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Social Awareness in Monkeys[1]

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SYNOPSIS. Tests of self-awareness in nonhuman primates have to date been concerned almost entirely with the recognition of an animal's reflection in a mirror. By contrast, we know much less about non-human primates' perception of their place within a social network, or of their understanding of themselves as individuals with unique sets of social relationships. Here we review evidence that monkeys who fail the mirror test may nonetheless behave as if they recognize themselves as distinct individuals, each of whom occupies a unique place in society and has a specific set of relations with others. A free-ranging vervet monkey, baboon, or macaque recognizes other members of his group as individuals. He also recognizes matrilineal kin groups, linear dominance rank orders, and behaves as if he recognizes his own unique place within them. This sense of "social self" in monkeys, however, is markedly different from self-awareness in humans. Although monkeys may behave in ways that accurately place themselves within a social network, they are unaware of the knowledge that allows them to do so: they do not know what they know, cannot reflect on what they know, and cannot become the object of their own attention.

INTRODUCTION

In our everyday lives we take human consciousness and self-awareness for granted. We assume that each person is actively aware of his own body and thoughts and of his identity as an individual distinct from all others. We also assume that each individual is aware of the thoughts and individual identities of others. Common sense, experience, introspection, and our conversations with others reassure us that these assumptions are valid for humans. Unfortunately, however, none of these methods is available in studies of animals. As a result, we know very little about whether non-human creatures are "conscious" in the human sense, whether they have a sense of their own identity, or whether they have a sense of the identities of others. Lacking a method for the study of animal consciousness or self-awareness, psychologists and ethologists have directed their attentions instead to behaviors and cognitive abilities that can be studied and that may be correlated with, or linked in some way, to the existence of consciousness and self-awareness.

William James (1892/1984) was perhaps the first to propose that human self-consciousness, or self-awareness, has many different components. At the most basic level, there is what James calls the "material" self, or awareness of the physical aspects of one's own body. It seems probable that almost all animals have an elementary recognition of their material self, in the sense that they react to painful stimuli and distinguish between sensory inputs that come from their own bodies and sensory inputs that come from elsewhere (see also Heyes, 1994). With the possible exception of some of the great apes, however, most animals' sense of their material self seems to remain tacit, without the individual being actively aware that the body he can see or touch is a part of his unique self. Tests of mirror self-recognition, originally devised by Gallup (1970) and recently extended by Povinelli *et al.* (1993, 1994), offer strong evidence that apes, but not monkeys, recognize that the body they see in the mirror is their own (see also Heyes, 1994; Tomasello and Call, 1997). Although it is not clear what aspects of consciousness are reflected by tests with mirrors, they do reveal a consis-

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tent and qualitative difference between monkeys and apes, and they suggest that apes may have some capacity to make bodily self-recognition at least partially accessible to active thought.

At higher, more complex levels, James describes in humans the "spiritual" self, defined as one's "psychic faculties and dispositions" (1892, p. 163), and the "social" self, defined as awareness of oneself as a distinct individual, embedded in a group or society that includes many other distinct individuals. We define our social selves by reference to others; there cannot be an "I" without a "you" or a "they" for comparison.

In this paper we consider whether monkeys have a sense of their social self as James defines it, and we contrast monkeys' social knowledge with self-awareness in humans, defined as the ability to become the object of one's own attention.

For those who propose to study self-awareness in animals, James' formulation provides a useful starting point because it takes a complex issue and breaks it down into component parts, some of which, like an elementary sense of one's own body, are likely to be widespread throughout the animal kingdom, while others, like an explicit awareness of one's own psychological dispositions, will probably be found only in humans.

James' notion of a social self is particularly useful to ethologists because it links an individual's knowledge of his own social identity with the individual's knowledge of the social identities of others. For James, an individual's self-awareness (what he thinks about himself) derives, at least in part, his knowledge of the individual identities of others. In studies of adult humans such an assumption is not controversial. In young children, however, an awareness of the individual identities of others and an awareness one's own identity appear to develop gradually (*e.g.*, Flavell, 1985), and there is no *a priori* reason to assume that they develop together.

Fortunately, however, there is now empirical evidence that a child's awareness of her own identity as a unique person develops at roughly the same time as her awareness of the unique social identities of other individuals (Damon and Hart, 1982; Rotenberg, 1982; Gopnik and Astington, 1988; Wellman, 1983; Gopnik and Meltzoff, 1994). If we accept the view that knowledge about one's own identity and knowledge about the identities of others are developmentally linked in children, and further assume that this linkage holds for nonhuman primates as well (see, for example, Gallup, 1982), then we may be able to use a monkey's knowledge of other individuals as an indirect measure of the monkey's knowledge of him or herself. Here are some examples of how this might be done.

