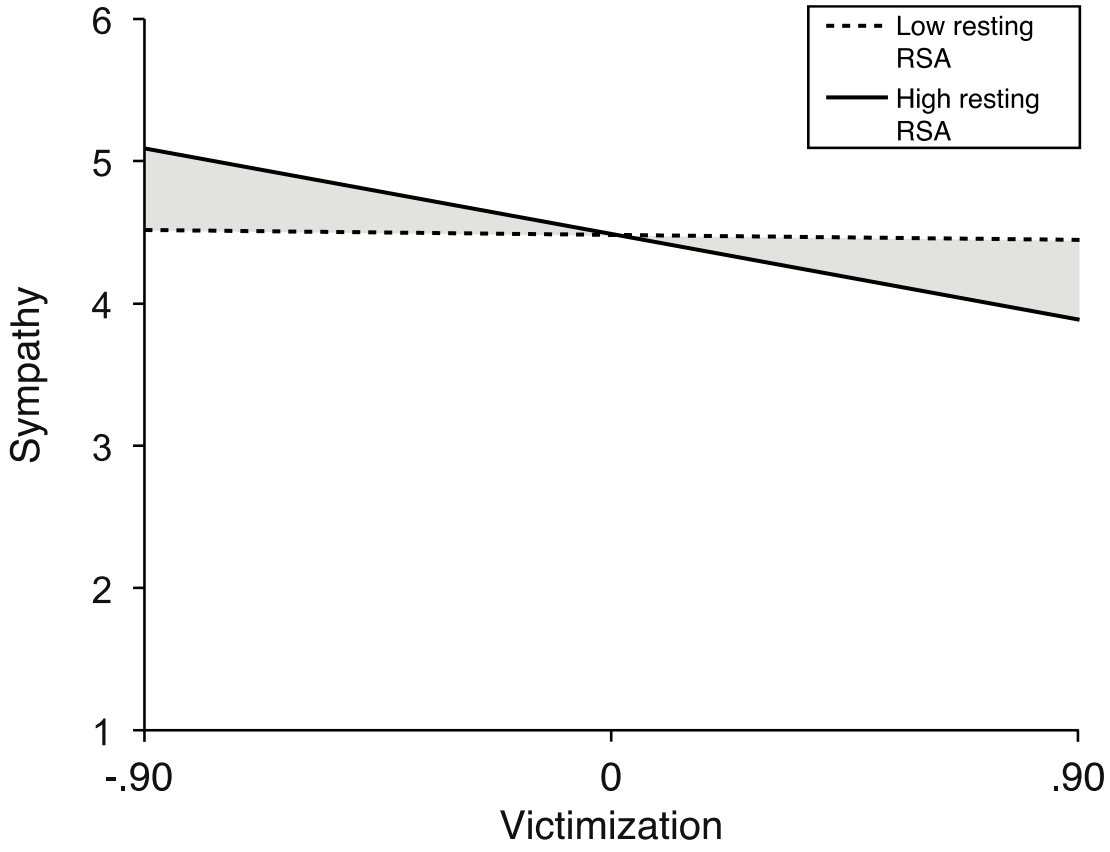

Figure 2. Relation between victimization and sympathy at low (-1 *SD*) and high (+1 *SD*) resting RSA.
Note. RSA = Respiratory Sinus Arrhythmia. Victimization is centered and plotted out to ±2 *SD*.