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It's a two-way street: Automatic and controlled processes in children's emotional responses to moral transgressions

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A B S T R A C T

This study examined children's automatic, spontaneous emotional reactions to everyday moral transgressions and their relations with self-reported emotions, which are more complex and infused with controlled cognition. We presented children ($N = 242$ 4–, 8–, and 12-year-olds) with six everyday moral transgression scenarios in an experimental setting, and both their spontaneous facial emotional reactions and self-reported emotions in the role of the transgressor were recorded. We found that across age self-reported guilt was positively associated with spontaneous fear, and self-reported anger was positively related to spontaneous sadness. In addition, we found a developmental increase in spontaneous sadness and decrease in spontaneous happiness. These results support the importance of automatic *and* controlled processes in evoking children's emotional responses to everyday moral transgressions. We conclude by providing potential explanations for how automatic and controlled processes function in children's everyday moral experiences and how these processes may change with age.

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Introduction

Children's emotional responses to moral transgressions are multifaceted and emerge from dynamic interactions between affective and cognitive mechanisms (Malti & Ongley, 2014). But, to what extent

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are these emotional responses driven by automatic versus controlled processes? And how do automatic and controlled emotional processes develop with age? Previous studies on the development of emotional responses to moral transgressions have mostly relied on self-reported measures, providing rich information on the development of children's *controlled* emotional responses to moral transgressions and their experiential dimension. However, less is known about the kinds of *automatic* emotional reactions (e.g., spontaneous happiness or fear) children experience in response to moral transgressions, which are often beyond one's awareness and/or deliberate control (Frijda, 1993). Here, we aimed to address these questions by examining children's automatic, spontaneous emotional reactions and self-reported emotions, which are more infused with controlled processes, to hypothetical everyday moral transgressions in an experimental setting using a sample of 4-, 8-, and 12-year-olds. Addressing this question is important because it may gauge the relative impact of the infusion of controlled mechanisms (e.g., moral reasoning, theory of mind, emotion recognition) in children's situational emotions in response to moral transgressions. Moreover, examining this question from a cross-sectional perspective may shed light on whether there is a developmental time window during which these controlled mechanisms exert their strongest influence on these emotions. We also sought to examine spontaneous and self-reported emotions across three morally relevant contexts: antisocial behavior, prosocial omission, and social exclusion.

Two forms of emotion

First, we observed spontaneous emotional reactions, also known as microexpressions, which are automatic emotional reactions that last a fraction of a second and can be observed in one's facial expressions (Ekman, 1992). Spontaneous emotional reactions are considered brief expressions of common emotions, which temporally precede intentional thought and depend only on automatic information processing mechanisms for their activation (Ekman, 1977). As such, they are affective in nature but also reflective of automatic cognition. Studies examining these spontaneous emotional reactions have supported the view that these brief reactions are automatic and beyond deliberate control (Dimberg, Thunberg, & Grunedal, 2002; Porter & ten Brinke, 2008). More specifically, the reactions appear in the absence of instruction despite instructions to inhibit such reactions and despite attempts to mask such reactions with other facial expressions (Dimberg, 1997; Dimberg et al., 2002). Here, we note that these spontaneous emotional reactions are distinct from macroexpressions, which typically last for a few seconds and are not necessarily reflective of automatic processing. Second, we assessed self-reported emotional responses to moral transgressions, which are generally more cognitively infused and controlled but are not necessarily a pure measure of controlled processes (Malti & Ongley, 2014; Scherer, 2009).

Next, to examine the roles of automatic and controlled emotional responses to moral transgressions, we explored whether automatic reactions were associated with self-reported emotions and, if so, whether there were specific kinds of self-reported emotions that showed stronger associations with spontaneous expressions. Strong relations between the two forms of emotion would suggest the dominance of automaticity because controlled processes would be associated with little or no change in emotional response. Conversely, no relations or only weak relations would suggest the centrality of controlled processes because controlled processes would be associated with substantial change in emotional response.

Given previous related work (e.g., Kochanska, Gross, Lin, & Nichols, 2002) linking dispositional fearfulness and observed guilt, we expected a relation between spontaneous fear and self-reported guilt. Our study offered to extend these findings by linking a more proximal, spontaneous fear response to self-reported moral guilt. We expected self-reported anger and sadness to be related to both spontaneous anger and sadness because events may elicit either emotion dependent on which elements children attend to (Levine, 1995). We also expected children's spontaneous expressions of happiness to be related to their self-reported happiness.

