

Inhibitory Control and Moral Emotions: Relations to Reparation in Early and Middle Childhood

Tyler Colasante\*, Antonio Zuffianò\*, Na Young Bae, and Tina Malti

Author Note

Tyler Colasante, Department of Psychology, University of Toronto Mississauga; Antonio Zuffianò, Department of Psychology, Fraser Mustard Institute for Human Development, University of Toronto Mississauga; Na Young Bae, Department of Psychology, University of Toronto Mississauga; Tina Malti, Department of Psychology, University of Toronto Mississauga (\*these authors contributed equally to this work).

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Correspondence concerning this article should be addressed to Tyler Colasante, Department of Psychology, University of Toronto Mississauga, 3359 Mississauga Rd, Mississauga, ON L5L 1C6. E-mail: tyler.colasante@mail.utoronto.ca.

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### Abstract

This study examined links between inhibitory control, moral emotions (sympathy and guilt), and reparative behavior in an ethnically diverse sample of 4- and 8-year-olds ( $N = 162$ ). Caregivers reported their children's reparative behavior, inhibitory control, and moral emotions through a questionnaire and children reported their guilt feelings in response to a series of vignettes depicting moral transgressions. A hypothesized mediation model was tested with inhibitory control relating to reparative behavior through sympathy and guilt. In support of this model, results revealed that high levels of inhibitory control were associated with high levels of reparative behavior through high levels of sympathy and guilt. However, the mediation of inhibitory control to reparation through guilt was significant for 4-year-olds only. Results are discussed in relation to the temperamental, regulatory, and affective-moral precursors of reparative behavior in early and middle childhood.

*Keywords:* reparative behavior, inhibitory control, sympathy, guilt, childhood

### Inhibitory Control and Moral Emotions: Relations to Reparation in Early and Middle Childhood

Reparative behavior, a subtype of prosocial behavior (i.e., voluntary behavior intended to benefit another; Eisenberg, Spinrad, & Knafo, in press), involves amending or repairing situations in which a moral norm or rule has been violated (Kochanska, DeVet, Goldman, Murray, & Putnam, 1994). The capacity of reparative behavior to facilitate and maintain positive peer relations makes it an essential component of children's social lives (Webster-Stratton & Reid, 2004). Indeed, the mutually rewarding outcomes of reparation (e.g., appeased guilt for the transgressor and comfort for the victim) are highly valued by children, their peers, and their parents (Eisenberg et al., in press). Reparative acts, such as apologizing and comforting, have been shown to emerge as early as the second year of life (see Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992). These early origins have prompted developmental researchers to investigate the genetically rooted, temperamental precursors of reparation. In particular, the temperamental construct of inhibitory control - the capacity to suppress dominant, maladaptive responses - has been associated with increased reparation in early childhood (Kochanska et al., 1994; Rothbart, 2011). This finding suggests that high levels of inhibitory control may predispose children to behave in a reparative manner. In addition, more proximal, emotional experiences in moral conflict situations may be associated with children's reparative tendencies. For instance, when children show concern for someone they have harmed, the moral emotions of sympathy and guilt become relevant, potentially prompting them to repair the harm done (Malti & Ongley, 2014). Albeit limited, empirical evidence from early childhood suggests that sympathy and guilt, respectively, are associated with increased reparative behavior (Kochanska, Casey, & Fukumoto, 1995; Zahn-Waxler et al., 1992). Interestingly, the slightly broader construct of effortful control (comprised of both inhibitory control and attentional control; see

Rothbart & Bates, 2006) has been linked to increased sympathy and guilt (Eisenberg et al., 2007; Rothbart, Ahadi, & Hershey, 1994). Thus, inhibitory control, in part, may predispose children to experience certain moral emotions (in addition to predisposing them to reparative behavior).

Despite these independent findings, the concurrent relations of inhibitory control, moral emotions, and reparative behavior have not been empirically detailed. Elucidating the interplay between these constructs would contribute to a more complete understanding of the antecedents of reparative behavior. In the present study, we therefore investigated children's inhibitory control and moral emotions (i.e., sympathy and guilt) in relation to their reparative behavior.

### **Inhibitory Control and Reparative Behavior**

Inhibitory control has been defined as the ability to inhibit dominant, maladaptive responses, either under instruction or in novel/ambiguous situations (Rothbart, Ahadi, Hershey, & Fisher, 2001). In conjunction with attentional control, it comprises the effortful control factor: a self-regulatory aspect of temperament (Rothbart & Bates, 2006). As a result of similarities between inhibitory and effortful control, researchers have often used the terms interchangeably (e.g., Fowles, Kochanska, & Murray, 2000; Gagne & Saudino, 2010; Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996). It could be argued that showing concern for others after causing them harm and consequently engaging in reparative behavior requires holding one's personal needs in abeyance and/or delaying associated gratification (i.e., inhibitory control). For example, by inhibiting a dominant, maladaptive response to harm done (e.g., avoidance), children may activate a subdominant, adaptive response (reparation in this case; see Eisenberg, 2005). However, despite numerous studies linking effortful control to prosocial behavior in general (e.g., Diener & Kim, 2004; Eisenberg et al., 1996; Kochanska, Barry, Jimenez, Hollatz, & Woodard, 2009; Luengo Kanacri, Pastorelli, Eisenberg, Zuffianò, & Caprara, 2013), only one

study to date has documented a positive relation between inhibitory control and reparation in early childhood (see Kochanska et al., 1994). In this cross-sectional study, Kochanska and colleagues (1994) collected maternal and paternal reports of 171 21- to 70-month-old children and found that inhibitory control was positively associated with reparation after wrongdoing.

