

Do Animals Communicate Using a Language?

Stephen R. Anderson

ORCID <https://orcid.org/0000-0003-4477-1635>

Draft of July 19, 2019

Abstract

Since animals (and other life forms) obviously engage in communication, the question in the title must be seen as relating to whether the systems that enable this are comparable to those of specifically human language. This is addressed here in terms of the cognitive organization that enables humans to produce and understand an essentially unbounded range of expressions. The internal components of that organization are outlined, and the evidence from animal communication discussed in relation to these. It is concluded that with very limited partial exceptions, animal communication does not evidence capacities that would allow for a system comparable to human language. The richness which is apparent in animal communication, however, suggests that human and some non-human communication systems do share an important component: a rich capacity for pragmatic interpretation.

How we take this question clearly depends on how we define its terms. If communication is a matter of one organism emitting some indicator (behavioral or otherwise) from which another organism derives information, then it is evident that animals do that. Even bacteria: some of these are sensitive to chemical signals produced by others, and their activity is regulated in part by this (Miller & Bassler 2001). Everything from there on up “communicates” in this general sense. Indeed, genes themselves communicate with one another: the inappropriately described “Language gene” *FOXP2* codes for a protein that does not build structure but is rather a transcription factor that regulates the expression of a variety of other genes (Fisher & Vernes 2015). Everything turns, then, on what we want to think of as a “language.”

The word is sometimes used in a way that includes essentially any collection of indicators with reasonably consistent interpretations in some context: thus, one finds mention of the “language” of traffic lights, the “language of the cinema”, etc. If that is what we mean by a language, there is no question that animals of all sorts do indeed “communicate using a language,” and the question becomes essentially trivial. If, on the other hand, we mean by language “the method of human communication, either spoken or written, consisting of the use of words in a structured and conventional way” as my online dictionary puts it, the question becomes an interesting one: do the communication systems of animals have the essential properties of human language or not?

Hugh Lofting’s Doctor Dolittle (Lofting 1920 *et seq.*) certainly believed animal communication systems have the same character and expressive capacity as human languages, though perhaps sometimes conveyed in different modalities. That made for a series of good stories, but the

scientific issue of the relation between animal and human “languages” remains: see Anderson (2004) for discussion. The current chapter, then, approaches the matter by attempting to outline the central properties of specifically human language, and asking how known animal communication systems line up in those regards.

Some Essential Properties of Human Language

Over the years, numerous efforts have been made to characterize human language in its relation to the communication systems of other organisms, and to identify important differences. Undoubtedly the best known in this regard is the effort of Charles Hockett to identify the “Design Features” of human language, a framework that evolved somewhat over time and whose last formulation is in Hockett 1960. This effort, however, like many that preceded it, suffers somewhat from its purely external and descriptive nature: that is, Hockett tries to identify the character of communicative systems (including language) in terms of their communicative function. In contrast, the focus of the present chapter is on the cognitive capacities that underlie the possibilities of communication, a perspective that provides a somewhat more categorical delineation of human language as opposed to other systems, while also drawing out some previously under-emphasized parallels.

We can take as a starting point a widely noted feature of human language that seems to provide a unique strength, its richness and flexibility of expression: the essentially unbounded range of things that sentences in a language can express, including the ability to refer to things and situations arbitrarily distant from the speech situation in time and space, to things and situations that may not or do not exist, to logical relations between states of affairs as well as to those states themselves, etc. Descriptively, this aspect of human languages is inescapable, but we must ask what sort of capacity supports it, and how this capacity is grounded in the nature of our species. We approach this in terms of the organization of linguistic knowledge as this is characterized in modern theories of language.

Syntax and Semantics

Glossing over a great many matters of detail, it is fair to say that students of language agree that our knowledge of a language includes several distinguishable components. Among these, obviously, is our knowledge of a range of lexical items, the words of the language. Each of these is a direct association between an externalizable expression and the meaning of that expression.