Lastly, we sought to examine age-related differences in spontaneous and self-reported emotions. We chose to study 4- and 8-year-olds because the period from early and middle childhood has revealed important changes in children's self-reported emotions in response to moral transgressions. Specifically, research has shown that 4-year-olds report more happiness in response to everyday

moral transgressions such as stealing a chocolate bar from a peer, whereas 8-year-olds report more guilt and sadness (for a review, see Arsenio, 2014). We extended this age range to early adolescence by including a group of 12-year-olds in order to investigate whether further changes in kinds of self-reported emotions occur as well as whether and how emotional facial expressions to everyday moral transgressions change from middle childhood to early adolescence. In line with previous work on children's emotions (Arsenio, 2014; Krettenauer, Malti, & Sokol, 2008), we expected a developmental decrease in self-reported happiness. By contrast, we expected a developmental increase in children's guilt because their understanding of this emotion is believed to emerge at around 6 to 8 years of age (Harris, 1989; Malti, 2016). We expected that children's reports of sadness may show a pattern somewhat opposite to guilt because sadness has been interpreted as a precursor or early form of guilt (Malti & Ongley, 2014), meaning that some younger children's reports of sadness may parallel feelings of guilt at later ages. Given the relative scarcity of research on the development of moral anger (see Malti & Ongley, 2014), we left our hypotheses about age-related changes in anger open-ended.

We investigated children's spontaneous and self-reported emotions in response to everyday moral dilemmas, including behaving antisocially, not helping, and socially excluding a peer. Developmental researchers have argued that it is important to use everyday situations involving morality in order to understand how we function in and resolve our own interpersonal, morally relevant conflicts (Gutzwiller-Helfenfinger, Gasser, & Malti, 2010). Based on the previous literature, we expected contextual differences in the anticipation of moral emotions. Specifically, we expected children to anticipate more moral emotions in contexts of antisocial behavior because these are judged as more severe by children than omitting prosocial duties or excluding a peer (Malti, Gummerum, Keller, & Buchmann, 2009; Malti & Ongley, 2014). We left our hypotheses about contextual effects on spontaneous emotions open-ended given the novelty of this approach in this line of research.

The current study

In summary, we investigated automatic and controlled processes in children's emotional responses to moral transgressions via their automatic, spontaneous emotional facial expressions and self-reported emotions. We examined whether and how these emotional responses change with age.

We focused on a developmental period that has shown changes in self-reported emotions and extended this focus by exploring whether and how automatic, spontaneous facial expressions change in a similar way. Based on previous work (see Arsenio, 2014), we expected self-reported emotions of happiness to decrease and self-reported guilt to increase. We also expected that with age spontaneous happiness would decrease, whereas fear and sadness would increase. Second, we investigated how spontaneous emotional reactions were related to children's self-reported emotions. We hypothesized that spontaneous fear and self-reported guilt would be related, as would spontaneous and self-reported happiness.

We studied these questions in the context of everyday moral dilemmas to understand how children typically function in familiar, morally relevant conflict situations (Blasi, 2005). We examined three types of contexts: acts of antisocial behavior (e.g., stealing, pushing), omissions of a prosocial duty (e.g., not sharing, not helping), and social exclusion (e.g., excluding a new child, leaving a child out of a game).

We controlled for child gender and parental education in our statistical analyses because previous studies have shown these variables to be related to children's self-reported emotional responses to moral transgressions (Malti et al., 2009).

Method

Participants

In total, 75 4-year-olds (M_{age} = 4.60 years, SD = 0.47; 35 girls [47%]), 94 8-year-olds (M_{age} = 8.38 years, SD = 0.33; 50 girls [53%]), and 73 12-year-olds (M_{age} = 12.54 years, SD = 0.38; 37 girls [51%]) from a major city in Canada participated in our study (N = 242). Our sample was ethnically diverse, with primary caregivers reporting backgrounds from Western Europe (31%), Eastern Europe (13%), South Asia (11%), East Asia (6%), the Caribbean (5%), West and Central Asia (3%), Central and South

America (3%), Africa (2%), and other/multiple origins (23%) (3% of the primary caregivers chose not to report their ethnic background). Regarding parental education, most primary caregivers reported completing an undergraduate university degree (55%), whereas the remainder reported completing a college degree (20%), graduate degree (15%), or high school diploma (8%) (2% of caregivers did not report their level of education). In comparison with recent census data, the level of education of the participants in our sample is representative of the city from which our sample was drawn (Statistics Canada, 2012).

