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EDITED BY

Ilaria Grazzani,
University of Milano-Bicocca, Italy

REVIEWED BY

Bianca Filippi,
University of Padua, Italy

*CORRESPONDENCE

Alessandra Geraci
✉ alessandra.geraci@unict.it

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Early markers of atypical socio-moral development

Alessandra Geraci^{1*}, Emanuela Borzi¹ and Laura Franchin²

¹Department of Educational Sciences, University of Catania, Catania, Italy, ²Department of Psychology and Cognitive Sciences, University of Trento, Trento, Italy

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Introduction

Human social relationships aim to care for mutual wellbeing (Afshordi and Liberman, 2021; Trivers, 1971). From birth, humans are motivated to look longer at social stimuli, as well as to select, engage, and bond with social partners (e.g., Fiske, 2018; Tomasello, 2014). Developmental literature indicates that infants employ intuitive theories that allow them to generate predictions and explanations for different events (e.g., Baillargeon et al., 2016; Carey, 2000; Gelman and Legare, 2011; Spelke, 1990; Spelke and Kinzler, 2007) and that infants understand and recognize enduring relationships between people (Thomsen and Carey, 2013). In her seminal work, Spelke (2022) reviews the evidence for the existence of six distinct “core knowledge” domains: objects, numbers, places, forms, agents, and social beings. Core knowledge systems include innate, abstract knowledge of specific fitness-relevant domains that is ancient, early emerging, invariant across development, and automatically activated, unconscious, and encapsulated. Recent evidence on infants’ moral cognition has led some researchers to argue for the existence of core moral knowledge (Buyukozer Dawkins et al., 2019; Surian et al., 2025; Ting et al., 2020), based on the assertion that young infants can represent social goals.

We believe that infants can infer social goals in different actions displaying different degrees of prosociality, such as in basic actions like approaching behaviors, or in more complex actions such as helping behaviors or distributive actions (Hamlin, 2023). Concerning affiliative behaviors, Powell (2021) argued that infants need a concept of social affiliation to use their understanding of rational actions to infer what others value and who they value. This concept is based on the extent to which one individual consistently takes on the goals of another, and it has three features: (a) it can be integrated with existing intuitive psychology based on “naïve utility calculus”, such as an interpersonal utility (Jara-Ettinger et al., 2016) it makes a prediction on infants’ expectations of social behaviors and affiliation; and (c) it reflects three domains of social cognition: intuitive psychology, intuitive sociology, and intuitive morality.

The ontogeny of the concept of affiliation is still unknown. Two prominent proposals suggest different origins. First, theoretical nativist views support that young infants possess an innate concept of social affiliation that enables them: (i) to estimate the value that one individual places on a partner’s goal, following the theory of utility adoption (Powell, 2022); or (ii) to represent social beings as individuals who exist in systems of relationships to each other and infants themselves, in line with the theoretical framework of core knowledge (i.e., core social being system; see Spelke, 2022). Other researchers argue for the existence of an innate moral core that enables infants to grasp social goals and make evaluations of potential social partners, which would reflect in an early preference for approacher over repellents (Buyukozer Dawkins et al., 2019; Hamlin, 2013; Ting et al., 2020; Woo et al., 2022). Second, theoretical constructivist views postulate that social affiliation is learned through early social interactions with caregivers (Frith and Frith, 2010) and that allostasis

is the incentive (Atzil et al., 2018). According to this view, social dyads encourage the acquisition of new behaviors and concepts that are necessary for social affiliation (Atzil et al., 2018). Although some researchers have described affiliative actions as social actions (non-moral), such as speaking or imitating (Lieberman et al., 2017; Powell and Spelke, 2013), it seems clear that these actions can be aimed at benefiting another (Dunfield, 2014; Eisenberg, 1986).

