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Regular Article

See the self through others' eyes: The development of moral emotions in young children with autism spectrum disorder

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Abstract

Despite the important social functions of moral emotions, they are understudied in the autism spectrum disorder (ASD) population. This three-wave longitudinal study is among the first to examine the development of moral emotions and their associations with theory of mind in 3- to 7-year-old children with ASD, using observational tasks. One hundred and forty-two children (52 with ASD) were followed over a period of 2 years. We found that while the expressions of shame and guilt remained stable in non-ASD children, they decreased with age in children with ASD. No group differences were found in the levels or the developmental trajectories of pride. Besides, better false-belief understanding was uniquely related to the expressions of pride in children with ASD. Our findings highlight the importance of enhancing understanding of moral emotion development and related factors in children with ASD.

Keywords: autism spectrum disorder; early childhood; longitudinal; moral emotions; theory of mind

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Moral emotions such as guilt, shame, and pride play an important role in regulating behaviors in accordance to moral standards and motivating prosocial actions. The experience and the anticipation of experiencing moral emotions inhibit moral transgressions and encourage socially appreciated deeds (Eisenberg, 2000; Tangney et al., 2007). Moral emotions are provoked when one evaluates oneself by social norms and judges oneself through other people's eyes (Leary, 2004; Tangney & Tracy, 2012). Children diagnosed with autism spectrum disorder (ASD) are known for their difficulties in reading others' minds (for reviews, see Baron-Cohen (2001) and Frith (2001)). Presumably, a lack of theory of mind (ToM) can compromise their awareness of how other people evaluate them and prevent them from experiencing moral emotions properly. To date, only a handful of studies have examined moral emotions in children with ASD, reporting lower levels of moral emotions as compared to non-ASD peers (Davidson et al., 2018; Heerey et al., 2003; Hobson et al. 2006). Albeit informative, these studies examined school-aged children and adolescents using cross-sectional design, and thus it remains unanswered whether a developmental gap already emerges at a younger age. Nor do we know how moral emotions develop in early childhood. Furthermore, it is barely explored whether the lower levels of moral emotions in children with ASD are related to their difficulties in ToM. To address the gap, this three-wave longitudinal study aimed to examine the developmental trajectories of moral emotions and the contributing role of ToM in 3- to 7-year-old children with ASD, as compared to non-ASD peers.

The nature and the development of moral emotions

A key feature that distinguishes moral emotions such as guilt, shame, and pride from basic emotions such as fear, anger, and happiness is that the former involve self-evaluation (Tracy & Robins, 2004). A child who breaks his mother's favorite vase will feel scared if he is concerned about the punishment. However, the child will feel ashamed or guilty if he ascribes the negative outcome to his personal attributes (I am clumsy) or his own action (I did a bad thing). Implementing self-evaluation is a complex cognitive process, which requires advanced cognitive abilities such as ToM. ToM is considered to play a key role in the evaluative process that provokes moral emotions (Harris, 2008; Lagattuta & Thompson, 2007; Lewis, 2000). As noted by Leary (2004), the self-evaluation that elicits moral emotions is not simply how people evaluate themselves, but often how they establish a self-evaluation based on others' view of them. If one thinks that others hold a positive view of himself, the person may feel proud; if one thinks that others have a negative view of himself, he usually feels guilty or ashamed (Muris & Meesters, 2014). Prior research using cross-sectional designs found that better ToM abilities were related to higher levels of moral emotions and more advanced moral understanding in children (Dunn et al., 2000; Gavazzi et al., 2011; Lagattuta & Thompson, 2007; Lane et al., 2010; Loureiro & Souza, 2013; Misailidi, 2018, 2020).

Given the complex nature of moral emotions, it is not surprising that unlike basic emotions which are already present in infancy, moral emotions emerge later in child development (Tracy &

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Robins, 2004). Children show the first manifestations of guilt, shame, and pride around the age of 2 (Izard et al., 1999; Lewis, 1995; Stipek, 1995). With a growing understanding that the self is separate from and constantly perceived by others, toddlers start to show distress when realizing they have misbehaved and show contentment when fulfilling a task (Emde et al., 1991; Izard et al., 1999; Kochanska et al., 2002). Throughout childhood, children's experience, recognition, and understanding of moral emotions increase with age. Studies comparing different age groups among toddlers, preschoolers, and school-aged children reported that older children show more regret at their transgressions and more concern for others than younger children (Bafunno & Camodeca, 2013; Kochanska et al., 1994; Zahn-Waxler & Robinson, 1995). While toddlers tend to attribute positive emotions to victimizers who achieved their goals by violating rules, children of age 6 and older usually attribute negative emotions such as shame and guilt to the victimizer, due to their increased concern about moral rules and enhanced ability to take others' perspectives (Arsenio et al., 2006; Krettenauer et al., 2013; Sokol & Chandler, 2003). Older children are also more able to recognize pride and more often attribute pride to situations where the self is responsible for the achievement (Graham & Weiner, 1991; Kornilaki & Chlouverakis, 2004; Tracy et al., 2005).

Moral emotions in children with ASD

One of the greatest challenges for people with ASD is to interpret others' thoughts and emotions (Baron-Cohen, 2001; Frith, 2001; however, see Gernsbacher & Yergeau (2019) for a critical review). Studies on moral cognition showed that although the basic understanding of social rules and moral principles is intact in people with ASD, their moral reasoning and judgment are affected by their impaired ToM abilities (for a review, see Grant et al., 2018). Children with ASD tend to make judgments based on the nature of the action (having or having not violated the rule) and have difficulties in processing and incorporating the mental information such as the motives of the agent (e.g., unintentional mistake versus intended offense) in their moral reasoning (Fadda et al., 2016; Garcia-Molina et al., 2019; Salvano-Pardieu et al., 2016; Weisberg & Leslie, 2012).

