

Contents lists available at ScienceDirect

Journal of Experimental Child Psychology

journal homepage: www.elsevier.com/locate/jecp

Children's moral self-concept relates to moral judgment, but not to arousal



Anja Kaßecker^{a,*}, Antonia Misch^{a,b}, Markus Paulus^a, Natalie Christner^a, Carolina Pletti^{a,c}

^a Department of Psychology, Ludwig Maximilians Universität München, 80802 Munich, Germany

^b Department of Psychology, Christian Albrechts Universität zu Kiel, 24118 Kiel, Germany

^c Department of Psychology, Universität Wien, 1010 Wien, Austria

ARTICLE INFO

Article history: Received 13 July 2024 Revised 8 October 2024 Available online 9 January 2025

Keywords: Moral development

Moral judgment Moral cognition Moral emotions Moral identity Pupillometry

ABSTRACT

We investigated the relationships among the moral self-concept, arousal reactions to third-party moral situations, and moral judgment in 5- to 7-year-old children (N = 59). Children's moral selfconcept was assessed using a puppet task. In addition, children were shown audiovisual scenes depicting prosocial, antisocial, and neutral interactions between children. We measured phasic pupil dilation responses to the actions and collected children's judgments of the actions. The results show that children judged antisocial behavior as more negative and prosocial behavior as more positive than neutral behavior. In addition, children showed significantly higher arousal when observing antisocial behavior compared with neutral and prosocial behavior. Moreover, children's moral judgment related to their arousal: the more negative the moral judgment, the higher the arousal, even in prosocial and neutral scenarios. Finally, children's moral self-concept correlated with their explicit judgments, but not with their physiological arousal. These results support developmental theories suggesting a relationship between the moral self and moral judgment.

© 2024 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (http://creativecommons.org/ licenses/by/4.0/).

* Corresponding author. *E-mail address:* a.kassecker@psy.lmu.de (A. Kaßecker).

https://doi.org/10.1016/j.jecp.2024.106172

0022-0965/© 2024 The Authors. Published by Elsevier Inc.

This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

Introduction

The early development of moral stances is a central topic in understanding children's moral cognition (Carpendale & Hammond, 2016; Malti & Ongley, 2014; Thompson, 2012). Although several theories propose that in morality cognitive processes, affective and physiological states, and self-related processes are intertwined (for different views, see Gibbs, 2019; Hoffman, 2001; Turiel, 2008), there is little research on their interrelations in early childhood. The current study aimed at contributing to this debate by exploring the interrelations among explicit moral judgment, implicit arousal reactions, and the moral self (i.e., the perception of one's own morality) in young children.

In the past years, studies on the early development of morality have often focused on either moral reasoning or arousal reactions. For instance, a variety of studies show that at 3 years of age children begin to reason differently about moral and conventional violation situations (Dahl et al., 2022; Smetana & Braeges, 1990). Moreover, at around the same age children begin to protest and use normative language against norm violators in different morally relevant situations such as unfairness and destroying property (Rakoczy & Schmidt, 2013; Rossano et al., 2011; Schmidt et al., 2016). Other studies have shown that physiological (affective) arousal is associated with moral violations rather than conventional ones (Essler & Paulus, 2023; Kassecker et al., 2023; Yucel et al., 2020). Thus, each line has progressed largely independent of each other.

Another branch of developmental studies focuses on the development of moral emotions, for instance, the ability to feel guilt, shame, pride, and compassion in a morally relevant context (Christner et al., 2020; Eisenberg et al., 2006; Hammond & Drummond, 2019; Malti & Latzko, 2010; Paulus & Moore, 2017). These studies mainly investigate first-party contexts (where the child is directly involved in a morally relevant action) and focus on personal behavior rather than on judgment. Such studies found, for instance, that children's ability to feel moral emotions such as guilt and sympathy relate positively to their prosocial behavior (Ongley & Malti, 2014). Further research has investigated emotions in a moral judgment context, but focusing on emotion attribution—that is, which specific emotions children expect the victims or perpetrators of a moral narrative to feel (Arsenio et al., 2006; Malti et al., 2010). Results show, for instance, that 9-year-olds who attribute guilt to the perpetrator of an antisocial act judge such an act more severely (Malti et al., 2010). Thus, empirical studies revealed that children react emotionally in moral situations and that the emotions they attribute to others are linked with judgment of the others' actions.

However, there is little research on the question to what extent children's implicit (arousal) reaction and their explicit judgment of moral situations are linked. In particular, no research has investigated whether a child's immediate reactive arousal to a third-party morally relevant action relates to the child's own judgment of that specific action. This would be in line with theories assuming that in early moral development moral judgments and moral emotions are coordinated (Turiel, 1983). In fact, developmental theories do suggest that young children find moral transgression to be emotionally salient and that their emotional reactions should interrelate with their moral judgments of these situations (Arsenio et al., 2006; Hoffman, 2001; Kochanska & Aksan, 2006; Malti & Latzko, 2010). A few studies have already provided some evidence for a tight connection between emotions and cognition (Rottman & Kelemen, 2012; Rottman et al., 2017). For example, one study showed that stronger empathic reactions to harm relate to more severe moral judgments-tested in a separate task-in preschool children (Ball et al., 2017). Moreover, moral judgments inform emotional reactions; if humans judge something to be negative, it relates with their emotional stance to it (Dahl & Killen, 2018). We expanded on this literature by investigating children's arousal reactions to realistic antisocial and prosocial situations, like those that children encounter in everyday life, and their relation to moral judgments of the same situations, capitalizing on pupil dilation as a measure of physiological arousal.

Pupil dilation reflects changes in autonomic arousal, with an increase in pupil diameter indicating when luminance is kept constant—increased arousal (Beatty & Lucero-Wagoner, 2000). This method is especially suited for developmental studies given that it can be measured non-invasively and it is not influenced by the child's ability or willingness to provide explicit responses (Hepach & Westermann, 2016). Of course, alternative explanations for pupil dilations such as changes in luminance or cognitive load (Sirois & Brisson, 2014) need to be excluded. In line with these considerations, we chose pupil dilation to measure children's arousal reactions to morally relevant behaviors as compared with neutral ones. We decided to investigate children's reaction to not only moral violations (i.e., antisocial behavior) but also prosocial acts given that prosociality plays an important role in theories and research on moral development and given that children also consider prosocial behavior as obligatory (Dahl et al., 2020; Paulus et al., 2020; Rakoczy et al., 2016).

