

# Contrasting the Social Cognition of Humans and Nonhuman Apes: The Shared Intentionality Hypothesis

Josep Call

*Max Planck Institute for Evolutionary Anthropology*

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## Abstract

Joint activities are ubiquitous in the animal kingdom, but they differ substantially in their underlying psychological states. Humans attribute and share mental states with others in the so-called shared intentionality. Our hypothesis is that our closest nonhuman living relatives also attribute some psychological mechanisms such as perceptions and goals to others, but, unlike humans, they are not necessarily intrinsically motivated to share those psychological states. Furthermore, it is postulated that shared intentionality is responsible for the appearance of a suite of behaviors, including joint attention, declarative communication, imitative learning, and teaching, that are the basis of cultural learning and the social norms and traditions present in every human culture.

*Keywords:* Cooperation; Joint action; Culture; Mindreading; Shared intentionality; Human development; Animal cognition; Enculturation

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Joint activities are ubiquitous in the animal kingdom. Every taxon, including insects, fish, birds, and mammals, shows numerous examples of coordinated activities to meet particular goals (see Dugatkin, 1997). Nest building, predator defense, and cooperative hunting represent some of the most prominent examples of cooperation. Human societies also show numerous examples of joint activities, but they have also attained a level of sophistication that is unmatched in the animal kingdom. Not only do humans show cases analogous to those described above in which a group of familiar individuals cooperate to achieve tangible goals aimed at shelter building or food procurement, but they have also created social norms and institutions such as marriage, money, and government where hundreds, thousands, and even millions of unrelated individuals cooperate to achieve what could be considered less tangible goals.

A key research strategy in attempting to explain the difference between human and nonhuman joint activities consists of investigating how coordination is achieved in various

species—the mechanism responsible for cooperation. Chemical regulation, visual signals, and meshing psychological states are some of the mechanisms responsible for the regulation of joint activities in different species (e.g., McFarland, 1999; Sperber & Wilson, 1986). In this paper, I will argue that it is precisely the meshing and sharing of psychological states (so-called shared intentionality) that holds the key to understanding how humans have achieved their sophisticated and numerous forms of joint activity (see Tomasello, Carpenter, Call, Behne, & Moll, 2005). As I hope it will become clear throughout the chapter, this shared intentionality did not begin *de novo* but is rooted in our ape heritage. I will argue (and present evidence) that we share with our closest nonhuman living relatives the reading of attention and intentions. To this ape heritage, our species added a special motivation to engage at a psychological level by sharing our psychological states with others. Thus, this article is devoted to exploring both the socio-cognitive mechanisms and the predispositions that we share with our closest living relatives and those that we do not share with them. The chapter is organized into three sections. In the first section, I will present the evidence that has accumulated in recent years about reading psychological states in nonhuman apes, focusing on attentional and perceptual states. I will be brief because this has been recently covered in some detail in a number of publications (see Call & Tomasello, 2008; Tomasello et al., 2005). Next, I will propose one of the aspects that may be unique to humans which in combination with other mechanisms that we share with our closest living relatives may be responsible for the emergence of human societies as we know them today. Next, I will argue that humans' special socio-cognitive make-up expresses itself in a constellation of behaviors that are the basis for human culture (Tomasello, 1999). Finally, I will explore the impact of human enculturation on the development of ape shared intentionality.

## **1. Reading attention and intentions**

Many animals have perceptions and goals. More important, to survive and reproduce they have to coordinate their perceptions and goals with others. A subset of these animals (so-called mindreaders) can also read the perceptions and goals of others. Determining what species possess mindreading abilities, and the particular psychological states that they exploit, has been a matter of intense research and debate in the last two decades. Some scholars have argued that it is unclear whether nonhuman animals read mental states. Instead, they may just read observable behavior (e.g., Heyes, 1993). Other authors have suggested that they read some mental states but the debate is which ones and to what extent (Tomasello, Call, & Hare, 2003; see also Povinelli & Vonk, 2003). The last 10 years have witnessed important advances in the areas of attention and intention reading, which I briefly review next.