Moral emotions in children with ASD may also be affected by their struggles in ToM. However, to date, only a small body of literature has examined moral emotions in children with ASD, and even fewer have looked into the relation between ToM and moral emotions. Overall, studies reported lower levels of moral emotions – especially shame and guilt – in children with ASD. Children with ASD aged 7–15 reported themselves to experience less shame and guilt than non-ASD peers (Davidson et al., 2018; Novin et al., 2019). When describing their personal experience of shame and guilt, children with ASD aged 8–13 provided accounts that were less personalized and less contextually appropriate (Losh & Capps, 2006). Children with ASD aged 8–16 were less able to recognize expressions of shame or attribute shame to social events (Heerey et al., 2003; Kotroni et al., 2019). Among these studies, two have examined the relations between ToM and moral emotions. They found that ToM abilities were positively related to self-reported levels of guilt (Davidson et al., 2018) and to the recognition of shame and embarrassment in children with ASD (Heerey et al., 2003).

In keeping with the above-mentioned studies on children with ASD who did not have intellectual disabilities, lower levels of shame and guilt were also found in intellectually disabled children with ASD. Hobson et al. (2006) found that compared to non-ASD children and adolescents who had general learning disabilities, 6- to 19-year-old children and adolescents with ASD and with intellectual disabilities less often used personal examples when describing their experience of guilt, expressed less guilt in guilt-provoking situations, and were evaluated by their parents as displaying less shame and guilt (Hobson et al., 2006). Also comparing intellectually disabled children with and without ASD, Williams and Happé (2010) found no group difference when evaluating children's accounts of personal experience of guilt. However, it should be noted that the average evaluations on both groups were very low, indicating that all participants were poor in providing contextually appropriate descriptions of guilt.

Compared to shame and guilt, pride seems to be less affected by ASD. Most studies reported comparable levels of pride in children with and without ASD (Davidson et al., 2018; Hobson et al., 2006; Kotroni et al., 2019; Losh & Capps, 2006; Tracy et al., 2011; Williams & Happé, 2010). As pointed out by Hobson et al. (2006), while interpersonal engagement was quintessential for experiencing moral emotions such as shame and guilt, one can experience pride without having acute awareness of another person's attitudes. Possibly, to experience pride, children do not need to relate to others' feelings or thoughts to the same extent as required for experiencing shame and guilt.

The Present study

To the best of our knowledge, this longitudinal study is the first to examine the development of moral emotions in children with ASD. Our goal was twofold. First, we aimed to investigate the levels and developmental trajectories of moral emotions in children with ASD aged 3–7 years, in comparison to non-ASD peers. In particular, we evaluated the expressions of positive (pride) and negative moral emotions (shame and guilt) in young children by observing their reactions in emotion-provoking situations. Based on previous findings on older children and adolescents, we expected children with ASD to display less shame and guilt, whereas they might not differ from non-ASD peers in their expressions of pride. We expected the expressions of moral emotions to increase with age in the non-ASD group (Bafunno & Camodeca, 2013; Kochanska et al., 1994; Kornilaki & Chlouverakis, 2004; Tracy et al., 2005; Zahn-Waxler & Robinson, 1995). Since we were not aware of any research that examined the age effect in children with ASD, we did not make directional hypotheses regarding their developmental trajectories.

Second, we investigated whether children's ToM abilities contributed to the prediction of moral emotion development. Although the literature has long been emphasizing the important role of ToM in moral emotions (Leary, 2004; Lewis, 2000), this view is argued mainly from a theoretical perspective and supported by empirical evidence from correlational studies (Beer et al., 2003; Davidson et al., 2018; Heerey et al., 2003; Misailidi, 2018, 2020; Treeby et al., 2016). To the best of our knowledge, the relation between ToM and moral emotions has not been examined longitudinally, and it is rarely investigated in the ASD population. Because people's mental states include both thoughts and emotions, we checked two ToM abilities: children's understanding of false beliefs and their understanding of other people's emotions. We expected that higher average levels of the ToM abilities (false-belief and emotion understanding) across time, and larger increases in the ToM abilities over time, would contribute to higher levels of moral emotions in children. Additionally, we explored

whether the relations between ToM abilities and moral emotions were moderated by having the diagnosis of ASD. Due to lack of empirical evidence, we did not make hypothesis regarding different moral emotions or the moderating effect.

Method

Participants and procedure

This study was part of a larger-scaled longitudinal research project on the social and emotional development of preschool children with limited access to a social learning environment, including children with hearing loss (Ketelaar et al., 2012), with developmental language disorder (Rieffe & Wiefferink, 2017), and with ASD (Broekhof et al., 2015; Li et al., 2020).

The total sample of the larger-scaled research project included 73 children with ASD (65 boys) and 418 non-ASD children (226 boys) from the Netherlands. However, due to the time limit, not all children were administered the full battery of tasks. Participants of the larger research project were included in this study if they had data of measures on at least one time point (see Table 2 for available data at each time point). The final sample used in the current study included 52 children with ASD (6 girls; aged 33–85 months at Time 1) and 90 non-ASD children (13 girls; aged 34–88 months at Time 1). See Supplementary Table 1 for our sample size justification.

Children with ASD were recruited via a specialized institution for diagnosis and treatment of ASD, Center for Autism, Leiden, The Netherlands. Non-ASD children were recruited from daycare centers and mainstream primary schools in the same region. Inclusion criteria for the ASD group were (a) the child received an ASD diagnosis according to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., *DSM-IV-TR*; American Psychiatric Association, 2000) based on the *Autism Diagnostic Interview-Revised* (Lord et al., 1994) set by a qualified child psychologist or psychiatrist at Time 1, (b) the parents confirmed 2 years later that the child retained the ASD diagnosis, (c) the child had IQ scores above 70 and no additional *DSM-IV-TR* diagnoses or disabilities, besides their ASD diagnosis. Inclusion criteria for the non-ASD group were (a) IQ scores above 70 and (b) no clinical diagnoses or disabilities.

