NON-HUMAN PRIMATES CANNOT DECONTEXTUALIZE AND OBJECTIFY THE ACTIONS OF THEIR CONSPECIFICS

TOM FROESE, TAKASHI IKEGAMI
Department of General Systems Studies, University of Tokyo, Japan

MIKE BEATON
Centre for Research in Cognitive Science, University of Sussex, UK

We argue that all primates primarily perceive the actions of conspecifics as meaningful expressions of agency. Social understanding is a perceptual capacity that does not require human reason or imagination. Conversely, only humans have an additional, sophisticated ability to decontextualize and objectify actions into abstract movements. We thereby turn the traditional consensus on its head: what distinguishes humans from other primates is *not* the ability to perceive other agents. Humans are different because they can detach from the goal-oriented and meaning-laden presence of their natural and social world in order to bring abstract physical details into focus. This objectifying stance is necessary for genuine innovation and fine-grained imitation, especially of opaque instrumental and symbolic gestures, and therefore has implications for the origins of tool use and language.

1. Introduction

The fields of primatology and comparative psychology are undergoing a 'social revolution'. Just over a decade ago it was still widely believed that non-human animals, including our closest primate relatives, are unable to comprehend that conspecifics are intentional agents like themselves (Tomasello, 1999). However, in subsequent years this longstanding consensus has been subjected to drastic revisions based on new empirical evidence. Today the key question is no longer whether chimpanzees understand the mental states of others, but which ones and to what extent (Tomasello, Call & Hare, 2003; Call & Tomasello, 2008).

For example, there is evidence that chimpanzees are sensitive to human attentional states (Hostetter et al., 2007), as well as to the perceptual and social relevance of human body and face orientation, respectively (Kaminski et al., 2004). They have some understanding of what others have perceived in the past and what they have knowledge of (Kaminski et al., 2008). More impressively, they have some grasp of the rationality of others' actions, and they use this

understanding to decide whether to imitate or emulate others (Buttelmann et al., 2007), and to distinguish between intentional actions and accidental behavior (Wood et al., 2007), as well as to distinguish between when a human observer is unwilling or unable to act (Call et al., 2004). In addition, it has been found that chimpanzees spontaneously offer altruistic help to human observers (Warneken & Tomasello, 2006) as well as to conspecifics (Warneken, et al. 2007), and they help each other upon request (Yamamoto et al., 2009).

Furthermore, this growing body of evidence is not limited to our nearest primate relatives. There is evidence that rhesus macaques correctly understand communicative gestures (Hauser et al., 2007) and rational, goal-direction actions (Wood et al., 2007). Japanese macaques have been taught joint attention through training in eye contact and pointing (Kumashiro et al., 2002), and this ability has facilitated their imitation of arbitrary body movements (Kumashiro et al., 2008). Even cotton-top tamarins, a more distant primate relative, appear to be able to understand rational, goal-directed actions of humans (Wood et al., 2007). This indicates that social understanding in primates is likely to have arisen at least as far back as the New World monkeys, some 40 million years ago.

Nevertheless, not everyone is convinced that the new evidence is sufficient to overturn the traditional, skeptical consensus concerning the ability of non-human primates to perceive intentional states (e.g. Penn & Povinelli, 2007; Povinelli & Vonk, 2003). For instance, evidence for false-belief understanding has yet to be found (Kaminski et al., 2008; Call & Tomasello, 2008). And even if we accept that the evidence shows that non-human primates can understand others as intentional agents, there still remains the problem of what form a new hypothesis should take, as to the similarities and differences in intentional perception between humans and other primates (Tomasello, et al. 2003; Call & Tomasello, 2008). We argue that the root of the dilemma is that the skeptical hypothesis continues to be logically forced on the field by a set of questionable assumptions. It is largely the commitment to these assumptions, and not a lack of evidence as such, which prevents an alternative theory from taking shape.

2. A logical proof of the skeptical hypothesis

An important first step toward developing a new theory of social understanding in non-human primates is to notice the logical force of the theoretical framework from which the skeptical hypothesis has traditionally been derived. Indeed, on the basis of its seemingly reasonable starting assumptions, it is possible to give a *logical proof* of the idea that non-human primates are *unable* to understand that their conspecifics are intentional agents like themselves.

To begin with, we note that cultural learning was believed to be a difficult achievement for non-human animals precisely because it is "made possible by a single very special form of social cognition, namely, the ability of individual organisms to understand conspecifics as beings *like themselves* who have intentional and mental lives like our own" (Tomasello, 1999: 5). Thus, social understanding, which is often called a 'theory of mind', was thought to be a uniquely human ability. This skeptical hypothesis is logically proved in Table 1.

Table 1. A logical proof of the skeptical hypothesis.