Measures

Self-reported emotions following moral transgressions

Children's self-reported emotions following moral transgressions were measured using vignettes that have been previously validated in developmental studies of moral emotions (Malti et al., 2009). Children were read six stories. Four stories depicted one of two traditional types of moral transgressions: behaving antisocially (e.g., stealing, hitting) or omitting a prosocial duty (e.g., not sharing, not helping). In addition to these scenarios, we added two stories about socially excluding a peer which have been used extensively in the literature (e.g., Malti and Ongley, 2014): excluding a new child from a group during lunch and excluding an outgroup member from playing a computer game. All story characters were matched to participants' gender and age. Each story was accompanied by two hand-drawn images displayed on a tablet computer placed directly in front of children. Because children were instructed to observe these images, they seldom looked at the interviewer during the story. Still, the interviewer was thoroughly trained to maintain a neutral expression throughout the task so as not to bias children's reactions. One sample story, depicting an antisocial act, went as follows: "Marc brought a chocolate bar to school. He shows the chocolate to James and puts it back in his jacket. James really likes chocolate, so when nobody is watching he takes the chocolate bar from Marc's jacket and eats it." In line with previous studies, children were then asked how they would feel if they had done what the transgressor did. Children's verbal responses were recorded by the tester. Whenever children answered "I don't know," their responses were probed by the interviewer. Although up to two emotions were recorded for each child, secondary emotions were provided in only 12% of stories and were at times coded under the same category (e.g., sad and bad). Consequently, and in line with previous research, only first-reported emotions were further analyzed in the current study (Malti et al., 2009).

Coding. Children's responses were coded using a validated coding system (Malti et al., 2009), which included the following categories: neutral; sad or bad; angry; guilty; ashamed or embarrassed; disgusted; fearful, anxious, or worried; other negative emotions; happy, good, or proud; other positive emotions; and undifferentiated responses. Two independent blind raters coded a random subsample (15% of the data) of self-reported emotions, Cohen's $\kappa = .99$. Initial disagreements were further discussed until a consensus was reached. Preliminary analyses revealed that shame, fear, disgust, neutral, and other responses were uncommon (each < 3%). Thus, only reports of happiness, anger, sadness, and guilt were analyzed.

Emotional facial expressions following moral transgressions

Children's interviews were video-recorded and analyzed using Noldus's FaceReader 4. This software, which was trained using the Facial Action Coding System (see Ekman, Friesen, & Hager, 2002), calibrates a three-dimensional model of 491 critical points on the face and neck. Next, the software uses its neural network to score the match between the observed expression and five common emotions that can be coded reliably (happiness, sadness, anger, fear, and disgust) as well as a neutral expression. The software scores each emotion individually and outputs a continuous score ranging between 0 (absence of the emotion) and 1 (full intensity of the emotion). The program has performed well on tests of validity, correctly classifying approximately 90% of validated facial expressions (Bijlstra & Dotsch, 2011). Next, a critical time interval needed to be established for the analysis of emotional facial expressions. We chose an interval of 1/10th of a second starting from the moment the experimenter finished asking children how they would feel if they had behaved like the moral transgressor because it best reflected children's automatic emotions toward themselves as transgres-

sors. Children's earlier spontaneous emotional reactions could have reflected their reactions to alternate perspectives such as those of the victim or a bystander, whereas later expressions could have been reflective of longer-lasting macroexpressions, which are more controlled emotions (Ekman, 1992). Moreover, given that microexpressions are believed to last between 1/25th and 1/5th of a second (Ekman, 1992), the length of the interval was sufficient.

Procedure

We obtained ethics approval from our institution's research ethics board. We then conducted a pilot study with 11 children to ensure the appropriateness of all measures with our age groups. In line with previous findings (Malti et al., 2009), the pilot testing demonstrated that all children understood that it was wrong to violate moral rules and that transgressions have negative consequences for their victims. For these reasons, children's understanding of the consequences for the respective victims was not further tested.

