

An ecological perspective of infants' early social development

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Humans are an inherently social species. Our lives are deeply intertwined with others from birth, providing the foundation for communication, language, and culture. Many theoretical accounts have argued that such abilities require specific cognitive adaptations that enable humans to acquire culturally relevant behaviours during childhood (Csibra, 2010; e.g. Csibra & Gergely, 2009).

In the current paper, I want to argue that these abilities instead emerge as a product of human infants' premature birth that requires a significantly longer period of post natal care. Consequentially, human infants are born with large brains stuck in bodies that only have a limited ability to explore and affect the environment on their own, forcing them to look for others to act on the environment on their behalf. Through this, children learn to “act through others” and “act with others” in the same way that they eventually learn to use tools. Therefore, the fundamental information necessary to become a social animal is provided by the specific environment that infants find themselves in and emerges from an interaction between innate bodily constraints that bias their learning environment towards others.

Human children are born comparatively premature, but with large brains. Compared to all other animals they spend a long period of their life being dependent on caregivers (Piantadosi & Kidd, 2016) and their ability to control their body is highly limited. Only at 3 months of age, children can control their head movements without support and lift their head above the floor (Payne & Chang, 2020). Prone to supine movement sets in at 5 months of age, and is important for visual exploration and frees up hands for object exploration (Payne & Chang, 2020). Infants typically start crawling between 7 and 8 months of age, and typically do not start walking before 9-11 months of age, albeit requiring support in the form of hand holding.

Whilst infants already have certain perceptual preferences towards the sources of social signals, e.g. eyes and faces by the time they are born (Farroni et al., 2005; Farroni, Menon, & Johnson, 2006) or even before (Reid et al., 2017), these perceptual preferences are not unique to humans. Other species, such as chimpanzees, also have a preference for

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direct gaze after birth (Myowa-Yamakoshi, Tomonaga, Tanaka, & Matsuzawa, 2003), some apes also share the white sclera that supports gaze following (Mayhew & Gómez, 2015) and gaze following shows a similar developmental trajectory across lifespan compared to humans (Rosati, Arre, Platt, & Santos, 2016). Despite this, other apes do not use social signals to the extent that humans do (Rosati et al., 2016). Already in rhesus monkeys, increased social interactions between neonates and their mothers increases social behaviour later in life (Dettmer et al., 2016), and human infants experience an environment that is marked by a significantly longer period lacking opportunities for own action but consequentially richer in social signals.

In their first few months, children in Western societies predominantly see ceilings and the faces of their caregivers (Jayaraman, Fausey, & Smith, 2015; Jayaraman & Smith, 2018). Over time, this visual input changes from faces to hands (Fausey, Jayaraman, & Smith, 2016), as children start to crawl. The prominence of these social signals over such a prolonged period of time, combined with the constrained action opportunities in early childhood allow young infants to learn the importance of these communicative signals. Once established, pointing emerges by the age of 12 months out of reaching actions (O'Madagain, Kachel, & Strickland, 2019; Ramenzoni & Liszkowski, 2016).

Only by the age of 12 months are human infants able to walk on their own (Payne & Chang, 2020). Meanwhile, young chimpanzees already start walking by 5 months of age (Yerkes & Tomilin, 1935), changing the way both species engage with the environment. Whereas chimpanzee children are able to interact with objects directly, human children focus on the relationships between objects (Potì & Spinozzi, 1994) and will play with less preferred objects since their unable to walk (Dosso & Boudreau, 2014). At the same time, caregivers provide opportunities for meaningful engagement through play, care, feeding, and contingent interaction (Brand, Shallcross, Sabatos, & Massie, 2007; Broesch et al., 2021; Goldstein et al., 2010).

Once children start crawling and walking, they are able to explore the environment on their terms (e.g. by moving towards preferred objects, Dosso & Boudreau, 2014) and become less reliant on their caregivers. Children who are able to successfully reach for objects pay less attention to their mothers (Fogel, Dedo, & McEwen, 1992) and walking infants rarely lift their heads to look out for others' faces, "because they are too busy playing with toys and running around the room" (Adolph & Hoch, 2019).

Parents adjust their engagement to children's emerging abilities (c.f. Brand et al., 2007), and this is also evident in children's motor abilities. Kretch et al. (2022) found that parents provide most learning opportunities to walking children, thereby engaging children's attention by providing enhanced opportunities for action. These results show that children's cognitive abilities coincide with their physical development. They also show that caregivers adjust their behaviour to compete for attention with children's own ability to explore the environment by themselves .

Throughout the first year of life, caregivers provide important opportunities to engage with the environment. These contingent interactions with caregivers place infants in an environmental niche in which it makes at least as much sense to predict others' actions as

it makes sense to predict their own. Thereby others' actions are predicted by children like tools, in a similar way as described by Gibson (1986). It is this particular and peculiar environment that provides the foundations of human communication (Pickering & Garrod, 2004, 2014) and social learning (Sebanz, Bekkering, & Knoblich, 2006; Sebanz & Knoblich, 2009).

In conclusion, the foundations of human social skills may not be exclusively cognitive but emerge from a unique early environment for children that prevents them from exploring on their own for a much longer time than any other species. Instead it forces them to rely on others to explore the world, which subsequently leads to an understanding of other agents that goes beyond any other species.

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