Developmental theories highlight the relevance of the moral self-concept in early moral development (Hardy & Carlo, 2011; Krettenauer & Hertz, 2015). Children's moral self-concept reflects the degree to which children see themselves as a moral person (i.e., in preschool/early school years, as people who like to be prosocial and avoid antisocial behavior; Kochanska, 2002; Sengsavang & Krettenauer, 2015). The moral self-concept thus represents children's moral behavioral preferences and is considered a precursor of moral identity (Sengsavang & Krettenauer, 2015), which defines how important it is for someone's sense of self to be a moral person (Hardy & Carlo, 2011). Scholars and empirical findings suggest that the moral identity emerges in the course of middle childhood and gets more fine-grained in adolescence (e.g., Kingsford et al., 2018; Krettenauer, 2013, 2022). According to social-cognitive accounts of moral identity, cognitive processes, affective processes, and selfprocesses are considered to be interwoven and form a coherent personality based on cognitive-affective moral schemas (Lapsley & Narvaez, 2004; Stets & Carter, 2012). Thus, persons with a strong moral identity or moral self-concept have developed well-consolidated moral schemas for processing the world, which activate automatically and facilitate processing of moral content. Based on this, some researchers suggest that individuals with a high moral self-concept would not only behave more morally but also differentially perceive and judge third-party morally relevant situations (Lapsley, 2015; Lapsley & Narvaez, 2004). In line with this theoretical notion, recent studies on adults and 10-year-olds showed that moral identity influences the processing of third-party moral situations (Pletti et al., 2019, 2022): participants' electroencephalograms (EEGs) were recorded while participants observed vignettes portraying prosocial and antisocial behavior. The analysis of event-related potentials extracted from the EEGs showed that, in both adults and children, moral identity was related to differential processing of prosocial scenes already around 200 ms after stimulus onset. However, this cannot be equated with moral judgments. Another theoretical concept (Blasi, 1984, 1995; Blasi & Milton, 1991) assumes, that integrating moral judgments into one's sense of self and feeling responsible to act accordingly is a key element for developing moral motivation. Yet, in this account it remains open to what degree moral judgments and moral identity are directly related.

Moral identity predicts prosocial behavior in adulthood and adolescence (Aquino & Reed, 2002: Christner et al., 2022; Hertz & Krettenauer, 2016). Similarly, children's moral self-concept-as a precursor of moral identity-starting from 4 years of age relates positively to prosocial behavior (Christner et al., 2020; Kochanska et al., 2010; Sticker et al., 2021) and negatively to antisocial behavior (Sengsavang & Krettenauer, 2015). The moral self-concept, as well as moral identity, is also related to the emotions elicited by moral actions; in both 5- to 9-year-old children and adults, individuals with higher moral self-concept and moral identity, respectively, reported more negative emotions associated with not being able to share, and these negative emotions were related to actual sharing behavior when it was possible to share (Christner et al., 2020, 2022). In addition, 4- to 7-year-olds moral self-concept positively related to children's tendency to experience guilt based on parents' reports (Misailidi & Tsiara, 2021). Moreover, a meta-analysis found a robust association between moral identity and moral emotions ranging from self-evaluative emotions (e.g., guilt, shame, pride), otherevaluative emotions (e.g., moral outrage, contempt, admiration), to other-regarding emotions (e.g., sympathy, empathy, compassion), which reflect the multifaceted role of moral identity in moral functioning (Lefebvre & Krettenauer, 2019). Taken together, it remains an open question how the moral self-concept relates to children's explicit moral judgments and their implicit arousal to moral scenes.

Aims and hypotheses

The current study investigated the following research questions. First, do children show different arousal responses to third-party prosocial and antisocial scenes as compared with neutral ones? Second, are such arousal reactions related to children's judgment? Third, does children's moral self-

concept relate to both explicit judgments of and implicit arousal to third-party moral scenes in children?

We chose to test 5- to 7-year-old children because children at this age can reliably provide explicit moral judgments (Killen & Smetana, 2015; Smetana et al., 1993) and their moral self-concept seems to be already a stable—and thus relatively consolidated—characteristic of a child (Gniewosz et al., 2023). Based on that theoretical and empirical information, we hypothesized that already by preschool age children would evaluate antisocial behavior more negatively and prosocial behavior more positively than neutral situations. Moreover, we hypothesized that preschool children would react with greater arousal to antisocial scenes—involving harm to others—as compared with prosocial and neutral scenes. Regarding the relationships among the moral self-concept, implicit arousal, and explicit judgment, we hypothesized that all three factors are intertwined (Blasi, 1983, 1999; Lapsley & Narvaez, 2004; Stets & Carter, 2012).

Method

Participants

A total of 59 children aged 5 to 7 years participated in this study (M = 6.15 years, SD = 0.85; 31 girls). Children were recruited through letters sent to their caregivers (addresses were obtained from the communal registry). All children were German speakers and had (according to their caregivers) no cognitive or neurodevelopmental disorders and no visual or auditory impairments. We tested 13 more children to compensate for data loss and dropouts. We needed to exclude 10 children from the pupil dilation analyses for not providing enough clean pupil data, 2 children from the judgment analyses due to technical issues with data saving, and 1 child from all analyses because of equipment failure. Because we excluded the moral self-concept data of 10 children due to high social desirability scores, the analyses on judgment were conducted on a sample of 59 children and for pupil dilation on a sample of 53 children.

To determine the required sample size, we ran two a priori power analyses in order to account for both analysis of variance (ANOVA) and correlation analyses, assuming medium effect sizes for each. First, we ran a power analysis for an ANOVA (repeated measures, within-factor design; f = 0.17, $\alpha = .05$, power = .80, number of groups = 1, number of measurements = 3), which would allow us to test whether children's explicit judgment and implicit arousal reactions differed among the three different conditions. This revealed a required sample size of 58 participants. Second, we ran a further power analysis for a correlation with r = .30, p < .05, and power = .80, which would be used to test the interrelations among children's moral self-concept, their implicit arousal reactions, and their explicit judgment competencies. The number of participants required for this analysis was 67. However, due to time constraints, we stopped testing approximately 1 year after the start of the study. This resulted in overall 72 tested children, with 59 children providing usable data. The study was approved by the local ethics committee.

Procedure

Children were guided into the lab room while their caregivers read and signed the informed consent. Then, children were seated approximately 62 cm from a 17-inch eye tracking screen (Tobii 1750 eye tracker; precision = 1°, accuracy = 0.5°, sampling rate = 50 Hz), where a 5-point calibration was performed. After the calibration, the first block of the task was administered, consisting of three prosocial stories, three neutral stories, and three antisocial stories presented in blocks (see "Storybook task" section for more detail). Then, to keep things interesting, children were given a break and were asked to answer some entertaining questions about supernatural powers. Afterward, the second block of the main task was administered, again including three prosocial stories, three neutral stories, and three antisocial stories (see "Storybook task" section for more detail). At the end of the task, participants sat at a table in front of the experimenter, and the moral self-concept was measured through a puppet interview (Sengsavang & Krettenauer, 2015). Finally, caregivers were debriefed and children received a small present for their participation.

