

Current Biology

The Neuroscience of Implicit Moral Evaluation and Its Relation to Generosity in Early Childhood

Highlights

- Temporal dynamics of morality in 3–5 year olds are examined with EEG and eye tracking
- Distinct early and later controlled waveforms in viewing helping and harming scenes
- Later (LPP), but not early (EPN), waveforms predicted actual generosity
- These results shed important light on theories of moral development

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In Brief

Prosocial behavior emerges early in development, and young children possess capacities for social and moral evaluations. In this study, Cowell and Decety explored their neural underpinnings in 3–5 year olds and how these predict actual generosity, exemplifying the potential of integrating development and neuroscience in refining moral theories.

The Neuroscience of Implicit Moral Evaluation and Its Relation to Generosity in Early Childhood

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Summary

Despite cultural and individual variation, humans are a judgmental bunch [1]. There is accumulating evidence for early social and moral evaluation as shown by research with infants and children documenting the notion that some behaviors are perceived as right and others are perceived as wrong [2]. Moreover, social interactions are governed by a concern for fairness and others' well-being [3, 4]. However, although generosity increases between infancy and late childhood, it is less clear what mechanisms guide this change [5]. Early predispositions toward prosociality are thought to arise in concert with the social and cultural environment, developing into adult morality, a complex incorporation of emotional, motivational, and cognitive processes [6, 7]. Using EEG combined with eye tracking and behavioral sharing, we investigated, for the first time, the temporal neurodynamics of implicit moral evaluation in 3- to 5-year-old children. Results show distinct early automatic attentional (EPN) and later cognitively controlled (N2, LPP) patterns of neural response while viewing characters engaging in helping and harming behaviors. Importantly, later (LPP), but not early (EPN), waveforms predicted actual generosity. These results shed light on theories of moral development by documenting the respective contribution of automatic and cognitive neural processes underpinning social evaluation and directly link these neural computations to prosocial behavior in children.

Results

Although infants appear sensitive to inequality [8], and toddlers can act prosocially [4], fairness in actual behavior does not appear to develop until late childhood, when children's sharing approaches equality in distribution [5]. However, although there is considerable change in expressed sharing behavior between infancy and late childhood, it is less clear what mechanisms guide this increase in generosity. For instance, studies with adults suggest that fast, intuitive, and automatic processes underlie cooperation and contribution [9]. Yet, expression of generosity in late childhood has been theorized to be dependent upon secondary considerations, such as cognitive concerns with actually being fair as well as appearing fair [10]. Taken together, both automatic and controlled computations seem to play a role in moral judgment and subsequent moral behavior.

To examine how specific neurodynamic responses are associated with implicit moral evaluations of antisocial (harming) and prosocial (helping) behaviors in young children and

whether early automatic or later cognitive controlled processes are predictive of their generosity, we collected electroencephalogram (EEG), eye-tracking, and behavioral measures (Figure 1). It was predicted that all children would show neural differentiation in earlier waveforms related to automatic processing; specifically, the amplitude of the early posterior negativity (EPN) waveform was expected to differ when viewing helping scenes compared to harming scenarios. Additionally, it was expected that children would exhibit differential amplitudes in later waveforms associated with cognitive detection of conflict and cognitive reappraisal of the stimuli (N2, late positive potential [LPP]). For the N2, children were expected to view harmful scenes in conflict with established moral rules and thus exhibit a greater negativity when perceiving harmful versus helping scenes. Children were also expected to show differential amplitudes for helping compared to harming scenarios for the LPP [11]. Finally, if prosocial behavior (sharing) is primarily facilitated by automatic reactivity or attention-based processes, then EPN differences are anticipated to predict explicit sharing in children. Conversely, if generosity is guided by controlled processes, then differences in later waveforms (LPP) would predict giving behavior.

