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The neurodevelopment of social preferences in early childhood

Jean Decety[1], **Nikolaus Steinbeis**[2], **Jason M. Cowell**[3]

[1.]Department of Psychology, and Department of Psychiatry, University of Chicago

[2.]Clinical, Education and Health Psychology, University College London

[3.]Department of Psychology, University of Wisconsin-Green Bay

Abstract

Human social preferences are the product of gene-culture coevolution, and rely on predispositions that emerge early in development. These social preferences encompasse distinct motivations, mechanisms, and behaviors, that facilitate social cohesion and cooperation. Developmental social neuroscience critically contributes in elucidating the mechanisms involved in social decision-making and prosociality, and their gradual maturation in interaction with the social and cultural environment.

Keywords

developmental neuroscience; empathy; fairness; morality; social preferences; prosociality

Successful social interactions often require individuals to balance their own self-interest with the wants and needs of others within specific contexts. This interplay between self-interest and other-regarding concerns plays a prominent role in human societies and is supported by social preferences. These preferences have evolved in response to the socio-ecological challenges faced by our ancestors who lived in environments, both natural and socially constructed, in which groups of individuals who were predisposed to cooperate and uphold social norms tended to survive and expand relative to other groups, thereby allowing these prosocial motivations to proliferate [1]. Moreover, selective pressures favoring alloparenting have shaped ontogenetic adaptations for social cognitive skills that distinguish human infants for navigating effectively the regime of cooperative childcare characteristic of *Homo sapiens* [2*].

Corresponding author: Dr. Jean Decety (decety@uchicago.edu), Department of Psychology, and Department of Psychiatry and Behavioral Neuroscience, The University of Chicago, 5848 S. University Avenue, Chicago, IL 60637, USA.

Declaration CI
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The term social preferences refer to motives such as altruism, reciprocity, intrinsic pleasure in helping others, aversion to inequity, and ethical commitments that induce people to help others beyond simply maximizing personal wealth or material payoffs. These prosocial motivations include different types of behaviors such as helping, cooperating, sharing, comforting, rescuing, and informing. These various forms of behaviors have distinct underlying motivations, such as caring, fairness, reputation management, group loyalty, reciprocity, and social rewards, and may rely on both domain-specific mechanisms for social preference, as well as co-opting domain general social cognitive systems responsible for sustained attention, theory of mind, and executive function. Many of these social motivations begin to emerge in nascent form in early ontogeny because they are needed for the child to survive and thrive. Studying the neural underpinnings of prosociality in young children deepens our understanding of the determinants of social preferences and the extent to which the epigenetic landscape shapes their development.

In this paper, we briefly review recent findings on the early emergence and development of social preferences from psychology, behavioral economics, and cognitive neuroscience. We examine early capacities for social evaluations that can be observed in non-verbal infants. This provides strong evidence for an embedded cognitive architecture, shaped by natural selection, that has been interpreted richly in support of a partner choice theory, or more leanly through approach/avoidance motivation that facilitate affiliation and cooperation, and thus survival.

Sociomoral evaluations and preferences

When visually presented with positive and negative third-party social interactions, involving puppets or cartoonish characters, 9-months-old infants have the ability to distinguish between prosocial actions such as helping or comforting and antisocial actions such as hitting or hindering, assign valence to these interactions, and express a preference for individuals who have acted prosocially to those who have acted antisocially [3,4]. Moreover, one study demonstrated that toddlers' and infants' emotional expressions are more positive after watching prosocial events than after watching antisocial events [5]. Importantly, these effects were not attributable to mere approach/avoidance behaviors, as infants' body movements did not differ following prosocial and antisocial events. These early evaluations have some degree of developmental consistency. Infant preference for prosocial over antisocial characters predicts fewer callous-unemotional traits in late preschool, suggesting that these rudimentary and developing social preference may set the stage for later social development [6]. Recent investigations suggest that these visual presentations, already in 3 years and older children, of third-part social interactions are predictive of traditional moral versus conventional violations using vignettes [7,8]. Thus, while these social preferences are not necessarily moral, per-se, the do appear to influence later moral-conventional distinctions.