### *1.1. Reading attention*

Establishing and coordinating an interaction, even more so a joint activity, often requires a communicative exchange of some sort. Apes, being visually based animals, often rely on

visual gestures. To be effective, such signals, unlike auditory signals, require that the potential recipient of those signals be in a position to receive those signals—it has to be able to see the signals. Thus, gauging the attentional state of recipients is crucial to getting the message across. Several studies have documented that apes use visual signals preferentially when others are oriented toward them (Kaminski, Call, & Tomasello, 2004; see Call & Tomasello, 2008). Moreover, apes place themselves in locations where others can see them (Liebal, Pika, Call, & Tomasello, 2004; Povinelli, Theall, Reaux, & Dunphy-Lelii, 2003) and chimpanzees use auditory or tactile signals to call the attention of distracted recipients to initiate or reestablish a communicative exchange that has been interrupted (Gómez, 1996; Leavens, Hostetter, Wesley, & Hopkins, 2004).

Conversely, chimpanzees competing against each other for food do not seek to be the focus of attention of others but actively avoid it. Thus, chimpanzees preferentially approach and take food that others are not looking at, cannot see, or have not seen in the immediate past (Hare, Call, Agnetta, & Tomasello, 2000; Hare, Call, & Tomasello, 2001, 2006; Melis, Call, & Tomasello, 2006). In some occasions, chimpanzees attempt to conceal their approach to the contested food from the competitor by taking detours (Hare et al., 2006; Melis et al., 2006) or avoid making noise when they are fetching the food (Melis et al., 2006). The fact that they seem to use both visual and auditory information is particularly intriguing because it suggests something beyond just discerning specific cues about what the other is visually oriented toward.

Shifting attention to a location indicated by another individual's gaze direction (i.e., gaze following) has also received considerable research attention. The triadic nature of this interaction has made it particularly appealing as a precursor for more elaborate forms of joint attention. Several mammals and some bird species have been documented to follow the gaze of conspecifics and/or humans to distant locations (primates: Tomasello, Call, & Hare, 1998; dogs: Miklosi, Polgardi, Topal, & Csanyi, 1998; ravens: Bugnyar, Stoewe, & Heinrich, 2004). Additionally, chimpanzees and other apes check back to the informer when they look in that direction and they find nothing new at the target location (Bates, 1979; Bräuer, Call, & Tomasello, 2005; Call, Hare, & Tomasello, 1998) and chimpanzees stop looking when repeatedly finding nothing there (Tomasello, Hare, & Fogleman, 2001). Furthermore, upon finding a human looking behind a barrier, apes move over to get a better viewing angle to look at the target location (Bräuer et al., 2005; Tomasello, Hare, & Agnetta, 1999). Chimpanzees are not distracted by a novel object that they find when they are turning to look at the target location (Tomasello et al., 1999), and they do not stop at the barrier when that has a window throughout which the human's line of sight is not interrupted (Okamoto-Barth, Call, & Tomasello, 2007).

### *1.2. Reading intentions*

If gauging the attentional states of others was crucial to be able to communicate effectively and produce appropriate actions both in cooperative and competitive situations, gauging the goals of others plays a key complementary role. It helps the individual to predict the impending behavior of others, especially when subjects have not

experienced certain situations before, and they cannot rely on memory of past interactions to make such predictions.

Premack and Woodruff (1978) showed that the chimpanzee Sarah attributed goals to actors in problem-solving situations by selecting pictures that depicted the correct solution to a problem faced by a human actor on a movie. Although the chimpanzee had never witnessed humans facing those problems, Sarah showed a remarkable accuracy in her choices. However, Savage-Rumbaugh, Rumbaugh, and Boysen (1978) objected that problems may have been solved by matching the elements depicted in the problem with those depicted in the alternatives provided to the chimpanzee. Povinelli, Perilloux, Reaux, and Bierschwale (1998) also found no empirical support for the idea that chimpanzees distinguish the intentional from the accidental actions of others.