### **Moral Emotions and Reparative Behavior**

In the present study, we focused on two prototypical moral emotions of particular relevance to children's reparative behavior: sympathy and guilt. Sympathy, like empathy, is an other-oriented concern that stems from the apprehension of another's emotional state. Unlike empathy, sympathy does not require experiencing the same or a similar emotion as the other (Eisenberg, 2000a). Guilt is commonly referred to as regret over wrongdoing (Malti & Latzko, 2012). Guilty individuals rightly accept or anticipate responsibility for causing or associating oneself with a transgression of internalized norms (Hoffman, 2000; Malti & Ongley, 2014).

Relations between sympathy and prosocial behavior in childhood have been well documented (for a review, see Eisenberg et al., in press). However, only one study, conducted with a sample of 2-year-old children, has provided empirical support for a positive relation between sympathy and reparative behavior (Zahn-Waxler et al., 1992). Likewise, despite substantial theorizing linking guilt to increased reparative behavior (e.g., Ferguson, Stegge, Miller, & Olsen, 1999; Olthof, Schouten, Kuiper, Stegge, & Jennekens-Schinkel, 2000), empirical support for this relation is limited to a single study from early childhood (e.g., Kochanska et al., 1995).

### **Inhibitory Control and Moral Emotions**

To our knowledge, the specific association between inhibitory control and sympathy has not been empirically detailed. However, a positive association between sympathy and effortful

control has been documented in 5- to 7-year-olds (Eisenberg et al., 1996) and 4- to 8-year-olds (Valiente et al., 2004). Furthermore, in a sample of 171 6- to 16-year-olds, high levels of effortful control and growth in effortful control have been shown to predict high levels of sympathy, both concurrently and longitudinally (Eisenberg et al., 2007). Only one study to date has documented a positive relation between inhibitory control and guilt, and this finding was solely for girls in early childhood (Kochanska et al., 1994). There are, however, limited studies documenting a positive relation between effortful control and guilt (Kochanska et al., 2009; Rothbart et al., 1994). In a notable longitudinal study, Kochanska and colleagues (2009) examined effortful control and guilt in children at 22, 33, and 45 months of age. Composite guilt and effortful control scores (from 22-45 months) were strongly and positively correlated. Given that inhibitory control represents a major component of effortful control (Rothbart & Bates, 2006), it is likely that inhibitory control is also positively related to both sympathy and guilt.

### **Inhibitory Control, Moral Emotions, and Reparative Behavior**

Conceptually, Eisenberg and colleagues (1994) have argued that empathic overarousal resulting from negative affect in moral conflict situations (e.g., after harming another) leads to personal distress and self-focused response tendencies (e.g., avoidance). By contrast, children who regulate such negative affect are thought to experience sympathy and consequently display other-oriented response tendencies (e.g., reparative behavior). From this perspective, the self-regulation afforded by inhibitory control (see Derryberry & Rothbart, 1997) may play a crucial role in the occurrence of sympathy and, consequently, optimal behavioral expressions of sympathy, such as reparative behavior. According to Hoffman (2000), feelings of guilt emerge after empathizing with, and assuming responsibility for, another's pain. Similar to its hypothesized role in promoting sympathy, inhibitory control may afford children with the

regulatory capacity to curb overarousal (e.g., anger and frustration), reflect upon the wrongfulness of their transgression (e.g., feel guilty), and engage in reparation. The primacy of inhibitory control in this theoretical framework has been supported by recent twin studies establishing a significant genetic component of inhibitory control (Gagne & Saudino, 2010; Gagne, Saudino, & Asherson, 2011). Also in line with the present theorizing, recent research has considered the role of sympathy in mediating the effect of temperamental tendencies on prosocial behavior (see Edwards et al., 2014).

### **The Present Study**

To summarize, we aimed to investigate the concurrent relations between children's inhibitory control, moral emotions (sympathy and guilt), and reparative behavior. Recent research has documented a strong genetic component of inhibitory control (e.g., Gagne & Saudino, 2010; Gagne et al., 2011) and self-regulation is thought to promote optimal levels and expressions of moral emotions, such as sympathy and guilt (Eisenberg et al., 1994; Hoffman, 2000). From this perspective, high levels of genetically predisposed inhibitory control may provide children with the self-regulation necessary to experience optimal levels of sympathy and guilt in response to harming another. In turn, painful feelings of sympathy and guilt over harm done may prompt children to engage in reparative behavior (as a method of alleviating their discomfort; see Hoffman, 2000). We therefore hypothesized that relations of inhibitory control to reparation would be mediated by children's moral emotions. Specifically, we hypothesized that high levels of inhibitory control would be associated with high levels of moral emotions, which, in turn, would be associated with high levels of reparative behavior.

In addition, we tested for developmental differences in these proposed relations with a sample of 4- and 8-year-old children. We selected these age groups because previous research

suggests that temperamental tendencies impact social behavior in early childhood more than middle childhood (e.g., Bates, 2012). Indeed, other factors that emerge in middle childhood, such as increased cognitive, moral, and social development (e.g., Jambon & Smetana, 2014), may assume the role of temperament in affecting reparative behavior. We therefore expected relations between inhibitory control and both moral emotions and reparative behavior to be stronger for 4-year-olds than 8-year-olds. Finally, gender was entered as a control variable in our multivariate analyses because previous research has documented gender differences in the main study variables (e.g., Keane & Calkins, 2004).