Storybook task

This task was developed to resemble an illustrated book. It was inspired by studies using illustrations to depict hypothetical scenarios of different moral valence to young children (e.g., Cowell & Decety, 2015; Killen et al., 2011; Malti et al., 2016). The task presented on the eye-tracking screen consisted of a series of audiovisual stories composed of three illustrations each (see Fig. 1 for some examples). The illustrated part of each story consisted of black and white pencil drawings with ambiguous endings (i.e., they could be interpreted as prosocial, antisocial, or morally neutral). During the presentation of the pictures, a female voice narrated the stories with a prosocial, antisocial, or morally neutral ending (depending on condition). The task included 6 stories, each portrayed in the three different versions, for a total of 18 stories. In each version of the same story, the visual depiction of the actions was the same, but the characters varied (e.g., girls in some versions and boys in others, with different clothes and hairstyles and different names in each version). The protagonists of the stories were always two same-gendered children. For each condition (prosocial, antisocial, or neutral), there was an equal number of stories with boys and with girls. During the first illustration, a female narrator introduced the characters. During the second illustration, she described the context. Finally, during the third illustration, she described the action. This final part is where the stories substantially differed (see Fig. 1 caption for examples).

This setup had the advantage of maintaining the visual stimulus constant between conditions, thereby preventing the effect of confounding variables such as contrast and luminance on pupil dilation. At the same time, the illustrations were interesting enough for children to keep looking at the screen during the whole task. To prevent the task from becoming too repetitive, we divided it into



Fig. 1. Example stimuli. The audio stimuli describing the pictures were the following (originally in German): 1a—These are Ron and Lukas. Ron has a lightning on his T-shirt. Lukas wears short pants. They meet in the park after kindergarten. 1b—They want to do a race; they want to see who can run faster to the swing. They start to run. 1c, prosocial—Suddenly Lukas trips. Ron catches Lukas in time before he falls. Then Ron and Lukas keep on running together. 1c, antisocial—Lukas is faster, but then Ron pushes Lukas and Lukas falls on the ground. Ron keeps on running alone. 1c, neutral—Suddenly Lukas finds a cool flower on the ground. Ron keeps on running alone. 2a—These are Nele and Elli. Nele wears a striped T-shirt. Elli wears a dress. They meet to play after kindergarten. 2b—Nele brings her new big spinner. It spins very fast. Nele and Elli play with the spinner. 2c, prosocial—Suddenly the spinner falls and breaks. Nele is very sad and starts crying. Elli feels sorry for Nele and comforts her. 2c, antisocial—Suddenly the spinner is broken. Nele is very sad and starts crying. Elli had broken the spinner on purpose. 2c, neutral—Suddenly the spinner falls and breaks. Until the spinner gets repaired, Nele and Elli will play with other toys.

two sessions. Each session contained three mini-blocks, one per condition, composed of three stories each. The order of the mini-blocks and the stories was counterbalanced between participants and sessions, so that all possible combinations appeared with similar frequencies, to prevent order effects in the results. Before each story, a fixation cross appeared for 2000 ms, allowing the pupil diameter to return to baseline. At the end of the last auditory stimulus of each story, the last picture remained on the screen for an additional 5000 ms, allowing enough time to measure the pupil response (see Fig. 2). Finally, at the end of each trial, children needed to judge the action in a two-step procedure using a smiley scale. First, they were asked whether what the agent did was good, OK, or mean. If they chose good or mean, they were asked whether the action was just good/mean, really good/mean, or really very good/mean (depending on the first answer). Children answered verbally, and the experimenter pressed the corresponding button. This allowed us to collect children's judgments on a 7-point rating scale, with – 3 indicating really very mean, 0 indicating OK, and 3 indicating really very good. We decided to use OK as neutral score for two reasons. First, rating a situation as neither good nor mean can be complex for preschool children. Second, the neutral condition included acts that were morally neutral (i.e., neither prosocial nor antisocial), but not necessarily emotionally neutral; most of the neutral actions included emotionally positive situations (e.g., children playing). Thus, the neutral score in the judgment scale was labeled as OK to indicate something that is not mean but also not particularly good. To encourage children to complete the whole task, a screen appeared after each mini-block showing a series of stars. For each completed mini-block, one additional star turned gold.



Fig. 2. Storybook task trial sequence and durations. The timings of the three audiovisual stimuli composing one story varied from story to story, as indicated in the figure.

2.14, SD = 1.45), antisocial stories as more *mean* than the other two (M = -2.34, SD = 0.89), and neutral in the middle (M = 0.79, SD = 1.58).

Moral self-concept measure

To measure the moral self-concept, we used the puppet interview created by Sengsavang and Krettenauer (2015), in which children were presented with identical pairs of puppets making opposing statements. For instance, in one trial one puppet stated, "If another child needs help, I like to help," and the other stated, "If another child needs help, I don't like to help." Then, the experimenter asked children whether they were more like one puppet or the other puppet. Based on their answer, then the experimenter asked how much they were like the chosen puppet (*a lot or a little*). These two questions together were coded on a Likert scale ranging from 1 (e.g., a lot like the non-helpful puppet) to 5 (e.g., a lot like the helpful puppet). The questionnaire contained 29 items divided into three scales: prosocial actions (12 items), avoidance of antisocial actions (10 items), and social desirability (7 items). The social desirability scale served as control; participants might score high on the moral self-concept scales due to social desirability, thereby compromising the reliability of the measure. We used binary coding to assess social desirability; if a child showed social desirability on an item, it was given 1 point, otherwise it was given 0 points. Finally, we aggregated all 7 social desirability items so that a maximum of 7 points could be achieved. Participants with a high score on the social desirability scale (more than 5 points; n = 10) were excluded from the moral self-concept analyses.

Data handling and statistical analyses

Eye-tracking data

For the pupillary analysis, we exported the 120-Hz raw pupillary data per eye from Tobii Studio. Initially, we separated the eye tracking data into the relevant analysis segment (the last 2 s of the crucial action phase). The decision to focus on this 2-s interval rather than the full combined action and sleep phase interval was based on prior studies indicating that pupil dilation effects occur immediately after the critical events (Jackson & Sirois, 2009; Vaish et al., 2018; Yucel et al., 2020). In our case, in all stories and conditions the crucial act starts at minimum after the first 2 s of that interval. Thus, the last 2 s compared with the whole action phase interval would contain the reaction to the act for all stories.