Since the IQ profiles of the ASD group were retrieved from school files or collected through testing at the institution, various intelligence tests were used, including the Snijders-Oomen Nonverbal Intelligence Tests, Wechsler Intelligence Scale for Children, Wechsler Preschool and Primary Scale of Intelligence, and Wechsler Nonverbal Scale of Ability. Non-ASD children were tested with the Snijders-Oomen Nonverbal Intelligence Tests. Parents also filled out Social Responsive Scale (SRS; Constantino & Gruber, 2005) at Time 3, to report on the degree of ASD symptoms in their children. The SRS consists of 65 items with responses on a 4-point scale, where higher scores indicated greater severity of ASD traits. First, raw total scores were calculated. Then the raw scores were converted to T scores according to the Dutch SRS manual (Roeyers et al., 2011).

Table 1 shows the descriptive characteristics of the two groups. The ASD and non-ASD group did not differ in age ($1.17 < ts < 1.78$, $ps > .05$) or gender distribution (χ^2 (1) = .240, $p = .624$). Children with ASD on average had a lower IQ than non-ASD children, t (118) = 5.14, $p < .001$. Children with ASD were given higher rates by parents than non-ASD children on the SRS scale at Time 3, t (38.12) = 10.27, $p < .001$. Mothers of children with ASD had lower education levels than mothers of non-ASD children, t (81.37) = −3.66, $p < .001$. The education levels of fathers did not differ between groups, t (88.34) = −1.12, $p = .268$. Families of children with ASD had lower income than families of non-ASD children, t (91) = −5.16, $p < .001$.

Table 1. Demographic characteristics of participants: means (standard deviations) of background variables

	Total participants at Time 1 N = 142	
	ASD N	**Non-ASD** N
	52	90
Age in months		
Time 1	66.90 (13.19) 49	63.80 (16.54) 79
Time 2	80.67 (11.80) 46	76.22 (16.03) 82
Time 3	93.07 (11.83). 40	88.38 (15.77) 71
Male%	88.5% 52	85.6% 90
IQ*	98.51 (16.63) 45	113.57 (14.88) 75
SRS T score at Time 3*	78.23 (15.77) 31	47.28 (7.59) 54
Education mother[a],*	3.90 (1.10) 49	4.57 (0.79) 70
Education father[a]	3.81 (1.33) 48	4.01 (1.03) 48
Net annual income[b],*	2.94 (1.21) 31	4.15 (0.99) 62

[a]Parental education level: 1 = no/primary education; 2 = lower general secondary education; 3 = middle general secondary education; 4 = higher general secondary education; 5 = college/university.[b]Net household income: 1 = less than €15,000; 2 = €15,000–€30,000; 3 = €30,000–€45,000; 4 = €45,000–€60,000; 5 = more than €60,000.*$p < .001$

During the year 2010 and 2016, children and their parents participated the study once a year for 3 consecutive years (mean duration between Time 1 and Time 2 = 12.06 months, SD = 1.92; between Time 2 and Time 3 = 12.16 months, SD = 1.02). Children were visited once a year either at school or at the specialized institution (for ASD group only), where they finished a series of tasks under the guidance of a psychologist who had received training for administering the tasks and for coding children's behaviors. Parents provided family background information and filled out various questionnaires about their children's social and emotional development. The Ethics Committee of Leiden University and Center for Autism granted permission for the larger-scaled research project (P08.140/SH/sh). All parents provided written informed consent. Below we reported the measures that were used in the current study.

Materials

Moral emotions

At each time point, three tasks were used to provoke shame and guilt and two to provoke pride in children (Ketelaar et al., 2015). These tasks were designed based on previous research (Alessandri & Lewis, 1993; Barrett, 1995; Lewis et al., 1992). To avoid that children remembered the tasks from the last time, the content of the tasks varied each year, yet the nature of the tasks remained unchanged. During these tasks, children's reactions were rated by the psychologist who administered the tasks. All the participating psychologists followed the same script for giving instructions during the tasks. The instructions were designed to be simple and short with a minimal demand on language communication. The participating psychologists received intensive training on administering the tasks and coding the behaviors. They had achieved a suitably high inter-rater reliability before they went

Table 2. Mean scores, standard deviations (SD), and statistics (group comparisons) of outcome and predictor variables for ASD and non-ASD group at three time points

	ASD			Non-ASD				
	Mean	*SD*	N	Mean	*SD*	N	*t*-value	*p-value*
Shame/guilt								
Time 1	.44	.26	52	.37	.23	87	1.74	.084
Time 2	.22	.15	47	.37	.27	82	−3.86	.000
Time 3	.18	.19	42	.50	.31	76	−6.94	.000
Pride								
Time 1	.99	.56	50	.93	.43	87	.78	.462
Time 2	1.11	.45	47	1.11	.43	82	−.06	.956
Time 3	.84	.45	42	1.12	.44	76	3.17	.002
False belief								
Time 1	.37	.49	52	.72	.45	90	4.19	.000
Time 2	.62	.49	47	.80	.40	82	2.36	.028
Time 3	.66	.48	41	.93	.25	76	4.09	.001
Emotion understanding								
Time 1	2.94	.90	50	4.07	.72	73	7.78	.000
Time 2	2.97	.96	45	4.11	.51	67	8.21	.000
Time 3	3.14	.98	31	4.10	.54	56	5.95	.000

to work independently on coding their participants' behaviors. Besides, the first author of this study took a random selection of 10% participants (9 children with ASD and 7 non-ASD children) and rated their behaviors from video recordings. Cohen's kappa ranged from .91 to 1.00, showing good agreement between the two raters. Although there was disagreement on a few individual items, the mean scores calculated from the ratings of the first rater did not differ from the mean scores calculated from the ratings of the second rater. Therefore, the original ratings were reported and used in the current study.