Significant differences were found in early automatic and later controlled temporal periods when children viewed the morally laden scenarios. Primarily, results from a 3 (Pz, P3, P4) × 2 (helping/harming) ANOVA showed a significant main effect of moral valence (helping/harming) in EPN mean amplitude ($F(1, 47) = 4.7, p = 0.036, \eta^2 = 0.090$). This difference was characterized by greater mean amplitudes (greater negativities) for positive (helping) versus negative (harming) scenes.

Moreover, later distinct modulations were observed in the N2 and LPP. For the N2, results from a 3 (Fz, F3, F4) × 2 (helping/harming) ANOVA showed a significant main effect of moral valence (helping/harming) in N2 mean amplitude ($F(1, 47) = 8.930, p = 0.005, \eta^2 = 0.165$). As expected, the mean amplitude in response to viewing harming scenes was significantly more negative than the mean amplitude of viewing helping scenes. Finally, a midline LPP difference was detected in the window of 380–600 ms after stimulus presentation. Results from a 3 (Fz, Cz, Pz) × 2 (helping/harming) ANOVA revealed a significant main effect of moral valence (helping/harming) in LPP mean amplitude ($F(1, 47) = 6.2, p = 0.02, \eta^2 = 0.110$). As expected, given the reference schematic, a significant effect of electrode was also observed for LPP mean amplitude ($F(2, 46) = 11.87, p < 0.001, \eta^2 = 0.479$; see Figure 2 for a layout of the temporal waveforms, as well as their scalp distributions). Given the small age range of the current sample (3–5 years), as expected, no age-related changes were observed for any of the event-related potential (ERP) differences, either early or late. Results from a paired-sample *t* test of power density in the 5–8 Hz range during the viewing of harming versus helping scenes failed to show a group-level difference ($t(45) = -.647$, nonsignificant [ns]) and remained nonsignificant after accounting for age-related changes ($F(1,44) = 0.119$, ns). Additionally, a paired-sample *t* test also failed to show differences in visual fixation percentage (from eye tracking) for bad and good scenes ($t(45) = 1.32$, ns).

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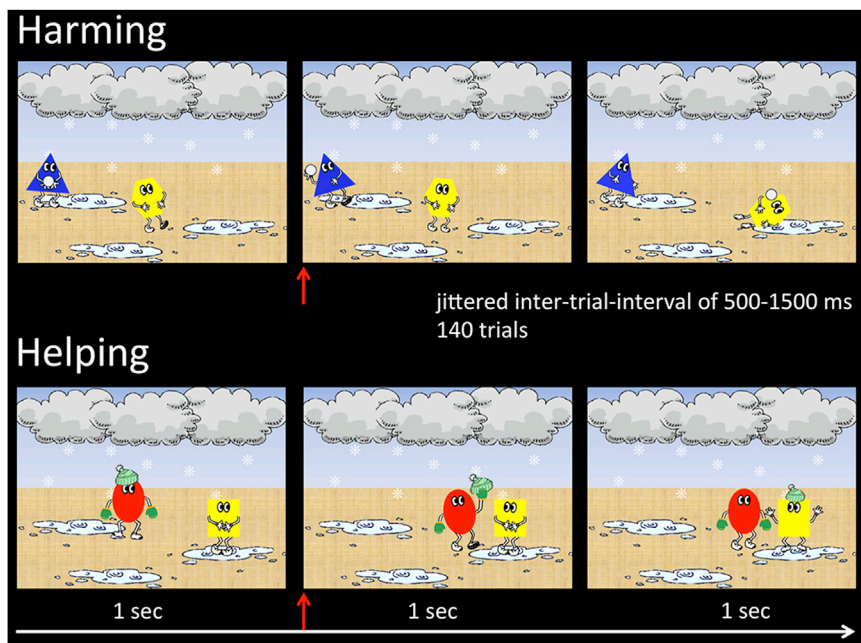


Figure 1. Examples of Stimuli

The Chicago moral sensitivity task (CMST) consists of short scenarios depicting two cartoon characters engaging in either intentional harm (see top row for examples) or intentional help (see bottom row for examples). Red arrows denote the onset of ERP time locking.