Data were recorded for both the left and right eyes. Data for each eye were initially filtered following previously used processing steps using R (Hepach et al., 2012; Kassecker et al., 2023; Kret & Sjak-Shie, 2019): We first applied an outlier rejection based on minimum and maximum pupil size (min = 1.5 mm, max = 9 mm). Then, we used a speed and edge artifacts outlier rejection technique, where we excluded those dilation measures that, in their averaged absolute differences from the immediately preceding and subsequent samples' measures, exceeded the 90th percentile of the respective distribution for a given sequence. Next, we interpolated both eyes separately (maximum gap = 66 ms). Then, data from the left and right eyes were combined by averaging them into one value. If only one of those was present, then the current data point was used. Finally, data for both eyes were then averaged, filtered, and interpolated again using the same methods and setting as for a single eye. After preprocessing the data, we calculated change scores in pupil dilation by subtracting from each sample within the 2-s time window of interest the average of 24 samples (corresponding to 200 ms) taken from the first second of the crucial action phase, which thus preceded that time window of interest (for the baseline correction technique, see Kret & Sjak-Shie, 2019; Mathôt et al., 2018). Finally, we then compared changes in pupil size during the 2-s time window following each crucial act in each condition. This comparison assessed whether participants in the antisocial condition showed a different physiological arousal compared with participants in the neutral and prosocial conditions.

Moral self-concept measure

For each scale, we summed the scores across all items ($M_{pro} = 51.10$, SD = 6.02, range = 1–60; $M_{anti} = 42.98$, SD = 6.07, range = 1–50). In addition, we calculated a total moral self-concept score

by combining scores of the avoidance of antisocial behavior and prosocial behavior scales ($M_{to-tal} = 94.08$, SD = 11.06, range = 1–110).

Statistical analysis

The statistical analyses were carried out in R Version 4.2.2 (R Core Team, 2022). First, we analyzed whether children's arousal (as measured through pupil dilation) and behavioral judgment differed in the three conditions. For these analyses, we averaged scores across each condition and stories (see Fig. 3 as an example for pupil dilation).

Because the judgment data partly deviated clearly from the assumptions of linearity (i.e., regarding homogeneity of variances), we used the Friedman's test (Friedman, 1937) on judgments with condition as a predictor variable. According to Cook's distance (CD < 1), no influential outliers were detected (Cook & Weisberg, 1982).

For all pupil dilation measures, we used generalized linear mixed-effects models that allow for the inclusion of both fixed and random effects to account for the non-independence of the data (i.e., repeated observations per child) (Bates et al., 2014). Because the pupil dilation data met the assumptions of linearity (e.g., homogeneity of variances; no significant deviations of normality), we used a Gaussian error structure. When calculating Cook's distance (CD < 1), no influential outliers were detected (Cook & Weisberg, 1982). First, we calculated the main effect of condition on pupil dilation. The full models included condition (antisocial, neutral, or prosocial) as a predictor variable and participants as a random intercept factor. The significance of the predictor variable (i.e., main effect of condition) was tested by comparing the fit of the full model with the fit of a null model that contained only the random effect using a likelihood ratio test (LRT; Dobson, 2002).

To investigate the relation between pupil dilation and judgment, we first calculated the interaction effect between condition and judgment on pupil dilation. Given that the interaction effect was not sig-



Fig. 3. Time course of the mean relative change in pupil diameter across the three different conditions. The graph illustrates the last 2 s of the crucial action phase. For illustration purposes, data were smoothed using a moving average filter.

nificant, $\chi^2(4) = 4.46$, p = .348, we tested the main effect of judgment on pupil dilation. Thus, the full models included judgment as a predictor variable and participants as a random intercept factor. The significance of the predictor variable (i.e., main effect of judgment) was tested by comparing the fit of the full model with the fit of a null model that contained only the random effect using the LRT (Dobson, 2002). Unstandardized parameter estimates (*b*), 95% confidence intervals of parameter estimates (*Cls*), and standard errors were obtained from all full models. Finally, we calculated whether the antisocial and prosocial moral self-concept scales (both separately and the total moral self-concept score) are interrelated with children's judgment of each condition using Spearman rank correlation *rho* (Zar, 2005). Then, we calculated whether the moral self-concept scales are interrelated with the pupil dilation measure (of antisocial scenes) using Pearson correlation *r* (Freedman et al., 2007).

Results

Judgment data

The Friedman's test on children's ratings yielded significant differences across condition, $\chi^2(2) = 128.63$, p < .001, $\omega = 0.95$ (see Fig. 4). Holm pairwise comparisons showed that this was due to antisocial actions (Mdn = -2.50) being rated more negatively than neutral (Mdn = 0.33) and prosocial (Mdn = 1.75) actions and to prosocial actions being rated more positively than neutral and antisocial actions (all ps < .001).

Pupil dilation

The linear mixed-effects model on pupil dilation yielded a main effect of condition, $\chi^2(2) = 12.834$, p = .002 (see Fig. 5). As predicted, children showed a significantly larger relative increase in pupil size in the antisocial condition (M = 0.05, SD = 0.01) than in the prosocial condition (M = 0.01, SD = 0.01), b = 0.05, SE = 0.02, t(120) = 3.11, p = .002, CI = [0.02, 0.07], and in the neutral condition (M = 0.008, SD = 0.01), b = 0.05, SE = 0.01, t(120) = 3.21, p = .017, CI = [0.02, 0.08]. Furthermore, there was no difference



Fig. 4. Boxplot of children's averaged judgment as a function of condition. The solid lines inside the boxes represent the group medians.



Fig. 5. Boxplot of the mean relative change in participants' pupil dilation as a function of condition (antisocial, neutral, or prosocial). The solid lines inside the boxes represent the group medians.

between the prosocial and neutral conditions, b = 0.001, SE = 0.01, t(120) = 0.10, p = .924, CI = [-0.03, 0.03].

Relation between pupil dilation and judgment

We found a significant main effect of judgment on pupil dilation, $\chi^2(1) = 11.18$, p = .001, b = -0.01, *SE* = 0.003, *t*(124.65) = -3.41, *CI* = [-0.02, -0.005]. The direction of the pupil effect was negative, indicating that the more negative the judgment, the greater the pupil dilation in response to the scenes.

Relation between moral self-concept and judgment

To investigate whether the moral self-concept is interrelated with children's judgments, we calculated correlations. We first investigated whether the total moral self-concept score interrelates with children's judgment per condition, then investigated specifically the prosocial behavior scale, and finally investigated the avoidance of antisocial behavior scale. There was a significant negative association between children's total moral self-concept scale and their judgment of the antisocial scenes, r(58) = -.27, p = .040 (two-sided), indicating that the higher the total moral-self-concept, the more negatively children judged the antisocial scenes. No significant association was found between children's total moral self-concept scale and their judgment of prosocial and neutral scenes (all ps > .05). Furthermore, there was a significant negative association between children's rating of the antisocial scenes, r(58) = -.40, p = .001 (two-sided), but no association was found between the prosocial self-concept scale and children's judgment of the neutral and prosocial scenes (all ps > .05). No association was found between the avoidance of antisocial behavior scale and children's judgment of the three different moral scenes (all ps > .05). Overall, the results suggest that children with a higher moral self-concept judged antisocial scenes more negatively and that this effect was driven by the prosocial dimension of the self-concept.