These early capacities are served particularly well with developmental neuroscience research, which has begun to identify specific neural computations related to early sociomoral evaluations. One study examined the neural dynamics of third-party moral scenarios in infants and toddlers, aged twelve to twenty-four months [9]. Infants watched cartoon characters engaging in prosocial and antisocial actions while continuous electroencephalography (EEG) and eye-tracking were collected. Children expressed preferential looking toward the prosocial characters over the antisocial characters, suggesting additional non-verbal metrics of a social preference. Moreover, overall alpha band hemispheric asymmetry (left) was stronger for antisocial versus prosocial behaviors, potentially indexing increased avoidance or withdrawal from antisociality. Using time-locked evoked potentials (ERPs), relatively automatic differences (300–500 milliseconds) after observing characters helping versus hindering each other were detected. Critically, children with greater negativity in this time window for the perception of prosocial characters compared with antisocial characters also tended to exhibit behavioral preference for the prosocial character, choosing to reach for it when prompted.

Infants may possess richer moral sensitivities, beyond harm avoidance, than was initially thought, harboring interactional predictions that are context sensitive. For example, 13-month-olds viewed provisions of assistance as obligatory when individuals belonged to the same social group, but as optional when individuals belonged to different groups or when group memberships were unspecified [10**]. These findings provide further evidence for an early-emerging expectation of ingroup loyalty, which is one universal moral principle [11].

Behavioral and neuroscience evidence converge to suggest that some foundational aspects of social evaluation are present very early in ontogeny. There is an aversion to antisocial actions, which constitutes a rudimentary and critical element of morality [12**]. These evaluations, in turn, can drive and interact with affiliative attitudes, critical for survival and setting the stage for cooperation. Importantly, these predispositions are in place before children integrate social conventions and norms from their culture.

Early sensitivity to fairness

Another hallmark of human morality is a deep sense of fairness. People are motivated by both self-interest and a concern for the welfare of others. Sensitivity to fairness appears to emerge by the end of the first year. Specifically, infants seem to possess expectations for how resources are typically distributed to other individuals. For example, 12, but not 6, month-old infants, looked significantly longer when one recipient received more crackers than the other versus equal distributions [13]. Similarly, infants appear to prefer to interact with fair over unfair individuals that they had seen distributing resources [14]. Fairness may dictate that a resource be divided equally between ingroup and outgroup recipients, but ingroup support may dictate that it be reserved for ingroup recipients, particularly when it is scarce or otherwise valuable [15**].

An EEG study compared 6-months and 12-months infants' ERP response to categorical versus continuous instances of unfairness, while ensuring that infants recognized the relevant perceptual distinctions that are necessary to detect unfairness [16*]. At 12 months, infants demonstrated 3 different waveform components that discriminate between fair and unfair outcomes. They noticed the perceptual differences between the fair and unfair outcomes, demonstrated greater attentional orienting to the unfair event, and also that evaluative processes were implemented in relation to the two outcomes.

Another neurodevelopmental study examined ERPs in preschool children while they watched equal and unequal resource distributions [17*]. Then children were given a limited number of candies to distribute to other children that varied in their merit, wealth, and need. The ERPs showed early differentiation (around 300 ms) between equal distributions and any type of distribution that deviates from equality reflected by a greater frontal negativity. Extreme unequal distributions were also distinguished from slightly unequal distributions by a later evoked response (400-800 ms). Further, differences in the magnitude of this LPP predicted the distribution of third-party contextual resources taking into account the wealth and merit of the recipient. Consistent with a developmental integration of context into social preferences, another EEG study in 5-year-old children documented a marked difference in both an early (P2) ERP waveform with greater positivity for inequitable versus equitable distributions (to poor or wealthy recipients) and a later LPP difference for equitable versus inequitable distributions, which was also predictive of harsher evaluations of the distributions [18].