underlying moral evaluations and behavior and, in particular, the respective contribution of automatic and controlled processes [13]. Indeed, most of the theoretical views of moral evaluation in adults indicate that it stems from a complex integration of both early automatic and later controlled components [14]. While burgeoning behavioral evidence in adults suggests the primary role of automatic processing in generosity [9], in developmental investigations, later controlled mechanisms, including cognitive reappraisal or saliency processing, play a greater role [10]. Neuroscience research is thus critical in

Sharing Behavior

Children shared an average of 1.78 out of 10 stickers with an anonymous other child ($SD = 2.35$), which is slightly less than preschoolers in previous studies using the dictator game, in which children shared nearly 2.5 out of 10 rewards [12]. There were no significant differences in sharing behavior by gender ($F(1, 47) = 2.8$, ns), and age in months was not a significant predictor of sharing ($r = -.04$, ns).

Brain-Sharing Behavior Relationship

To assess whether early automatic or later controlled neural computations associated with the processing of viewing helping and harming scenes predicted actual generosity, we calculated difference scores for parietal (P3, Pz, P4) electrodes for the EPN and central and frontal (Cz, F3, Fz, F4) sites for the N2 and LPP by subtracting the mean amplitude of the signal for harming scenes from the mean amplitude of the signal for helping scenes during these time periods. Individual differences in these sites were then related to sharing in the dictator game. Individual differences in early automatic processing (EPN) of harming and helping were not predictive of explicit sharing. Additionally, generosity was not related to changes in the N2 waveform, global 5–8 Hz power density for helping and harming, or visual fixation percentage. However, temporal dynamics associated with later controlled cognitive reappraisal of helping versus harming (LPP differences at left frontal sites) were significantly predictive of sharing ($F(3) : r = 0.33$, $p = 0.022$). This relation was particularly strong when only children who had chosen to share any resources were included in the analysis ($n = 20$) ($F(3) : r = 0.49$, $p = 0.029$) (see Figure 3).

Discussion

Social and moral evaluations play a key role in motivating prosociality, guiding our preferences, and shaping our decisions and behaviors when living in complex social groups. Developmental neuroscience studies are critical to inform theoretical debates about the nature of the mechanisms

clarifying the nature of the computational systems, which mediate early social evaluations and behaviors, often considered a prerequisite for moral thought. However, due to the methodological constraints of most neuroimaging methods, few neuroscience studies have investigated moral evaluation [13, 15] or prosocial behavior in very young children [16].

Consistently, several time-locked neural responses in infants and children have been associated with early visual differentiation of stimuli and relatively automatic attentional or emotional responding (EPN) [17]), as well as temporally later waveforms that index conflict detection in processing of stimuli (N2) [18] and cognitive reappraisal, top-down regulation, or saliency processing (LPP) [19, 20]). Each of these waveforms can serve as a proxy for domain-general mechanisms of automatic and controlled processing in the developing brain.

The results of the current study provide the first evidence that in young children, neural computations involved in both early automatic and later controlled processes build to form implicit moral evaluations, but only neural differences indexing the later controlled processes predict actual sharing behavior. Previous work in adolescents and adults using EEG/ERP indicate an early differentiation between scenarios depicting helping and harming behaviors [11, 21, 22]. This early differentiation relates temporally to the early posterior negativity waveforms, often thought to index automatic visual processing of affective stimuli [23]. Consistent with these results, in the present study, modulations in temporal patterns were observed between perceiving helping and harming scenes in posterior areas for early automatic processes (between 100 ms and 175 ms after stimulus). Although source localization cannot be reliably employed here given the number of channels used in this study, it is worth noting that the EPN modulations are maximal over regions of the cortex where previous studies have precisely identified early neural responses that distinguish intentional from accidental harmful actions over the posterior superior temporal sulcus, a region that plays a critical role in intention understanding and moral cognition [11, 20, 21, 24, 25].