In the shame/guilt-provoking tasks, the child was made believe that either he or she had misbehaved (e.g., having damaged a property of the experimenter), or he or she had failed a task which was supposed to be easy to accomplish (e.g., failing to copy a drawing). One and the same pre-designed checklist which consisted of 11 items was used to rate children's reactions during each task on a 3-point scale (0 = *not at all*, 1 = *a little*, 2 = *a lot*), which coded the occurrence of reactions such as "negative response to the situation," "looking away from the experimenter," "looking down," "frowning," "facial expressions changing towards negative," "collapsed body," "pouting," etc. (Ketelaar et al., 2015). The final score of shame/guilt expression of a child was calculated by averaging the scores the child received from the three shame/guilt-provoking tasks. The original scale showed acceptable to satisfactory reliabilities across time for the two groups except for the reliability of the ASD group at Time 2 ($\alpha = .63$). A closer examination showed that two items of the checklist ("fidgeting on the face" and "showing repairing behaviors") had poor fit and thus were removed. The final scale showed improved reliabilities across time for both groups (non-ASD: $.79 \leq \alpha \leq .83$; ASD: $.71 \leq \alpha \leq .97$; measure reliabilities at three time points were reported in Supplementary Table 2).

The pride-provoking tasks succeeded the shame/guilt-provoking tasks, where the child was given a second chance to finish the tasks that he had just failed. For example, the child was asked to copy the drawing again and this time received positive feedback from the experimenter. The pride-provoking tasks were arranged directly after the shame- and guilt-provoking tasks for two reasons: first, to assure children that they had not done anything wrong and to show them that the final outcome was positive. Second, letting children fail at the first time was to prime them with the belief that the task was difficult to accomplish. When children accomplished the task at the second try, this was supposed to provoke pride in them. A separate checklist for pride consisting of 7 items on a 3-point scale (0 = *not at all*, 1 = *a little*, 2 = *a lot*) was used to code children's reactions during the pride-provoking tasks, such as "positive response to the situation," "uplifted chin," "smiling/laughing," "eye contact with the experimenter," "erect posture," etc. (Ketelaar et al., 2015). The final score of pride expression of a child was calculated by averaging the scores the child received from the two tasks. The scale showed satisfactory reliability across time for both groups (non-ASD: $.78 \leq \alpha \leq .81$; ASD: $.79 \leq \alpha \leq .88$).

ToM

Children's understanding of people's thoughts was measured by false-belief tasks. At each time point, a task adapted from the Sally-Anne task (Baron-Cohen et al., 1985) was used to measure children's understanding of false belief (Broekhof et al., 2015; Ketelaar et al., 2012). For example, at Time 1, the experimenter told the child a story (also presented with picture illustrations) about a boy who left his toy at one location, and while he was away, a girl came in and hid his toy at another location. Later on, the boy returned and looked for his toy. Children were asked three questions about the story: (a) the test question: "Where will the boy look for his toy?" and (b) two control questions: "Where is the toy actually?" and "Where did the boy put his toy when he went away?". Only when a child answered all three questions correctly did he or she receive a score of "1," otherwise "0." Before the testing, the experimenter had checked with the child whether he or she understood the words that were used in the tasks. Like the moral emotion tasks, the content of the false-belief tasks varied every year, but the nature of the tasks remained unchanged.

Children's understanding of peoples' emotional state was measured by parental reports. The Emotion Expression Questionnaire is a 35-item parent-report questionnaire that measures a child's emotion expressions and emotion acknowledgement (Rieffe et al., 2010). We used the Emotion Acknowledgment Scale (6 items) of the questionnaire. Parents reported the extent to which children recognized and understood happiness, anger, fear, sadness, and joy in their parents (e.g., item: "Does your child understand when you are happy?"). Parents rated each item on a 5-point scale ranging from 1 = *(almost) never* to 5 = *(almost) always*. For both groups, the internal consistency of the Emotion Acknowledgment Scale was satisfactory across time ($\alpha \geq .74$).

A correlation matrix of moral emotions, age and ToM abilities at the three time points can be found in Supplementary Table 3.

Statistical analyses

Statistical analyses were performed using IBM SPSS Statistics for Macintosh, Version 26.0 (Armonk, NY: IBM Corp.). Figures were produced using R (R Core Team, 2019) with the package ggplot2 (Wickham, 2009). First, independent *t*-tests were conducted to explore group differences in demographic characteristics and the

Table 3. Fixed and random effects of the best age models for moral emotions

	Shame/guilt				Pride			
Fixed effects	Estimates	***SE***	CI [low, high]		Estimates	***SE***	CI [low, high]	
Intercept	.34	.04	[.25, .42]		.94	.08	[.78, 1.10]	
Age	.002	.001	[−.0002, .004]		.003	.002	[−.001, .006]	
Diagnosis	.13	.08	[−.04, .29]		-.06	.06	[−.18, .05]	
Age × Diagnosis	−.005	.002	[−.01, −.002]					
Random effects	**Estimates**	***SE***	**CI [low, high]**	**Wald's Z**	**Estimates**	***SE***	**CI [low, high]**	**Wald's Z**
Residual	.06	.006	[.05, .08]	10.61	.137	.02	[.11, .17]	9.47
Intercept	.005	.004	[.001, .03]	1.17	.254	.090	[.13, .51]	2.81
Age					.0001	.00005	[.0001, .0003]	2.42

Note. SE = standard error. CI = confidence interval.

predicting and outcome variables at the three time points. Second, linear mixed models (LMMs) were used to examine how moral emotions developed with age and how ToM abilities contributed to the prediction of moral emotions over time.

LMMs have the advantages of accounting for the dependency within the longitudinal data where the data of time points are nested within the participants (Hox et al., 2017). Besides, LMMs are robust in handling missing data when they miss (completely) at random (Twisk et al., 2013). The current data had missing values at every time point. Little's missing completely at random tests indicated that the missing patterns could be completely at random (Time 1: $\chi^2 = 1900.72$, $df = 1983$, $p = .906$; Time 2: $\chi^2 = 794.71$, $df = 887$, $p = .988$; Time 3: $\chi^2 = 840.46$, $df = 857$, $p = .650$).