## Method

### Participants

A sample of 81 4-year-olds ( $M$  age = 4.54,  $SD$  = .66, 49% girls), 81 8-year-olds ( $M$  age = 8.47,  $SD$  = .24, 53% girls), and their primary caregivers participated in the current study ( $N$  = 162,  $M$  age = 6.48,  $SD$  = 2.03; 50% girls). The families resided in a suburban area of a major Canadian city. They were recruited from community centers, recreational facilities, and a pre-existing family database. Exclusion criteria included the presence of an autism spectrum disorder in children and an inability to understand, read, and/or write English on behalf of caregivers.

The ethnic composition of the sample included Western European (36%), Eastern European (10%), South Asian (16%), East Asian (4%), West, Central, and Southeast Asian (5%), African (3%), Latin, Central, and South American (5%), and other/multiple (21%) origins. As a proxy of socioeconomic status (SES), caregivers reported their highest level of education achieved. The majority of primary caregivers (55%) had completed university, while the remainder had completed graduate (13%), college (23%), or high school (9%) level education. This distribution of SES was representative of the community from which the sample was drawn

(Statistics Canada, 2009). Ethical approval for the study was received from the researchers' institution.

### **Procedure**

Children and their primary caregivers attended the research laboratory for a single session. Written informed consent was obtained from the caregiver and oral assent was obtained from the child. A child interview was conducted separately from the caregiver in a designated room and lasted approximately 30-40 minutes. Meanwhile, the caregiver remained in a waiting area and completed a questionnaire. Upon completion of the child interview, the caregiver was debriefed and the child was awarded a certificate and an age-appropriate book.

### **Measures**

**Reparative behavior.** Caregivers completed the nine-item Reparation Scale from the My Child conscience instrument developed by Kochanska and colleagues (1994; e.g., "My child seems relieved when given an opportunity to repair a damage s/he has caused"). This scale has proven valid and reliable with samples from early childhood (Kochanska et al., 1994; Kochanska, Gross, Lin, & Nichols, 2002). Caregivers were asked to rate how well each item described their child on a 7-point Likert scale ranging from *extremely untrue* to *extremely true*. Cronbach's  $\alpha$ s were .71 and .84 for 4- and 8-year-olds, respectively.

**Inhibitory control.** Caregivers of 4-year-olds completed the Inhibitory Control subscale of The Children's Behavior Questionnaire (CBQ; Rothbart et al., 2001; e.g., "My child can easily stop an activity when s/he is told 'no'"). Caregivers of 8-year-olds completed the Inhibitory Control subscale of The Temperament in Middle Childhood Questionnaire (TMCQ; Simonds & Rothbart, 2004; e.g., "My child can stop him/herself when s/he is told to stop"). For both scales, caregivers rated the items on a 7-point Likert scale ranging from *extremely untrue* to

*extremely true*. These scales were chosen for their respective age groups because they use developmentally appropriate language and content for early versus middle childhood. We computed an aggregate score of inhibitory control based on the four items that tapped into similar constructs across the two scales. Cronbach's  $\alpha$ s were .62 and .65 for 4- and 8-year-olds, respectively.

**Sympathy.** Caregivers completed a sympathy scale consisting of five items from Zhou, Valiente, and Eisenberg (2003; e.g., "My child feels sorry for others who are less fortunate"). This scale has proven valid and reliable in previous studies employing samples of similar ages to the present study (see Eisenberg et al., in press). Caregivers rated the items on a 6-point Likert scale ranging from *not at all true* to *always true*. Cronbach's  $\alpha$ s were .85 and .88 for 4- and 8-year-olds, respectively.

**Guilt.** Caregiver-reported scale responses and children's self-reported responses to vignettes were used to assess guilt.

**Caregiver reports.** Caregivers completed the 18-item Guilt, Remorse/Other Emotional Reactions after Transgression/Mishap/Wrongdoing scale from the My Child conscience instrument (Kochanska et al., 1994; e.g., "My child may continue to feel bad even if forgiven for a mishap or blunder"). This scale has proven valid and reliable with samples from early childhood (Groenendyk & Volling, 2007; Kochanska et al., 2002). Caregivers rated the items on a 7-point Likert scale ranging from *extremely untrue* to *extremely true*. Cronbach's  $\alpha$  was .84 for both 4- and 8-year-olds.

**Child reports.** Children's guilt feelings were assessed in response to two vignettes depicting intentional harm against another child (i.e., stealing and pushing). The vignettes had been extensively validated by previous research in the happy-victimizer paradigm with samples

ranging from early childhood to adolescence (Malti & Ongley, 2014). They were accompanied by gender-matched illustrations and their wording was slightly modified to be appropriate for each age group.

Two questions followed the interviewer's reading of each vignette: *Question 1* asked, "How would you feel if you had done what (*hypothetical victimizer's name*) did?" If children said, "I don't know", they were then asked, "If you had (*behavior of hypothetical victimizer*), would you feel a little good, a little bad, or a little good and bad?" Children's answers to the latter prompt were recorded verbatim. For *Question 2*, children heard, "You said you would feel (*emotion attribution from Question 1*). How strongly would you feel (*emotion attribution from Question 1*)?" Children answered this question by pointing to a visual, 3-point Likert scale depicting squares of increasing size (1 = not strong; 2 = somewhat strong; 3 = very strong). Prior to this, 4-year-olds were calibrated with a similar scale depicting animals of increasing size (i.e., a mouse corresponding to low intensity emotions, a horse corresponding to medium intensity emotions, and an elephant corresponding to high intensity emotions) to ensure they understood the scale format.