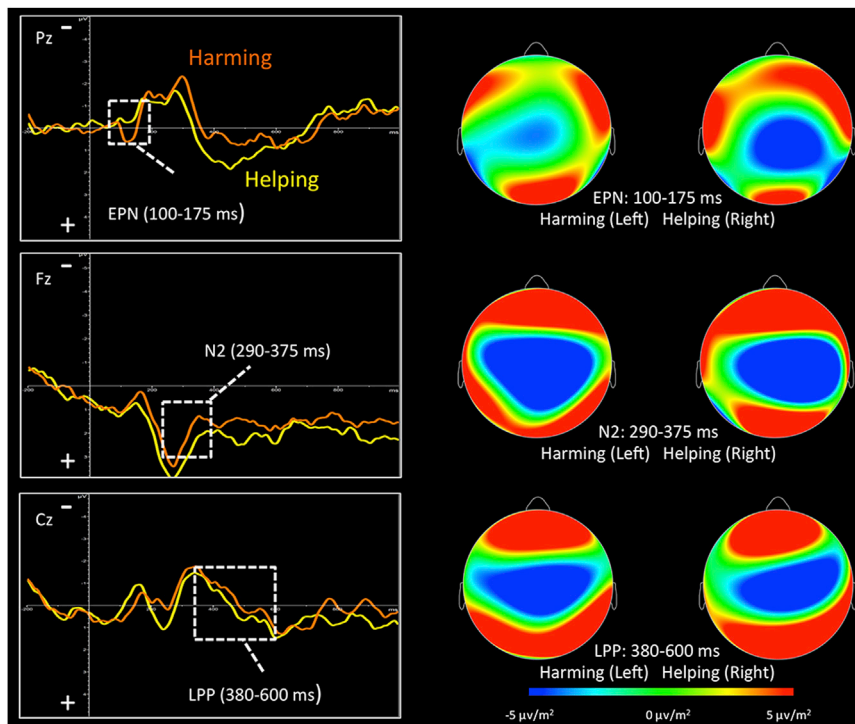


Figure 2. Spatiotemporal Neural Dynamics of Moral Evaluations

On the left are grand averaged ERP waveforms (1 s) at Pz, Fz, and Cz from 48 children when viewing scenarios depicting harming (orange lines) and helping (yellow lines), with positive values plotted downward, consistent with previous practices in ERP reporting. EPN, N2, and LPP differences are highlighted on relevant electrodes. Additionally, scalp-topographic plots are presented on the right for EPN, N2, and LPP.

sharing, suggesting the necessity of cognitive reappraisal or regulation in generosity and giving behaviors in young children. While these findings may contradict some behavioral results in adults [9], they are in keeping with one study with adults relating neural modulation of later waveforms to prosocial dispositions [26] and current theories in developmental science [10].

One alternative interpretation of these results would be that children who exhibit greater attention to helping versus harming scenarios in the Chicago moral sensitivity task (CMST) are more likely to share in the dictator game.

In adolescent and adults studies of moral evaluation, middle temporal differences have also been observed in the N2 when perceiving moral scenarios. These differences have been interpreted as reflecting attention allocation and cognitive conflict regarding the moral and affective content of these stimuli [26, 27]. In our study with young children, midlatency temporal differences over frontal sites were extremely significant ($p < 0.01$). These findings demonstrate, as expected from evidence with infants [1, 28], that preschool-age children automatically encode the emotional valence of moral stimuli and detect conflict in harmful situations. Moreover, whereas the early automatic component (EPN) was greater for the observation of helping versus harming scenes, the waveform related to cognitive conflict (N2) was greater (in negativity) for harming.

Moral scenarios elicit reliable LPP responses, which are greater for positive social interactions than negative ones in adult participants, and dispositional cognitive, but not emotional, empathy predicted larger differences [11]. The later controlled processes indexed by the LPP are argued to reflect cognitive reappraisal of stimuli, top-down cognitive control, and attentional reallocation to motivationally salient stimuli [19, 20, 29]. In the present study, children's LPP at midline sites was significantly modulated, wherein helping scenes elicited a significantly more positive LPP than harming.