Children and their caregivers visited the research laboratory, where caregivers provided written informed consent for their children's participation in the study and children provided verbal assent. Children were read the transgression stories and interviewed about them. Interviews were recorded using two cameras, one of which was positioned directly in front of children to allow for accurate facial expression analyses. All testers were undergraduate psychology students who had been thoroughly trained in developmental interview techniques, emotion recognition technology, and coding. Testers received regular follow-up training sessions to ensure that they applied correct developmental interview techniques effectively and regularly.

Handling of missing data and data analysis approach

In total, 4796 emotional facial expressions were generated, translating to a missing data rate of 31%. We experienced this degree of missing data primarily due to artifacts (i.e., blurred frames) that occurred as a result of movement. As such, we assumed our central missingness mechanism to be missing at random (MAR; see Little, 2013). Here, we emphasize that the mechanism underlying missingness is far more important than the rate of missingness (Enders, 2010). Given our strong reasons for assuming a MAR mechanism and variables related to the patterns of missingness (e.g., age, gender, parental education, adjacent emotion scores), we could soundly handle our missing data, which we did using the Multiple Imputation by Chained Equations (MICE) package in the statistical software R. The process involves replacing missing values with plausible estimates of what those values would have been had they been observed using other available variables in the dataset (Little, 2013). We generated 40 multiply imputed datasets using variables related to the patterns of missingness in order to satisfy the recommendation that the number of imputations exceed the percentage of missing data (31%; White, Royston, & Wood, 2011). To reduce noise variance in the imputation process, we collapsed variable scores within each context (i.e., antisocial behavior, prosocial omission, and social exclusion) prior to imputing (Little, 2013). Final statistics for emotional facial expressions were conducted using averaged results from all 40 imputed datasets.

Data analysis proceeded in two steps. First, to test age-related differences in self-reported and spontaneous emotional reactions, we ran analyses of variance (ANOVAs) with each emotion score as the dependent variable, age group as the independent variable, and gender and socioeconomic status (SES, as indicated by the proxy parental education) as control variables (see Ongley & Malti, 2014). Second, we used multiple regressions to test whether there were any associations between longer-lasting self-reported emotions (dependent variables) and brief, spontaneous emotional reactions (independent variables).

Results

Self-reported emotions following moral transgressions

Children most often reported feelings of sadness, happiness, anger, and guilt (see Table 1). To test developmental differences in self-reported emotions, a series of ANOVAs was conducted (see Table 2).

In line with previous research (Malti, 2016; Malti et al., 2009), analyses of age differences in reports of guilt revealed significant differences, $F(2, 231) = 26.38$, $p < .001$. For follow-up analyses of developmental differences, we employed the LSD (least significant difference) procedure because it is the most appropriate one for multiple comparison tests involving three means (Carmer & Swanson, 1973). Follow-up tests showed that 4-year-olds reported less guilt than 12-year-olds (Cohen's $d = .95$), and 8-year-olds reported less guilt than 12-year-olds (Cohen's $d = .85$, $ps < .001$). We also found developmental effects for sadness, $F(2, 231) = 11.58$, $p < .001$. Post hoc tests revealed that 4- and 8-year-olds reported higher levels of sadness than 12-year-olds (Cohen's $ds = .77$ and $.66$, respectively, $ps < .001$). We found developmental differences for happiness, $F(2, 231) = 13.60$, $p < .001$. Follow-up tests demonstrated that 4-year-olds reported more happiness than 8-year-olds (Cohen's $d = .59$), and they also reported more happiness than 12-year-olds (Cohen's $d = .74$, $ps < .001$). Analyses revealed no developmental differences in self-reported anger.