*Coding of guilt.* The coding method used in the present study was adapted from the procedures of past research on children's moral emotions (Malti & Ongley, 2014). For *Question 1*, children's expressed emotions were coded as 1 (*guilty*) or 0 (*not guilty*). Specifically, *bad, a little bad, sad, and guilty* attributions were coded as 1 (*guilty*), while *neutral, angry, happy, proud, good, a little good, other positive emotion, fearful, embarrassed/ashamed, and other negative emotion* attributions were coded as 0 (*not guilty*). Including basic emotional correlates of guilt in our coding (e.g., *bad, a little bad, sad*) allowed us to examine moral emotion expectancies in younger children who may not be able to explicitly label complex emotions (e.g.,

guilt) but can already name their basic emotional correlates and provide moral reasoning in line with guilt (Malti & Ongley, 2014; Tracy, Robins, & Lagattuta, 2005). Due to minimal occurrence, *psychosomatic complaint* and *other* attributions were coded as missing. Two independent raters randomly selected and independently coded 15% (i.e.,  $n = 24$ ) of the responses to *Question 1* from both vignettes. On average, Cohen's  $\kappa$  was .99 with little variation in reliability across vignettes. Raters discussed disagreements until a consensus was reached.

For *Question 2*, the strength (i.e., intensity) of children's guilt feelings was assigned as follows: A score of 0 was assigned to *not guilty* attributions (i.e., *no guilt*). For guilty attributions, a score of 1 was assigned if the child pointed to the smallest square (i.e., *not strong guilt*) following the attribution. A score of 2 was assigned if the child pointed to the middle-sized square (i.e., *somewhat strong guilt*). Lastly, a score of 3 was assigned if the child pointed to the largest square (i.e., *very strong guilt*). Intensity scores were aggregated across both vignettes. The resulting continuous, aggregate scores were used in analyses. High scores indicated high levels of guilt.

## Results

### Descriptive Analyses

The means and standard deviations of study variables by age group are presented in Table 1. Eight-year-olds were rated higher than 4-year-olds on reparation,  $F(1,159) = 5.71, p = .02, \eta_p^2 = .04$ , sympathy,  $F(1,159) = 4.01, p = .05, \eta_p^2 = .03$ , and caregiver-reported guilt,  $F(1,160) = 6.42, p = .01, \eta_p^2 = .04$ . Child-reported guilt and inhibitory control did not significantly differ by age.

Table 2 displays the correlations among study and control variables. Reparation was positively related to inhibitory control, sympathy, guilt (caregiver-reported), and age. Inhibitory

control was positively related to sympathy and guilt (child-reported), and negatively related to gender. Furthermore, sympathy was positively related to guilt (caregiver-reported). None of the variables presented a problematic deviation from normal distribution (i.e., skewness > 2 and kurtosis > 7; see Curran, West, & Finch, 1996).

### **Modeling Strategies**

Using *Mplus 7* (Muthén & Muthén, 2012), we tested the plausibility of the hypothesized mediation model within a path analytic framework using maximum likelihood estimation of the parameters. According to recent recommendations of Hayes and Scharkow (2013), we used the bias-corrected bootstrap confidence interval method to formally test the significance of the mediated effect (i.e., *ab*) of inhibitory control on reparation through guilt and sympathy. In comparison to other approaches, such as the Sobel test (1982), this method has been found to offer more power to detect mediated effects (Hayes & Scharkow, 2013; see also MacKinnon, Lockwood, & Williams, 2004). The upper and lower limits of the 95% confidence interval (CI) of the indirect effect were calculated with 5000 bootstraps. If the 95% lower and upper CI limits did not include zero, we concluded that the mediated effect was different from zero. Since we hypothesized that the effect of inhibitory control on guilt, sympathy, and reparation would be moderated by age (i.e., stronger for 4-year-olds than 8-year-olds), the interaction of inhibitory control x age was also included in our analyses. In all models, gender was entered as a control variable.

Model fit was evaluated following standard recommendations (Kline, 2011): The  $\chi^2$  likelihood ratio statistic, Comparative Fit Index (CFI), Root-Mean-Square-Error-of-Approximation (RMSEA) with associated 90% CI, and the Root-Mean-Square-Residuals-Standardized (SRMR) were considered. A non-significant  $\chi^2$  statistic is indicative of perfect fit

(Kline, 2010). In terms of alternative fit indices, we accepted CFI > .95, RMSEA < .08, and SRMR < .06 (Kline, 2010). Finally, since we tested the plausibility of alternative models explaining our data, the Akaike Information Criterion (AIC) was used to evaluate model fit (with lower values indicating better fit; Kline, 2010) because it is appropriate for comparing the fit of non-nested models. In this regard, Burnham and Anderson (2004) have recommended that differences in AIC ( $\Delta$  AIC) computed between two alternative models should be considered before selecting the best fitting model. Burnham and Anderson (2004) note that, as a rule of thumb, models with  $\Delta$  AIC  $\leq$  |2| have substantial support, models with  $|4| \leq \Delta$  AIC  $\leq$  |7| have considerably less support, and models with  $\Delta$  AIC  $\geq$  |10| have essentially no support.

