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Awareness of goal-oriented behavior during infancy and early childhood, in human- and non-human primates☆

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ABSTRACT

We review the literature surrounding the phylogenetic and developmental emergence of goal-oriented behavior, among human and non-human primates. We define goal-oriented awareness as the ability to perceive goals and perceptions in others. We examine empirical literature involving gaze-following, shared attention, distinguishing between actions and intentions, and the ability to generate and understand communicative cues. We conclude that at least a rudimentary awareness of goal-oriented behavior is present from birth in humans, and in adult great apes. The evidence in other primate species shows phylogenetic differences as well as gaps in the empirical literature.

1. Introduction

Social cognition includes any process that enables conspecifics to interact together effectively, including verbal and non-verbal signals. Although sociality in human adults is largely comprised of the former, the latter are informative because they exist in both pre-verbal children and non-human primates (hereafter, primates), and thus, represent the development of social cognition in its earliest forms. In this chapter, we examine one aspect of non-verbal social cognition – goal-oriented behavior – as it develops both ontogenetically and phylogenetically. We discuss the theoretical and methodological challenges inherent in the study of this behavior. Next, we trace its development in infants and primates, as seen in the ability to follow gazes and share attention, infer goals and distinguish intentions, and use and understand communicative cues. We conclude that both populations exhibit goal-oriented behavior, and further, that the evidence of such abilities so early in life (in the case of humans), and phylogenetically (in the case of primates) suggests a critical predisposition for more complex social abilities.

☆ Reprint of goal oriented behavior among human and non human primates.

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1.1. Defining goal directed behavior and intentions

Predicting a social partner's goals is a critical yet complex aspect of social cognition. Humans and other animals are similar to non-living moving objects, in that they have physical characteristics (e.g. form, color, and size), but they are different in that living beings have inner lives that drive their behavior: They communicate, and have feelings and intentions, in ways that are often outwardly subtle (Gelman & Spelke, 1981). Moreover, unlike inanimate objects, social animals react to the physical and social environments in which they are embedded. This makes the behavior of social partners much less predictable than that of non-living objects.

Because primates (human and non) have complex social lives, maintaining relationships demands flexible socio-cognitive abilities. Human adults are experts at predicting others' behavior because they react to overt behavioral cues, and they know that people act according to mental processes that allow them to plan and choose between different actions to attain goals. Without an understanding that behavior is organized by a governing sense of purpose, it would be nearly impossible to form accurate predictions or interpretations of others' behavior. Understanding goal-oriented behavior, therefore, requires the ability to both perceive what another is doing, and why (i.e., what is the desired outcome?) This would allow an individual to predict a social partner's behavior, even if the desired end-state is not achieved. Moreover, as noted by Call and Tomasello (2008, p. 189), in order to perceive a social partner as goal-directed, an individual "must understand not only his goals but also his perceptions because what he sees and knows helps to determine what he does." Thus, an individual who has an understanding of goal-directed action should follow gazes and understand some connection between seeing and knowing, distinguish between action sequences that have the same external appearance, but which differ by the underlying intention, and read and use communicative gestures effectively.

Note that this constellation of abilities might not result in a comprehensive appreciation of the psychological states of others (i.e., a representational theory of mind, or ToM), as we know exists in human adults. For instance, the definition above does not imply an awareness of another's beliefs (which may differ from the true state of the world). The current literature suggests that neither infants nor primates have a representational ToM, in which they are aware not only of others' minds, but also that their thoughts and beliefs might differ from their own (Call & Tomasello, 2008; Sabbagh, Benson, & Kuhlmeier, 2013). Therefore, an understanding of goal-oriented behavior in others might be viewed as a rudimentary, but essential and precursory component of a representational ToM.

2. Theoretical orientations

Although it is generally agreed that goal-oriented behavior plays a significant role in social cognition, several aspects of this ability remain under debate. Among developmentalists, there are differing views on the timeline of its emergence. Most agree that by four years of age children are aware of the minds and beliefs of others, and further, that those thoughts and beliefs may differ from their own (Wellman, 1990). However, pre-verbal children's understanding of others' minds remains a controversial subject. One viewpoint is that infants are born as a 'blank slate', and can only learn to socialize through experience (James, 1890; Piaget, 1954). Accordingly, infants must learn to distinguish between physical and underlying psychological states through a domain-general process. Thus, for the first 2 years of life, infants perceive social partners only in terms of their external physical behavior, rather than psychologically, and do not become aware of the thoughts underlying actions until as late as the end of the second year of life (Piaget, 1954).

In contrast, others assert that infants are born with a "social brain", containing domain-specific abilities that make newborns pre-adapted to social interaction (e.g., Grossmann & Johnson, 2007; Trevarthen, 1979). This allows them to process information about the social environment differently from the physical world (e.g., Grossmann & Johnson, 2007). According to this view, the mind consists of specialized domains that each process and represent certain kinds of information (e.g., Legerstee, 2013). The social cognition domain directs infants to perceive social input appropriately. Within this framework, it is possible to examine rudimentary non-verbal social abilities during the first two years of life, to trace the development of social cognition. It is from this latter perspective that we examine goal-oriented behavior in infants and toddlers. Because normal socio-cognitive development is dependent not only on biological predispositions, but also on interactions with the social environment, it should be noted that there are cultural variations in the development of goal-oriented behavior, particularly with respect to the timeline of the emergence of the abilities described below.

In comparative psychology, the problem is somewhat different; whereas we know that human children will eventually develop a representational ToM because this ability exists in adults, the same cannot be said with certainty about primates. Among comparative researchers, theoretical controversies focus on *whether* primates have goal-directed awareness, rather than *when* it emerges. In their seminal paper, Premack and Woodruff (1978) assessed whether a chimpanzee understood the goals of a human who was confronted with a series of physical problems, and tentatively claimed that chimpanzees showed evidence of a ToM. However, twenty years later, evidence seemed to suggest the opposite (see Tomasello & Call, 1997; for a review). Many argued that Premack and Woodruff's (1978) results could be explained in terms of 'lower-level' mechanisms such as learned associations between stimuli (e.g., Savage-Rumbaugh & Rumbaugh, 1979). Subsequent studies also failed to find evidence in support of complex social cognition, such as understanding others' goals, perceptions, or false beliefs, in apes (e.g., Call & Tomasello, 1999; Povinelli, Rulf, & Bierschwale, 1994). This led many to conclude that primates did not perceive others as psychological beings, after all (e.g., Heyes, 1998; Tomasello & Call, 1997).