Relation between moral self-concept and pupil dilation

Similarly, we calculated three different correlations to investigate whether the total moral selfconcept interrelates with children's arousal arising from the antisocial condition or whether there were specific interrelations with the prosocial scale or with the antisocial scale. There were no significant correlations (all *ps* > .05), indicating no association between children's moral self-concept and their implicit affective reaction to antisocial behavior.

Discussion

This study investigated the relations among the moral self-concept, explicit moral judgments, and implicit arousal to moral scenarios in early childhood. Although influential developmental theories highlight the importance of each of these aspects (Blasi, 1984, 1999; Hardy & Carlo, 2011; Lapsley & Narvaez, 2004; Stets & Carter, 2012; Turiel, 1983), the interrelations have remained subject to debate. From an empirical point of view, developmental science has accumulated evidence on the ontogeny and breadth of young children's moral reasoning (Fast & Riggs, 2024; Malti & Ongley, 2014), their arousal when being confronted with immoral behavior (Essler & Paulus, 2023; Kassecker et al., 2023; Yucel et al., 2020), and their moral self-concept (e.g., Sengsavang & Krettenauer, 2015; Sticker et al., 2023), but the relations among these three facets of early morality have not been explored. The current study contributes to this question.

To this end, we presented 5- to 7-year-old children with audiovisual scenes portraying prosocial, antisocial, and neutral actions. We assessed their arousal reaction to such scenes by means of pupil dilation. Moreover, we asked participants for their moral judgments. Finally, children's moral self-concept was assessed. Overall, the results demonstrate that children's moral judgments differed for the scenes, judging the antisocial scenes as most negative and the prosocial scenes as most positive. Furthermore, they showed more arousal (in terms of greater pupil dilation) for the antisocial scenes. Moreover, children's moral judgment relates to their arousal; the more negative the moral judgment, the higher the arousal. Such a result applied to all situations rather than only to the antisocial ones. Finally, children's moral judgments, but not their pupil dilations, were related to their moral self-concept, suggesting a link between moral reasoning and how children think about themselves. This finding corroborates views that the moral self-concept and moral cognition are interrelated (Kochanska et al., 2010).

Given that negative emotional responses to harm to others appear early in life (Davidov et al., 2013; Eisenberg et al., 2006; Hoffman, 2001; Roth-Hanania et al., 2011), we hypothesized that children would react with greater arousal (measured as increase in pupil dilation) to antisocial scenes as compared with prosocial and neutral scenes. Our results are in line with this hypothesis; we found that immediately after the onset of the action (the last 2 s of the crucial action phase), children showed greater pupil dilation for antisocial actions as compared with both prosocial and neutral actions. This result relates well to work with adults (Cushman et al., 2012; Miller & Cushman, 2013) and supports developmental theories suggesting that moral violations would be emotionally salient for children (Arsenio et al., 2006; Hoffman, 2001; Kochanska & Aksan, 2006; Malti & Latzko, 2010). In addition, when considering individual differences in relation to children's judgment and arousal, we found that, irrespective of the condition, children were overall more aroused when they also evaluated the situation more negatively. Given a link between emotions and arousal (Bradley et al., 2008), this relates well to proposals that moral cognition and moral emotions are coordinated in development (Turiel, 1983) and are not dissociated areas.

A further aim of this study was to investigate whether the moral self-concept is related to implicit and explicit reactions to third-party morally relevant situations, measured as arousal and judgments, respectively. A child's moral self-concept reflects how much the child sees himself or herself as someone who performs prosocial actions and avoids antisocial actions (Kochanska, 2002; Sengsavang & Krettenauer, 2015). Previous work showed that in young children the moral self-concept relates to moral behavior and moral emotions (Christner et al., 2020; Sticker et al., 2021). The moral selfconcept is considered a precursor of moral identity in adults that not only influences first-party moral behavior and emotions (Aquino & Reed, 2002; Christner et al., 2022; Hertz & Krettenauer, 2016) but also is related to increased moral judgment competencies (Patrick et al., 2018; Reed et al., 2007). We hypothesized that if children with a high moral self-concept are also more competent in their moral judgment, there should be relations to their judgments of prosocial, antisocial, and neutral actions. Our results are partially consistent with this hypothesis. We found a relationship between children's overall score of their moral self-concept and their evaluation of the antisocial scenes. This was mostly driven by their prosocial self-concept. This indicates that it is especially children's view of themselves as "good" or "prosocial" children that comes with increased negative judgments of antisocial behavior. This relates well to research showing that the prosocial part of children's moral selfconcept (i.e., whether they see themselves as helpful, generous, and concerned with others' wellbeing) relates to prosocial behavior (Christner et al., 2020; Sticker et al., 2021). Taken together, this study extents previous work by demonstrating that children with a high moral self-concept not only behave more prosocially (or avoid behaving antisocially) but also evaluate moral norm transgressions more negatively.

Another question concerned whether the moral self-concept relates to implicit reactions to thirdparty moral situations as assessed by pupil dilation. Although the pupil dilation patterns confirmed theories that children show greater arousal for antisocial scenarios, there was no relation to the moral self-concept. This finding complements other studies that found no relation between the explicit moral self-concept and implicit measures of the self (Sticker et al., 2021). It suggests that the moral self-concept operates on an explicit level, probably based in a propositional format, and that there is no clear relation to general arousal processes. The findings thus indicate that children's moral self-concept first builds on reflections of what they consider right or wrong and how they perceive their own behavior rather than affective experiences. Moreover, our findings are in line with theoretical assumptions on the development of the moral self-concept and moral identity (Blasi, 1995; Blasi & Milton, 1991; Kingsford et al., 2018; Krettenauer, 2013, 2022). For instance, Blasi and Milton (1991) discussed that the sense of self develops in adolescence from being closely tied to social relations and feelings of social approval-the pre-identity mode-to a core sense of self. Relatedly, for the development of moral identity, Krettenauer (2022) proposed that moral identity becomes less externally and more internally motivated across development. Our findings, although focusing on the moral self-concept in children, fit to these notions by suggesting that children first begin to integrate the evaluation of antisocial behavior, which is strongly linked to societal disapproval, into their moral self as a way of initialing understanding what is good. Yet, one should be aware that this study was of a cross-sectional nature. It would be interesting to explore the relations among arousal, moral judgment, and self-concept in a longitudinal study.