Next, using a mixed ANOVA, we analyzed the effect of context (within-participants factor) and age (between-participants factor) on each self-reported emotion (i.e., sadness, happiness, anger, and guilt). Guilt produced significant contextual differences, $F(2, 448) = 4.62$, $p < .05$, with a main effect of age group, $F(2, 224) = 25.88$, $p < .001$. Post hoc LSD t-tests revealed that children reported more guilt in harm contexts as compared with social exclusion (Cohen's $d = .58$, $p < .001$) and prosocial omission (Cohen's $d = .74$, $p < .001$). However, the main effect of context was qualified by a significant two-way interaction of age by context, $F(4, 448) = 5.88$, $p < .001$. Bonferroni-corrected multiple comparisons revealed that 12-year-olds reported more guilt than 4- and 8-year-olds in harm contexts ($ps < .01$) and prosocial omission contexts ($ps < .05$). Furthermore, 8-year-olds reported more guilt in harm contexts compared with exclusion contexts ($p < .05$), whereas 12-year-olds reported more guilt in harm contexts than in exclusion contexts ($p < .01$) and prosocial omission contexts ($ps < .05$). No other emotions showed contextual differences.

Emotional facial expressions following moral transgressions

As expected, children mostly showed facial expressions of sadness in response to the vignettes, although happiness, anger, and fear were also common (Table 1). Disgust was uncommon (1%); therefore, it was omitted from further analyses. Next, a series of ANOVAs was conducted on each emotional facial expression (i.e., sadness, happiness, anger, and fear) to test for developmental differences while controlling for gender. Between-participants ANOVAs revealed significant age effects for sadness, $F(2, 237) = 5.42$, $p < .01$, and happiness, $F(2, 237) = 6.10$, $p < .01$. Further analyses, using an LSD post hoc test, revealed that 4-year-olds showed less sadness than 8-year-olds (Cohen's $d = .42$, $p < .01$), and they also showed less sadness than 12-year-olds (Cohen's $d = .50$, $p < .01$). Post hoc LSD t-tests revealed differences in happiness between 4- and 12-year-olds, with 4-year-olds showing more happiness than 12-year-olds (Cohen's $d = .60$, $p < .001$) and 8-year-olds showing more happiness than 12-year-olds

Table 1
Means and standard deviations for self-reported and spontaneous emotions by age.

	4-year-olds ($n = 75$)		8-year-olds ($n = 94$)		12-year-olds ($n = 73$)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Self-reported emotions						
Happiness	0.20	0.28	0.07	0.16	0.04	0.12
Anger	0.13	0.22	0.11	0.15	0.14	0.19
Sadness	0.58	0.33	0.54	0.31	0.34	0.29
Guilt	0.01	0.10	0.04	0.09	0.17	0.22
Spontaneous emotional reactions						
Happiness	0.05	0.07	0.05	0.09	0.01	0.07
Anger	0.03	0.04	0.05	0.08	0.05	0.09
Sadness	0.12	0.13	0.19	0.20	0.20	0.18
Fear	0.02	0.06	0.04	0.07	0.06	0.15

Table 2
Correlations matrix of study and demographic variables.

Variable	1	2	3	4	5	6	7	8	9	10
1. SR Happiness	–									
2. SR Anger	−.18[**]	–								
3. SR Sadness	−.28[***]	−.34[***]	–							
4. SR Guilt	−.18[**]	−.11	−.35[***]	–						
5. SP Sadness	−.08	.14[*]	−.12	−.02	–					
6. SP Happiness	−.04	.08	.14[*]	−.11	−.13	–				
7. SP Anger	−.03	−.01	−.06	−.07	.03	.01	–			
8. SP Fear	−.09	−.01	.03	.20[**]	.07	.08	−.07	–		
9. Gender	.01	−.02	.02	−.09	.18[**]	−.09	−.00	−.06	–	
10. Age	−.29[***]	.00	−.28[***]	.40[***]	.19[**]	−.21[***]	.12	.12	−.03	–

Note. SR = self-reported; SP = spontaneous. Gender: 1 = girls, 2 = boys.
  [*] $p \leqslant .05$.
  [**] $p \leqslant .01$.
  [***] $p \leqslant .001$.

(Cohen's d = .47, $p < .01$). Finally, mixed ANOVAs for contextual differences in emotional facial expressions showed no significant effects.