Thus, to explore this issue, we focus primarily on recent research examining early preferences for agents performing approaching behavior, which is described as a basic prosocial action. Recent research presented young infants with both affiliative and aggressive actions by investigating their visual or reaching preference based on the social goals (i.e., Geraci et al., 2024; Kanakogi et al., 2013). These findings demonstrated a preference for agents displaying approaching behaviors as compared to aggressive actions, suggesting early emerging inferences of social goals, and a sophisticated evaluation of non-moral forms of prosocial vs. anti-social basic actions. Affiliative behavior can be defined as a basic prosocial action, that is, a non-moral kind of prosocial act aimed at benefiting recipients. The lack of preference for affiliative interactions in infancy could suggest an atypical socio-moral development. Also, it is well-known that specific symptoms in some clinical populations are related to the socio-cognitive impairments (Gliga et al., 2014).

Since there is evidence that preverbal infants positively and negatively evaluate agents who have previously acted prosocially and antisocially, we examine in more depth the relationship between social affiliation and the moral sense, concluding with brief remarks on the importance of identifying early markers for impairments in socio moral functioning.

Infants' preferences for approaching behaviors

Approach is a basic behavior that is prompted by and indicates attraction to a person or object for both adults (e.g., Cacioppo et al., 1993; Chen and Bargh, 1999) and infants (Gergely et al., 1995; Martin et al., 2012; Sommerville and Woodward, 2010; Woodward, 1998). Previous studies on fetuses and newborns revealed early (and maybe not learned) predispositions to detect (and prefer) social stimuli, such as faces (e.g., Reid et al., 2017; Turati et al., 2006; Valenza et al., 1996) and gazes (Farroni et al., 2004, 2006). More recent research on newborns found a visual preference for non-human objects (Orioli et al., 2018) and human figures (Roberti et al., 2024) moving according to trajectories approaching and receding from their body, compared to trajectories directed to the space around their body, suggesting an early predisposition toward social closeness. Intriguingly, these findings suggest an innate mechanism aimed at detecting and preferring agents who perform approaching behaviors.

Another line of research sheds light on how visual and motion cues can trigger infants' detection of social affiliation. It is well-known that synchronized motion by animate characters prompts social affiliation in adults (Hove and Risen, 2009) and infants (Cirelli et al., 2014), and we also know that this is interpreted by infants as a sign of social affiliation (Geraci and Franchin, 2021; Powell and Spelke, 2013). Recent studies demonstrated that

infants use similar behaviors and preferences to infer affiliation between others (Lieberman et al., 2017, 2021), as well as patterns of imitation (Powell and Spelke, 2017, 2018a,b). A recent study aimed to investigate infants' intention-based evaluations of distributive actions, by using both preferential looking and reaching paradigms, found a visual preference not only for fair over unfair distributors but also for more affiliative over less affiliative agents from nine months of age (Geraci et al., 2022a). Importantly, another recent study found an early visual preference for approaching over repulsing actions, as well as a developmental shift between 4 and 8 months of age (Geraci et al., 2022b). Specifically, Geraci et al. (2022b) presented infants with familiarization events displaying a basic interaction involving two agents: one of them (the "repulser") moved toward the other (the "approacher"), which reacted by simply moving toward the repulser without contacting it. In the test phase, by using both preferential looking and preferential reaching paradigms, they found that 8-month-olds looked longer at the approacher than at the repulser, whereas 4-month-olds showed no preference. Taken together, these findings prompt an early-emerging concept of social affiliation, since preverbal infants between 4 and 8 months of age show a visual preference for affiliative agents in different scenarios.