Recently, however, the pioneering results of Premack and Woodruff (1978) have received some support and have been extended in various directions. Chimpanzees can gauge whether a human is unwilling or unable to give them food (Call, Hare, Carpenter, & Tomasello, 2004). For example, they wait longer and gesture less often when someone is unsuccessfully attempting to give them a grape that is too big to pass through a hole that is too small compared to a situation in which the human simply refuses to put the grape through a hole that is large enough. Chimpanzees and orangutans can distinguish when a human has placed an object intentionally or accidentally to indicate the location of food (Call & Tomasello, 1998). Children presented with the same situation behaved in the same way as the apes in these two situations (Behne et al., 2005; Call & Tomasello, 1998).

There is one alternative explanation though. One could argue that subjects simply reacted to the behavior of the humans, not their goals, because intentional and nonintentional actions differed in their topography. Otherwise, it would not have been possible to distinguish them in the first place. However, recent studies using imitation paradigms cast some doubt on a behavior-reading explanation as the sole explanation for the observed behavior. Using a paradigm pioneered by Meltzoff (1995) with 18-month-old children, chimpanzees have been found to complete unfulfilled goals—rather than reproduce what the experimenter was attempting (and that it never took place) (Myowa-Yamakoshi & Matsuzawa, 2000; Tomasello & Carpenter, 2005). Furthermore, chimpanzees imitate rationally—that is, they skip certain actions that the experimenter produced due to her physical constraints (Buttelmann, Carpenter, Call, & Tomasello, 2007). One possible interpretation of these results is that chimpanzees showed a sensitivity to the intentions of others, understood as plans for action. That is, chimpanzees were not just sensitive to others' goals but also to the means by which goals were enacted. In a sense, chimpanzees' responses are a window that allows researchers to peek into the chimpanzees' understanding of the experimenter's goal. Finally, chimpanzees modulate their responses to food loss depending on what has caused it (Jensen, Call, & Tomasello, 2007). In particular, chimpanzee subjects are more likely to punish an individual for eating food that the subject possessed if that individual was also responsible for taking the food (as opposed to not being responsible for the loss). This means that the same outcome (i.e., losing the food to another individual) is treated differently depending on whether that individual was responsible for the subject's loss.

## **2. From reading to sharing intentions**

The current analysis coincides with Suddendorf and Whiten's (2001) conclusion that chimpanzees can read attention and intention. There are other mental states such as beliefs in which the jury is still out (see Call & Tomasello, 2008). In fact, the evidence seems to suggest that they probably do not attribute false beliefs to others (e.g., Hare et al., 2001; Kaminski et al., 2008), but future work may modify this conclusion. A different question is whether apes can also share (and know that they share) those mental states that they can read. Although going from reading to sharing may seem a comparatively small step, this may not be the case. Let me offer two examples.

Chimpanzees engage in mutual gaze during communicative exchanges, and they also follow the gaze of others toward external entities. As noted above, chimpanzees upon not finding anything reestablish mutual gaze. This kind of triadic interaction may be considered akin to the joint attentional episodes observed in human infants beginning at the end of their first year of life (Bates, 1979). There is an important difference, however. Unlike chimpanzees, children will initiate and direct attention to outside entities simply to get the attention of their partners and to share certain experiences (e.g., the appearance of a puppet behind their partner's back). This is not to say that apes do not direct the attention of others toward outside entities. They do so routinely when they request to receive food or help in agonistic interactions (Goodall, 1986). Moreover, chimpanzees and orangutans will direct the attention of their human partners via pointing to hidden food that is outside of their reach so that the human can give it to them (Call & Tomasello, 1994; Gómez, 1996; Leavens, Hopkins, & Bard, 2005). Crucially, apes' motivation to direct attention to outside entities is subordinate to getting the object or the action that they desire. Upon getting their goal, they cease the social engagement. Children also engage in this kind of communicative exchange (called imperative) but additionally, children also produce declarative gestures, whose purpose is not to get any object but instead to engage with their partner and share a particular experience, like an interesting sight or event. Chimpanzees, just like many other animals, will produce vocalizations or gestures to warn others about the presence of a potential danger (e.g., a predator), which could easily be mistaken for declarative communicative acts. However, it is unclear whether such acts are used to signal the predator that it has been detected or to inform others about the predator's presence. In any case, the motivation to communicate is generated by an external stimulus that produces fear while, in the other case, it is mainly generated by an intrinsic motivation to get pleasure out of a social interaction with the external referent playing a secondary role at best. I think that this is an important distinction.

