

Infants actively seek and transmit knowledge via communication

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Abstract

Supporting the central claim that knowledge representation is more basic than belief representation, we focus on the emerging evidence for pre-verbal infants' active and selective communication based on their representation of both knowledge and ignorance. We highlight infants' ontogenetically early deliberate information-seeking and information transmission in the context of active social learning, arguing that these capacities are unique to humans.

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Supporting the central claim of Phillips et al. that knowledge rather than belief representation constitutes the more basic cognitive capacity, we highlight emerging evidence from developmental research on infants' communicative use of such knowledge representations. This work suggests that infants actively and selectively seek epistemic input from more knowledgeable others and, in turn, transmit such information to less knowledgeable others. As active participants in the bi-directional exchange of knowledge, infants take an interrogative stance and also themselves act as informants, using developmentally available tools from their pre-verbal communicative repertoire.

To actively solicit information, infants have been shown to socially reference adults who were more likely to help them resolve an epistemically uncertain situation (Bazhydai et al., 2020; Goupil et al., 2016, Harris et al., 2017, Stenberg, 2013; Vaish et al., 2011) and point to objects they want to learn about in the presence of a knowledgeable rather than an uninformed person (Begus & Southgate, 2012; Kovács, et al., 2014; Lucca et al., 2018). To actively transmit information in situations where infants themselves were more knowledgeable than their social partners, they have been shown to use informative pointing (Liszkowski et al., 2006, 2008; Meng & Hashiya, 2014; O'Neill, 1996) and deliberate action demonstration (Bazhydai, Silverstein, et al., 2020; Vredenburg et al., 2015; Flynn, 2008) as communicative tools indicative of early emerging, proto-teaching strategies (Strauss & Ziv, 2012).

Not only do infants represent others' states of knowledge versus ignorance, they also form epistemic expectations and actively seek explanations or clarifications when adults do not act in accordance with those prior expectations (Harris et al., 2018). For instance, infants expect to learn from previously knowledgeable informants (Begus et al., 2016) and look longer towards adults who provide inaccurate labels for familiar objects (Koenig & Echols, 2003) or object

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location information incongruent with their true knowledge (Galazka et al., 2016). Such enhanced attention to a speaker can be plausibly interpreted as indexing a violation of the expectation that social partners are, by default, reliable rather than misleading in their information provision (Sperber et al., 2010). Furthermore, infants are less likely to subsequently learn from previously untrustworthy informants (Brooker & Poulin-Dubois, 2013; Koenig & Woodward, 2010) or from those who provide information incongruent with what was asked of them (Begus et al., 2014).

These early behaviors indicate that in social situations of epistemic uncertainty, infants act to close both intra- and inter-individual knowledge gaps, ultimately achieving an equal distribution of knowledge upon its social transfer (Harris, 2017; Strauss & Ziv, 2012). Prominent theories of epistemic curiosity (information gap and learning progress; for a review, see Bazhydai, Twomey, & Westermann, 2020) conclude that the information being sought is inherently factual, as it is in the case of curiosity in social learning (Begus & Southgate, 2018; Harris, 2020). When providing information, evidence to date shows that infants transmit factual information (e.g., where a hidden object is located or how to make a new toy play music).

Notably, and in accord with the proposals by Phillips et al., the ability to actively exchange knowledge does not presuppose a full-blown mentalizing ability: although infants exert control over their information-seeking and information-provision, their behaviors are likely proto-metacognitive (but see e.g., Goupil & Kouider, 2016, for evidence of metacognitive sensitivity in infancy) (Harris, 2020; Heyes, 2016; Strauss & Ziv, 2012). For example, when infants indicate what they know to ignorant others, there is no evidence so far to suggest they realize that they possess unique transferable knowledge, or that they deliberately reason about the nature of their communicative behaviors, which nevertheless perform an informative

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function, as a result of which others can also know. Thus, the intra- and inter-individual epistemic gaps do not have to be realized as such for active social learning to occur.

Crucially, and dissenting from the picture painted by Phillips et al., we argue that this deliberate process of ‘asking for’ knowledge and spontaneously taking steps to pass it on is a distinctively human ability. Although non-human animals represent others’ knowledge and act in accordance with those representations, in contrast to infants (Ronfard & Harris, 2015; Harris & Lane, 2014), we see little evidence of active information solicitation in them. Similarly, evidence of information transmission remains limited and less diverse and flexible than that of humans (Burdett et al., 2017; Strauss & Ziv, 2012, but see Musgrave et al., 2020, for new evidence of teaching-like behaviors in wild chimpanzees). For example, infants have the capacity to exchange cultural information (e.g., the label or function of an artifact) as opposed to exclusively functional information (e.g., the location of a food source), thereby distinguishing human infants’ information exchange from that of any other non-human primate. Thus, among the various social learning strategies that involve the transmission of knowledge from one social partner to another, and which we share to a large extent with non-human animals (imitation, emulation, observation), the active and selective seeking and provision of information among conspecifics appears to be unique to humans.

We are excited about the directions outlined in the paper’s call to arms and emphasize the need to investigate the developmental foundations of information-seeking and transmission. In light of the likely connections between curiosity and teaching in cultural evolution (van Schaik et al., 2019), future studies should investigate how the active solicitation of information impacts its subsequent transmission, examining whether the motivation to seek knowledge rather than belief makes information sharing more likely. If knowledge representations are primary, knowledge-

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rather than belief-based information would be more likely to be both sought and further propagated.

In summary, we support the knowledge-as-more-basic view and propose to strengthen the account by adding to the list of signature properties of knowledge representation, the ability of infants to engage in active social learning as manifested in information-seeking and information transmission. These emerging findings support the proposal that knowledge representation as a basic capacity may be shared with other evolutionarily close species, whereas the active communication of knowledge evolved in humans to optimize learning from others and informing others.

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