Importantly, individual differences in later waveforms (LPP) predicted children's explicit sharing behavior. This relation was even more pronounced when limited to only the children that shared at least one sticker. This fundamental brain-behavior relationship clarifies the nature of the computational mechanisms that link moral evaluation and sharing behavior in children, specifically early automatic or later controlled. In the present study, differences seen in specific online electrophysiological components in response to morally laden stimuli reliably predicted children's own sharing behavior. Notably, only the later controlled waveforms predicted

Analyses of both global 5–8 Hz frequency band during the CMST (a frequency band thought to index attention to stimuli in children) and eye tracking of visual fixation to the characters/action failed to show difference in attention between helping and harming scenes. Moreover, individual differences in the power density of the 5–8 Hz band in children while viewing helping or harming scenarios were not predictive of generosity, nor were individual differences in visual fixation percentage to actions. In sum, using two measures of attention to stimuli provided no evidence that global attention to either harming or helping scenes drives the relation between LPP and generosity.

Taken together, the current study demonstrates how young children exhibit automatic responses to morally laden stimuli and reappraise these stimuli in a controlled manner. Thus, children's moral judgments are the result of an integration of both early and automatic processing of helping and harming scenarios and later cognitively controlled reappraisal of these scenes. Importantly, the latter, but not the former, predicts actual sharing behavior. Finally, this investigation, by combining developmental research on moral evaluation and actual prosocial behavior with neuroscience methods, exemplifies the potential of such an integrative approach in refining moral developmental controversies as advocated by Killen and Smetana [30] and provides new insights into moral judgment and decision-making.

Experimental Procedures

Participants

Fifty-seven children between the ages of 3 and 5 years ($m = 48.06$ months, $SD = 6.35$, 31 female) were recruited from a large midwestern city. The study was approved by the University of Chicago Institutional Review Board.

Procedure

Upon arrival, parents completed consent and basic demographics. Children were acclimatized to the lab (the University of Chicago Child Neurosuite)

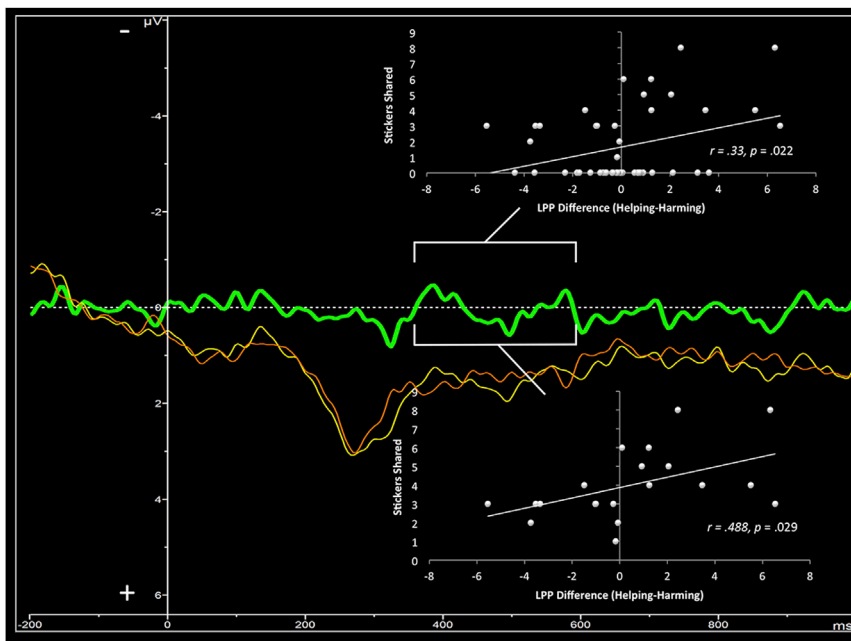


Figure 3. LPP Modulation Predicts Generosity

Individual differences in LPP modulation (mean amplitude of helping scenarios versus mean amplitude of harming scenarios) at electrode F3 predict differences in sharing (top: full sample of 48 children; bottom: sample of 20 children who shared at least one sticker).