Let me present a second example. Chimpanzees cooperate (i.e., two or more individuals work together so that their combined behavior increases the chances of mutual benefit compared to the outcome of an individual's efforts) to hunt monkeys in the Tai forest (Boesch & Boesch-Achermann, 2000). However, one interpretation of that cooperative activity is that each individual is trying to get the prey by himself and the result is that, together, they are more successful than they would be trying to get the prey alone. There is no question that the end result is a cooperative joint activity but a question that is still unresolved is whether chimpanzees have an intrinsic motivation to cooperate. Would chimpanzees cooperate if

there was no need to do so? Probably not. Indeed in habitats with fragmented forests, cooperative hunting is much less prominent than individual hunting (Stanford, 1998). There, chimpanzee hunting is mostly an individual venture. This is not to say that humans cooperate at every opportunity that they have, or that humans do not choose individual over cooperative solutions. They often do. But there are other cases in which an individual effort would have sufficed, yet we engage in a cooperative activity for its intrinsic value.

But let's go back to the example of chimpanzee hunting. Boesch and Boesch-Achermann (2000) have described how chimpanzees play different roles during the hunting episodes. One chimpanzee drives the monkey, whereas others block the potential escape routes. Much less is known about planning and role assignment before the event takes place, although to be fair, this could be very hard to demonstrate in nonverbal organisms. For now, it appears that most cases of cooperation are based on mutualism. Again, this is not to say that chimpanzees and other animals do not do things like help each other. They do this routinely. Chimpanzees comply with requests to transfer food, objects, or perform actions, and they will come to the help of individuals requesting help during agonistic interactions, sometimes incurring great risks of injury in the process (e.g., de Waal, 1978, 1982; Warneken, Hare, Melis, Hanus, & Tomasello, 2007). However, cases in which a chimpanzee helps another without having requested the help are virtually nonexistent (Warneken & Tomasello, 2006).

There is one thing that these two examples have in common. It appears that chimpanzees, unlike humans, are not motivated to share interesting sights or work together when there is no need to do so. Several other studies support this conjecture. Declarative gestures are rare, not to say nonexistent, compared to imperative gestures, which are well developed (Call & Tomasello, 2007; Plooij, 1984). Triadic joint attention is also virtually nonexistent in nonhuman great apes. Three studies conducted in three different laboratories reached similar negative conclusions. Chimpanzees, unlike humans, do not engage the attention of others when manipulating objects (Bard & Vauclair, 1984; Carpenter, Savage-Rumbaugh, & Tomasello, 1995; Tomonaga et al., 2004). Finally, there is very little evidence of active teaching among chimpanzees. Boesch (1991) only observed a couple of instances of active teaching in chimpanzees after hundreds of hours of observation.

Our hypothesis is that although chimpanzees are very social animals that read the attention and intentions of others, they are less interested in sharing their psychological states with others or meshing theirs with others to create joint psychological enterprises (Tomasello et al., 2005). Note, however, that our conjecture is based on postulating the absence of a motivational component in chimpanzees and proving this absence is admittedly not a trivial enterprise. Although we cannot prove the null hypothesis, we have indicated the kind of evidence (e.g., declarative gestures, triadic joint attention, teaching, and unprompted helping) that would falsify the shared intentionality hypothesis as a unique feature of human cognition.

