Actions and objects: unequal partners in the evolution of communication

Colin Allen
Department of Philosophy
Texas A&M University
College Station, TX 77843-4237
colin-allen@tamu.edu

Some theorists have argued that the evolutionary development of human language lies buried with our hominid ancestors and that the search for precursors of language in nonhuman animals is misguided (Pinker 1994). This view is supported by a common conception of animal communication according to which signal production is an involuntary manifestation of emotional arousal, so that signals convey no independent information about referents external to the signaller. In contrast, human language is thought to be under voluntary control and capable of referring to objects regardless of the emotional state of the speaker.

Recent comparative studies of species including chickens and monkeys provide evidence to support the view that the vocalizations of nonhuman animals are under a greater degree of voluntary control than previously believed (Cheney & Seyfarth 1990; Evans & Marler 1995; Marler & Evans 1996) and that they are "functionally referential" in that they provide specific information about events external to the signaller (Macedonia & Evans 1993). These studies suggest closer similarities between certain aspects of human language and animal communication systems than was previously recognized. It is still unclear whether these similarities reflect common ancestry (homology) or convergent evolutionary processes (analogy) and broader comparative studies are necessary to resolve these issues. Nonetheless, the available data do allow for some interesting comparisons that may allow us to understand some puzzling aspects of human language acquisition.

The concept of a "medium-sized" or "basic-level" category specified in terms of perceived similarity to a morphologically-identified prototype (Rosch et al. 1976) is often appealed to by language learning theorists to account for the ability of human children to identify the correct reference of learned count nouns such as "dog" or "bird" (Hall 1994). But this designation seems suspiciously ad hoc for in some cases the category is at the taxonomic level of species or family (e.g. "dog") and sometimes at the level of a class (e.g. "bird"). The degree of abstraction in these categories does, however, correspond closely to those identified by Cheney & Seyfarth as the referents of vervet monkey alarm calls (e.g., "leopard", "snake", or "eagle") which also correspond to different taxonomic levels. These differentiations are considerably less abstract than the categories identified by Marler & Evans as referents of the alarm calls of chickens (e.g., "avian predator" and "terrestrial predator"). It is possible that these translational differences reflect nothing more than a lack of knowledge about the vocalizations of chickens and vervets. But if the differences are real, then some available data about the ontogeny of vervet alarm calls suggest an interesting hypothesis about the evolution of communication systems and the ability to conceptualize objects independently of their typical behaviors. The hypothesis would, if correct, have consequences for understanding the acquisition of human language.

Infant vervets begin by giving recognizable "eagle" alarm calls to a variety of birds and even to leaves falling from trees, but as they get older the calls become more specific to those species of eagle that prey on vervets (Seyfarth et al. 1980). Analysis of the ontogeny of eagle alarm calls shows that infants' "mistakes" are most common for nonpredatory species diving rapidly from the sky or closely approaching the vervets, and that such errors not associated merely with morphological similarity (Cheney & Seyfarth 1986). Because these are behaviors that may reasonably be associated with predation, and because moving objects are more easily discriminated from background than static objects, it makes sense that vervets would be innately disposed to react to such events. This suggests the hypothesis that insofar as these calls refer to objects, the objects are initially classified in terms of their behavior or actions. This is consistent with discovery by Evans & Marler (1995) that a moving image of a raccoon shown to a chickens on a video monitor mounted overhead will elicit aerial predator calls at a higher rate than terrestrial predator calls (although such calls were less reliably elicited than by video footage of a raptor on the overhead monitor).

The evidence from chickens suggests that while their signals are referential, the categories referred to are action-oriented (predation from the air versus predation from the ground) although morphological features are also important in affecting call frequency (Evans & Marler 1995). The evolution of functional reference to these categories may have been driven by the different anti-predatory strategies that are appropriate for chickens faced by these different predators (Macedonia & Evans 1993). Similarly, infant vervets seem to begin with an action-oriented classification scheme. In vervets, refinements due to adult reinforcement of infant vocalizations may lead to a classification scheme that is based more on perceptual characteristics abstracted away from behavior. The ability to categorize and refer to objects independently of behavior would be an adaptive trait when the costs of responding to false positives (such as non predators behaving in a predatory fashion) or of failing to respond to false negatives (such as predators behaving in non-typical ways) are relatively high.

If the ontogeny of sophisticated referential skills recapitulates the phylogeny in a transition from action-based categories to feature-based categories, then it may not be necessary to postulate morphologically-specified, innate "middle-sized" or "basic-level" categories to explain how children settle on a reasonable level of interpretation for count nouns. The behavioral differences between dogs and cows (although belonging to the same taxonomic order) may have been evolutionarily salient to humans in ways that differences between behavior in different species of birds was not and thus humans might innately be disposed to categorize initially according to such behaviorally specified categories. An evolutionary and comparative approach to the notion of reference and similarities to various nonhuman communication systems may thus help provide a specification of the basic categories that facilitate the earliest stages of language acquisition.

References

Cheney, D. L. & Seyfarth, R. M. (1986) Vocal development in vervets. *Animal Behavior*, 34, 1640-1658.

Cheney, D. L. & Seyfarth, R. M. (1990) *How monkeys see the world.* Chicago: University of Chicago Press.

Evans, C.S. & Marler, P. (1995) Language and animal communication. In Roitblat, H. & Arcady-Meyer, J. (eds.) *Comparative Approaches to Cognitive Science*. Cambridge, MA: MIT Press.

Hall, D. G. (1994) How children learn common nouns and proper names: a review of the experimental evidence. In Macnamara, J. & Reyes, G. E. (eds.) *The Logical Foundations of Cognition*. New York: Oxford University Press.

Macedonia, J. H. & Evans, C. S. (1993) Variation among mammalian alarm call systems and the problem of meaning in animal signals. *Ethology*, 93, 177-197.

Marler, P. & Evans, C. (1996) Bird calls: just emotional displays or something more? *Ibis*, 138, 26-33

Pinker, S. (1994) The Language Instinct. New York: William Morrow and Company.

Rosch, E., Mervis, C., Gray, W., Johnson, D. & Boyes-Braem, P. (1976) Basic objects in natural categories. *Cognitive Psychology*, 3, 382-439.

Seyfarth, R. M, Cheney, D. L. & Marler, P. Monkey responses to three different alarm calls: Evidence of predator classification and semantic communication. *Science*, 210, 801-803.