performed on EEG data to identify and correct ocular movements, seeded off electrode Fp1 [31]. Following basic EEG preprocessing, data were segmented according to stimulus type (harming/helping). Epochs were created with 200 ms baselines and 1,000 ms stimulus presentation following the onset of the second stimulus frame. Epochs were averaged by trial type and were baseline corrected. Corrected averages per individual were combined for a grand average per individual and ERPs were analyzed across subjects by trial types. Due to exhaustion, not all participants completed 140 trials of the CMST. Only children who had at least 20 artifact-free trials for each condition (harming and helping) were included in the grand average and further analyses ($n = 48$). An average of 61 artifact-free trials was included in the harming

and then brought to the EEG testing room. In the room, a 32-channel EEG cap (EasyCap, Brain Products) was applied, and impedances were reduced to less than 30 kOhms. Following impedance reduction, the CMST was administered while eye tracking was continuously monitored to ensure attentiveness. After EEG collection, children played a child-modified dictator game.

The CMST

The CMST integrates aspects of the infant and toddler moral paradigms into a neuroscience-friendly assessment. In the CMST, children watched dynamic visual scenarios of characters intentionally performing either prosocial acts (e.g., sharing food, helping another character after they fall) or antisocial acts, predominately those where a character harms another (e.g., hitting another character, pushing another character).

The CMST consisted of three-picture sequences depicting prosocial behaviors and antisocial behaviors. These scenarios were validated with an independent group of 40 children between the ages of 3 and 8 years, and each scenario was classified as “good” or “bad.” Following the presentation of the second picture in this validation study, children were able to differentiate between the good and bad actions significantly better than chance; thus, ERPs were time locked to the onset of the second picture. The EEG version of the CMST included 140 trials of 3 s duration, randomly presented, with a jittered intertrial interval of 500–1,500 ms (Figure 1).

The Dictator Game

In this task [12], children were given ten rewards (stickers) and were told that the rewards were theirs to keep and that the experimenter could not give any to an anonymous other child that would come to the lab later. Children were then asked whether they wanted to give any of their resources to this anonymous other child. Children had two boxes, one for themselves and one for the other child. To prevent experimenter bias, the experimenter turned around while the child decided how much to share, and the child was instructed to voice their completion.

EEG/ERPs Collection and Data Analysis

Data were collected from a 32-channel active electrode system (actiCHamp, Brain Products) at 2 kHz, referenced to Cz, and all electrodes impedances were kept below 30 kOhms. Electrophysiological data analysis was performed using Brain Vision Analyzer software (Brain Products). Data were downsampled offline (256 Hz) and referenced to the average of all electrodes. Following rereferencing, EEG data were filtered using an IIR filter of 1–30 Hz and a notch filter of 60 Hz. Artifact rejection was carried out using a $-200 \mu\text{V}$ to $200 \mu\text{V}$ threshold and visual inspection and rejection by trained researchers. Gratton-Coles ocular artifact correction was

performed on EEG data to identify and correct ocular movements, seeded off electrode Fp1 [31]. Following basic EEG preprocessing, data were segmented according to stimulus type (harming/helping). Epochs were created with 200 ms baselines and 1,000 ms stimulus presentation following the onset of the second stimulus frame. Epochs were averaged by trial type and were baseline corrected. Corrected averages per individual were combined for a grand average per individual and ERPs were analyzed across subjects by trial types. Due to exhaustion, not all participants completed 140 trials of the CMST. Only children who had at least 20 artifact-free trials for each condition (harming and helping) were included in the grand average and further analyses ($n = 48$). An average of 61 artifact-free trials was included in the harming scenes, and 57 artifact-free trials were included in the helping scenes. From the grand average, three time periods of interest were defined that relate to consistent ERP waveforms: EPN (100–175 ms), N2 (290–375 ms), and LPP (380–600 ms). For the EPN, mean amplitude between 100 ms and 175 ms was extracted for three midline and lateralized posterior electrodes (10–20 coordinates: P3, Pz, P4), and for the N2, mean amplitude between 290 ms and 375 ms from the three frontal electrodes (F3, Fz, F4) was calculated. Finally, for the LPP, mean amplitude from midline electrodes (Fz, Cz, Pz) was used. In all comparisons, a 3 (electrode) \times 2 (helping/harming) repeated-measures ANOVA examined differences in mean amplitude on the grand average waveforms for each time window. Where appropriate, the Greenhouse-Geisser correction was applied for violations of sphericity. For brain-behavioral analysis, difference waves (helping scenes/harming scenes) were calculated for the EPN, N2, and LPP waveforms at frontal (F3, Fz, F4) and midline (Cz, Pz) electrodes. These difference waves were then subjected to a correlation analysis to determine their relation to sharing behaviors.