Together, these behavioral and developmental neuroscience investigations illuminate the constructive nature of developing fairness conceptions across early and middle childhood, stemming from early recognition of inequalities, to later integration of this knowledge and context into attempts to attenuate inequalities through prosocial action.

Empathy

Naturalistic observations suggest that by the end of the first year some children comfort others in distress through simple, nonverbal, mostly gestures and postures such as touching, patting, hugging, and affectionately leaning in [19]. Preliminary developmental neuroscience investigations have found that infants at eight months of age display increased left versus right frontal alpha power activity when witnessing a peer in distress were more likely to approach the peer [20]. In laboratory settings, another study reported that 12-month-olds are in fact not especially interested nor concerned by their peers in distress [21]. Eighteen- and twenty-four-month-olds, by contrast, were generally similar in their positive social interest and attentiveness to the infant in distress, but twenty-four-month-olds exhibited greater affective concern. Moreover, empathic concern was rare at eighteen months, with only 25 percent of children at that age exhibiting any concern at all. In contrast, by twenty-four months of age, two-thirds of children exhibited affective concern for the crying infant, and 10 percent displayed high levels of concern.

A negativity bias has been observed in the first days of life for the vocal modality [22], and it emerges later for facial expressions. Only in the first year of life do infants begin to pay more attention to negative emotions expressed by others. For instance, seven-month-olds looked longer at fearful than happy faces [23], and they exhibited greater amplitudes in a negative component over the frontal and central electrodes around 700 milliseconds labeled negative central (Nc) in response to fearful rather than to happy faces. The Nc is usually interpreted to reflect infants’ allocation of attention.

Facial expressions in response to adults expressing happiness, fear or anger, as measured with electromyography, show no corresponding selective activation in babies aged 4 months

[24]. This further supports the absence of an innate capacity for imitation [25**]. A recent study presented two-years-old children and adults with videos showing a crying baby, a laughing baby, a babbling baby, and a neutral baby with white noise [26]. Facial expressions of joy and sadness when viewing the videos. While adults exhibited more sadness toward an infant crying than any other stimulus, the response of young children to crying and white noise was similar. As such, this response seems to correspond more to a reaction to an aversive stimulus than to empathy.

Children’s ability to respond prosocially to others’ distress seems to emerge more clearly during the second year of life, and this is associated with an increased understanding of other people as psychological agents with internal states that differ from the child’s own [27]. Developmental studies have supported a positive relation between empathy and prosocial behavior in young children, although it is worth noting that this relation is modest in strength [28,29].

One study measured EEG/ERP responses while children aged three to nine years watched visual stimuli depicting physical injuries to people. Irrespective of the age, both an early component, which reflects attention to emotionally salient stimuli (affective arousal or emotional empathy), and a late-positive potential, indexing the purposeful and more complex processing of emotional stimuli were detected. Only the LPP component showed an age-related differentiation between painful and neutral scenarios, suggesting a developmental difference in the level of processing [30].

A cross sectional functional magnetic resonance imaging study has demonstrated that perceived intentional harm in 4years-olds is associated with increased activation in brain areas involved is understanding of others’ mental states, such as the medial prefrontal cortex (mPFC), right posterior superior temporal sulcus/temporoparietal junction (pSTS/TPJ), regions processing the valence of these actions (amygdala and insula), and social valuation (ventromedial prefrontal cortex, vmPFC) [31]. Ratings of empathic sadness for the victim was associated with activity in the insula and subgenual prefrontal cortex. This latter region shares extensive and reciprocal anatomical connections with areas implicated in emotional and behavioral regulation, such as the orbitofrontal cortex, amygdala, hippocampus and hypothalamus.

There is limited solid evidence for signs of empathic concern and comforting behavior before the first year of life. The neural pathways that allow affect sharing are in place early in ontogeny, but activation alone of these circuits is not sufficient to elicit a comforting response [12**]. Neural maturation and prefrontal regulation in dynamic interaction with learning and socialization seem requisite to give rise to such behaviors, allowing rudimentary empathic sensitivities to be actualized in motivated behaviors.