We followed a formal model-fitting procedure of LMMs, that is, fitting increasingly more complex models to the data step by step. Simpler models with better model fit were selected over more complex model. To evaluate model fit, for nested models, the preferred model showed significant less deviance (i.e., lower values of −2 log-likelihood [−2LL]) tested by a likelihood ratio test. For non-nested models, the preferred model showed lower Akaike information criterion and Bayesian information criterion values.

To examine the developmental trajectories of moral emotions, we started with an unconditional means model which included only a fixed and random intercept. Then, age (centered around 33 months, the youngest age of all participants) was added to the model to examine how moral emotions changed over time, and diagnosis (0 = non-ASD, 1 = ASD) was added to the model to examine whether the levels of moral emotions across three times points differed between children with and without ASD. Note that while *t*-tests compared the mean of the ASD group to the mean of the non-ASD group at Time 1, 2, and 3, respectively, fitting LMM models allowed for comparing the two groups longitudinally across the three times points. Considering that the measurements took place at three time points, we examined two models of change: linear and quadratic, respectively. Third, we added the interactions between age and diagnosis to the model to examine whether the two groups differed in developmental trajectories. We also added IQ to the best age model, but it did not improve the model fit and thus not reported here.

To explore whether ToM abilities contributed to the prediction of the levels of moral emotions over time, first, a mean variable and a change variable were created for each ToM ability. The ToM mean variables checked the between-person effects of the predicting variables, informing us whether participants who had better ToM abilities had higher levels of moral emotions. The ToM change variables checked the within-person effects of the predicting variables, informing us whether larger increases of ToM within participants contributed to higher levels of moral emotions.

The mean variable of false-belief understanding ("FB [mean]" in Table 3) and the mean variable of emotion understanding ("EU [mean]") were created by averaging the scores at Time 1, 2, and 3. The change variable of false-belief understanding ("FB [change]" in Table 3) and the change variable of emotion understanding ("EU [change]") were created by subtracting the scores at each time point by the initial score at Time 1, that is, Time 1 − Time 1, Time 2 − Time 1, Time 3 − Time 1. In the long data format, the mean variables had one value per participant across time points, whereas the change variables were time varying and had three values per participant.

Then we fitted the model with only age and diagnosis as the control variables. Next, we fitted all the predicting variables (i.e., the mean score and the change score of each ToM ability) to the model. Fourth, we added the interactions of the ToM abilities (mean and change scores) with diagnosis to the model, to explore whether the groups differed in the relations. Nonsignificant interactions were removed during the procedure.

The above-mentioned models were first fitted with the raw scores of the predicting variables, that is, the raw mean and change scores of false-belief and emotion understanding. The unstandardized coefficients of predicting variables provide intuitive and easily interpretable information on the predicting effects. However, it is not possible to directly compare the effect sizes among different predicting variables. To check the effect sizes, we also fitted models with the standardized *z*-scores of the predicting variables. For multilevel models, the standardized coefficients of predicting variables provide a good indication of effect sizes of the fixed effects (Lorah, 2018).

Results

Table 2 shows the mean scores and standard deviations of the outcome and predicting variables at three time points. *T*-tests showed that ASD group did not differ from non-ASD group in their expressions of shame and guilt at Time 1: $t\ (137) = 1.74$, $p = .084$. However, ASD group displayed fewer expressions of shame and guilt at Time 2: $t\ (126.99) = -3.86$, $p < .001$, and Time 3: $t\ (114.74) = -6.94$, $p < .001$. As for pride, ASD group did not differ from non-ASD group in expressions of pride at the first two time points, but they showed less pride at Time 3: $t\ (116) = 3.17$, $p = .002$.

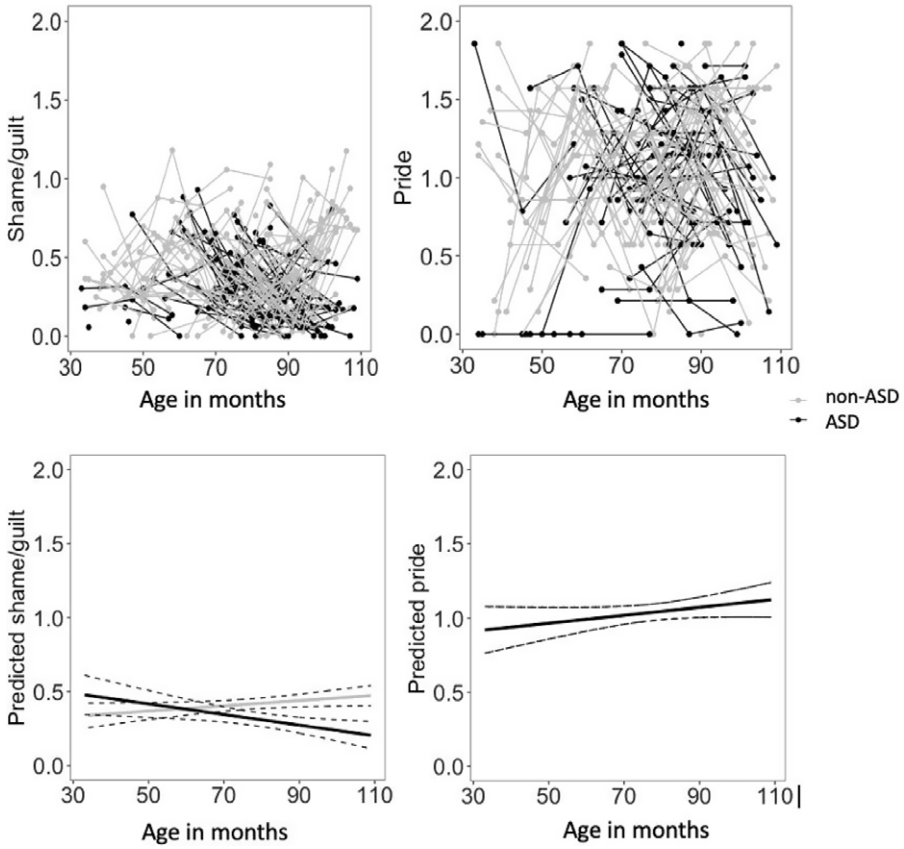

Figure 1. Upper left and right: graphic representations of the levels of shame/guilt and pride of all participants at three time points. The points were connected in lines, each line representing one participant. Participants had data at one time point are presented by points. Lower left and right: regression lines depicting predicted levels of shame/guilt and pride with 95% confidence intervals based on the best fitting models.