Additionally, spectral analyses of the 5–8 Hz frequency band were analyzed for good and bad scenarios. In spectral analyses, following the basic preprocessing stream described above, scenes were segmented into 500 ms epochs with 50% overlap. A fast Fourier transformation (FFT) was then applied to each epoch. FFTs for each epoch and all 32 electrodes were averaged, and power density in the 5–8 Hz range was extracted.

Eye-Tracking Analyses

Eye-tracking data were collected during the CMST with a SensoMotoric Instruments (SMI) RED-m (60 Hz), and participants were located ~ 60 cm from the screen. Data processing was performed in SMI BeGaze software. All fixations less than 80 ms or dispersions greater than 100 pixels were eliminated. Areas of interest (AOIs) were defined around the characters of interest (subtending ~ 27 degrees of visual angle, extending ~ 6 degrees beyond the character in all directions). Fixation duration for each AOI was extracted and averaged based on content (good or bad action). Percent fixation on AOI was calculated by dividing the fixation duration by the duration of the trial.

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References

1. Hamlin, J.K. (2014). The origins of human morality: complex socio-moral evaluations by preverbal infants. In *New Frontiers in Social Neuroscience Research and Perspectives in Neurosciences*, J. Decety and Y. Christen, eds. (Switzerland: Springer International Publishing), pp. 165–188.
2. Hamlin, J.K., Wynn, K., and Bloom, P. (2010). Three-month-olds show a negativity bias in their social evaluations. *Dev. Sci.* *13*, 923–929.
3. Sommerville, J.A., Schmidt, M.F.H., Yun, J., and Burns, M. (2013). The development of fairness expectations and prosocial behavior in the second year of life. *Infancy* *18*, 40–66.
4. Schmidt, M.F.H., and Sommerville, J.A. (2011). Fairness expectations and altruistic sharing in 15-month-old human infants. *PLoS ONE* *6*, e23223.
5. Fehr, E., Bernhard, H., and Rockenbach, B. (2008). Egalitarianism in young children. *Nature* *454*, 1079–1083.
6. Warneken, F., and Tomasello, M. (2009). The roots of human altruism. *Br. J. Psychol.* *100*, 455–471.
7. Decety, J., and Howard, L.H. (2013). The role of affect in the neurodevelopment of morality. *Child Dev. Perspect.* *7*, 49–54.
8. Sloane, S., Baillargeon, R., and Premack, D. (2012). Do infants have a sense of fairness? *Psychol. Sci.* *23*, 196–204.
9. Rand, D.G., Greene, J.D., and Nowak, M.A. (2012). Spontaneous giving and calculated greed. *Nature* *489*, 427–430.
10. Shaw, A., Montinari, N., Piovesan, M., Olson, K.R., Gino, F., and Norton, M.I. (2014). Children develop a veil of fairness. *J. Exp. Psychol. Gen.* *143*, 363–375.
11. Yoder, K.J., and Decety, J. (2014). Spatiotemporal neural dynamics of moral judgment: a high-density ERP study. *Neuropsychologia* *60*, 39–45.
12. Benenson, J.F., Pascoe, J., and Radmore, N. (2007). Children's altruistic behavior in the dictator game. *Evol. Hum. Behav.* *28*, 168–175.
13. Decety, J., Michalska, K.J., and Kinzler, K.D. (2012). The contribution of emotion and cognition to moral sensitivity: a neurodevelopmental study. *Cereb. Cortex* *22*, 209–220.