Although the current study brings novel evidence on the interrelations among moral judgments, the moral self-concept, and arousal in young children, it also comes with some limitations. First, pupil dilation, albeit especially suited for measuring implicit reactions in children, is a generic measure of arousal and does not specifically reflect emotional or cognitive processes. Thus, one needs to rely on experimental and stimuli design to distinguish between interpretations and at the same time keep open the possibility of different mechanisms influencing pupil dilation. To do so, we controlled for luminance and cognitive load by keeping the pictures and content of each story over the three conditions as constant as possible. Yet, speech length differed slightly across conditions given that the sentences could not be completely matched. However, due to the selection of different stimuli, we render the impact of this part as rather irrelevant. Future research could employ different setups and different stimuli to explore this in greater detail. Moreover, because we could not achieve an ideal sample size and power, the current findings need to be replicated in larger samples. Second, the current study relied on a sample of children in a WEIRD (Western, educated, industrialized, rich, and democratic) culture. It would be interesting to study these processes also in other societal or cultural settings. Finally, the study is of a correlational nature. Thus, it is not suitable to provide a strong test for causal claims for the relations among the three variables. Further longitudinal or experimental work would be required to explore the interrelations in greater detail.

To conclude, this article expands literature on early moral development by showing that in 5- to 7year-old children judgment relates to their arousal and to their moral self-concept. These results open the path to future studies providing a more complete picture on the relations among arousal, moral judgment, and the self in young children.

CRediT authorship contribution statement

Anja Kaßecker: Writing – original draft, Visualization, Methodology, Formal analysis, Data curation. **Antonia Misch:** Investigation, Writing – review & editing. **Markus Paulus:** Conceptualization, Methodology, Supervision, Writing – review & editing, Funding acquisition. **Natalie Christner:** Writing – review & editing. **Carolina Pletti:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Supervision, Writing – original draft.

Data availability

Data will be made available on request.

Acknowledgments

This work was supported by a European Research Council (ERC) Starting Grant (MORALSELF; 679000) to Markus Paulus. We thank all the parents and children who participated in this study as well as the student research assistants and colleagues who helped with data collection and coding.

Author contributions

C.P. and M.P. developed the study concept and design. Data collection was performed by C.P. Data analysis was performed by A.K. and C.P., who also drafted the first version of the manuscript. A.M., N. C., and M.P. provided critical revisions. All authors approved the final version of the manuscript.

References

- Aquino, K., & Reed, A. I. (2002). The self-importance of moral identity. Journal of Personality and Social Psychology, 83(6), 1423–1440. https://doi.org/10.1037//0022-3514.83.6.1423.
- Arsenio, W. F., Gold, J., & Adams, E. (2006). Children's conceptions and displays of moral emotions. In M. Killen & J. G. Smetana (Eds.), Handbook of moral development (pp. 599–628). Lawrence Erlbaum.
- Ball, C. L., Smetana, J. G., & Sturge-Apple, M. L. (2017). Following my head and my heart: Integrating preschoolers' empathy, theory of mind, and moral judgments. *Child Development*, 88(2), 597–611. https://doi.org/10.1111/cdev.12605.
- Bates, D., Maechler, M., Bolker, B., & Walker, S. (2014). Fitting linear mixed-effects models using lme4. Journal of Statistical Software, 67(1), 1–48 https://doi.org/10.18637/jss.v067.i01.
- Beatty, J., & Lucero-Wagoner, B. (2000). The pupillary system. In J. T. Cacioppo, L. G. Tassinary, & G. G. Berntson (Eds.), Handbook of psychophysiology (2nd ed., pp. 142–162). Cambridge University Press.
- Blasi, A. (1983). Moral cognition and moral action: A theoretical perspective. Developmental Review, 3(2), 178–210. https://doi. org/10.1016/0273-2297(83)90029-1.
- Blasi, A. (1984). Moral identity: Its role in moral functioning. In W. M. Kurtines & J. L. Gewirtz (Eds.), Morality, moral behavior, and moral development (pp. 128–139). John Wiley.
- Blasi, A. (1995). Moral understanding and the moral personality. In W. Kurtines & J. Gewirtz (Eds.), Moral development (pp. 229–253). Allyn & Bacon.
- Blasi, A. (1999). Emotions and moral motivation. Journal for the Theory of Social Behaviour, 29(1), 1–19. https://doi.org/10.1111/ 1468-5914.00088.
- Blasi, A., & Milton, K. (1991). The development of the sense of self in adolescence. Journal of Personality, 59(2), 217–242. https:// doi.org/10.1111/j.1467-6494.1991.tb00774.x.
- Bradley, M. M., Miccoli, L., Escrig, M. A., & Lang, P. J. (2008). The pupil as a measure of emotional arousal and autonomic activation. Psychophysiology, 45(4), 602–607. https://doi.org/10.1111/j.1469-8986.2008.00654.x.
- Carpendale, J. I., & Hammond, S. I. (2016). The development of moral sense and moral thinking. *Current Opinion in Pediatrics*, 28 (6), 743–747.
- Christner, N., Pletti, C., & Paulus, M. (2020). Emotion understanding and the moral self-concept as motivators of prosocial behavior in middle childhood. *Cognitive Development*, 55. https://doi.org/10.1016/j.cogdev.2020.100893 100893.
- Christner, N., Pletti, C., & Paulus, M. (2022). How does the moral self-concept relate to prosocial behaviour? Investigating the role of emotions and consistency preference. *Cognition and Emotion*, 36(5), 894–911. https://doi.org/10.1080/ 02699931.2022.2067133.

Cook, R. D., & Weisberg, S. (1982). Residuals and influence in regression. Chapman & Hall.

- Cowell, J. M., & Decety, J. (2015). The neuroscience of implicit moral evaluation and its relation to generosity in early childhood. *Current Biology*, 25(1), 93–97. https://doi.org/10.1016/j.cub.2014.11.002.
- Cushman, F. A., Gray, K., Gaffey, A., & Mendes, W. B. (2012). Simulating murder: The aversion to harmful action. *Emotion*, 12, 2–7. https://doi.org/10.1037/a0025071.