It must be emphasized that a piecemeal approach to this problem would not be sufficient to put the shared intentionality hypothesis to the test. After all, one can find isolated examples of particular behaviors that play a key role in human societies scattered throughout the animal kingdom including teaching in cats (Chesler, 1969), cooperation between moray eels and groupers (Bshary, Hohner, Ait-el-Djoudi, & Fricke, 2006), and storing food for the

winter in insects, mammals, and birds (see Van der Wall, 1990). Yet one would be on very shaky ground if one assumed that the same psychological mechanisms are underlying analogous behaviors manifested in different species. For instance, cooperation can be achieved through various routes, and although the end product can be similar, their underlying mechanisms may be very different. One would be on firmer ground if one were to observe a suite of behaviors that have been postulated to depend on a common psychological construct. This approach has been already used, for instance, to infer the existence of secondary representation or the attribution of perceptual states to others in great apes (Suddendorf & Whiten, 2001; Tomasello & Call, 2006).

### **3. Ape enculturation and shared intentionality**

The skeptic could argue that the lack of evidence for shared intentionality in the chimpanzee is more apparent than real because the apes in the studies mentioned above had a rearing history that did not foster the development of certain socio-cognitive skills. Note that rearing history did not seem to be a problem for developing the ability to read others' attention and intentions, given that both nursery- and mother-reared apes display this ability. Nevertheless, it is a valid point that apes, like human infants, may only develop shared intentionality when they are embedded in a socio-cultural matrix provided by human adults. Leavens et al. (2005) have made this point with regard to the emergence of pointing in apes.

There are at least two ways to question the idea that humans are innately predisposed to develop shared intentionality from the point of view of ape enculturation experiments. One is that apes do not show evidence of shared intentionality because having an innate predisposition to share psychological states, just like humans, they were not exposed to the same socio-cultural environment as humans. Another more environmentally driven possibility consists of denying any innate motivation to share psychological states (both to apes and humans) and argue that rearing apes in a human socio-cultural environment will foster the development of shared intentionality. Although the processes involved in each of these two options differ in important ways, they would produce identical phenotypes. In particular, exposing apes to human cultural practices would create apes displaying evidence of shared intentionality. Such a finding would falsify the idea that shared intentionality is a uniquely human trait. Putting these ideas to the test is not easy but luckily for us, some apes have been reared in human homes in the past and we can look at their results to gain some insight into this question.

Let me say from the outset that I think that environmental influences interact with genetic predispositions and can potentially affect cognition in significant ways. Chimpanzees raised under severe deprivation conditions show certain cognitive deficits, but they can improve substantially after the deprivation period is over (Davenport & Rogers, 1970). In fact, a profound effect of rearing condition on cognition has been harder to prove than one may expect (Call, 2006; Davenport & Rogers, 1970). This is partly because different environments also mean that subjects face different problems, and their "cognitions" may be geared toward solving those and directly comparing those populations is not easy.

Nevertheless, Call and Tomasello (1996) found that enculturated chimpanzees showed more sophisticated forms of gestural communication and imitation than mother-reared chimpanzees (we found no differences in 13 other domains). We postulated that enculturation, and being treated intentionally by others in particular, may have enabled enculturated chimpanzees to understand intentions in others. Tomasello and Call (2004) later revised this conclusion in light of recent data on attribution of intention in nonenculturated chimpanzees cited in previous sections (see also Call & Tomasello, 2008). The revised position is that enculturation does not appear to have a profound impact in the way enculturated individuals (as opposed to mother-reared ones) attributed goals and intentions to others. Bering (2004) also offered an alternative view to the nature of the changes produced by enculturation, mostly with regard to imitation, that was less psychologically loaded than the original Call and Tomasello (1996) position. Bering (2004) argued that enculturated apes have learned that humans are a good source for solutions to problems that are often quite opaque to them and consequently, enculturated apes had learned to pay more attention to humans' actions in general than their mother-reared counterparts. This explanation makes no reference to the psychological states of humans, only to their observable behavior and its consequences.