14. Killen, M., and Smetana, J. (2013). *Handbook of Moral Development*, Second Edition (New York: Psychology Press).
15. Cheng, Y., Chen, C., and Decety, J. (2014). An EEG/ERP investigation of the development of empathy in early and middle childhood. *Dev Cogn Neurosci* *10*, 160–169.
16. Paulus, M., Kühn-Popp, N., Licata, M., Sodian, B., and Meinhardt, J. (2013). Neural correlates of prosocial behavior in infancy: different neurophysiological mechanisms support the emergence of helping and comforting. *Neuroimage* *66*, 522–530.
17. Hajcak, G., and Dennis, T.A. (2009). Brain potentials during affective picture processing in children. *Biol. Psychol.* *80*, 333–338.
18. Lamm, C., White, L.K., McDermott, J.M., and Fox, N.A. (2012). Neural activation underlying cognitive control in the context of neutral and affectively charged pictures in children. *Brain Cogn.* *79*, 181–187.
19. Solomon, B., DeCicco, J.M., and Dennis, T.A. (2012). Emotional picture processing in children: an ERP study. *Dev Cogn Neurosci* *2*, 110–119.
20. Sabatinelli, D., Lang, P.J., Keil, A., and Bradley, M.M. (2007). Emotional perception: correlation of functional MRI and event-related potentials. *Cereb. Cortex* *17*, 1085–1091.
21. Decety, J., and Cacioppo, S. (2012). The speed of morality: a high-density electrical neuroimaging study. *J. Neurophysiol.* *108*, 3068–3072.
22. Escobar, M.J., Huepe, D., Decety, J., Sedeño, L., Messow, M.K., Baez, S., Rivera-Rei, A., Canales-Johnson, A., Morales, J.P., Gómez, D.M., et al. (2014). Brain signatures of moral sensitivity in adolescents with early social deprivation. *Sci Rep* *4*, 5354.
23. Olofsson, J.K., Nordin, S., Sequeira, H., and Polich, J. (2008). Affective picture processing: an integrative review of ERP findings. *Biol. Psychol.* *77*, 247–265.
24. Saxe, R., Xiao, D.K., Kovacs, G., Perrett, D.I., and Kanwisher, N. (2004). A region of right posterior superior temporal sulcus responds to observed intentional actions. *Neuropsychologia* *42*, 1435–1446.
25. Young, L., and Saxe, R. (2009). An fMRI investigation of spontaneous mental state inference for moral judgment. *J. Cogn. Neurosci.* *21*, 1396–1405.
26. Chiu Loke, I., Evans, A.D., and Lee, K. (2011). The neural correlates of reasoning about prosocial-helping decisions: an event-related brain potentials study. *Brain Res.* *1369*, 140–148.
27. Lahat, A., Helwig, C.C., and Zelazo, P.D. (2013). An event-related potential study of adolescents' and young adults' judgments of moral and social conventional violations. *Child Dev.* *84*, 955–969.
28. Hamlin, J.K., Wynn, K., and Bloom, P. (2007). Social evaluation by preverbal infants. *Nature* *450*, 557–559.
29. Dennis, T.A., and Hajcak, G. (2009). The late positive potential: a neurophysiological marker for emotion regulation in children. *J. Child Psychol. Psychiatry* *50*, 1373–1383.
30. Killen, M., and Smetana, J. (2008). Moral judgment and moral neuroscience: Intersections, definitions, and issues. *Child Dev. Perspect.* *2*, 1–6.
31. Gratton, G., Coles, M.G.H., and Donchin, E. (1983). A new method for off-line removal of ocular artifact. *Electroencephalogr. Clin. Neurophysiol.* *55*, 468–484.