	Propositions
Premise 1	*Homo sapiens* is the only primate capable of cumulative cultural evolution.
Premise 2	Cumulative cultural evolution requires (i) innovation and (ii) imitation.
Premise 3	Non-human primates are capable of innovation by trial and error.
Conclusion 1	*Homo sapiens* must be the only primate capable of genuine imitation.
Premise 4	Imitative learning requires perception of intentional behavior.
Premise 5	Perception of intentional behavior requires (i) perception of physical behavior plus (ii) theory of mind.
Premise 6	All perception provides information about physical aspects of the world.
Conclusion 2	Non-human primates are capable of perceiving others' physical behavior.
Conclusion 3	*Homo sapiens* must be the only primate species capable of theory of mind.

The logical argument begins with the relatively uncontroversial proposition that only humans are capable of giving rise to cumulative cultural evolution (Premise 1). In order to explain this unique ability we need to posit the conditions that enable cumulative cultural evolution to take place. Useful new behaviors must be invented and then retained by a 'ratchet effect' (Tomasello et al., 1993). This necessity of creative innovation and faithful imitation (Premise 2) could explain the essential difference between *H. sapiens* and other primates. Evidence from ethology appears to demonstrate the key factor: "Perhaps surprisingly, for many animal species it is not the creative component, but rather the stabilizing ratchet component, that is the difficult feat" (Tomasello, 1999: 5). In other words, it is assumed that other primates are capable of creative innovation (Premise 3). We have now followed the argument to a specific claim. If we accept that non-human primates are capable of innovation (Premise 3), and that cumulative cultural evolution requires both innovation and imitation (Premise 2), then given that only humans are capable of such cultural evolution (Premise 1), it logically follows that *only humans are capable of imitative learning* (Conclusion 1).

We can now inquire about the necessary conditions of imitative learning to find out why it appears to be uniquely human. Firstly, we note that true imitation requires the perception of *intentional* behavior (Premise 4): if one does not see a behavior as aimed towards a purpose, then one cannot copy it in order to achieve

that same purpose for oneself. Traditionally, it is supposed that two conditions have to be fulfilled for perception of intentional behavior, namely the agent must perceive the physical aspects of behavior, and have an additional capacity for a 'theory of mind' (Premise 5). Now, it is also traditionally assumed that the basic function of perception is to provide information about objective properties of the physical world (Premise 6), in which case we should certainly grant this ability to non-human primates, too (Conclusion 2). Therefore, we are in a position to deduce precisely what must make humans unique. If we accept that non-human primates can perceive the physical aspects of the behavior of others (Conclusion 2), and that imitative learning requires both perception of the physical behavior and a theory of mind (Premise 5), then given we have already accepted that only humans are capable of such imitation (Conclusion 1), it logically follows that *only humans are capable of a theory of mind* (Conclusion 3). This final conclusion corresponds to the traditional assumption that the uniqueness of human cumulative cultural evolution is explainable by appealing to a single factor: our capacity for a 'theory of mind', i.e. understanding others as social agents like themselves. Given this logically consistent framework, it is easy to see why there has been such a persistent negative bias against the very possibility of social understanding in non-human species: *uncovering empirical evidence against the presence of a theory of mind in other primate species was the only logically acceptable outcome given the traditional set of assumptions*.

The full extent of the current dilemma is now clear: considering there is a growing body of empirical evidence demonstrating that chimpanzees (and other non-human primates and animals) understand conspecifics as other intentional agents like themselves, then, given the argument's logical structure, some of the premises leading to the skeptical hypothesis must be false. Given that each of the premises seems to be intuitively plausible, the problem now is to determine which of them must be rejected and for what reason.

3. What is wrong with the premises? Uncovering cultural bias

We agree with Povinelli and Vonk (2003) that current research in comparative psychology is distorted because humans have a strong tendency to a biased view of the mind of other creatures. However, we disagree that the main challenge in this regard is to reject an assumed *evolutionary bias* for humans to perceive other creatures as intentional beings. On the contrary, we suggest that what needs to be overcome is a *cultural bias* for scientists to conceive other creatures as mere automata, a view that was popularized by Descartes. In this section we make this cultural bias explicit and criticize its methodological assumptions.

3.1. *Methodological physicalism*

First, there is the overarching assumption of *methodological physicalism*, which holds that the faculty of perception is in the business of manufacturing 'mental representations' of bare physical reality. These representations are conceived as informational statements about objects in the world, and are thus assumed to correspond to the abstract descriptions produced by modern physics (e.g. about a set of particulars with coordinates in a three-dimensional space). But the very idea of treating the world as a set of independent objects located in an abstract space devoid of meaning is a cultural product of the scientific revolution. The assumption that methodological physicalism is a valid description of perceptual experience (Premise 6) is therefore highly questionable; most animals do not in general perceive the world as it is described by physics. It is more likely that they primarily live in an *Umwelt*, i.e. a meaningful situation of Gestalten and affordances relevant to their body plans, skills, and drives.