But what about things like declaratives, joint attention and teaching? Is there any evidence that enculturated chimpanzees display the suite of behaviors that would serve to falsify the shared intentionality hypothesis as a uniquely human feature? Is there any evidence that when chimpanzees are reared in the human home they develop those just like human infants do? The data are far from perfect, partly because those studies were not aimed at answering these questions directly, but at least, they offer us some insights. There are three studies that have systematically analyzed the use of imperative and declarative gestures in apes. Two studies with enculturated bonobos and chimpanzees concluded that imperative gestures vastly outnumbered declarative or demonstrative gestures (Carpenter et al., 1995; Greenfield & Savage-Rumbaugh, 1991), and it is not completely clear whether some of the cases classified as demonstratives were in reality imperatives or not even communicative acts. Similarly, Gómez, Sarriá, and Tamarit (1993) found numerous examples of imperative gestures but no evidence of declarative gestures in a hand-reared gorilla with extensive human contact. Recently, Rivas (2005) found no evidence of declarative gestures in sign language-trained chimpanzees—a finding that stands in stark contrast with Fouts and Mills' (1997) characterization of the same chimpanzees as routinely having conversations and "sharing experiences" with others. According to Rivas (2005), chimpanzees used signs with their caregivers to request food or activities, not to share activities. Hayes (1951) also reported that Viki, one of the best known enculturated chimpanzees, used gestures to request things, not to show things.

Carpenter et al. (1995) also compared the triadic joint attention of mother-reared and enculturated chimpanzees and bonobos and 18-month-old human infants during the manipulation of objects. Although enculturated apes focused on objects as much as human infants (and more than mother-reared apes), they focused on the experimenter's face much less and also produced fewer episodes of joint attention. In addition, human infants displayed longer looking durations to the experimenter's face than apes. In contrast, enculturated apes did not

substantially differ from mother-reared apes in those measures. There is even less data on teaching, which appears nearly nonexistent among enculturated apes. There is one example of the chimpanzee Washoe teaching the chimpanzee Loulis to use signs (Fouts, Fouts, & Van Cantfort, 1989). As far as I know, this case stands as *the* example of chimpanzee–chimpanzee teaching among enculturated apes and, based on the descriptions provided by the authors, it is not clear whether Washoe’s intent was to instruct Loulis at all. Unfortunately, no systematic study has been undertaken to further document the occurrence of teaching and to analyze possible alternative explanations for this behavior. Without such systematic observational or experimental studies, it is hard to make of much of those observations. Ideally, such initial observations should motivate systematic studies, not become a substitute for them. Again, taken together, the picture that emerges is not one that lends itself to the conclusion that shared intentionality is widespread in enculturated apes either.

Much of the shared intentionality hypothesis depends on the idea that humans have an intrinsic motivation to share psychological states without requiring an additional external reinforcer. Such an intrinsic motivation predisposes humans to enter in shared formats just for the sake of it and those individuals who do not share such predisposition (e.g., children with autism) show severe deficits in their social interactions with others (see Baron-Cohen, Tager-Flusberg, & Cohen, 1993). A key idea here is that even though the predisposition to share with others is innate, constructing sharing intentionality requires social input, but social input alone does not generate an intrinsic motivation to share psychological states. It is important to emphasize that many species, not just humans, possess a strong social motivation but the activity that fulfils it differs across species. Cats engage in rough and tumble play, chimpanzees groom each other, and humans have conversations. Dunbar (1996) has argued that gossip is functionally equivalent to the allo-grooming observed in our closest living relatives and therefore, although both chimpanzees and humans possess social motivations, perhaps only humans fulfill theirs with psychological content.

#### **4. Two concluding remarks**

First, the shared intentionality hypothesis is above all a hypothesis. A hypothesis that I think is reasonably supported by the evidence currently available in the literature. And just like any other hypothesis, it is amenable to empirical scrutiny and I have indicated the kinds of evidence that would serve to falsify the shared intentionality hypothesis as a unique human trait. For now, think that a productive research strategy is to treat the lack of evidence of shared intentionality in chimpanzees as the null hypothesis and try to reject it.

Second, even if chimpanzees were found to display shared intentionality when reared with humans, we would still have to explain why humans follow such a different developmental path compared to chimpanzees. More interesting, why might chimpanzees have evolved such social predispositions but do not turn them into shared intentionality whereas humans do? This is not an impossible problem, but a convincing explanation will require some good data and some clever answers.

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