Sharing resources

Sharing is prevalent in all human societies and facilitates reciprocity and cooperation. This behavior can be observed in toddlers as young as fifteen months. At this age sensitivity toward equal distributions and fairness norms also emerges [32]. Around the third year of age, children state that sharing equally is the norm; from then on, they increasingly follow such sharing norm with their actual behavior. Across preschool and through pre-adolescence, children exhibit a marked shift towards equal divisions of resources [28,33], a developmental shift that has been argued to depend on a host of potential social and cognitive mechanisms including executive functions/behavioral control, developing empathy and theory of mind, shifting number concept, and an increased concern for appearing fair [34].

One study examined the neurocognitive mechanisms facilitating sharing in three- to five-year-old children in response to animations depicting social interactions between two characters engaging in prosocial or antisocial behavior [35]. Observing helpful and harmful actions differentially affected early and late ERP components. Only the later waveform differences were predictive of behavioral sharing.

There is some evidence that behavioral control is positively associated with sharing in preschoolers [36]. More recently, explicit experimental manipulations of behavioral control impacted sharing directly. In one such study, children aged six to nine years shared less after having engaged in a behavioral motor control task compared with sharing after a speeded reaction time task [37**]. Moreover, executive function and more advanced theory of mind (2^{nd} order), were found to predict sharing in a Dictator game in a cross-cultural sample from 5 to 12 years of age [28], and several investigations have implicated the role of executive function in resource distributions [8]. Importantly, neural maturation, specifically regarding connectivity of the prefrontal cortex and parietal lobes throughout childhood and adolescence is thought to underlie a vast shift in executive function [38]. These top-down executive interpretations of prosocial development are buttressed by the findings of an ERPs study that showed an increase of regulatory processes in bringing about sharing during childhood [39]. Thus, in older children the P3, a component reflecting behavioral control mechanisms, predicted the equal sharing of resources. In younger children, however, this was predicted by the early posterior negativity, an early component reflecting affective evaluation.

Social influences, such as observation of other peers, also changes children’s sharing decisions. One study examined the developmental origins of sensitivity to cues associated with reputationally motivated prosociality by presenting five-year-olds with the option to provide one or four stickers to a familiar peer recipient at no cost to themselves [40]. Children were consistently generous only when the recipient was fully aware of the donation options. In all cases in which the recipient was not aware of the donation options, children were strikingly ungenerous. This dovetails with theoretical arguments in older children suggesting that they develop a “veil of fairness” wherein increases in distributional sharing are seen as children begin to care about seeming fair to other potential playmates [41]. To date, studies have not yet investigated the neural mechanisms involved in the interplay of social influence, expectation and resource allocations using EEG, functional near-infrared spectroscopy, or eye-tracking. This critical line of investigation remains ripe for exploration.

Generally, it appears that the development of top-down behavioral control mechanisms, supported by the maturation of executive function and connectivity of prefrontal cortical

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circuitry, may account for many developmental increases in sharing. Such a mechanism helps to shift decisions away from the immediate desires of reward maximization, toward compliance with social norms of equal sharing.

Conclusion

Human society is a cultural construction that provides the environment for fitness-enhancing genetic changes in individuals [42]. As a result, infants possess innate predispositions towards sociomoral evaluations as well as preferences that guide their expectations of others in relation to fairness, empathic concern, reciprocity, and group affiliation. Such predispositions can be considered as emergent properties of gene-culture coevolution. The burgeoning body of multi-level analyses (behavioral, neural, environmental) of social preferences are arriving at a similar set of findings, early, potentially rudimentary, concepts of and sensitivities to interpersonal harm, distress in others, and inequality, followed by a later development of motivated actions in these domains, be they reductions of inequality through sharing, preferring prosocial characters, or seeking to help or comfort others in distress. Developmental research is critical to understanding the foundations of social preferences and identifying the mechanisms that guide social decision-making and prosociality. Characterizing the psychological mechanisms and understanding ultimate causes of why social preferences have evolved is important for promoting and fostering moral behavior.