Associations between spontaneous and self-reported emotional responses

To test our research question on the relations between spontaneous and self-reported emotional responses to moral transgressions, we ran hierarchical linear regression models with each of the self-reported emotions as the dependent variable and spontaneous emotional reactions as the independent variables. We controlled for age, gender, and parental education in Step 1 of each model and inserted spontaneous emotional reactions as predictors in Step 2. Significant models emerged for two self-reported emotions: guilt and anger. For our guilt model, the first step was associated with our dependent variable, R^2 = .174, $F(3, 230)$ = 16.17, $p < .001$. In the second step, spontaneous fear was associated with self-reported guilt above and beyond the control variables, ΔR^2 = .026, $F(1, 229)$ = 7.48, $p < .01$. The first step of our anger model showed that control variables were not related to the dependent variable, R^2 = .00, $F(3, 230)$ = 0.29, *ns*. However, in the second step, spontaneous sadness was associated with self-reported anger, ΔR^2 = .023, $F(1, 229)$ = 5.46, $p < .05$. All tests of age- and gender-related interactions were insignificant.

Discussion

In this study, we took a first step toward better understanding the roles of automatic and controlled processes in children's emotional responses to everyday moral transgressions and their development. Specifically, we examined the development of children's automatic, spontaneous emotional facial expressions to moral transgressions, their *more* controlled, self-reported emotional responses, and the relations between the two. This latter approach allowed us to parse out the role of controlled cognitive processes from automatic affective processes.

This is an important question to consider because it may address the relative impact of controlled processes (e.g., moral reasoning, theory of mind) that are often assumed to be the prime influences over evaluations and responses to morally salient situations (e.g., Kohlberg & Candee, 1984). Moreover, by examining this question from a developmental perspective, we can understand whether controlled processes have a developmental window within which they exert greater influence or whether they exert a uniform impact across ages. This study is the first to directly examine automatic emotional reactions to morally salient situations as well as their relations to self-reported emotions. By providing data that can help to clarify previous inconsistencies in the empirical literature (which was limited by the absence of direct comparison between automated and controlled processes), the current study makes a novel contribution to a long-standing theoretical debate that might have

potential to generate new lines of work that move beyond hypotheses on unidirectional influence to dynamic, process-oriented models and levels of analysis.

Our findings revealed that children typically reported feelings of sadness, happiness, anger, or guilt in response to everyday moral transgressions, and they most frequently spontaneously expressed sadness, happiness, anger, and fear. Interestingly, we found age-related differences in both forms of emotional responses. Consistent with our hypotheses and previous works (for a review, see Arsenio, 2014), self-reported happiness decreased with age. Furthermore, self-reported sadness decreased while guilt increased with age. Extending previous research, this study is the first to show that there are developmental decreases in spontaneous happiness and increases in sadness. These changes may reflect children's internalizing of moral norms, perhaps as a result of previous conclusions that they reached through reflection. In other words, children's previous distal deliberate thoughts may become *encapsulated* in their future automatic reactions. This idea is in line with Darwin's (1872) *principle of serviceable associated habits,* which asserts that repeated associations between a purposeful voluntary act (in this case, perhaps reflecting on the emotional consequences for one's victim) and a state of mind (e.g., a feeling of sadness) may lead to a habit in the form of an automatic emotional reaction.

Our hypotheses regarding contextual effects were supported by our findings. In line with previous findings (e.g., Malti, Ongley, Dys, & Colasante, 2012), children reported more guilt in contexts of antisocial behavior compared with instances of prosocial omission or social exclusion, suggesting that children judge antisocial acts as more serious and/or morally relevant than failures to assist or include others. This is likely because children (a) tend to consider prosocial norms as more flexible than norms involving harm and fairness (Malti & Ongley, 2014) and (b) need to balance fairness considerations with concerns for group norms such as group identity in contexts of social exclusion (Killen, 2007; Malti et al., 2012). Moreover, we found an age by context interaction, demonstrating that children increasingly differentiate between these contexts with age. Our analyses of spontaneous emotions showed no contextual effects. This suggests that differentiating contexts may require controlled cognitive effort and that initial automatic appraisals might provide only very rough evaluations of social milieus (see Cunningham, Zelazo, Packer, & Van Bavel, 2007; Malti & Dys, 2015).