SOCIAL KNOWLEDGE IN VERVET MONKEYS AND BABOONS

Knowledge of other animals' kin relations

East African vervet monkeys (*Cercopithecus aethiops*) live in groups of 10–20 individuals. Each group occupies a territory that is surrounded by the territories of other vervet groups. A typical group contains 3–4 adult males, together with 5–8 adult females and their offspring. When young males reach adult size at approximately 4–5 yr of age, they leave the group where they were born and join another, neighboring group. Young females remain in the group where they were born throughout their lives and form close, long-lasting bonds with their matrilineal relatives. Adult female vervets and their offspring can be arranged in a linear dominance hierarchy in which offspring rank immediately below their mothers. The stable core of a vervet social group, then, is a hierarchy of matrilineal families (Cheney and Seyfarth, 1990).

Most affinitive social interactions, such as grooming, mutual tolerance at feeding sites, and the formation of aggressive alliances, occur within families (Seyfarth, 1980; Whiten, 1983; reviewed in Cheney and Seyfarth, 1990). Clearly, individuals distinguish their own close matrilineal relatives from all others because their behavior toward them is so different. For a monkey to achieve a complete understanding of her society, however, she must be able to step outside her own sphere of interactions and recognize the relations that exist among

others (Cheney and Seyfarth, 1986; Harcourt, 1988). Such knowledge can only be obtained by observing interactions in which oneself is not involved and making the appropriate deductions (Cheney and Seyfarth, 1990). There is, in fact, growing evidence that monkeys do possess knowledge of other animals' social relationships and that such knowledge affects their behavior.

Evidence that vervet monkeys recognize other animals' social relations first emerged as part of a relatively simple playback experiment designed to document individual recognition by voice (Cheney and Seyfarth, 1980). We began by noting that, when infant and juvenile vervets screamed during rough play, their mothers often ran to support them. This observation, like many other studies (*e.g.*, Hansen, 1976; Gouzoules *et al.*, 1984) suggested that mothers recognized the calls of their offspring. To test this hypothesis, we waited until three vervet females were sitting close enough together to be filmed, and then from a concealed speaker played the distress scream of one of the female's two year-old offspring. As expected, mothers consistently looked toward or approached the loudspeaker for longer durations than did control females. Even before she had responded, however, a significant number of control females looked at the mother. They behaved as if they recognized the close social bonds that existed between particular juveniles and particular adult females (Cheney and Seyfarth, 1980, 1982).

In an attempt to replicate these results, we recently carried out a similar set of experiments on free-ranging baboons (*Papio cynocephalus ursinus*) in the Okavango Delta of Botswana (for details of the study area and subjects, see Hamilton *et al.* (1976). The social organization of baboons is similar to that of vervets. In these experiments, two unrelated females were played a sequence of calls that mimicked a fight between each of their close relatives. The females' immediate responses to the playback were videotaped, and both subjects were also followed for 15 min after the playback to determine whether their behavior was affected by the calls they had heard. In separate trials, the same two subjects also heard two control sequences of calls. The first sequence mimicked a fight involving the dominant subject's relative and an individual unrelated to either female; the second mimicked a fight involving two individuals who were both unrelated to either female (for details see Cheney and Seyfarth, 1999).

After hearing the test sequence, a significant number of subjects looked toward the other female, suggesting that they recognized not just the calls of unrelated individuals, but also those individuals' kin (or close associates). Moreover, in the minutes following playback, dominant subjects were significantly more likely to supplant subordinate subjects, suggesting that the dominant female's behavior toward others was influenced by her perception of whether one of her own relatives and another individual's relative had recently been involved in a fight. Females' responses following the test sequence differed significantly from their responses following control sequences. Following the first control sequence, when only the dominant subject's relative appeared to be involved in the fight, only the subordinate subject looked at her partner. Following the second control sequence, when neither of the subjects' relatives was involved, neither subject looked at the other. Finally, following both control sequences, the two subjects were significantly more likely to approach each other and interact in a friendly manner than following the test sequence.

Taken together, these experiments argue that baboon and vervet monkeys recognize the members of their group as distinct individuals and classify these individuals into what we call matrilineal families based on their associations with each other.