### **Mediation Analyses**

Given the presence of two methods of guilt assessment (i.e., caregiver- and child-reported), we tested the robustness of the mediational role of guilt across informants by running two separate mediation models. In order to be parsimonious in terms of the number of parameters estimated in our models (see Kline, 2010), guilt, sympathy, and reparation were regressed one at a time on the interaction of inhibitory control x age and only significant interaction effects were maintained in the final models (Cohen, Cohen, West, & Aiken, 2003).

Model 1 (caregiver-reported guilt), in which only the path from inhibitory control x age to caregiver-reported guilt was estimated, fit the data very well,  $\chi^2(2) = 0.54$ ,  $p = .76$ , CFI = 1.00, RMSEA = .00 (90% CI = .00 – .11), SRMR = .01, AIC = 1063.36. In this model (see Figure 1a), the path from the interaction of inhibitory control x age to caregiver-reported guilt was statistically significant ( $p < .05$ ). Simple slope analyses (Cohen et al., 2003) indicated that the effect of inhibitory control on caregiver-reported guilt was statistically significant for 4-year-olds ( $b = .23$ ,  $p < .01$ ), but not 8-year-olds ( $b = .01$ ,  $p = .93$ ). Of note, in Model 1, the further

estimation of the paths from inhibitory control x age to sympathy and reparation did not significantly improve the fit of the model as indicated by the chi-square difference test for nested models,  $\Delta\chi^2(1) = 0.53, p = .46$  and  $\Delta\chi^2(1) = 0.01, p = .94$ , respectively. Since none of these additional paths were statistically significant, they were not given further consideration in the path model. Accordingly, only the effect from inhibitory control x age to caregiver-reported guilt was included. The results of the final model (see Figure 1a) accounted for a large amount of the variance of reparation ( $R^2 = 50\%$ ). The direct effect of inhibitory control on reparation was positive, but only marginally significant ( $p < .07$ ), whereas the unstandardized mediated effect from inhibitory control to reparation via sympathy was statistically significant (i.e.,  $ab = .06$ , 95% CI = .02 – .11), highlighting the role of sympathy in mediating the effect of inhibitory control on reparation. Interestingly, the significant, unstandardized mediated effect from inhibitory control to reparation via caregiver-reported guilt was moderated by child age. Specifically, the mediated effect was significant for 4-year-olds (i.e.,  $ab = .12$ , 95% CI = .06 – .22), but not 8-year-olds (i.e.,  $ab = .01$ , 95% CI = -.08 – .08).

For Model 2 (child-reported guilt), we followed the same analytical approach as Model 1 (caregiver-reported guilt). The model in which the path from inhibitory control x age to child-reported guilt was estimated (see Figure 1b) fit the data very well  $\chi^2(2) = 2.10, p = .35$ , CFI = 1.00, RMSEA = .02 (90% CI = .00 – .16), SRMR = .01, AIC = 1219.38, and the effect of the interaction term was statistically significant ( $p < .05$ ). As for Model 1, simple slope analysis indicated that the effect of inhibitory control on child-reported guilt was statistically significant for 4-year-olds ( $b = .29, p < .01$ ) but not 8-year-olds ( $b = .01, p = .94$ ). Further estimation of the paths from the interaction of inhibitory control x age to sympathy and reparation did not significantly increase the model's fit (i.e.,  $\Delta\chi^2(1) = 0.54, p = .46$ , and  $\Delta\chi^2(1) = 1.57, p = .21$ ,

respectively) and, therefore, these paths were no longer considered in the analysis. This model explained 36% of the variance of reparation and both the direct effect of inhibitory control on reparation and the mediated effect via sympathy were statistically significant (i.e.,  $ab = .09$ , 95% CI = .03 – .17). The effect of child-reported guilt on reparation, however, was not significant and the mediated effect from inhibitory control to reparation via child-reported guilt was neither significant for 4-year-olds (i.e.,  $ab = -.01$ , 95% CI = -.06 – .03) nor 8-year-olds (i.e.,  $ab = .00$ , 95% CI = -.02 – .02).

### Alternative Models

In order to account for different explanations of our data, four alternative models (*AM*) were tested (for both caregiver- and child-reported guilt). Because the four *AMs* were not nested in the hypothesized model,  $\Delta$  AIC was used to compare their fit to that of the current model (see Table 3). In *AM 1*, inhibitory control was the independent variable, reparation was the mediator, and guilt and sympathy were the outcomes. In *AM 2*, reparation was the independent variable, inhibitory control was the mediator, and sympathy and guilt were the outcomes. In *AM 3*, sympathy and guilt were the independent variables, inhibitory control was the mediator, and reparation was the outcome. Finally, in *AM 4*, reparation was the independent variable, sympathy and guilt were the mediators, and inhibitory control was the dependent variable. As indicated by  $\Delta$  AIC (see Table 3), only *AM 1* represented an acceptable alternative approximation of the data compared to the hypothesized mediation model (i.e.,  $\Delta$  AIC < |2|), whereas *AM 2*, *AM 3*, and *AM 4* had essentially no support (i.e.,  $\Delta$  AIC  $\geq$  |10|). In *AM 1*, reparation significantly mediated the effect of inhibitory control on sympathy ( $ab = .10$ , 95% CI = .04 – .17) and caregiver-reported guilt ( $ab = .11$ , 95% CI = .04 – .17), but not child-reported guilt ( $ab = -.01$ , 95% CI = -.05 – .04).