Consistent with our predictions, our multivariate analyses indicated that some self-reported emotions were predicted by spontaneous emotional reactions. Specifically, self-reported guilt was positively associated with spontaneous fear and negatively associated with spontaneous happiness. This further substantiates and extends previous work identifying a predictive association between fear proneness and guilt during infancy and early childhood (e.g., Kochanska et al., 2002) by demonstrating that fear responses also tend to be more proximately activated for children who report feelings of guilt (Malti, 2016). In conjunction with previous developmental findings (e.g., see Malti & Ongley, 2014), it appears that guilt may, in part, be promoted by sadness and fear on a macro time scale (i.e., over years) but be triggered only by fear on a micro scale (i.e., over fractions of a second). Over the course of years, feelings of sadness may serve to reflect deeply internalized other-oriented concerns by highlighting the emotional salience of a moral transgression situation (Malti, 2016; see Dunn, 2014), which may increasingly allow children to appreciate the consequences of the transgression on the victim and, in turn, promote guilt. In addition, because children realize that they have violated their moral code or parents' expectations for their social behavior, they may experience a spontaneous feeling of fear, which may reflect memories of previously received discipline (e.g., from caregivers) or concern over other social consequences such as being disliked by one's peers (Kagan, 1998). These experiences of fear may in turn activate scripts instilled by children's caregivers, prompting children to take ownership over their transgressions. In doing so, children connect themselves to the consequences of their actions, thereby inducing longer-lasting feelings of guilt (Hoffman, 2000). Future longitudinal research is warranted to substantiate our cross-sectional finding and investigate these speculative interpretations further.

The current study comes with a number of limitations. First, it is limited by its cross-sectional design, which prevents us from making any causal claims with confidence. Second, it is possible that children's self-reported emotions were subject to the influence of social desirability. However, previous studies that have employed this methodology and controlled for social desirability have replicated key findings (e.g., Krettenauer & Eichler, 2006). Third, our measurement of spontaneous emotional reactions is limited by the accuracy of the emotion recognition software. However, the program has

been extensively tested and validated and has shown greater accuracy at classifying emotions than human coders (van Kuilenburg, Wiering, & den Uyl, 2005). Fourth, although we interpreted relations between spontaneous facial expressions and self-reported emotions as reflecting the strength of automaticity in emotional responding, these relations may in part reflect differences in the methodological properties of these methods. Still, moderate relations should be expected in light of previous work finding small- and medium-sized correlations between these methods (e.g., Casey, 1993; Underwood & Bjornstad, 2001). Alternatively, our timing window might not have allowed some children sufficient time to take the perspective of the transgressor and might not have detected children's spontaneous reactions. As such, future studies using hypothetical vignettes may benefit from immediately presenting stories from a first-person perspective.

Nevertheless, the findings yield new insights into children's emotional responding to moral transgressions. Although children expressed and reported more negatively valenced emotional responses with age, it is interesting that the relations between the two forms of responses held constant across age, suggesting a structural consistency in the relations between these forms of emotions despite age-related differences in their frequency. In other words, this suggests a uniform influence of controlled processes on emotional responses between early childhood and early adolescence. As such, it suggests that interventions targeting the development of these controlled processes, such as moral reasoning, may exert their influence on moral emotion experiences very similarly across this developmental range.

However, only two of the four most commonly self-reported emotions (i.e., guilt and sadness) were associated with spontaneous emotional reactions to any extent. This is at odds with intuitionist theories of morality (e.g., Haidt, 2001), which consider automatic processes as dominant and typically unidirectional in their influence over self-reported emotions in the context of morality. Instead, our findings suggest a more balanced relationship between automatic and controlled processes underlying moral emotions. We posit that automatic processes function by initially processing the rudimentary characteristics of a moral transgression. If the transgression parallels one encountered previously, an individual's first appraisal of the transgression may activate spontaneous emotional reactions that serve to affectively highlight elements of the situation in a manner consistent with the individual's most deeply internalized concerns. Then, controlled processes may reevaluate and refine one's initial emotional response in light of additional cognitive insights (e.g., a theory of mind, a theory of agency, moral reasoning; Gummerum, Cribbett, Nogueira Nicolau, & Uren, 2013; Killen, Mulvey, Richardson, Jampol, & Woodward, 2011) and/or characteristics unique to the situation at hand. Over time, if refinements by controlled processes occur with consistency, they may become internalized and encapsulated in future automatic responses. Taken together, our results suggest that there may be emotion-specific patterns in how these processes interact, which may prove a fruitful investigation for future research and suggest that the relation between automatic and controlled processes in children's moral experiences is best described as a bidirectional two-way street.

Acknowledgments

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