Other studies provide additional evidence of monkeys' abilities to distinguish both their own and other individuals' close associates. For example, in a playback study using the contact calls of rhesus macaques (*Macaca mulatta*), Rendall *et al.* (1996) found that females not only distinguish the identities of different signallers but also categorize signallers according to matrilineal kinship. Similarly, in an experiment performed on captive long-tailed macaques

(*Macaca fascicularis*), Dasser (1988) trained a female subject to choose between slides of one mother-offspring pair and slides of two unrelated individuals. Having been trained to respond to one mother-offspring pair, the subject was then tested with 14 novel slides of different mothers and offspring paired with an equal number of novel pairs of unrelated animals. In all tests, she correctly selected the mother-offspring pair. In so doing, she appeared to use an abstract category to classify pairs of individuals that was analogous to our concept of "mother-child affiliation."

In each of these studies, animals that were grouped into familial associations nonetheless retained their individual identities: a mother and her offspring, for example, were judged to be alike in belonging to the same family but still recognized as distinct individuals. It appears, therefore, that monkeys have a sophisticated knowledge of the social identities, or social selves, of others: they recognize others not only as individuals but also as individuals that occupy particular places in the social group. If we accept the view that an awareness of oneself as an individual is linked to an awareness of others as individuals, then it seems possible that baboons, vervets, and macaques may also have some understanding of their own social identities or social selves, in the sense that they recognize their position and status in the social group.

In many species of monkeys, an individual who has just threatened or been threatened by another animal will often 'redirect aggression' by threatening a third, previously uninvolved, individual. Judge (1982) was the first to note that redirected aggression does not always occur at random; rather than simply threatening any nearby individual, animals will instead specifically target a close matrilineal relative of their recent opponent. Similar kin-biased redirected aggression occurs in Japanese macaques (*Macaca fuscata*) (Aureli *et al.*, 1992) and vervets (Cheney and Seyfarth, 1986, 1989).

Kin-biased redirected aggression also appears in more complex forms. In two different vervet groups studied over two different time periods, we found that a female was more likely to threaten another individual if one of her own close relatives and one of her opponent's close relatives had recently been involved in a fight (Fig. 1; see Cheney and Seyfarth, 1986, 1989). These results support Dasser's (1988) contention that monkeys recognize that certain types of social relationships share similar characteristics. When a vervet monkey (A2 in Fig. 1) threatens B2 following a fight between one of her own relatives (A1) and one of her opponent's relatives (B1), A2 acts as if she recognizes that the relationship between B2 and B1 is in some way similar to her own relationship with A1 (Cheney and Seyfarth, 1990). In a similar manner, when a baboon female hears a playback sequence mimicking a fight between her own relative and the relative of another female, this temporarily increases the likelihood that her subsequent interactions with that female will be antagonistic (Cheney and Seyfarth, 1999).

In order to selectively target a relative of her own relative's opponent, however, a female vervet or baboon must have some recognition of the distinction between her own social relationships and the social relationships of others. This would seem to require that she perceive herself as a distinct social being, one who occupies a particular place in a society that is defined according to a specific set of behavioral relations with certain other individuals.

Knowledge of other animals' dominance ranks

A similar phenomenon may underlie monkeys' knowledge of their relative place in a linear dominance hierarchy. As already noted, individuals in many species of Old World monkeys can be arranged in a linear dominance hierarchy that accurately predicts the direction of competitive interactions between any two individuals. A linear rank order might be indicative of an ability to recognize transitive relations among other group members. It is also possible, however, that monkeys simply recognize who is dominant or subordinate to themselves. In the latter case, a linear hierarchy could emerge as the incidental outcome of paired interactions. The hierarchy would be a