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References and recommended reading

Papers of particular interest have been highlighted as:

* of special interest

** of outstanding interest

1. Silk JB, House BR: The evolution of altruistic social preferences in human groups. Philosophical Transactions B 2016, 371:20150097.

2*. Hrdy SB, Burkart JM: The emergence of emotionally modern humans: implications for language and learning. Philosophical Transactions of the Royal Society B 2020, 375(1803):20190499.The unusual way hominins reared their young generated novel phenotypes subsequently subjected to Darwinian social selection favoring those young apes best at monitoring the intentions, mental states and preferences of others and most motivated to attract and appeal to caretakers. Early humans during late Pleistocene responded to social and ecological challenges in ways that favored the evolution of even more costly, anatomically modern, brains. Declaration of Interests: The authors declare no competing interests.

3. Ting F, Buyukoyer Dawkins M, Stavans M, Baillargeon R: Principles and concepts in early moral cognition. In Decety J (Ed), The social brain: A developmental perspective (pp.41–65). Cambridge: MIT Press, 2020.

4. Hamlin JK: The infantile origins of our moral brains. In Decety J & Wheatley T (Eds.), The moral brain: Multidisciplinary perspectives (pp. 105–122). 2017: Cambridge, MA: MIT Press.

5. Steckler CM, Liberman Z, Van de Vondervoort JW, Slevinsky J, Le DT, Hamlin JK: Feeling out a link between feeling and infant sociomoral evaluation. British Journal of Developmental Psychology 2018, 36(3):482–500.

6. Tan E, Mikami AY, Hamlin JK: Do infant sociomoral evaluation and action studies predict preschool social and behavioral adjustment? Journal of Experimental Child Psychology 2018, 176:39–54. [PubMed: 30076997]

7. Smetana JG, Ball CL, Jambon M, Yoo HN: Are young children's preferences and evaluations of moral and conventional transgressors associated with domain distinctions in judgments? Journal of Experimental Child Psychology 2018, 173:284–303. [PubMed: 29772455]

8. Tan E, Mikami AY, Luzhanska A, Hamlin K: The homogeneity and heterogeneity of moral functioning in preschool. Child Development, 2020 (in press).

9. Cowell JM, Decety J: Precursors to morality in development as a complex interplay between neural, socio-environmental, and behavioral facets. Proceedings of the National Academy of Sciences of the United States of America, 2015, 112(41):12657–12662. [PubMed: 26324885]

10**. Ting F, He Z, Baillargeon R: Toddlers and infants expect individuals to refrain from helping an ingroup victim's aggressor. Proceedings of the National Academy of Sciences 2019, 116(13):6025–6034.Two-year old children, like adults are more likely to punish transgressions that do not affect them when these transgressions victimize ingroup members. When the victim belonged to the bystander's group, children expected third-party punishment. They detected a violation when the bystander chose to help the wrongdoer. When the victim did not belong to the bystander's group, however, children no longer expected third-party punishment. Young children thus selectively expect indirect third-party punishment for harm to ingroup members.

11. Curry OS, Mullins DA, Whitehouse H: Is it good to cooperate? Testing the theory of morality-as-cooperation in 60 societies. Current Anthropology 2019, 60(1):47–69.

12**. Decety J, Cowell JM: Interpersonal harm aversion as a necessary foundation for morality: A developmental neuroscience perspective. Development and Psychopathology 2018, 30:153–164. [PubMed: 28420449] This paper reviews empirical evidence from developmental psychology and neuroscience in support of the importance of third-party harm aversion for constructing morality. A sensitivity to interpersonal harm emerges very early in ontogeny, as reflected in both the capacity for implicit social evaluation and an aversion for antisocial agents. Yet it does not necessarily entail avoidance toward inflicting pain to others. Later, an understanding that harmful actions cause suffering emerges, followed by an integration of rules that can depend on social contexts and cultures.