Social affiliation and moral sense

There are some reasons to consider that affiliative or approaching behaviors are non-moral forms of prosocial actions, which are different from more complex and moral prosocial actions, such as helping behaviors or distributive actions (Hamlin, 2013; Surian et al., 2025; Ting et al., 2020). First, some researchers found early visual preferences for either affiliative or prosocial agents by using the same scenarios, and usually these preferences toward affiliative agents are like those for prosocial agents to the point that no significant difference between conditions emerges (Geraci et al., 2022a,b; Geraci and Surian, 2023; Strid and Meristo, 2020). Certainly, these results reflect a positive evaluation of affiliative behaviors, which is similar to that of agents displaying prosocial behaviors (Hamlin et al., 2007; Hamlin and Wynn, 2011; Surian and Franchin, 2017a,b). A recent study on newborns found that five-day-old newborns attend more to prosocial interactions both for simple, clearly non-moral forms of prosocial vs. anti-social acts (approach vs. avoidance), and for interactions that are more complex and that possess some moral value (helping vs. hindering) (Geraci et al., 2025). Thus, early detection of agents' social goals triggers the evaluation process, suggesting possible coevolution and cooperation between social beings and moral cores (Hamlin, 2023). Taken together, these findings shed light on possible different mechanisms that are involved when infants evaluate different actions: (a) an intention-based attribution for non-moral prosocial acts, and (b) a value-based judgment for moral prosocial acts.

Second, following a developmental perspective, social evaluation seems to emerge earlier than the use of prosocial behaviors for affiliative inferences, in line with prior findings on infants' social evaluations of different prosocial actions as young as 3 months of age (Hamlin et al., 2010; Geraci and Surian, 2023). Prior studies found that younger infants did not expect the recipient of helping behaviors to approach the helper over the

hinder (Hamlin et al., 2007; Kuhlmeier et al., 2003). Otherwise, older infants who were presented with scenarios depicting recipients' approaching behaviors toward prosocial or antisocial agents demonstrated their expectations about others' positive social attitudes in different kinds of prosocial interactions, such as helping behaviors (e.g., Hamlin et al., 2007; Kuhlmeier et al., 2003), distributive actions (e.g., Geraci and Surian, 2011; Strid and Meristo, 2020), and defending/interfering behaviors (e.g., Geraci, 2020; Kanakogi et al., 2017).

Third, from a comparative perspective, De Roni et al. (2023) explored newborn chick preferences for affiliative behaviors by using the same stimuli used on human infants (Geraci et al., 2022b). In particular, newborn chicks were presented with events displaying a basic interaction, in which at first Agent A approached Agent B slowly, and then Agent B rejected Agent A, by hitting it. This pattern of actions was repeated three times by displaying the same dynamic cues (i.e., speed and trajectories), showing that Agent A, even after being rejected, expressed the same desire to get close to Agent B again. Certainly, Agent A performed a voluntary positive interaction with Agent B (Eisenberg et al., 2006), while Agent B showed a negative interaction with Agent A (Geraci and Simion, 2022; Kanakogi et al., 2013, 2017). Like infants between 4 and 8 months of age, newborn chicks also showed a preference for the approacher agents, demonstrating an early sensitivity to both social goals and roles. Certainly, the precocity of the concept of social affiliation in both human and non-human social species suggests the existence of an evolutionary root for core social cognition (Spelke, 2022), but also for moral core (for human infants see Hamlin, 2013; Ting et al., 2020; Surian et al., 2025; for non-human species see Brosnan, 2023). Crucially, both newborn chicks and human infants demonstrated the ability to identify and prefer the best social-cooperative partner by inferring agents' social goals and attributing positive or negative valence to their actions. Non-human species' social preferences can hardly be due to the approval of agents for acting as they should (i.e., in terms of morality by considering whether actions are "right" or "wrong") but might reflect a more basic inference that the approaching agent followed both social and prosocial goals. To choose the best social partner, infants and newborn chicks must *distinguish and evaluate* two different agents' social goals: approaching (positive disposition) or repulsing (negative disposition) (Kuhlmeier et al., 2003). Thus, we believe that both social and moral cores are involved in social contexts and together cooperate to navigate the social world. Future research could assess pre-term newborns visual preference toward events displaying social and prosocial goals to know early markers of atypical development (Dean et al., 2021; Sansavini et al., 2011), starting from the recent developmental views posing that we are born hardwired to be social and moral.