While some of these meanings are tied to a specific situation — pronouns, such as *I, we, you, they* and demonstratives such as *this, that, there, then* — most are independent of a particular context. The word *cat* designates a particular kind of animal, regardless of whether we are talking about the one on the mat, one that we used to have or might plan to look for at the animal shelter, or the fact that some object looks like a small bear and not like a cat. The meanings of words include not only objects, actions, and properties, but also relations (*on, around, if . . . then*) and logical operators such as *not, all, any*. The properties of the lexical items of our language, the diversity and range of the meanings they can convey directly, obviously begins to account for the richness

their meaning, as a function of the meanings of their parts and the manner of their combination. We know, that is, that (in informal if traditional terms) when the verb phrase *feed the cat* is formed from the verb *feed* and the noun phrase *the cat* (itself formed from the determiner *the* and the noun *cat*), *the cat* is to be interpreted as the direct object of *feed*. The resultant combined meaning can then be further combined with the meaning of another noun phrase, interpreted as its subject, to yield the overall interpretation of a sentence like *The cat-sitter will feed the cat* (incorporating also the future sense contributed by *will*). This kind of knowledge of the semantics of linguistic expressions is another component of our overall knowledge of our language.

Phonology and Morphology

Discussion of the cognitive underpinnings of the rich expressivity of human language often stop at a discussion of words, their syntax and recursivity, but these are not the only structural dimensions that deserve discussion in this regard. One of Hockett's (1960) "design features" for language was what he called "duality of patterning." Languages, that is, are built on the basis of not just one combinatory system, the syntax, but also rely on another: phonology. The syntactic system combines meaningful words into larger meaningful units (phrases, clauses, etc.) while the phonological system combines individually meaningless elements (sounds, or in their linguistic function phonemes) into meaningful words. A relatively small number of sound units (44 in English, according to one widespread account, with a few more or less in any particular dialect) combine according to strict rules to form all of the thousands and thousands of words in the language.

It is tempting to see the presence of phonology as simply an ornament, an inessential elaboration of the way basic meaningful units are formed. This would be a mistake, however: it is phonology that makes it possible for speakers of a language to expand its vocabulary at will and without effective limit. If every new word had to be constructed in such a way as to make it holistically distinct from all others, our capacity to remember, deploy and recognize an inventory of such signs would be severely limited, probably to something like a few hundred. As it is, however, a new word is constructed simply as a new combination of the inventory of familiar basic sound types, built up according to the regularities of the language's phonology. This is what enables us to extend the language's lexicon freely as new concepts and conditions require.

It is necessary to note in this regard that speech is not the only possible medium for a human language. In particular, as research over the past half century or so has demonstrated, the visually transmitted signed languages that emerge and become current in communities with large numbers of deaf members develop all of the richness of expression and all of the basic structural characteristics of spoken languages, apart from modality (see chapter 9 of the present volume for some discussion). And in that connection, it is important that the individual meaningful signs of such a language also have an internal organization based on the rule-governed combination of limited numbers of separately meaningless formative elements (handshape, location, movement, etc.). In signed as in spoken language, this combinatory system, quite separate from syntax, makes possible the arbitrary expansion of the language's lexicon to express many more ideas than if signs had to be separate but unanalyzable wholes.

Knowledge of a language's phonology, then, is another aspect of a speaker's cognitive

organization that allows for the communicative deployment of the language. In fact, there is arguably yet a third combinatory system knowledge of which is essential to functioning of language. This is morphology, the system by which meaningful indicators combine within a single lexical word. *Cat*, on the one hand, has no particular structure beyond the combination of the sounds [k], [æ] and [t], but *undescribable* is a combination not only of sounds, but also of meaningful parts (*un-*, *-able* and *describe*, which may itself be seen as a combination of *de-* and a root *scribe*), according to yet another system of regularities.

Some linguists wish to see morphology as simply a special case of syntax, internal to whatever a given language may treat as its words, while others emphasize the ways in which the internal organization of words may be quite different from ways in which these are organized by the syntax. We can ignore this theoretical dispute here, however, and simply recognize that knowledge of the internal organization of words as well as that of larger structures constitutes a substantive part of what makes it possible for languages to be as expressive as they are. Indeed, in some languages the resources of word-internal organization may be much more important to this than is evident in the case of English. A well known instance is provided by West Greenlandic “Eskimo”, a language famous for much elaborate morphology and in which an example like (2) constitutes a single word, combinable with other words by the (distinct) principles of the syntax.