At all three time points, ASD group showed lower ToM abilities: they received lower scores of the false-belief tasks ($2.23 \leq ts \leq 4.33$, $ps < .05$), and they received lower ratings from parents on Emotion Acknowledgment Scale as compared to non-ASD group ($5.09 \leq ts \leq 7.36$, $ps < .001$).

Developmental trajectories of moral emotions

Table 3 shows the estimates of the fixed and random effects in the best fitting models for predicting the developmental trends of moral emotions.

As for shame and guilt, compared to the unconditional means model (−2LL = 82.32), adding linear age and diagnosis (−2LL = 62.58) contributed to increasing model fit ($\chi^2 = 19.74$, $df = 2$, $p < .001$). The fixed effect of linear age did not reach the significant level, t (255.69) = .00004, $p = .963$. The significant effect of diagnosis, t (138.46) = −4.05, $p < .001$, indicated that when holding the value of age constant, children with ASD showed less shame and guilt as compared to children without ASD.

To examine whether children with and without ASD differed in their developmental trajectories, the interaction of age and diagnosis was added to the model. The interaction model (−2LL = 53.22) with the fixed effects of linear age, t (230.09) = 1.80, $p = .074$, diagnosis, t (278.17) = 1.53, $p = .128$, and their interaction, t (297.92) = −3.19, $p = .002$, showed the best model fit compared to the unconditional means model: $\chi^2 = 29.1$, $df = 3$, $p < .001$; compared to the model with only the main effects of age and diagnosis: $\chi^2 = 9.36$, $df = 1$, $p < .001$. While the expressions of shame and guilt did not change over time in non-ASD group, $b = .002$, t (230.09) = 1.80, $p = .074$, they decreased with age in ASD group, $b = -.005$, t (297.92) = −3.19, $p = .002$; see also Figure 1. In addition to the fixed effect of age, we also checked the random effect of age, which could inform us whether the age slopes varied significantly among participants. In the model for shame and guilt, adding the random effect of linear age did not contribute to a better model fit, indicating that there was no substantial slope variability.

As for the development of pride, the best fitting model was with the fixed effects of linear age and diagnosis and with a random slope of linear age (−2LL = 444.96) compared to the unconditional means model (−2LL = 478.61): $\chi^2 = 29.1$, $df = 4$, $p < .001$. None of the fixed effects was significant. The insignificant age effect, t (115.51) = 1.68, $p = .096$, indicates that pride did not change over time. The insignificant effect of diagnosis, t (111.95) = −1.11, $p = .268$, indicates that the two groups did not differ in the overall levels of pride when holding the value of age constant. Adding the interaction of age and diagnosis did not improve the model, indicating that the two groups did not differ in the overall developmental trajectories. Yet, the significant random slope of age indicated that that there were great individual differences in the developmental trends among participants (see also Figure 1).

ToM abilities and the development of moral emotions

To explore whether ToM abilities contributed to the development of shame and guilt, the mean and change variables of ToM were fitted to the baseline model with age and diagnosis. Although adding the ToM variables showed a significant improvement in model fit, the Hessian matrix was not positive definite, indicating redundant covariance parameters (West et al., 2007). By removing the ToM variables one by one from the full model, we found that the problem was caused by the change variable of emotion

Table 4. Fixed and random effects of the best predicting models for pride with ToM abilities as the predictors

Fixed effects	**Raw estimates (*SE*)**	CI [low, high]	**Standardized estimates (*SE*)**	CI [low, high]
Intercept	1.11 (.21)	[.70, 1.52]	1.08 (.05)	[.99, 1.17]
Age	.003 (.002)	[−.001, .007]	.05 (.04)	[−.02, .12]
Diagnosis	−.46 (.15)	[−.77, −.16]	.01 (.08)	[−.15, .17]
FB (mean)	−.11 (.14)	[−.39, .17]	−.04 (.05)	[−.14, .06]
FB (change)	.11 (.06)	[−.02, .23]	.04 (.03)	[−.01, .10]
EU (mean)	−.03 (.05)	[−.12, .07]	−.02 (.04)	[−.10, .06]
EU (change)	−.07 (.05)	[−.18, .04]	−.04 (.03)	[−.09, .02]
Diagnosis × FB (mean)	.68 (.18)	[.32, 1.05]	.25 (.07)	[.12, .38]
Random effects	**Estimates (*SE*)**	**CI [low, high]**	**Wald Z**	
Residual	.16 (.02)	[.13, .20]	8.70	
Intercept	.03 (.02)	[.01, .09]	2.07	

Note. SE = standard error; CI = confidence interval; FB = false belief; EU = emotion understanding.

understanding. However, fitting the simpler model without the change variable of emotion understanding did not show a better model fit than the baseline model with diagnosis and age: −2LL of the baseline model was 62.58; −2LL of the simpler model without the change variable of emotion understanding was 56.36, $\chi^2 = 6.21$, $df = 3$, $p > .05$. Adding interactions of ToM variables and diagnosis did not improve the model fit either. The results showed that the mean levels and changes of ToM abilities were not related to the levels of shame and guilt in all children.

