Travaux neuchâtelois de linguistique, 2018, 68, 69-75

Intentional communication in primates

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Human communication, including language, is the product of underlying intentions that are purposely expressed, epistemically monitored and flexibly interpreted. A main question in science has been about the evolutionary origins of this cognitive capacity. One way to address the problem is by studying the natural communication of animals, particularly non-human primates. As everything in biology, evolutionary transitions are gradual events, suggesting that intention may also have evolved in different stages as a function of increasing brainpower and cognitive complexity. In this chapter, I review empirical work on primate communication, which suggests that goal-directed intentional communication is well within the scope of animals, while simple mind-directed intentionality may be restricted to great apes and humans and shared intentionality may be an exclusively human capacity.

1. Introduction

Scientific interest in primate communication has emerged as a mainstream research programme in the 1960s, particularly with pioneering fieldwork on vervet monkeys, which documented unprecedented complexity in vocal communication (Struhsaker 1967). A particularly important finding was that this species was capable of producing acoustically distinct alarm calls to different predators, which elicited distinct behavioural reactions in recipients, as if the calls were meaningful to them (Seyfarth, Cheney & Marler 1980). This basic finding has since been replicated to other species, suggesting that basic referential capacities are a general feature of animal communication (Zuberbühler & Neumann 2017).

The wider implications of these findings, however, have caused considerable debate. For instance, it became rapidly clear that primates, and animals in general, possess species-specific call repertoires, with different signals used in clearly defined situations, suggesting a strong genetic component. The contrast to human language turned out to be immense, with no signs of arbitrarily structured, culturally determined, and socially conventionalised utterances in any animal communication system. At the same time, the results of various artificial language projects demonstrated that some animals were very able to acquire and use symbols to communicate with their human caretakers and sometimes with each other e.g. (Segerdahl, Fields & Savage-Rumbaugh 2005). Also, recent studies of spontaneous gesturing in great apes demonstrated high levels of production flexibility with clearly identifiable social goals (Call & Tomasello 2007). Overall, these findings created somewhat of a theoretical conundrum: How could the same individual, be able to produce visual signals in flexible, symbolic and intentional ways on the one hand, and on the other hand be so bound by hardwired and inflexible vocal signals (Seyfarth & Cheney 2011)?

2. Intentionality in animal communication

There are at least two different notions of intentionality (Zuberbühler & Gomez in press). First, intentionality has been defined as aboutness, or "the power of minds to be about, to represent, or to stand for things, properties and states of affairs" (Stanford Encyclopedia of Philosophy) (Searle 1983). Second, in developmental psychology intentionality is usually defined in terms of a commitment to carrying out an action with planning and forethought. This view has also been adopted by philosophers of language, who have pointed out that in human language the literal meaning of a linguistic utterance is often superseded by an underlying intended meaning (Grice, 1969). In this view, intentional communication is conceptualised as goal-directedness, with our without reference to mental states.

3. The intentional stance

3.1 Levels of intentionality

One particularly influential way of distinguishing between different types of intentionality has been proposed by (Dennett 1983). In human language speakers communicate to their social partners by producing highly structured vocal utterances to convey mental representations of objects or events. Different languages do this in different ways, but they are all capable of conveying and transmitting roughly the same mental content, either directly by literal meaning or indirectly by invoking intentions.

Although vervet monkey alarm calls are undoubtedly part of this species' communicative repertoire, they share interesting properties with human language. In particular, playbacks of alarm calls given to eagles, leopards, and pythons cause others to respond in ways that suggest that the calls are meaningful to them. For instance, after hearing a snake alarm, monkeys respond by bipedally scanning the surrounding area, as if trying to locate the putative snake. Yet, these findings cannot determine whether monkeys delivered their signals with an intention to inform others, or as part of an inbuilt mechanism. To address this, Dennett (1983) proposed a theoretical framework, the 'intentional stance', to assess animal behaviour in relation to levels of intentionality, as seen in human communication (table 1).

Intention	Content
0 order	A *recognises* x
1st order	A *wants* B *to* x
2nd order	A *wants* B *to recognize* x
3rd order	A *wants* B *to recognize that* A *wants* B to x
4th order	A *wants* B *to recognize that* A *wants* B *to recognise* x
5th order	….

Table 1: Dennett's (1983) levels of intentionality in animal communication

According to Dennet's model, 0-order intentionality attributes no intentionality to a monkey giving eagle alarm calls. Instead, the caller may simply react automatically to the perception of an eagle, which may trigger a distinct flavour of anxiety, linked to the production of a distinct signal, the eagle alarm. Due to the tight link between external event and signal, listeners can form simple associations, allowing them to react appropriately. Signallers and recipients, in other words, are not mentally connected during such events, and what looks like deliberate communication is nothing but an evolved system.

3.2 First order intentionality

However, if monkeys produced alarm calls with the specific purpose to influence each other's behaviour, they may be granted with first order intentionality. Several studies have suggested that this level is well within the cognitive capacities of non-human animals. In one striking example, male Thomas langurs produced alarm calls to a tiger model and continued to produce alarm calls until every group member had responded with an alarm call, as if to ensure that the predator had been perceived (Wich & de Vries 2006). Similarly, female Diana monkeys continue to alarm call to a predator, until their own male also produced his own matching alarm calls, in response to which they stop their vocal behaviour (Stephan & Zuberbuhler 2016).