- (2) tusaa -nngit -su -usaar -tuaannar -sinnaa -nngi -vip -putit
 hear not INTR-PART pretend all.the.time can not really 2S.INDIC
 You simply cannot pretend not to be hearing all the time (Fortescue 1984: 315)

When we look at the richness of expression provided by human languages (and thus by our species’ capacity for language), we see that there are a number of rather essential aspects of our cognitive organization that make this possible: in particular, knowledge of the particular sorts exemplified by the phonological, morphological, syntactic, lexical and semantic systems of natural languages. If we want to address the question of whether non-human animals make use (or indeed, are capable of making use) of a ‘language’ in the human sense, we can do so by asking whether there is reason to attribute to them the cognitive capacities necessary to support such systems.

Characteristics of Animal Communication Systems

For a great many animals, a major form of communication is through some form of visual display. This may range from the passively produced signals of the stickleback (Shettleworth 2009: 508), a classic model of communication in the literature of behavioral biology, to the elaborate strutting behavior of the greater sage grouse (*Centrocercus urophasianus*) and the complex mating dance of the western grebe (*Aechmophorus occidentalis*). Importantly, most of these convey essentially the same rather simple message: advertising the availability of the individual for mating. This is of course by no means the only message an animal can communicate, but it is typical in its directness and its relation to the immediate context in which the signal is presented.

Apart from visual displays, there are a number of other channels through which animals inform one another. Chemicals including pheromones and other olfactory signals (in ants, bees, moths,

mice, lemurs, and many others), ultrasound (in bats, dolphins, and the courtship songs of mice, among others), infrasound (in elephants) and the production and perception of characteristic electric fields (in certain fish) all provide efficient signalling channels under ecologically appropriate conditions.

Of course many non-human species communicate in sound as humans do. This includes frogs, birds (who produce a variety of calls, in addition to the specialized class of vocalizations represented by true song in most of the nearly 4,000 species belonging to the order Passeriformes), as well as virtually all mammals to at least some extent. Birdsong is a particularly interesting and complex form of vocal signalling, of which more will be said below. However, despite a number of distinctive characteristics, the songs of birds are in the end no different in their essential character from other animal signals. The song is an assertion of the bird's possession of a territory, for the purpose of defending it against competitors and attracting potential mates. No matter how internally complex, that complexity is never linked to a more complex message.

Compared with the lexicon of a human language, the inventories of available signals in animal systems are several orders of magnitude smaller. Abstracting away from varying degrees of the intensity with which a communicative display is produced, the characteristic repertoire of any given species is quite limited. A sensitive observer will generally find a number of distinguishable signals, but that number is still typically quite limited: fewer than 40 in any species that has been seriously studied.

Each message in these systems is limited to the here and now, driven by the immediate circumstances of production. The messages typically reflect the immediate internal state of the organism, and their production is often triggered by measurable internal factors such as hormone levels. For example, in most temperate species of oscine birds, it is the male that defends territory, and thus only male birds sing. When injected with appropriate levels of testosterone, however, female birds of such species can be induced to sing as well, as do normal females in other species where they defend territories.

The interpretation of an animal's signal is dependent on the immediate spatial and temporal context in which it is produced, in contrast to the words of a human language that have meanings not bound to the immediate context. Thus, we can describe objects or events that are in the past or future, hypotheticals, negatives, and other concepts that are outside the immediate factual horizon. None of the ideas formulated in the sentences in (3) are expressible in any non-human communication system, however useful that might be in a particular situation.

- (3) a. Far away in the middle of that forest, there lives a dangerous leopard.
- b. Last week there was a leopard around here, but it's gone now.
- c. If I had seen a leopard, I would have climbed a tree.
- d. Any bird that is not an eagle is not dangerous.

As described above, the expressive capacity of a human language rests largely on the existence of a system of hierarchical, recursive syntactic combination. No such system has ever been found in the communicative signals of any non-human species, and attempts to teach such systems to

animals in the laboratory have been quite unsuccessful. A review of the relevant literature in support of this assertion would take us far beyond the scope of the present chapter; some discussion will be found in Anderson 2004. Of course, in the absence of generalized syntactic combination, there is no need (or evidence) for a system of semantic interpretation.

As a result of the limitations just discussed, all non-human animals have limited, fixed sets of discrete messages that they can convey. These messages constitute a fixed list, and one that cannot be expanded by combining elements to form new and different messages to respond to new and different communicative needs.