13. Ziv T, Sommerville JA: (2017). Developmental differences in infants' fairness expectations from 6 to 15 months of age. Child Development 2017, 88, 1930–1951. [PubMed: 27869290]

14. Lucca K, Pospisil J, Sommerville JA: Fairness informs social decision making in infancy. PLoS One 2018, 13(2):e0192848–14. [PubMed: 29444166]

15**. Bian L, Sloane S, Baillargeon R: Infants expect ingroup support to override fairness when resources are limited. Proceedings of the National Academy of Sciences of the United States of America 2018, 115:2705–2710. [PubMed: 29483252] Empirical evidence is provided to support that infants and toddlers expect fairness to prevail when there were as many items as puppets, but they expect ingroup support to trump fairness otherwise.

16*. Hudac CM, Sommerville JA: Understanding others' minds and morals: Progress and innovation of infant electrophysiology. In Decety J (Ed), The social brain: A developmental perspective (pp. 179–197). Cambridge, MA: MIT Press, 2020.At 12 months, infants demonstrated 3 different waveform components that discriminate between fair and unfair outcomes. FP100 and P400 components varied as a function of fair versus unfair outcomes, and a NC component, which is thought to reflect differences in attentional orientation, also differed between fair and unfair outcomes for 12 month olds, suggesting that the unfair event yielded greater attentional orientation. Finally, there were late-slow wave differences in late slow-wave components, thought to reflect different evaluations of the events.

17*. Cowell JM, Sommerville JA, Decety J: That's not fair: Children's neural computations of fairness and their impact on allocation behaviors and judgments. Developmental Psychology 2019, 55(11):2299–2310. [PubMed: 31436460] The study examined the electrophysiological markers associated with children's third-party evaluations of equal, slightly unequal, and extremely unequal resource distributions, as well as the link between individual differences in these neural computations and children's allocation behaviors and judgments. Differences in later waveforms predicted sharing and third-party contextual resource distributions.

18. Pletti C, Paulus M: Neural processing of equitable and inequitable distributions in 5-year-old children. Social Neuroscience 2020, 15:584–599. [PubMed: 32876537]
19. Zahn-Waxler C, Schoen A, Decety J: An interdisciplinary perspective on the origins of concern for others: Contributions from psychology, neuroscience philosophy and sociobiology. In Roughley N and Schramme T (Eds), Forms of Fellow Feeling: Empathy, Sympathy, Concern and Moral Agency (pp. 184–215). New York: Cambridge University Press, 2018.
20. Crespo-Llado MM, Vanderwer R, Roberti E, Geangu E: Eight-month-old infants' behavioral responses to peers' emotions as related to the asymmetric frontal cortex activity. Scientific Reports 2018, 8:17152. [PubMed: 30464309]
21. Nichols SR, Svetlova M, Brownell CA: Toddlers' responses to infants' negative emotions. Infancy 2015, 20(1):70–97.
22. Cheng Y, Lee SY, Chen HY, Wang P, Decety J: Voice and emotion processing in the human neonatal brain. Journal of Cognitive Neuroscience 2012, 24(6):1411–1419. [PubMed: 22360593]
23. De Haan M, Belsky J, Reid V, Volein A, Johnson MH: Maternal personality and infants' neural and visual responsivity to facial expressions of emotion. Journal of Child Psychology and Psychiatry 2004, 45:1209–1218 [PubMed: 15335341]
24. Kaiser J, Crespo-Llado MM, Turati C, Geangu E: The development of spontaneous facial responses to others' emotions in infancy: An EMG study. Scientific Reports 2017, 7(1):17500. [PubMed: 29235500]

25**. Oostenbroek J, Suddendorf T, Nielsen M, Redshaw J, Kennedy-Costantini S, Davis J et al. Comprehensive longitudinal study challenges the existence of neonatal imitation in humans. Current Biology 2016, 26:1334–1338. [PubMed: 27161497] In this unique longitudinal study of neonatal imitation, over 100 infants were tested on four occasions during the first two months of life. Results showed that newborns failed to imitate any of the gestures from an adult female model.