- Dahl, A., Gross, R. L., & Siefert, C. (2020). Young children's judgments and reasoning about prosocial acts: Impermissible, suberogatory, obligatory, or supererogatory? *Cognitive Development*, 55. https://doi.org/10.1016/j.cogdev.2020.100908 100908.
- Dahl, A., & Killen, M. (2018). A developmental perspective on the origins of morality in infancy and early childhood. Frontiers in Psychology, 9. https://doi.org/10.3389/fpsyg.2018.01736 1736.
- Dahl, A., Martinez, M. G. S., Baxley, C. P., & Waltzer, T. (2022). Early moral development: Four phases of construction through social interactions. In M. Killen & J. G. Smetana (Eds.), Handbook of moral development (3rd ed., pp. 135–152). Routledge.
- Davidov, M., Zahn-Waxler, C., Roth-Hanania, R., & Knafo, A. (2013). Concern for others in the first year of life: Theory, evidence, and avenues for research. *Child Development Perspectives*, 7(2), 126–131. https://doi.org/10.1111/cdep.12028.
- Dobson, A. J. (2002). An introduction to generalized linear models (2nd ed.). Chapman & Hall/CRC. Eisenberg, N., Spinrad, T. L., & Sadovsky, A. (2006). Empathy-related responding in children. In M. Killen & J. G. Smetana (Eds.), Handbook of moral development (pp. 535–568). Lawrence Erlbaum.
- Essler, S., & Paulus, M. (2023). Normative language understanding and behavioral compliance longitudinally predict 2.5-yearolds' social norm enforcement. Cognitive Development, 66. https://doi.org/10.1016/j.cogdev.2023.101337 101337.
- Fast, A. A., & Riggs, A. E. (2024). Preschoolers negatively evaluate conventional norm violations in pretend play. Journal of Experimental Child Psychology, 241. https://doi.org/10.1016/j.jecp.2024.105861 105861.
- Freedman, D., Pisani, R., & Purves, R. (2007). Statistics (4th ed.). W. W: Norton.
- Friedman, M. (1937). The use of ranks to avoid the assumption of normality implicit in the analysis of variance. *American Statistical Association*, 32, 675–701.
- Gibbs, J. C. (2019). Moral development and reality: Beyond the theories of Kohlberg, Hoffman, and Haidt. Oxford University Press. Gniewosz, G., Sticker, R. M., & Paulus, M. (2023). A longitudinal assessment of the stability of the three-dimensional moral selfconcept during early childhood. European Journal of Developmental Psychology, 20(2), 327–346. https://doi.org/10.1080/ 17405629.2022.2090333.
- Hammond, S. I., & Drummond, J. (2019). Rethinking emotions in the context of infants' prosocial behavior: The role of interest and positive emotions. *Developmental Psychology*, 55(9), 1882–1888. https://doi.org/10.1037/dev0000685.
- Hardy, S. A., & Carlo, G. (2011). Moral identity: What is it, how does it develop, and is it linked to moral action? Child Development Perspectives, 5(3), 212-218. https://doi.org/10.1111/j.1750-8606.2011.00189.x.
- Hepach, R., Vaish, A., & Tomasello, M. (2012). Young children are intrinsically motivated to see others helped. Psychological Science, 23(9), 967–972. https://doi.org/10.1177/0956797612440571.
- Hepach, R., & Westermann, G. (2016). Pupillometry in infancy research. Journal of Cognition and Development, 17(3), 359–377. https://doi.org/10.1080/15248372.2015.1135801.
- Hertz, S. G., & Krettenauer, T. (2016). Does moral identity effectively predict moral behavior? A meta-analysis. Review of General Psychology, 20(2), 129–140. https://doi.org/10.1037/gpr0000062.
- Hoffman, M. L. (2001). Empathy and moral development: Implications for caring and justice. Cambridge University Press.
- Jackson, I., & Sirois, S. (2009). Infant cognition: Going full factorial with pupil dilation. Developmental Science, 12(4), 670–679. https://doi.org/10.1111/j.1467-7687.2008.00805.x.
- Kassecker, A., Verschoor, S. A., & Schmidt, M. F. H. (2023). Human infants are aroused and concerned by moral transgressions. Proceedings of the National Academy of Sciences of the United States of America, 120(31). https://doi.org/10.1073/ pnas.2306344120 e2306344120.
- Killen, M., Mulvey, K. L., Richardson, C., Jampol, N., & Woodward, A. (2011). The accidental transgressor: Morally-relevant theory of mind. Cognition, 119(2), 197–215. https://doi.org/10.1016/j.cognition.2011.01.006.
- Killen, M., & Smetana, J. G. (2015). Origins and development of morality. In R. M. Lerner (Ed.), Handbook of child psychology and developmental science (pp. 1–49). John Wiley. https://doi.org/10.1002/9781118963418.childpsy317.
- Kingsford, J. M., Hawes, D. J., & De Rosnay, M. (2018). The moral self and moral identity: Developmental questions and conceptual challenges. British Journal of Developmental Psychology, 36(4), 652–666. https://doi.org/10.1111/bjdp.12260.
- Kochanska, G. (2002). Committed compliance, moral self, and internalization: A mediational model. Developmental Psychology, 38(3), 339–351. https://doi.org/10.1037//0012-1649.38.3.339.
- Kochanska, G., & Aksan, N. (2006). Children's conscience and self-regulation. Journal of Personality, 74(6), 1587–1618.
- Kochanska, G., Koenig, J. L., Barry, R. A., Kim, S., & Yoon, J. E. (2010). Children's conscience during toddler and preschool years, moral self, and a competent, adaptive developmental trajectory. *Developmental Psychology*, 46(5), 1320–1332. https://doi. org/10.1037/a0020381.
- Kret, M. E., & Sjak-Shie, E. E. (2019). Preprocessing pupil size data: Guidelines and code. Behavior Research Methods, 51(3), 1336–1342. https://doi.org/10.3758/s13428-018-1075-y.
- Krettenauer, T. (2013). Revisiting the moral self-construct: Developmental perspectives on moral selfhood. In B. W. Sokol, F. M. E. Grouzet, & U. Müller (Eds.), Self-regulation and autonomy (pp. 115–140). Cambridge University Press. https://doi.org/ 10.1017/CB09781139152198.010.
- Krettenauer, T. (2022). Development of moral identity: From the age of responsibility to adult maturity. Developmental Review, 65. https://doi.org/10.1016/j.dr.2022.101036 101036.
- Krettenauer, T., & Hertz, S. (2015). What develops in moral identities? A critical review. Human Development, 58(3), 137–153. https://doi.org/10.1159/000433502.
- Lapsley, D. (2015). Moral identity and developmental theory. Human Development, 58(3), 164–171. https://doi.org/10.1159/ 000435926.
- Lapsley, D., & Narvaez, D. (2004). A social-cognitive approach to the moral personality. In D. K. Lapsley & D. Narvaez (Eds.), Moral development, self, and identity (pp. 201–224). Lawrence Erlbaum.
- Lefebvre, J. P., & Krettenauer, T. (2019). Linking moral identity with moral emotions: A meta-analysis. Review of General Psychology, 23(4), 444–457. https://doi.org/10.1177/1089268019880887.
- Malti, T., Gasser, L., & Gutzwiller-Helfenfinger, E. (2010). Children's interpretive understanding, moral judgments, and emotion attributions: Relations to social behaviour. British Journal of Developmental Psychology, 28(2), 275–292. https://doi.org/ 10.1348/026151009X403838.