The bounded nature of non-human animal communication systems can be related to the absence of systems for elaborating the inventory of signals by employing something like the phonology (and morphology) of human languages. To the extent every signal in an inventory is produced and recognized as a whole, completely distinct from all the others, the number that can be independently controlled and deployed is subject to significant cognitive limitations. The duality of patterning found in human languages allows us to circumvent that limitation, by constructing arbitrary numbers of new words out of a limited set of meaningless elements of sound (or gesture, in the case of signed languages). This capacity is not present in animal signalling systems, and such efforts as have been made to elicit something similar in the laboratory have not produced results.

There are some limited exceptions to the generalization that phonology is not present in animal communication, but these do not affect the general point. Most notably, song in many oscine bird species is constructed out of a set of basic formative elements. Individual members of a given species may have a repertoire of a few, or even hundreds of different songs all built from the same basic components, combined according to species-specific regularities. What is significant about this, however, is the fact that no matter how many various songs a bird may sing, they all have the same content: fundamentally, an assertion of territorial possession and/or an advertisement for mating. While humans combine sounds in different ways to convey different meanings, birds do something analogous while maintaining the same message. The reasons for the repertorial diversity of birds are to some extent disputed, though in some cases it seems that this serves to advertise high levels of fitness.

Something similar seems to be the case in some cetacean species, especially in the well known songs of some whales. These can be shown to be composed of recurrent motifs, variously combined and used to identify individuals, to maintain contact over long distances, and to warn others of dangers. Once again, however, there is no reason to believe that the difference between one combination of groans, moans, roars, sighs and high pitched squeals and another is used to distinguish meanings.

Apart from the sorts of knowledge underpinning the use of human language, there are other aspects of cognitive organization that can be explored in comparing human and non-human communicative behavior. One of these is the path by which the communicative system emerges in the development of the individual.

In humans, knowledge of the language(s) of the surrounding speech community arises on the basis of experience in the early years of life. Many if not most linguists believe this is made possible by a rather rich set of cognitive principles (the “Language Acquisition Device”) that is

structured by the nature of human language and able to take advantage of relatively weak and impoverished cues in the environment to arrive at a particular system as evidenced by observed utterances. Although the richness of assumptions in this regard is a matter of dispute, there is no question about the most basic point: a human language is acquired fairly rapidly on the basis of somewhat limited early experience.

This path to communicative knowledge is quite distinctive. In nearly all non-human species, the communication system emerges without need for relevant experience, although in some instances there may be some “fine tuning” possible concerning the precise conditions of use of some signal in the system. As in the case of phonological organization, the outstanding exceptions to this generalization are provided by birds: oscine songbirds (and probably also hummingbirds, although the evidence here is more fragmentary) are apparently the only animals apart from us that acquire a significant communicative signal on the basis of experience, rather than having it emerge innately without a role for conspecific models. The shaping effect of a species-specific acquisition system can be quite strong: experiments with zebra finches have shown that even in the absence of any other adult models from which to learn, the song patterns that emerge converge on species-typical song within a few generations (Fehér et al. 2009).

For a communication system in the vocal-auditory modality, of course, any possibility of experience based learning rests on a prerequisite that the animal be capable of imitating a model. In this connection, it is significant that the capacity for vocal imitation is extremely limited in nature. Apart from oscine songbirds and hummingbirds, this capacity is obviously present in even more general form in members of the order Psittaciformes (parrots), who can imitate a wide range of sounds although unlike oscines, they do not learn a song in this way. Outside of birds, some limited vocal imitative abilities have been shown in a few mammals, including elephants. Importantly this capacity is not present in non-human primates apart from the possibility of minor shaping effects on innately present vocalizations: some convergence of pant-hoots within a troop of chimpanzees, for example, is apparently useful in coordinating hunting behavior.

Another important property of human language is that its use is voluntary, controlled mainly by cortical centers, while other animals produce communicative signals under various sorts of non-voluntary control mediated by other parts of the brain. Animal vocalizations (and other signals) are apparently always under the control of involuntary sub-cortical structures, particularly the limbic system (Jürgens 1992, 2009). This kind of vocalization can be suppressed under some circumstances, but not produced voluntarily. Some human vocalizations are similar, such as laughter, cries of pain, moans of pleasure or of pain, etc. Of course, humans also have a system of voluntary sound production, and we can imitate the involuntary sounds of our own (or other animals’) vocalizations, but this is not the same. Human vocalizations like speech, singing and intentional imitation are under the control of a completely separate system that other animals lack, based on cerebral motor cortex and related pathways.