Methodological physicalism demands both too much and too little of the faculty of perception. On the one hand, it imputes to animal perception an advanced capacity for decontextualization and abstraction. On the other hand, it ignores the possibility that animals live in a meaningful situation shaped by various affordances for social and instrumental action. To be sure, humans are good at bringing abstract physical details into focus, which turned out to be a technological and scientific virtue, but it is a cultural bias to assume that this is the primary role of perception. In nature, meaning comes first, abstraction later.

3.2. *Methodological solipsism*

When methodological physicalism is applied to the case of social understanding we get the assumption of *methodological solipsism,* which holds that perception of another animal's behavior is the same as perception of a moving or changing *object*. It is assumed that animals perceive each other as meaningless physical forms with shifting coordinates in an abstract space, and for them to know that some moving objects could be other agents requires additional effort. Thus, it is believed that most of the actual work supporting interaction with others is done by processing 'mental representations' of a "behavioral code (abstracted spatio-temporal invariances)" (Povinelli & Vonk, 2003: 157). But this is posing a false problem that, again, demands too little and too much of perception. Primarily, perception of others is about making sense of social affordances, which does not require objective analysis of physical properties. On the contrary, the presence of social meaning may prevent the physical medium from coming into view.

3.3. *Methodological dualism*

A further crucial consequence of methodological solipsism is the assumption of *methodological dualism*, which holds that there is a need "to go beyond the surface appearance of behavior to draw inferences about an individual's mental states" (Wood et al., 2007: 1402). If an animal's perceptual (natural and social) world is assumed to contain nothing but meaningless objects, but other agents are assumed to exist as well, then we are forced to assume that there is a dualist split between other agents' purely physical 'surface behavior' and their 'hidden' mind, whereby the being of the latter can only be ascertained by an additional process of reasoning or imagining by analogy (often called 'mind-reading').

However, as the history of philosophy makes abundantly clear, the idea that there is an absolute dichotomy between mind and behavior is another relatively recent socio-cultural bias. The assumption that mindedness cannot be directly perceived in the expressive bodily actions of others was first popularized in the European intellectual climate of the 17th century. Descartes' famous philosophy of mind-body dualism set up the well known 'problem of other minds' and its tentative solution in a 'theory of mind'. In fact, the assumption of mind-body dualism has become so ingrained that evidence to the contrary, such as provided by our own experience, is widely neglected (indicating a socio-cultural version of Kant's categories of perception). Worse, it is even actively suppressed (e.g. Povinelli & Vonk, 2003). However, when we leave this cultural bias aside and carefully attend to our lived experience we find that we directly *perceive* other humans as other minded beings without having to reflect at all on the fact of the matter (and the same is true when we perceive other primates). Instead of seeing mere 'surface behavior', the presence of others minds is immediately visible in their living embodiment. Of course, we can make use of abstraction, reasoning, and imagination as well, but *only* with additional mental effort and *only* on the basis of a preexisting intuitive insight into the existence of other mental lives.

In sum, after leaving these traditional cultural biases aside, it is reasonable to assume that non-human primates are situated in a social milieu and directly perceive conspecifics as other embodied agents. This claim is strongly supported by empirical, philosophical, and phenomenological arguments. What remains debatable is to what extent they can spontaneously decontextualize and objectify aspects of their *Umwelt* in order to analyze its abstract physical properties.

4. Concluding remarks: Steps toward an alternative framework

Animals perceive a meaningful *Umwelt*, and not an abstract physical universe devoid of meaning. Humans are set apart by their objectifying stance, i.e. their

capacity for decontextualizing elements of their natural and social *Umwelt* into abstract objects whose physical properties can then be scrutinized. We conclude by highlighting the explanatory value of this alternative hypothesis with respect to the origins of cumulative cultural evolution, tool-use, and language.

Cumulative cultural evolution depends on innovation and imitation, and it is now generally accepted that non-human primates can partially fulfill both of the requirements. We suggest that it is the lack of a sophisticated objectifying stance that accounts for the crucial differences with human cultural evolution. First, if the perceptual presence of the *Umwelt* is defined by the existing affordances of the organism, then it will be difficult to innovate practices and tools based on previously unexploited properties of the environmental medium, since those will not make a direct perceptual appearance as such. Second, non-human primates may have problems in imitating complex gestures, because they cannot objectify them into a specific arbitrary sequence of movements. In both cases the physical medium itself is hidden by the expression of natural and social affordances.