As for pride, adding the mean and change variables of ToM abilities contributed to a significant improvement of the model fit: −2LL with age and diagnosis only was 453.60; −2LL when ToM variables were added was 332.23, $\chi^2 = 121.37$, $df = 5$, $p < .001$. The best fitting model showed a significant main effect of diagnosis, $t\,(124.03) = -3$, $p = .003$, and a significant interaction effect of diagnosis and the mean variable of false-belief understanding, $t\,(120.05) = 3.69$, $p < .001$. The standardized coefficients for comparing the effect sizes showed that the size of the diagnosis effect was relatively small, and the interaction had the largest effect (see Table 4). While the average levels of false-belief understanding were not longitudinally associated with the development of pride in non-ASD group, $b = -.11$, $t\,(147.71) = -.76$, $p = .448$, they were longitudinally associated with an increase of pride in ASD group, $b = .58$, $t\,(125.53) = 4.05$, $p < .001$. See Table 4 for the fixed and random effects of the best predicting model for pride with unstandardized and standardized ToM predictors.

Discussion

Moral emotions keep people attuned to the society and getting along with others (Muris & Meesters, 2014; Muris et al., 2016; Tangney et al., 2007). Despite their important social functions, moral emotions are understudied in the ASD population. This longitudinal study is among the first to examine the development and contributing factors of moral emotions in young children with ASD. Our main findings are the following: First, the expressions of shame and guilt stayed stable in non-ASD children, whereas the expressions of shame and guilt decreased in children with ASD. Second, the overall trend of pride did not differ between groups and the expression of pride remained stable over time in all children. Third, ToM abilities (i.e., false-belief and emotion understanding) were not associated with the expressions of shame and guilt in all children. Fourth, better false-belief understanding was uniquely related to an increased expression of pride in children with ASD. Below we discuss these findings in more detail.

First, we did not find the expected age effect on the expressions of moral emotions in non-ASD children. This seems to diverge from the literature, which suggests that moral emotions develop throughout childhood. This may have to do with our focus on the expressive component of moral emotions. While past research found that children's concerns for others and their understanding of moral emotions grow with age (Bafunno & Camodeca, 2013; Kornilaki & Chlouverakis, 2004; Tracy et al., 2005; Zahn-Waxler et al., 1992), their external emotion expressions as measured in the current study may remain stable, because children's ability to regulate emotions also grow with age (Kochanska et al., 2002). When a child transgresses or misbehaves, expressing shame and/or guilt is socially expected, because it signals to others that the child is aware of the mistakes and feels regretful. Nonetheless, excessive expression of distress does not help correct the wrong or amend the relationship, and thus needs to be regulated (Tangney & Dearing, 2002). Likewise, although pride expression is expected when a child does a right thing, excessive expression of pride can distance oneself from others and harm the social relations (Kitayama et al., 2006; Oveis et al., 2010).

What is concerning, unlike non-ASD children whose shame and guilt expressions stayed stable, a decreasing trend of shame and guilt expressions was observed in children with ASD. It should be noted that the two groups did not differ in the expressions of shame and guilt at the initial time point. However, children with ASD expressed less shame and guilt when they grew older. This decreasing trend may not be attributed to the task demand because the tasks were designed to have similar complexity and minimized language requirements at all time points, and the finding remained unchanged when IQ was controlled for. According to Stipek (1995; Stipek et al., 1992), young children first experience moral emotions in an autonomous form. Failing or accomplishing a task gives them the immediate feelings of frustration or efficacy. With age, the experience of moral emotions becomes less autonomous. As children grow older, they attend more to other people's reactions, and learn that their failure or accomplishment can affect others and induce social disapproval or approval from others (Hart & Matsuba, 2007). Possibly, while the immediate frustration and distress induced by the outcomes of the tasks faded over time in all

children, non-ASD children had grown a concern about how the other person would think of them. However, for children with ASD, who are known to have reduced social interest (for a review, see Chita-Tegmark (2016)), they probably did not develop the sense of relatedness with others to the same extent as non-ASD children. If children with ASD are not aware of or concerned with how other people think of them, this could compromise their experience and expression of shame and guilt. Nonetheless, it remains unclear why children with ASD showed a decreasing trend in their shame and guilt expressions. Some recent research suggested that social attention in children with ASD decreased with age (Fujioka et al., 2020). More future studies on moral emotions and the related factors in children with ASD can help us gain better understandings in this regard.

Although a group difference was found in the development of shame and guilt, as we expected and consistent with the literature (Davidson et al., 2018; Hobson et al., 2006; Kotroni et al., 2019; Losh & Capps, 2006; Tracy et al., 2011; Williams & Happé, 2010), children with ASD did not differ from non-ASD children in the levels or the developing trend of pride expressions. As mentioned before, pride may not require the same magnitude of interpersonal engagement as shame and guilt and thus it is less affected by ASD (Hobson et al., 2006). However, it should be noted that in the pride-provoking tasks, in order to elicit pride in children, the experimenter gave compliments when children finished the tasks. It could be that the positive feedback made it easier for children with ASD to interpret the experimenter's view. Yet, in the shame/guilt-provoking tasks, the experimenter did not orally blame the child. Children did not receive explicit prompts informing them that their actions were being evaluated by another person, and this could present extra challenges to children with ASD. Future studies should check whether children with ASD still express pride to the same extent as non-ASD children when the explicit social cues are absent, and vice versa, whether providing explicit social cues can help children with ASD understand people's view better and hence promote their development of moral emotions. We want to point out that, although our LMM analyses did not confirm group differences regarding the overall trend and levels of pride expressions, children with ASD showed lower levels of pride at Time 3. Follow-up research is needed to inform us whether children with ASD continue keeping up with their non-ASD peers in the development of pride, or they show a decrease in pride expression in the long run. A recent study found that adults with ASD experienced lower levels of pride than non-ASD adults (Davidson et al., 2017).