The distinct neural underpinnings of communicative vocalization in humans and non-humans are an instance of the general fact that animal communication systems of all sorts can typically be shown to be deeply embedded in the species-specific biology of the animals that employ them. In many cases, specialized organs of production and perception are involved, something that is obvious in the use of ultrasound by (Microchiroptera) bats and dolphins or the use of electric fields by fish. The mouse, for whom olfactory signals associated with pheromones are extremely

significant, has a specialized sensory organ, the vomeronasal organ, that is sensitive specifically to a range of substances including most pheromones. This organ (shared with a great many other animals, including humans, in which its function is somewhat controversial) is distinct from the more general olfactory sensory system (the olfactory epithelium) and projects to different regions in the mouse's brain.

Somewhat similarly, the sensory membranes in the auditory systems of frogs tend to be most sensitive in exactly those frequency regions that predominate in the calls of their species. The brains of birds that learn their songs contain specialized nuclei that support the song learning system, structures that are absent in other species. In general, when we examine the ecologically significant communicative signals of any animal species, we find that evolution has shaped the animal's biology so as to be particularly effective in the relevant domain.

Given the otherwise highly distinctive character of human linguistic communication, it would be surprising indeed if the same were not true in this instance. We expect, that is, that our linguistic abilities are grounded in evolved biological characteristics of our species. In that case, there is no reason to anticipate that the communicative behavior of any different species would be based on something like a human language, and as we have seen, there are excellent reasons to doubt this.

The Other Side of “Communication”

If we deny that the systems of communicative signals employed by non-human animals have the essential characteristics of a human language, how then are we to account for the fact that animals do indeed manage to communicate a great deal of ecologically relevant information with one another, enough to manage sometimes quite complex social lives, coordinate hunting parties, etc.? The answer to this apparent contradiction lies in the fact that the information humans convey through their utterances is by no means limited to the literal content of the linguistic forms themselves. While words, phrases and sentences have a semantic interpretation provided by their individual meanings and the manner of their combination, the information conveyed by an utterance can be much richer, given the context in which it is produced and understood. Understanding the role of context, pre-existing knowledge concerning the individuals involved and their relationships to one another, the inferred intent of the speaker, and other factors is the business of *pragmatics*, which studies the way language conveys meaning in use, as opposed to semantics, which studies the meanings of linguistic expressions independent of the circumstances in which they are used.

In important ways, animal signals do not have a “meaning” that is independent of the context in which they occur. There are apparent exceptions to this, including the famous alarm calls of vervet monkeys (Cheney & Seyfarth 1990), which appear to refer to specific types of predatory threat (eagles, leopards and snakes), but the point to note here is that these calls are only produced in rather restricted contexts, and so there is virtually no effort of interpretation required to understand the information they convey to conspecifics. Indeed, when we look at alarm calling behavior more generally, we can see that the specificity of the vervet example is rather exceptional, closely connected with the world in which the vervets live and the threats they encounter, and that the interpretation of alarm signals elsewhere in the animal kingdom is

generally somewhat more reliant on contextual conditions. For some discussion of these and related matters, see Anderson 2017.

Animals, including primates, are quite skilled at interpreting their environment, and that includes the behavior of other animals, including (but not limited to) their conspecifics. Some of that behavior, including visual, auditory, olfactory and other signals, is likely to be characteristic of somewhat restricted circumstances, and thus to convey substantial information (in the sense of reducing uncertainty about what may be going on in the world) without much elaboration. Other behavior is rather less informative in itself, requiring more interpretation.

Animals are also sensitive to the contexts in which they produce their signals. Thus, female primates engaged in copulation with a male other than the dominant one in their group can suppress their characteristic vocalizations when the dominant male is within earshot. While the system of vervet alarm calls emerges in the infant without need for experience, the developing baby vervet observes that some of the observations that might trigger an “eagle” call — for instance, a falling leaf, or a bird other than the two species of eagle that are dangerous — do not elicit such a call from others in the vicinity, and so learns to attune the system so as to produce this call only in the context of a narrower class of events.