### Discussion

This study examined associations of inhibitory control and moral emotions to reparation in 4- and 8-year-olds. Given that reparation is an important behavioral component of morality, the present findings shed light on the potential antecedents of early moral conduct.

Our hypothesis linking inhibitory control to reparative behavior through moral emotions was partially confirmed. Specifically, high levels of inhibitory control were associated with high levels of reparation via the positive associations of caregiver-reported sympathy and guilt. The primacy of inhibitory control in this mediational chain is in line with recent twin studies documenting a significant genetic component of inhibitory control (Gagne & Saudino, 2010; Gagne et al., 2011). For example, Gagne and Saudino (2010) found that genetic factors accounted for 58% of the variance in caregiver-reported inhibitory control in a sample of 294, 24-month-old twin pairs. Furthermore, unlike moral emotions, which have been found to increase throughout childhood (Eisenberg, Spinrad, & Morris, 2014; Malti et al., 2013), inhibitory control is regarded as a relatively stable component of child temperament (Rothbart & Bates, 2006). Thus, in line with the sequencing of our model, it is likely that inhibitory control forms the basis for later moral emotions and not vice versa.

In addition, we found that high levels of inhibitory control were associated with high levels of sympathy and guilt in our mediation model. Inhibitory control is thought to underlie emotional and behavioral regulation (Derryberry & Rothbart, 1997) and the experience of moral emotions, such as sympathy and guilt, is thought to require a certain degree of self-regulation. Specifically, it has been argued that intense, negative emotions in moral conflict situations (e.g., anger after harming another) lead to personal distress and sympathy is more likely to occur if children are able to regulate such vicariously induced negative emotions (see Eisenberg, 2000b).

In support of this argument, personal distress stemming from evocative, empathy-inducing stimuli has been linked to higher levels of physiological arousal (i.e., galvanic skin response) than sympathy stemming from evocative stimuli (see Eisenberg et al., in press). Thus, the regulation afforded by inhibitory control may facilitate sympathetic responding in children. Likewise, children with high levels of inhibitory control may possess the regulatory capacity to curb over-arousal, reflect upon the wrongfulness of their transgressions, and feel guilt, although further empirical investigation into this relation is necessary. However, it is important to note that the relation between inhibitory control and both caregiver- and child-reported guilt was significant for 4-year-olds, but not 8-year-olds. Inhibitory control may play a more crucial role in promoting feelings of guilt after transgression for younger, as opposed to older, children – a trend that has been documented with other facets of child temperament and social behavior (see Bates, 2012). Despite inhibitory control remaining relatively stable from early to middle childhood, the role of inhibitory control in predisposing children to guilt may become less drastic with age as other, more immediate, factors become established. For example, socialization practices become increasingly internalized (Hoffman, 2000) and peer influences become paramount with the advent of middle childhood (Killen & Rutland, 2011). Both of these factors have been associated with increases in moral emotions (Gasser & Malti, 2012) and may assume the role of inhibitory control in promoting guilt as children develop.

Nonetheless, the positive relation between inhibitory control and sympathy was similar for both 4- and 8-year-olds. In relation to guilt, markers of empathy and sympathy develop earlier in life. Infants as young as 14 months (and in some cases as young as 8 months) react to the distress of others with resonant negative affect (i.e., empathy) and show concern for victims of transgression (i.e., sympathy; Davidov, Zahn-Waxler, Roth-Hanania, & Knafo, 2013; Roth-

Hanania, Davidov, & Zahn-Waxler, 2011). Early markers of guilt, however, seem to emerge relatively later around the second year of life (e.g., Kochanska et al., 1994; see Malti, Dys, & Zuffianò, in press) after the requisite empathy/sympathy has developed (see Hoffman, 2000). It is possible that sympathy, as a result of this developmental precedence, may be more intimately tied to genetically rooted levels of inhibitory control. If so, this early coupling may contribute to a relatively stable relationship between inhibitory control and sympathy across development. Indeed, positive relations between effortful control and sympathy have been well documented in diverse samples ranging from preschool to adolescence (for a review, see Eisenberg, Smith, & Spinrad, 2011).

Importantly, both sympathy and guilt (caregiver-reported) were associated with high levels of reparation in our mediation model. These results extend previous findings linking sympathy and prosocial behavior (see Eisenberg et al., 2014) to include the prosocial subtype of reparation. They also lend further support to the notion that sympathy is an important motivator of prosocial action (Eisenberg, 2000a; Hoffman, 2000). According to Hoffman (2000), sympathy (i.e., concern for others) often elicits prosocial behavior as a way to ease the other's distress. Triggered by sympathetic concern, reparative acts may serve to alleviate distress in others and thereby repair transgressions. Our results also support the notion that guilt promotes the desire to amend or repair situations in which a moral norm or rule has been violated (e.g., Kochanska et al., 1995; Malti & Latzko, 2012; Olthof et al., 2000) and extend existing empirical evidence linking guilt and reparation in early childhood (Kochanska et al., 1995) to include middle childhood. Thus, reparation may stem from both other-oriented feelings of sympathy and self-focused feelings of guilt following transgression.