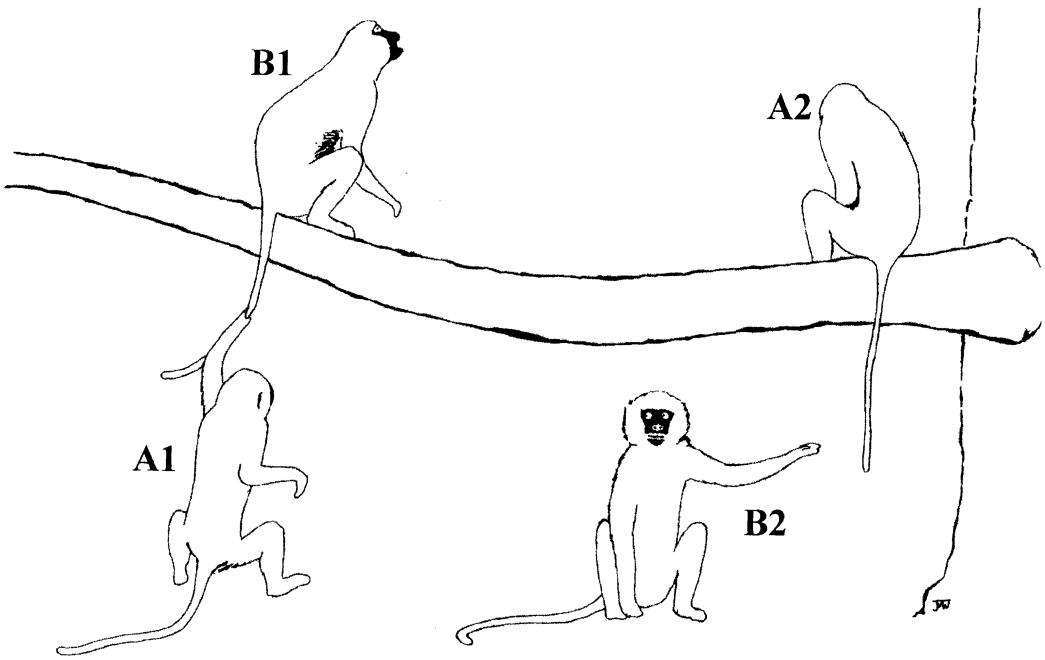

FIG. 1. Redirected aggression in vervet monkeys. Nonkin were significantly more Likely to act aggressively toward an opponent after a fight between their own relatives And their oppenent's relatives than during matched control periods. Data from Cheney and Seyfarth (1989); drawing by John Watanabe from Cheney and Seyfarth (1990).

product of the human mind, not the minds of the monkeys themselves.

There is evidence, however, that monkeys do recognize the rank relations that exist among others in their group. For example, dominant female baboons often grunt to mothers with infants as they approach the mothers and attempt to handle or touch their infants. The grunts seem to function to facilitate social interactions by appeasing anxious mothers, because an approach accompanied by a grunt is significantly more likely to lead to subsequent friendly interaction than is an approach without a grunt (Cheney *et al.*, 1995*a*). Occasionally, however, a mother will utter a submissive call, or "fear bark," as a dominant female approaches. Fear barks are an unambiguous indication of subordination; they are never given to lower-ranking females. To test whether baboons recognize that only a more dominant animal can cause another individual to give a fear bark, we designed a playback experiment in which adult females subjects were played a causally inconsistent call sequence in which a lower-ranking female apparently grunted to a higher-ranking female and the higher-ranking female apparently responded with fear barks. As a control, the same subjects heard the same sequence of grunts and fear barks made causally consistent by the inclusion of additional grunts from a third female who was dominant to both of the others. For example, if the inconsistent sequence was composed of female 6's grunts followed by female 2's fear barks, the corresponding consistent sequence might begin with female 1's grunts, followed by female 6's grunts and ending with female 2's fear barks. Subjects responded significantly more strongly to the causally inconsistent sequences, suggesting that they recognize not only the factors that cause one individual to give submissive vocalizations to another, but also the rank relations that exist among others in their group (Cheney *et al.*, 1995*b*).

Further evidence that monkeys recognize other individuals' ranks comes from cases

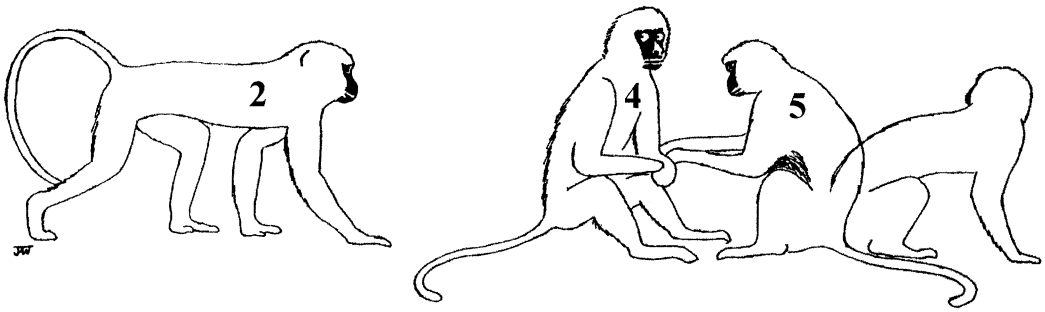

FIG. 2. Competition over access to a grooming partner in vervet monkeys. When a high-ranking female (for example, female 2) approached two lower-ranking females (for example, females 4 and 5) and supplanted one individual and groomed the other, of the two females who were approached the lower-ranking was significantly more likely to be supplanted. Drawing by John Watanabe and data from Cheney and Seyfarth (1990).