The fact that the signals themselves that animals produce do not have the structural characteristics (and thus the intrinsic richness) of expressions in a human language does not mean that they are uninformative. In real-world situations, a rich capacity for pragmatic interpretation can derive a great deal of information from otherwise sparsely informative events.

Conclusion

It appears, then, that while the answer to the question in the title of this chapter is “no” if we interpret *language* in terms of the essential properties of human language, that does not mean that their communication does not share important properties with the language based communication of humans. In particular, both human and non-human animals derive a great deal of the information they actually obtain from pragmatic interpretation of the signals observed in relation to the situational context, what they already know about the world and the individuals involved, and other factors. As a result, animal communication systems can often be quite rich, subtle and closely attuned to the ecological circumstances of the animals involved without making use of a signal system comparable to ours. Animals communicate quite accurately about the circumstances in their worlds that matter to them, on the basis of fine abilities to interpret their observations in relation to the contexts in which they are made. It’s just that the sets of signals they employ in this way do not have the properties of a “language” in the human sense. Every species has a range of species-specific properties: “language” is one of ours.

Acknowledgments

The discussion and descriptions in this chapter are drawn from many past lectures and publications, and would require acknowledgment of a large number of students, colleagues and commentators, too many to be enumerated here. Some of the specific points made here are also presented in Anderson 2017.

Further Reading

Anderson, Stephen R. 2004. *Doctor Dolittle's delusion: Animals and the uniqueness of human language*. New Haven: Yale University Press.

Bradbury, Jack W., and Sandra L. Vehrencamp (2011). *Principles of Animal Communication* [2nd edition]. Oxford: Oxford University Press.

Hockett, Charles F. 1960. Logical considerations in the study of animal communication. In W. E. Lanyon & W. N. Tavolga (eds.), *Animal sounds and animal communication*, 392–430. Washington, DC: American Institute of Biological Sciences.

Wacewicz, Sławomir, and Przemysław Żywicznyński (2015). Language evolution: Why Hockett's Design Features are a non-starter. *Biosemiotics* 8: 29-46

References

- Anderson, Stephen R. 2004. *Doctor Dolittle's delusion: Animals and the uniqueness of human language*. New Haven: Yale University Press.
- Anderson, Stephen R. 2017. The place of human language in the animal world. In Joanna Blochowiak, Cristina Grisot, Stephanie Durrleman & Christopher Laenzlinger (eds.), *Formal models in the study of language*, 339–351. Springer.
- Cheney, Dorothy L. & Robert M. Seyfarth. 1990. *How monkeys see the world*. Chicago: University of Chicago Press.
- Fehér, Olga, Haibin Wang, Sigal Saar, Partha P. Mitra & Ofer Tchernichovski. 2009. *De novo* establishment of wild-type song culture in the zebra finch. *Nature* 459. 564–568.
- Fisher, Simon E. & Sonja C. Vernes. 2015. Genetics and the language sciences. *Annual Review of Linguistics* 1. 289–310.
- Fortescue, Michael. 1984. *West Greenlandic*. London: Croom Helm.
- Hockett, Charles F. 1960. Logical considerations in the study of animal communication. In W. E. Lanyon & W. N. Tavolga (eds.), *Animal sounds and animal communication*, 392–430. Washington, DC: American Institute of Biological Sciences.
- Jürgens, Uwe. 1992. On the neurobiology of vocal communication. In H. Papoušek, U. Jürgens & M. Papoušek (eds.), *Nonverbal vocal communication: Comparative and developmental approaches*, 31–42. Cambridge: Cambridge University Press.
- Jürgens, Uwe. 2009. The neural control of vocalization in mammals: A review. *Journal of Voice* 23. 1–10.
- Lofting, Hugh. 1920. *The story of Doctor Dolittle*. New York: Frederick A. Stokes.
- Miller, Melissa B. & Bonnie L. Bassler. 2001. Quorum sensing in bacteria. *Annual Review of Microbiology* 55. 165–199.
- Pinker, Steven. 1994. *The language instinct*. New York: William Morrow.
- Shettleworth, Sara J. 2009. *Cognition, evolution, and behavior*. Oxford: Oxford University Press.