26. Ruffman T, Then R, Cheng C, Imuta K: Lifespan differences in emotional contagion while watching emotion-eliciting videos. PloS One 2019, 14(1):e0209253. [PubMed: 30657754]
27. Svetlova M, Nichols SR, Brownell CA: Toddlers' prosocial behavior: From instrumental to empathic to altruistic helping. Child Development 2010, 81(6):1814–1827. [PubMed: 21077866]
28. Cowell JM, Lee K, Malcolm-Smith S, Selcuk B, Zhou X, Decety J: The development of generosity and moral cognition across five cultures. Developmental Science 2017, 20(4):e12403.
29. Malti T, Gummerum M, Keller M, Buchmann M: Children's moral motivation, sympathy, and prosocial behavior. Child Development 2009, 80(2):442–460. [PubMed: 19467003]
30. Cheng Y, Chen C, Decety J: An EEG/ERP investigation of the development of empathy during early childhood. Developmental Cognitive Neuroscience 2014, 10:160–169. [PubMed: 25261920]
31. Decety J, Michalska KJ, Kinzler KD: The contribution of emotion and cognition to moral sensitivity: A neurodevelopmental study. Cerebral Cortex 2012, 22:209–220. [PubMed: 21616985]
32. McAuliffe K, Blake PR, Steinbeis N, Warneken F: The developmental foundations of human fairness. Nature Human Behaviour 2017, 1(2):0042.
33. Huppert E, Cowell JM, Cheng Y, Contreras C, Gomez-Sicard N, Gonzalez-Gaeda ML, Huepe D, Ibanez A, Lee K, Mahasneh R, Malcolm-Smith S, Salas N, Selcuk B, Tungodden B, Wong A, Zhou X, Decety J: The development of children's preferences for equality and equity across 13 individualistic and collectivist cultures. Developmental Science 2019, 22(2):e1279.
34. Blake P: Giving what one should: Explanations for the knowledge-behavior gap for altruistic giving. Current Opinions in Psychology 2018, 20:1–5.
35. Cowell JM, Decety J: The neuroscience of implicit moral evaluation and its relation to generosity in early childhood. Current Biology 2015, 25:93–97. [PubMed: 25532892]
36. Paulus M, Licata M, Kristen S, Thoermer C, Woodward A, Sodian B: Social understanding and self-regulation predict preschoolers' sharing with friends and disliked peers: A longitudinal study. International Journal of Behavioral Development 2015, 39:53–64.

37**. Steinbeis N: Taxing behavioral control diminishes sharing and costly punishment in childhood. Developmental Science 2018, 21(1):e12492.Do altruistic acts occur automatically and spontaneously, or do they require behavioral control. This study focused on the mechanisms that give rise to prosocial decisions such as sharing and costly punishment. Two experiments with children aged 6–9 years demonstrate that behavioral control plays a critical role for both prosocial decisions and costly punishment.

38. Best JR, Miller PH: A developmental perspective on executive function. Child Development, 2010, 81 (6), 1641–1660. [PubMed: 21077853]

39. Meidenbauer KL, Cowell JM, Decety J: Children's neural processing of moral scenarios provides insight into the formation and reduction of in-group biases. Developmental Science 2018, 21:e12676. [PubMed: 29691954]

40. Leimgruber KL, Shaw A, Santos LR, Olson KR: Young children are more generous when others are aware of their actions. PLoS One 2012, 7:e48292. [PubMed: 23133582]

41. Silver IM, Shaw A: Pint-sized public relations: The development of reputation management. Trends in Cognitive Sciences 2018, 22:277–279. [PubMed: 29571663]

42. Gintis H: Gene-culture coevolution and the nature of human sociality. Philosophical Transactions of the Royal Society B: Biological Sciences 2011, 366(1566):878–888.