

Primate Vocal and Gestural Communication

Michael Tomasello and Klaus Zuberbühler

One way to investigate animal cognition is to investigate acts of social communication. In the broadest definition of the term, many acts of communication do not involve complex cognitive processes, since they are simply involuntary behavioral reactions or emotional displays in social situations. But especially in the case of primates, there are many acts of communication that clearly do involve complex cognitive processes, since they are undoubtedly "flexible behavioral adaptations in which individual organisms make informed choices based on mental representations" (Tomasello and Call 1997, p. 12). Here we review -- very schematically -- what is currently known about the cognitive processes involved in primate communication. Based on the above definition, we focus on two key aspects: (1) the flexibility with which individuals use their communicative signals; and (2) the mental representations that might underlie this signal use. We review findings first for vocal communication, which mostly involve monkeys, and then for gestural communication, which mostly involve apes.

Vocal Communication

Primates vocalize to one another most often in the context of evolutionarily urgent events such as avoiding predators, defending against aggressors, traveling as a group, and discovering food. For the most part, all of the individuals of a given species use the same vocal signals, and no new vocal signals are invented by individuals. However, there is some flexibility in the precise manner in which a given call is produced. For example, rhesus monkeys can be trained to alter the duration of their 'coo' calls (Sutton et al. 1973), newly-paired pygmy marmosets tend to converge on a common structure in their 'trill' calls (Snowdon and Elowson 1999), and subordinate cotton-top tamarins change the way they produce food 'chirps' as soon as they become dominant (Roush and Snowdon 1999).

Ontogenetically, there is evidence that in natural populations learning plays at least some role in determining the exact acoustic structure of vocalizations. For example, rhesus monkey 'coo' calls are acoustically more similar within than between matriline (Hauser 1992), and a number of species display population-specific "dialects" in some vocal signals (e.g., saddle-backed tamarins, Hodun et al. 1981; chimpanzees, Mitani et al. 1992 and others). Experimental studies suggest, however, that such flexibility is limited. For example, in a cross-fostering experiment Owren et al. (1992) found only limited modifications in the calls of two cross-fostered macaque species. The modifications that were found occurred in only a few limited contexts and involved only a subtle shift in some vocalization patterns and an increase in the frequency of use of calls already in the animals' repertoires. It is also relevant that squirrel monkeys produce most call types from soon after birth even if reared in isolation (see Snowdon et al. 1997, for a review), and that hybrid gibbons (*Hyllobates lar* and *pileatus*) produce songs with an acoustic structure morphologically intermediate to those of the two parent species (e.g. Geissmann 1984).

As with call morphology, call usage seems to have only limited flexibility, with learning playing a highly constrained role. Thus, in most cases calls are used in adult-like contexts from early in ontogeny, but then there is a learning phase in which more adult-like usage is fine-tuned (Seyfarth and Cheney 1997). For example, infant vervet monkeys often make mistakes by giving an eagle alarm call to various moving things in the sky (Seyfarth and Cheney 1986), and they produce inter-group calls whenever they are distressed. Only later do they confine these to adult-like contexts (Hauser 1989). And young pigtail macaques are less precise when using agonistic screams than are adults (Gouzoules and Gouzoules 1989). Flexibility of use persists to some degree in adults. For example, in cotton-top tamarins, social and reproductive status can affect call usage (Roush and Snowdon 2000), and Japanese macaques show population-level differences in their use of food and contact calls (Green