in which adult female vervet monkeys compete with one another for access to a grooming partner (Seyfarth, 1980). Such competition occurs whenever one female approaches two that are grooming, supplants one of them, and then grooms with the female that remains. In a small proportion of cases, this competition takes a form that is especially interesting for our present purposes. As shown in Figure 2, a high-ranking female (ranked 2, for example) approaches two groomers who are both subordinate to herself (say, females ranked 4 and 5). Though 4 and 5 both rank lower than 2, they are not equally likely to depart. In a significant number of cases, the higher-ranking of the two females remains seated, while the lower-ranking of the two moves away (Cheney and Seyfarth, 1990).

In so doing, the higher-ranking of the two females acts as if she recognizes that, although she is lower-ranking than the approaching female, her grooming partner is even more subordinate. In order to accomplish this ranking, a female must know not only her own status relative to other individuals but also other individuals' status relative to each other. In other words, she must recognize a rank hierarchy (Cheney and Seyfarth, 1990).

The ability to rank other group members is perhaps not surprising, given the evidence that captive monkeys and apes can be taught to rank objects according to an arbitrary sequential order (D'Amato and Columbo, 1988), the amount of food contained within a container (Gillan, 1981), their size, or the number of objects contained within an array (*e.g.*, Hauser *et al.*, 1996; Brannon and Terrace, 1998). What distinguishes the social example, however, is the fact that, even in the absence of human training, female monkeys seem able to construct a rank hierarchy and then place themselves at the appropriate location within it.

DISCUSSION

Tests of self-awareness in nonhuman primates have to date been concerned almost entirely with the recognition of an animal's reflection in a mirror. As Tomasello and Call point out, however, "Mirror self-recognition is ... about perception of the body" (1997, p. 337). By contrast, we know much less about non-human primates' perception of their place within a social network, or of their understanding of themselves as individuals with unique sets of social relationships.

Although monkeys consistently fail the mirror test of self-recognition, under natural conditions they seem to recognize their own close associates and the close associates of others. They also seem to recognize their own and other individuals' dominance ranks. They behave as if they recognize their own unique place in a network of social relations. In other words, they behave as if they have what William James might have called a sense of their "social selves."

This kind of knowledge, however, is very different from the conscious self-awareness exhibited by humans. By the time they are

about four years of age, humans are explicitly aware of the thoughts, beliefs, and mental states, both of others and of themselves. In contrast, all the evidence gathered to date suggests that monkeys cannot attribute mental states to others and are unaware of their own knowledge (reviewed by Cheney and Seyfarth, 1990; Tomasello and Call, 1997). The inability to examine their own knowledge or to recognize the mental states of others (what Premack and Woodruff (1978) termed the lack of a "theory of mind") means that, when monkeys interact with other group members, their understanding of those individuals' social relationships and behavior derives primarily from what they have observed those individuals do in the past. Monkeys can use this information to predict another animal's behavior, but they have little understanding of the motives, belief, or knowledge that caused it to occur.

Similarly, if knowledge of self and knowledge of others develop in parallel, then monkeys' apparent ability to place themselves within a social network may also derive primarily from learned behavioral contingencies. Although monkeys may behave as if they recognize their own relative ranks and kin relations, they are probably not be aware of the knowledge that allows them to do so: they do not know what they know, cannot reflect on what they know, and therefore cannot become the object of their own attention.

In conclusion, monkeys appear to view their social groups not just in terms of the individuals that comprise them but also in terms of a web of social relationships in which certain individuals are linked with particular others. Their behavior is influenced not only by their own interactions with others but also by their observation of interactions in which they are not themselves involved. As a result, they recognize not only their own relative ranks and kinship relations but also the relative ranks and kinship relations of others. Perhaps more important, monkeys seem able to integrate information about their own social relations with information about the social relations that exist among others, and through such computations place themselves at the appropriate position in a network of social relationships. The acquisition of this knowledge, however, does not require active self-reflection or awareness. Indeed, it demands only observational learning and a sensitivity to complex behavioral contingencies. Although monkeys' knowledge of social relationships may exceed that of many other social mammals, they apparently achieve such knowledge without reflecting actively upon their behavior, examining their own knowledge, or conceiving of themselves as social agents. They place themselves within a social network without being aware of doing so.

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