Overall, our findings suggest that high levels of inhibitory control are associated with an increased likelihood of moral emotions and, consequently, an increased likelihood of reparation (although the mediated relationship from inhibitory control to reparation through caregiver-reported guilt was significant for 4-year-olds only). In line with Eisenberg's (2005) theorizing linking inhibitory control to prosocial behavior, inhibiting a dominant, maladaptive response to vicariously induced negative emotions (e.g., personal distress/avoidance) may result in children activating a subdominant, adaptive response that involves moral emotional responding (e.g., sympathy/guilt) and associated moral action (e.g., reparation). Substituting caregiver-reported guilt with child-reported guilt, we partially replicated our caregiver-reported moderated mediation model with the exception of relating child-reported guilt to reparation (see Figure 1b). This discrepancy may be attributed to the measure we used to assess reparation. Our reparation measure was designed to tap into stable, reparative tendencies over time (e.g., "My child is not particularly likely to offer to clean up if s/he has caused a mess"). Our child-reported guilt measure, however, was situationally based and context dependent (i.e., children's anticipated guilt feelings in real time regarding the context of intentional harm; see Malti & Ongley, 2014). While it is likely that inhibitory control, a relatively stable component of temperament, plays at least some role in situational feelings of guilt, such specific, context-dependent guilt feelings may not be strongly related to broadband tendencies of reparation. Future studies should consider matching our context-specific guilt measure with a more situation-based assessment of reparation in order to increase the consonance between guilt and reparation assessments.

Our findings also contributed to our understanding of developmental differences in reparation, inhibitory control, sympathy, and guilt, respectively. Eight-year-olds were rated higher on reparative behavior than 4-year-olds. This finding suggests that, like other prosocial

behaviors (see Eisenberg & Fabes, 1998), reparation increases from early to middle childhood, possibly as a function of internalized norms developing sharply in this developmental period (Hoffman, 2000). As internalization takes place, children's self-identified readiness to maintain moral order may prompt them to engage in reparative acts after transgression. In line with previous studies, no age differences in inhibitory control were reported (Eisenberg, 2005; Valiente et al., 2006). This finding supports the notion that inhibitory control is itself a relatively stable facet of child temperament (see Rothbart & Bates, 2006). Finally, consistent with past research (see Eisenberg, Spinrad, & Morris, 2014; Malti, Eisenberg, Kim, & Buchmann, 2013), 8-year-olds were rated as more sympathetic and guilty than 4-year-olds. These differences may be attributed to increases in self- and other-oriented cognitive coordination from early to middle childhood (Hoffman, 2000).

The present study was limited by its cross sectional design, which did not allow for temporal inferences to be made about relations between study variables. In light of this limitation, we assessed the suitability of our hypothesized mediation model in relation to alternative models. Indeed, three out of four alternative models showed less support than the hypothesized model. Specifically, removing inhibitory control from its primary position significantly reduced model fit. This supported our emphasis on inhibitory control as a primary predictor of later moral emotions and reparative behavior. However, an alternative model (i.e., AM 1) in which inhibitory control was positively related to reparative behavior and reparative behavior was positively related to moral emotions was of comparable fit to our hypothesized model. Together with our hypothesized model, this alternative model may indicate a recursive relationship between moral emotions and reparative behavior. Specifically, reparative behavior may foster moral emotions in the same way that moral emotions may foster reparative behavior,

although longitudinal studies are needed to corroborate these potential bidirectional relations. Finally, the primary caregivers in our study were predominantly middle to high SES (i.e., well-educated university graduates). We urge future studies to test the replicability of our findings with children from low-income families and samples representing a broad range of socio-economic strata.

Despite its limitations, this study documented associations of inhibitory control to reparation through moral emotions in early and middle childhood. The present findings may be of particular interest to practitioners designing intervention programs aimed at promoting prosocial behavior in children. Since moral emotions appear to be more malleable than inhibitory control, they may be manipulated through appropriate educational strategies and their enhancement may help less regulated children behave prosocially.

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Table 1

*Means and Standard Deviations for Study and Control Variables*

Variable	Overall ( $N = 162$ )	4-year-olds ( $n = 81$ )	8-year-olds ( $n = 81$ )
	$M (SD)$	$M (SD)$	$M (SD)$
Reparative behavior	4.83 (.96)	4.66 (.86)	5.01 (1.02)
Inhibitory control	4.84 (1.13)	4.90 (1.12)	4.78 (1.14)
Sympathy	4.68 (.83)	4.55 (.80)	4.81 (.84)
Caregiver-reported guilt	4.70 (.83)	4.53 (.88)	4.86 (.76)
Child-reported guilt	1.29 (1.02)	1.15 (1.03)	1.41 (.99)

Table 2

*Correlation Matrix of Study and Control Variables*

Variable	1	2	3	4	5	6	7
1. Reparative behavior	—						
2. Inhibitory control	.25**	—					
3. Sympathy	.58***	.22**	—				
4. Caregiver-reported guilt	.57***	.14	.49***	—			
5. Child-reported guilt	.06	.17*	.11	.14	—		
6. Child age	.21**	-.01	.14	.21**	.15	—	
7. Child gender	-.08	-.19*	-.13	.10	-.07	-.01	—

*Note.* Child gender was dummy coded (girls = 0, boys = 1). Child age was measured in years up until interview date. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