For great apes, there is also good evidence for first order intentional signalling. For instance, wild chimpanzee that are victims of aggression have been observed to "exaggerate" their victim screams, but only in the presence of high-ranking audiences, as if to persuade them to come for help (Slocombe & Zuberbühler 2007). Also, prior to travel, chimpanzees sometimes produce distinct 'travel hoos' as part of a complex departure behaviour that includes audience checking and other signs of goal-directed behaviour (Gruber & Zuberbuehler 2013).

Great apes also possess a rich repertoire of gestures, mostly produced during social interactions. These signals are delivered with some awareness of the audience, in the sense that they are socially directed and often produced with

goal-oriented persistence. For example, when shown the location of hidden food, one captive chimpanzee was able to direct a searching and ignorant human with gestures to the correct location (Roberts, Vick, Roberts & Menzel 2014). In natural communication, bonobos use beckoning gestures to persuade sexual partners to follow them to a desired location, also with persistence and signal elaboration (Genty & Zuberbuhler 2014). Such goal-directed intentional signalling is also present in facial expressions, such as chimpanzee lip-smacking during grooming, which is linked to longer and more reciprocal grooming bouts (Fedurek, Slocombe, Hartel & Zuberbuhler 2015).

These results and other studies indicate that primate alarm calls are not just automatic and direct responses to external events, but the product of at least first-order intentionality, according to Dennett's (1983) scale.

3.3 Second-order intentionality: Communication as mental state attribution

The evidence reviewed so far is consistent with the idea that primates are at least capable of first-order intentionality, which is particularly visible during ape gesturing but also in some vocal behaviour. But are primates also able to take into account each other's mental states when producing and understanding signals? The fact that signallers are sometimes influenced by the presence of specific audiences does not provide very strong evidence, as this could be explained by subconscious 'implicit' rather than conscious, goal-directed cognition. To this end, it would be necessary to demonstrate that signallers not only show signs of 'wanting' a recipient to do something specific, but also of wanting to be understood. Behavioural evidence for this requires monitoring and acting upon an addressee's mental state, such as a percept, desire or belief.

There is relatively strong evidence that great apes at least can make judgments about what others can or cannot see. For example, before gesturing, great apes sometimes try to attract the attention of an addressee, suggesting that they are aware of the other's visual attention (Hostetter, Cantero & Hopkins 2001). Other studies suggest that great apes can go beyond mere visual perception and attribute knowledge to others. For example, when interacting with a familiar or unfamiliar human caretaker, and when reluctant to hand over food, bonobos were more likely to repeat their gestures to a familiar keeper and more likely to elaborate their gestures to an unfamiliar one, as if taking into account their knowledge differences (Genty, Neumann & Zuberbuhler 2015). In the vocal domain, the most progress has been made with chimpanzees reacting to snake models. In one study, it was shown that alert calls to snakes were more common if signalers were in the company of unaware audiences compared to knowledgeable ones (Crockford, Wittig, Mundry & Zuberbuhler 2012; Crockford, Wittig & Zuberbuhler 2015).

In sum, there is some evidence that great apes at least are able to take into account the mental states of others when communicating to them. Higher orders of intentionality, such as the active desire to instill a mental state, however, may be beyond the cognitive capacities of animals.

3.4 Intention as aboutness

As outlined before, there is another sense of intentionality, intention as aboutness. In this view, a signal is emitted or understood as being about an object. In the vervet monkey example, a receiver may interpret an eagle alarm call as indicating, not just that there is an eagle, but also that a caller has found an eagle and that the alarm call is about the eagle (Zuberbühler & Gomez in press). Obviously, it is much more challenging to find clear behavioural indicators for signal processing at this level. There is some evidence that some primates perceive intentionality in the communication behaviour of others, but this only partially fulfils the required criteria. For example, free-ranging baboons can distinguish between calls directed at themselves and calls directed at other individuals (Engh, Hoffmeier, Cheney & Seyfarth 2006). In chimpanzees, victims of aggressions will retreat from the playback of aggressive barks given by an ally of the former opponent, but ignore the same barks if given by other group members, even hours after the conflict (Wittig, Crockford, Langergraber & Zuberbuhler 2014). In sum, when witnessing vocal signals, baboons, chimpanzees and probably other primates seem to understand something about the targeted recipient, an ability required to recognize others' intentions and motives.

3.5 Shared intentionality

A recent proposal has been that humans are not only capable of higher orders of intentionality, but that they are additionally able to perceive others' intentions and align them with their own (Tomasello & Moll 2010). This ability to share goals and intentions when participating in collaborative activities has been linked with powerful forms of mindreading and a motivation to share mental states with others, to enter some kind of shared cognitive representation of joint intentions (Zuberbühler & Gomez in press). The proposal is that the implications of this ability are enormous, by enabling subjects to create linguistic conventions, social norms and social institutions. Although great apes understand the basics of intentional action, and may use communicative signals to affect others' intentions, they do not appear to reach the level of shared intentionality. The primary reason may well be that sharing intentions necessitates an ability to not only perceive the mental states of others, but also to have a desire to change them in ways that enable joint intention.

4. Conclusions

There is good evidence that primates and possibly many other groups of animals use vocal and gestural signals in a goal-directed, first-order intentionality sense, as proposed by Dennett (1983). The evidence is less strong for second-order intentionality in communication, although numerous other studies have shown that great apes at least are able to attribute mental states to others, suggesting that this capacity should also reveal itself during acts of communication. However, there is no clear evidence that any animal has the capacity to want to influence another's mental state, which may prevent them from sharing intentionality with each other.

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