The literature has assigned an important role of ToM to the occurrence of moral emotions (Leary, 2004; Lewis, 2000). In line with this, we assumed that higher levels and larger increase of ToM abilities such as false-belief and emotion understanding would contribute positively to the development of moral emotions in children both with and without ASD. This hypothesis was only partly confirmed regarding the development of pride. Better false-belief understanding was related to increased expressions of pride. Note, however, this relation was found only in children with ASD. This finding mirrors previous findings that ToM was related to moral emotions in individuals with ASD whereas not in non-ASD individuals (Davidson et al., 2017; Davidson et al., 2018). A possible explanation is that while non-ASD individuals have a rich reservoir of skills to help them navigate in the social world, individuals with ASD rely more heavily on their ToM skills in social interactions (Davidson et al., 2017; Davidson et al., 2018).

To our surprise, we did not find any relations between ToM abilities and the expressions of shame and guilt. If as suggested by the literature, ToM plays an important role in provoking shame and guilt, we would expect to find relatively strong associations between ToM abilities and negative moral emotions, especially in children with ASD. One possibility is that before children with ASD could use their ToM abilities to establish a self-evaluation based on other people's view, the first step is to pay attention to others and be aware that their behaviors are perceived by others. However, this first step might be hindered for children with ASD, as the shame/guilt-provoking tasks did not provide explicit cues indicating that their behaviors were evaluated by another person. This may explain why ToM had little influence on their reactions.

Nonetheless, it still remains unclear why the associations were absent in non-ASD children, who were supposed to have more social interests and better self-other awareness. It should be mentioned that the cognitive aspect of ToM was measured only by a single false-belief task. Although this task is widely used and proven valid for measuring false belief in young children with ASD, it might be inadequate to capture the full variance of the construct. Besides, the near-ceiling effect observed in non-ASD children at Time 3 indicates that they might have acquired the first-order cognitive abilities and started developing more advanced ToM abilities (Lane et al., 2010; Liddle & Nettle, 2006). The choice of the task may partly account for the absent longitudinal association between false-belief understanding and moral emotions in this study. Likewise, the emotional aspect of ToM was measured by asking parents whether their children were able to recognize basic emotions. Social interactions in the daily life often involve multiple and complex emotional exchange. Besides, understanding other people's emotional state includes not only recognizing the emotion but also knowing what causes the emotion. A child who breaks his or her mother's favorite vase will feel ashamed or guilty only if he or she understands how this will make the mother feel and why. To understand whether and how ToM abilities relate to and influence the development of moral emotions in early childhood, especially shame and guilt, future research should consider using more comprehensive test batteries for examining ToM abilities in young children.

This study has its advantages of using a longitudinal design and examining moral emotions in an ASD sample at a young age. Nonetheless, there are also limitations, such as focusing on one aspect of moral emotions, that is, emotion expression. Although the extent to which a child expresses an emotion is related to the extent to which the child experiences that emotion, emotion expression can be influenced by other factors such as emotion regulation. To gain a comprehensive understanding of the early development of moral emotions in children with ASD, future studies should include different informants and use multiple measurements to investigate how other aspects such as the recognition and experience of moral emotions unfold at young ages. Besides, we measured moral emotions only at the global level, without distinguishing between shame and guilt, nor between hubristic and authentic pride. Shame and guilt are a pair of negative moral emotions which often arise in the same situation and co-occur (Tangney et al., 2007). Likewise, the two types of pride are often intertwined (Tracy & Robins, 2007). We decided to examine negative and positive moral emotions at the global level, because pure and mature forms of moral emotions did not develop until middle to late childhood (Muris & Meesters, 2014; Parisette-Sparks et al., 2017), and so far there is little evidence that discrete moral emotions can be reliably distinguished in young children (Baker et al.,

2012; Berti et al., 2000; Kochanska et al., 2002; Olthof et al., 2000). Nonetheless, it would be informative to examine whether children already show higher proneness to one type of moral emotion than the other at a young age. As a hindsight, we could have refined our coding schemes by adding more items to observe children's action tendencies. For example, children who are prone to shame would display more withdrawing behaviors, whereas children who are prone to guilt would display more repairing behaviors (e.g., Bafunno & Camodeca, 2013). Well-designed parental questionnaires and interviews can also help unravel the possibly distinctive and unique development of discrete moral emotions in young children, which may have been masked when analyzing them at a global level. However, given the scarcity of research in moral emotions in young children with ASD, we consider our findings, albeit at the global level, are worth sharing and made the valuable first step towards the understanding of the topic. We should also note that this study included only children without intellectual disabilities. Caution is warranted when generalizing our findings to other ASD groups. Also, moral emotions can be heavily influenced by cultural, ethnic, or religious values (Bear et al., 2009; Furukawa et al., 2012). The outcomes of the current study were based on observations of Dutch children, which may not be simply generalized to children from other cultures. Besides, we did not control for children's language abilities. However, all the tasks were designed with minimal demand of language communication and it was confirmed before the testing that children understood all the words used in the tasks.

This study added valuable new information to the existing knowledge. Our findings showed that the development of pride in young children with ASD was on a par with non-ASD children. However, they displayed lower levels of shame and guilt than non-ASD children already at a young age and this difference enlarged over time. This is alarming given that appropriate experience and expression of shame and guilt play a crucial role in preventing behavioral problems and promoting psychosocial well-being (for a review on typically developing children, see Muris & Meesters (2014); for a review on clinically referred children, see Muris et al. (2016)). Our findings call for more attention to the early development of moral emotions in children with ASD. Importantly, given that moral emotions serve higher-order social needs and develop in interactions with the social world (Miller et al., 2019; Tracy & Robins, 2004), future research should examine how emotion socialization such as emotion communication with parents and peers, and overall how an inclusive social environment can foster the development of moral emotions in children with ASD.

Supplementary material. For supplementary material accompanying this paper visit https://doi.org/10.1017/S0954579421000973

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