Conversely, we hypothesize that the evolution of an incipient objectifying stance will be facilitated by a medium that is not already saturated with existing signification. In the case of the natural world, normally negligible aspects, such as stones, sticks, and other scattered materials, best serve this requirement of neutrality. They are the most accessible foundation for the invention of tools that go beyond natural affordances. In the social world, the living body itself is not a suitable medium because it is already the vehicle of natural expressions and instrumental action. Vocal production has the advantage that it is mostly hidden from view, and its neutrality is further enhanced by arbitrary vocalizations such as singing. The voice, perhaps aided by materials, creates a new medium for the ritualization of meanings that go beyond existing social affordances. These final remarks cast doubt on 'gesture-first' and 'animal call-first' theories of the origin of language, but support a 'song-first' theory (e.g. Merker & Okanoya, 2007).

Acknowledgements

Froese was supported by a Grant-in-Aid awarded by the JSPS. We thank David Leavens and three anonymous reviewers for their helpful comments.

References

Buttelmann, D., Carpenter, M., Call, J., & Tomasello, M. (2007). Encultured chimpanzees imitate rationally. *Developmental Science*, *10(4)*, F31-F38.

Call, J., Hare, B. H., Carpenter, M., & Tomasello, M. (2004). Unwilling or unable: chimpanzees' understanding of human intentions. *Dev. Sci.*, *7*, 488-9

Call, J., & Tomasello, M. (2008). Does the chimpanzee have a theory of mind? 30 years later. *Trends in Cognitive Sciences*, *12(5)*, 187-192.

Hauser, M. D., Glynn, D., & Wood, J. (2007). Rhesus monkeys correctly read the goal-relevant gestures of a human agent. *Proc. R. Soc. B*, *274*, 1913-1918

Hostetter, A. B., Russell, J. L., Freeman, H., & Hopkins, W. D. (2007). Now you see me, now you don't: evidence that chimpanzees understand the role of the eyes in attention. *Anim. Cogn.*, *10*, 55-62.

Kaminski, J., Call, J., & Tomasello, M. (2004). Body orientation and face orientation: two factors controlling apes' begging behavior from humans. *Anim. Cogn.*, *7*, 216-223.

Kaminski, J., Call, J., & Tomasello, M. (2008). Chimpanzees know what others know, but not what they believe. *Cognition*, *109*, 224-234.

Kumashiro, M., Ishibashi, H., Itakura, S., & Iriki, A. (2002). Bidirectional communication between a Japanese monkey and a human through eye gaze and pointing. *Curr. Psychol. Cogn*., *21*, 3-32.

Kumashiro, M., Yokoyama, O., & Ishibashi, H. (2008). Imitation of Body Movements Facilitated by Joint Attention through Eye Contact and Pointing in Japanese Monkey. *PLoS ONE*, *3(11)*, e3704.

Merker, B., & Okanoya, K. (2007). The Natural History of Human Language: Bridging the Gaps without Magic. In C. Lyon, C. L. Nehaniv and A. Cangelosi (Eds.), *Emergence of Communication and Language* (pp. 403-420). London, UK: Springer-Verlag.

Penn, D. C., & Povinelli, D. J. (2007). On the lack of evidence that non-human animals possess anything remotely resembling a 'theory of mind'. *Phil. Trans. R. Soc. B*, *362*, 731-744.

Povinelli, D. J., & Vonk, J. (2003). Chimpanzee minds: suspiciously human? *Trends in Cognitive Sciences*, *7(4)*, 157-160.

Tomasello, M. (1999). *The cultural origins of human cognition*. Cambridge, MA: Harvard University Press.

Tomasello, M., Call, J., & Hare, B. (2003). Chimpanzees understand psychological states – the question is which ones and to what extent. *Trends in Cognitive Sciences*, *7(4)*, 153-156.

Tomasello, M., Kruger, A. C., & Ratner, H. H. (1993). Cultural learning. *Behavioral and Brain Sciences*, *16*, 495-552.

Warneken, F., Hare, B., Melis, A. P., Hanus, D., & Tomasello, M. (2007). Spontaneous Altruism by Chimpanzees and Young Children. *PLoS Biology*, *5(7)*, e184.

Warneken, F., & Tomasello, M. (2006). Altruistic Helping in Human Infants and Young Chimpanzees. *Science*, *311*, 1301-1303.

Wood, J. N., Glynn, D. D., Phillips, B. C., & Hauser, M. D. (2007). The Perception of Rational, Goal-Directed Action in Nonhuman Primates. *Science*, *317*, 1402-1405.

Yamamoto, S., Humle, T., & Tanaka, M. (2009). Chimpanzees Help Each Other upon Request. *PLoS ONE*, *4(10)*, e7416.