Table 3

*Alternative Models' (AM) Fit*

AM	$\chi^2$ (df)	<i>p</i>	CFI	RMSEA (90%CI)	SRMR	AIC	$\Delta$ AIC
Caregiver-reported guilt							
AM 1	1.83 (2)	.40	1.00	.01 (.00 – .15)	.01	1064.65	1.29
AM 2	104.53 (2)	<.001	.60	.57 (.48 – .66)	.12	1147.77	84.41
AM 3	14.89 (4)	<.01	.80	.13 (.06 – .21)	.06	1603.33	539.97
AM 4	3.43 (1)	.06	.98	.12 (.00 – .27)	.02	1151.53	88.17
Child-reported guilt							
AM 1	1.83 (2)	.40	1.00	.00 (.00 – .15)	.01	1219.12	-0.26
AM 2	104.82 (2)	<.001	.44	.57 (.48 – .66)	.12	1269.86	50.48
AM 3	8.62 (4)	.07	.94	.09 (.00 – .16)	.05	1719.91	500.53
AM 4	4.74 (1)	.03	.95	.15 (.04 – .30)	.03	1274.66	55.28

*Note.* AM = Alternative Model; df = Degrees of Freedom; CFI = Comparative Fit Index; RMSEA = Root-Mean-Square-Error-of-Approximation; SRMR = Root-Mean-Square-Residuals-Standardized; AIC = Akaike Information Criterion.  $\Delta$  AIC was computed by subtracting the AIC value of the hypothesized model from the AIC value of the alternative model.

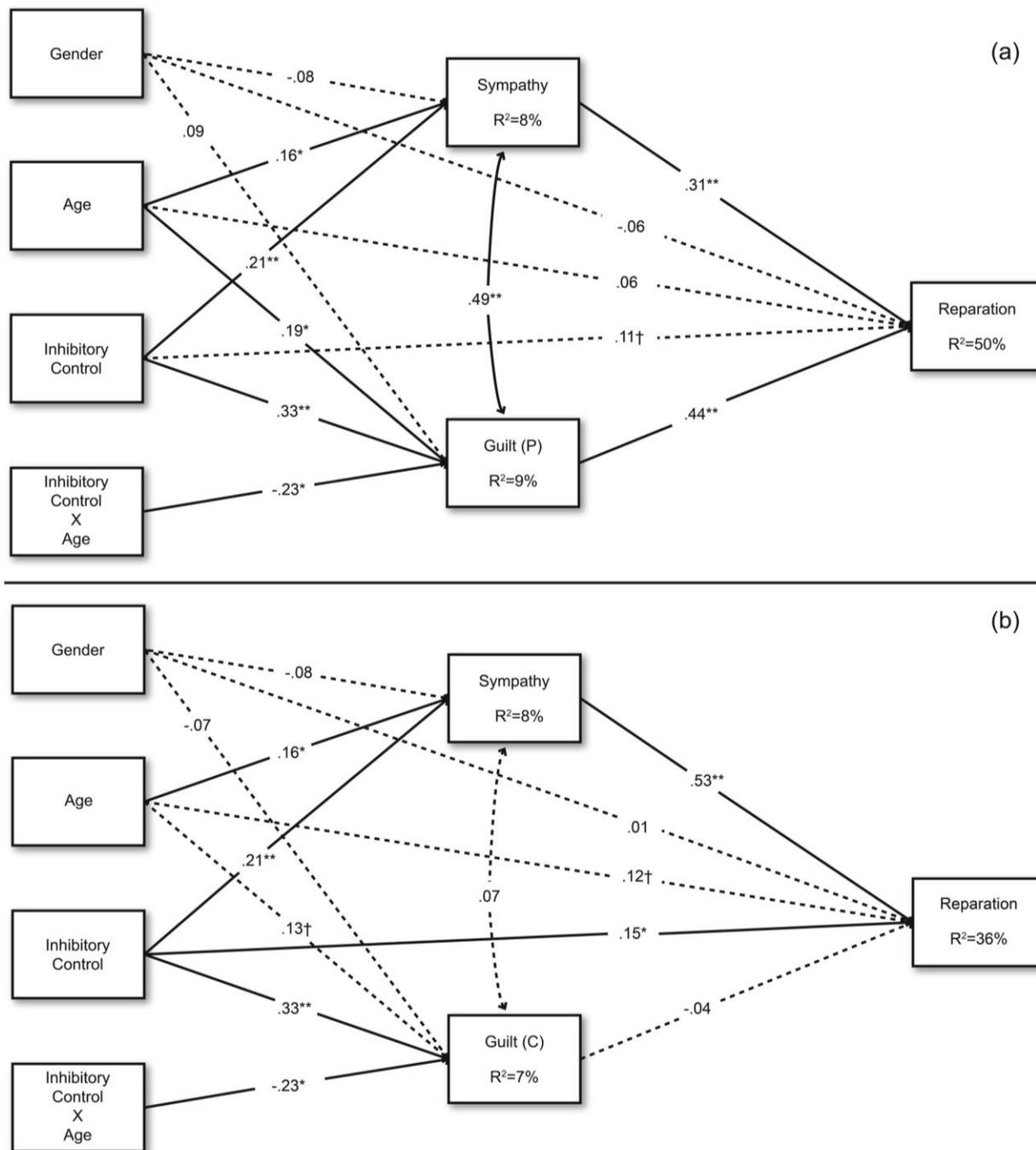


Figure 1. Mediation models.

Note. Model 1 (a): Mediation model with primary caregiver-reported guilt (P). Model 2 (b): Mediation model with child-reported guilt (C). Standardized coefficients were reported. For simplicity, correlations among exogenous variables were estimated but not depicted. Dotted lines are non-significant paths ( $p > .05$ ). †  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$ .