Early markers of atypical socio-moral development

To our knowledge, the frequency of prosocial behaviors was almost similar between atypical (e.g., Autism Spectrum Disorder,

ASD) and neurotypical groups, even if some studies revealed differing patterns, strategies, and moderating factors from autistic children to their comparison groups (for a systematical review regarding for autistic children's prosocial behaviors, see Ryan-Enright et al., 2022). In particular, it seems plausible that the lack of attention toward social events, and a failure to prefer prosocial events over antisocial ones, may indicate not only atypical visual attention to social stimuli, as a potential early marker of social and communicative deficits (as in ASD; Di Giorgio et al., 2016, 2021; Filipe et al., 2018), but also impairments of socio-moral functioning (Calkins and Keane, 2009; Clarkson et al., 2023). Crucially, infant studies demonstrated that decreased preferential tracking of the human face soon after birth is associated with later Callous-Unemotional (CU) traits, as a precursor of psychopathy, supporting the hypothesis that reduced attention to social stimuli (i.e., faces with direct gazes) in infancy can have downstream consequences for the socio-affective development (Bedford et al., 2015; Dadds et al., 2011).

We believe that infants looking reactions toward prosocial and antisocial events could be early markers for impairments in socio-moral functioning (i.e., conduct disorders) or deficits in specific stages of socio-moral information processing (e.g., perception, cognition, and regulation; Blair, 2013; Salekin, 2017). In line, previous developmental studies suggested the possibility for an earlier diagnosis, by indicating two main potential sources of early-onset of antisocial tendency (Tremblay, 2012) neuropsychological deficits, such as poor verbal and executive functions, which emerge in utero or shortly after birth and cause persistent adjustment problems (Moffitt, 1993); family-related risks that prevent very young children from acquiring the skills and resources needed to inhibit antisocial impulses (Gottfredson and Hirschi, 1990). Moreover, some researchers supported that some individuals may be genetically predisposed to exhibit such traits (Glenn, 2019; Mills-Koonce et al., 2015).

In addition, infants' visual or behavioral reactions could reflect early signs of impairments in the development of empathy, which plays a foundational role in guiding appropriate moral behavior and social understanding. Several researchers have demonstrated that empathic responses to distress exhibited during the first year of life predicted subsequent prosocial behavior, greater social competence, and reduced aggression at 18 and 36 months (Davidov et al., 2021; Paz et al., 2021, 2022, 2024). In particular, to understand the behavior of infants later diagnosed with ASD, Paz et al. (2024) considered several features of infants' behavioral responses: a less empathic concern for a distressed other, no evidence of elevated self-distress, at 6 months (but not at later ages) a looking behavior that shifts away more from the distressed other. This result is in line with the findings of Chawarska et al. (2013) who found that infants later diagnosed with ASD looked less at the face of a female actor at 6 months, and with the findings of Jones and Klin (2013), who demonstrated that their attention to an actor's eyes declined from 2 to 6 months. Thus, low empathic abilities evaluated based on different behavioral responses exhibited by children in the early years of life are not exclusive to ASD and may predict other developmental difficulties, including aggression and Callous-Unemotional traits (Paz et al., 2021; Waller et al., 2020). Detecting

such signs early enables targeted interventions that can prevent the onset of problematic behaviors and promote empathy, self-regulation, cooperation, and, in general, a well-functioning and adaptive socio-moral development.

Discussion

Understanding the developmental roots of social affiliation is key to uncovering how infants begin to navigate complex social environments. On the other hand, identifying early markers of difficulties in socio-moral functioning is crucial to fostering healthy social and moral development in children. Future research should aim to clarify the interplay between innate and learned components of affiliation, shedding light on how these early capacities shape lifelong social functioning. Finally, this knowledge could contribute to the improvement of early interventions for children at risk of socio-moral impairments.

Author contributions

AG: Writing – original draft, Resources, Investigation, Software, Visualization, Data curation, Validation, Formal analysis, Writing – review & editing, Project administration, Methodology, Conceptualization, Supervision. EB: Investigation, Conceptualization, Writing – review & editing, Writing – original draft. LF: Investigation, Conceptualization, Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Validation, Supervision.

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