- Malti, T., Gummerum, M., Ongley, S., Chaparro, M., Nola, M., & Bae, N. Y. (2016). "Who is worthy of my generosity?" Recipient characteristics and the development of children's sharing. *International Journal of Behavioral Development*, 40(1), 31–40. https://doi.org/10.1177/0165025414567007.
- Malti, T., & Latzko, B. (2010). Children's moral emotions and moral cognition: Towards an integrative perspective. New Directions for Child and Adolescent Development, 2010(129), 1–10. https://doi.org/10.1002/cd.272.
- Malti, T., & Ongley, S. F. (2014). The development of moral emotions and moral reasoning. In M. Killen & J. G. Smetana (Eds.), Handbook of moral development (2nd ed.,, pp. 163–183). Psychology Press.
- Mathôt, S., Fabius, J., Van Heusden, E., & Van Der Stigchel, S. (2018). Safe and sensible preprocessing and baseline correction of pupil-size data. Behavior Research Methods, 50(1), 94–106. https://doi.org/10.3758/s13428-017-1007-2.
- Miller, R. M., & Cushman, F. A. (2013). Aversive for me, wrong for you: First-person behavioral aversions underlie the moral condemnation of harm. Social and Personality Psychology Compass, 7(10), 707–718. https://doi.org/10.1111/spc3.12066.
- Misailidi, P., & Tsiara, E. (2021). Conscience and theory of mind in children aged 4 to 7 years. Journal of Experimental Child Psychology, 203. https://doi.org/10.1016/j.jecp.2020.105007 105007.
- Ongley, S. F., & Malti, T. (2014). The role of moral emotions in the development of children's sharing behavior. *Developmental Psychology*, 50(4), 1148–1159. https://doi.org/10.1037/a0035191.
- Patrick, R. B., Bodine, A. J., Gibbs, J. C., & Basinger, K. S. (2018). What accounts for prosocial behavior? Roles of moral identity, moral judgment, and self-efficacy beliefs. *Journal of Genetic Psychology*, 179(5), 231–245. https://doi.org/10.1080/ 00221325.2018.1491472.
- Paulus, M., & Moore, C. (2017). Preschoolers' generosity increases with understanding of the affective benefits of sharing. Developmental Science, 20(3). https://doi.org/10.1111/desc.12417 e12417.
- Paulus, M., Wörle, M., & Christner, N. (2020). The emergence of human altruism: Preschool children develop a norm for empathy-based comforting. Journal of Cognition and Development, 21(1), 104–124.
- Pletti, C., Decety, J., & Paulus, M. (2019). Moral identity relates to the neural processing of third-party moral behavior. Social Cognitive and Affective Neuroscience, 14(4), 435–445. https://doi.org/10.1093/scan/nsz016.
- Pletti, C., Decety, J., & Paulus, M. (2022). Neural processing of moral content reflects moral identity in 10-year-old children. Developmental Science, 25(4). https://doi.org/10.1111/desc.13232 e13232.
- R Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing. https:// www.R-project.org.
- Rakoczy, H., Kaufmann, M., & Lohse, K. (2016). Young children understand the normative force of standards of equal resource distribution. Journal of Experimental Child Psychology, 150, 396–403. https://doi.org/10.1016/j.jecp.2016.05.015.
- Rakoczy, H., & Schmidt, M. F. H. (2013). The early ontogeny of social norms. Child Development Perspectives, 7(1), 17–21. https:// doi.org/10.1111/cdep.12010.
- Reed, A., Aquino, K., & Levy, E. (2007). Moral identity and judgments of charitable behaviors. Journal of Marketing, 71(1), 178–193. https://doi.org/10.1509/jmkg.71.1.178.
- Rossano, F., Rakoczy, H., & Tomasello, M. (2011). Young children's understanding of violations of property rights. Cognition, 121 (2), 219–227. https://doi.org/10.1016/j.cognition.2011.06.007.
- Roth-Hanania, R., Davidov, M., & Zahn-Waxler, C. (2011). Empathy development from 8 to 16 months: Early signs of concern for others. Infant Behavior and Development, 34(3), 447–458.
- Rottman, J., & Kelemen, D. (2012). Aliens behaving badly: Children's acquisition of novel purity-based morals. Cognition, 124(3), 356-360. https://doi.org/10.1016/j.cognition.2012.06.001.
- Rottman, J., Young, L., & Kelemen, D. (2017). The impact of testimony on children's moralization of novel actions. *Emotion*, 17(5), 811–827. https://doi.org/10.1037/emo0000276.
- Schmidt, M. F. H., Svetlova, M., Johe, J., & Tomasello, M. (2016). Children's developing understanding of legitimate reasons for allocating resources unequally. *Cognitive Development*, 37, 42–52. https://doi.org/10.1016/j.cogdev.2015.11.001.
- Sengsavang, S., & Krettenauer, T. (2015). Children's moral self-concept: The role of aggression and parent-child relationships. Merrill-Palmer Quarterly, 61(2), 213-235 https://doi.org/10.13110/merrpalmquar1982.61.2.0213.
- Sirois, S., & Brisson, J. (2014). Pupillometry. Wiley Interdisciplinary Reviews. Cognitive Science, 5(6), 679-692. https://doi.org/ 10.1002/wcs.1323.
- Smetana, J. G., & Braeges, J. L. (1990). The development of toddlers' moral and conventional judgments. Merrill-Palmer Quarterly, 36(3), 329–346 https://www.jstor.org/stable/23087284.
- Smetana, J. G., Schlagman, N., & Adams, P. W. (1993). Preschool children's judgments about hypothetical and actual transgressions. Child Development, 64(1), 202-214. https://doi.org/10.2307/1131446.
- Stets, J. E., & Carter, M. J. (2012). A theory of the self for the sociology of morality. American Sociological Review, 77(1), 120–140. https://doi.org/10.1177/0003122411433762.
- Sticker, R. M., Christner, N., Pletti, C., & Paulus, M. (2021). The moral self-concept in preschool children: Its dimensions and relation to prosocial behaviors. *Cognitive Development*, 58. https://doi.org/10.1016/j.cogdev.2021.101033 101033.
- Thompson, R. A. (2012). Whither the preconventional child? Toward a life-span moral development theory. *Child Development Perspectives*, 6(4), 423–429. https://doi.org/10.1111/j.1750-8606.2012.00245.x.

Turiel, E. (1983). The development of social knowledge: Morality and conventions. Cambridge University Press.

- Turiel, E. (2008). The development of children's orientations toward moral, social, and personal orders: More than a sequence in development. Human Development, 51(1), 21–39. https://doi.org/10.1159/000113154.
- Vaish, A., Hepach, R., & Grossmann, T. (2018). Desire understanding in 2-year-old children: An eye-tracking study. Infant Behavior and Development, 52, 22–31. https://doi.org/10.1016/j.infbeh.2018.05.002.
- Yucel, M., Hepach, R., & Vaish, A. (2020). Young children and adults show differential arousal to moral and conventional transgressions. Frontiers in Psychology, 11. https://doi.org/10.3389/fpsyg.2020.00548 548.
- Zar, J. H. (2005). Spearman rank correlation. In P. Armitage & T. Colton (Eds.), Encyclopedia of biostatistics. https://doi.org/ 10.1002/0470011815.b2a15150.