

# The Place of Human Language in the Animal World

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## Abstract

Animals across a broad range of species convey meaning through their communicative behavior. The meaning we convey in our use of human language must be seen as jointly contributed by the semantics of the words, phrases, and sentences employed and the pragmatics of the situation in which the communication occurs. Much discussion of animal communicative behavior has sought to analyze it by attributing semantic content to particular signals: such an approach, for instance, characterizes the treatment of vervet monkey alarm calls as “functionally referential.” Some scholars have offered a formal semantics for the signaling behavior of other monkeys. In contrast, a growing trend in the animal behavior literature rejects the attribution of properly semantic content to such signals, arguing that the meaning they convey should be attributed to their pragmatic value in particular contexts. Following a review of the known properties of animal communication systems, the applicability of this account is assessed in terms of the partitioning of semantics and pragmatics proposed by Moeschler and others.

There is no doubt that virtually every organism in the animate world engages in communication of some sort, whereby one organism produces an observable signal from which others derive some information. At one extreme, bacteria engage in quorum sensing, “the regulation of gene expression in response to fluctuations in cell-population density. Quorum sensing bacteria produce and release chemical signal molecules called autoinducers that increase in concentration as a function of cell density. The detection of a minimal threshold stimulatory concentration of an autoinducer leads to an alteration in gene expression. Gram-positive and Gram-negative bacteria use quorum sensing communication circuits to regulate a diverse array of physiological activities” (Miller & Bassler 2001: 165). Indeed, genes themselves communicate with one another: the inappropriately characterized “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).

It is fairly obvious that we can withhold the designation “language” from the informational exchanges of genes and bacteria, but there is a much greater temptation to see non-human animals as having languages of their own — less complex and elaborated than ours, perhaps, but still falling within the same general class of systems. We will see,

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however, that differences of an essential character separate animal communication from human language by so great a distance that it is effectively meaningless to use the same word for both.

In section 1 below, I summarize a set of basic properties that characterize the communicative behavior of all animal species other than *Homo sapiens*. In section 2, I contrast these with fundamental properties of human natural languages, based as these are on principles of unbounded combination that provide an unlimited scope of expression found in no non-human system. In section 3 I ask whether it makes sense, despite the fact that they cannot be freely combined to make new messages, to consider individual signals in an animal communication system as comparable to the words of a human languages, and to assign them lexical semantic meanings. I conclude that this is not warranted, and that the way animal signals convey meaning should be understood is not in terms of their semantics, but rather in terms of pragmatics, grounded in the situations in which they are produced rather than in intrinsic meanings of the signals themselves. Section 4 provides a brief summary and conclusion.

## 1 Communicative Signals of Non-Human Animals

Perhaps the classic ethological example of animal communication is provided by the the stickleback (*Gasterosteus aculeatus*). When the male of this species is in breeding condition, his belly becomes red (a fact over which he has no control, and which he cannot even see), while the belly of a breeding female is swollen by the egg mass it contains. When members of the two sexes perceive the corresponding signals, this causes them to enter into a somewhat elaborate mating ritual. Each “animal provides the stimulus for its partner’s response, which in turn provides the stimulus for the next response in the chain, and so on” (Shettleworth 2009: 508).

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 to the elaborate strutting behavior of the greater sage grouse (*Centrocercus urophasianus*) and the complex mating dance of the western grebe (*Aechmophorus occidentalis*), but all 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.

Abstracting away from varying degrees of the intensity with which a communicative display is produced, the repertoire available to any given species is characteristic of that species and 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.

Visual displays provide by no means the only channel 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.

Human natural language is primarily a matter of sound in the oral/aural channel (although signed languages transmitted in the manual/visual channel have all of the same

essential characteristics as spoken languages), and of course many non-human species communicate in sound as well. 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; while a few other species (though notably no non-human primates) are capable of at least some vocal imitation and learning, oscine songbirds (and possibly hummingbirds) are apparently the only animals apart from us that acquire a significant communicative signal on the basis of experience, rather than innately. Furthermore, the songs of many birds have very considerable internal complexity, and may be arranged from separately occurring recurrent components. Nonetheless, despite these 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.

When we look at the communicative behavior of other species, all of the systems that we find display a somewhat similar character, based on a number of shared properties. A primary feature is that all (non-human) animals have limited, fixed sets of discrete messages to 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. Even in those cases where the system is learned, of which birdsong is by far the most robust example, the actual system acquired does not go beyond the character of an essentially fixed inventory.

Each message in these systems is limited to the here and now, driven by the immediate circumstances of production. The messages 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 can be induced to sing as well.

In nearly all cases (again apart from birdsong), 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. This innate character is related to the fact that animal communication systems can generally 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 the 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. 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 exam-

ine 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.

With the exception of the matter of relevant biological specialization, these properties are quite unlike those of human language, to which I now turn.

## 2 Structural Characteristics of Human Language

The most important properties of human natural language are in general quite different from those of animal communication systems. On the one hand, just as methods and modalities of communication in other animals are rooted in their distinctive biology, so human language is unique and distinctive to our species, and grounded in our biology (Anderson 2013). The human vocal tract is adapted for speech in ways that are otherwise dysfunctional; the inner ear and auditory system is highly responsive over the frequency range that is manipulated in speech production.

The path of human growth and development involves a sensitive period in which the characteristics of the language of the ambient environment are efficiently discovered and incorporated despite noise and underdetermination in the available data (Yang 2006). Human language is thus learned, in the sense that experience affects which possibility from within a limited space will be realized in a given child. Apart from the similar pattern of song development in oscine birds, in most animals, including all of the other primates, communication is entirely innate, and develops in a fixed way that is independent of experience.

In addition, human language use is voluntary, controlled mainly by cortical centers, while other animals produce communicative signals under various sorts of non-voluntary control mediated by sub-cortical structures. And most importantly, where other species have fixed, limited sets of messages they can convey, humans have an unbounded range of things that can be expressed in language.

The distinctive, indeed unique structural property that makes this possible is what Steven Pinker (1994) has called a “discrete combinatorial system”: new messages are formed as new combinations, rather than as novel signals or as modulations of intensity or some other continuous variable in an existing message — the only dimensions of flexibility in non-human systems. This system is based on recursive, hierarchical combination, where “recursion” refers to the fact that structural units can include other instances of the same sort as components. As a result, there is no limit to the number of different structures that can be accommodated by a small, fixed number of structural regularities.

Given the principles for constructing a few basic phrase types, these can be re-used to produce and understand an unbounded range of novel expressions. For instance, a sentence like (1) below is built up from a comparatively small vocabulary, together with a few principles governing the structure of prepositional phrases, noun phrases, and verb phrases. Since a prepositional phrase, for example, can contain a noun phrase as a constituent, and a noun phrase in its turn can contain a prepositional phrase, it is easy to see that this small set of structures can be used to construct novel messages of arbitrary length.

- (1) [<sub>S</sub> [<sub>NP</sub> The lady [<sub>S</sub> [<sub>NP</sub> who] [<sub>VP</sub> told me [<sub>NP</sub> the story [<sub>PP</sub> about [<sub>NP</sub> [<sub>NP</sub> that man]’s mother]]]]]] [<sub>VP</sub> lives [<sub>PP</sub> in [<sub>NP</sub> a house [<sub>S</sub> that [<sub>NP</sub> she] [<sub>VP</sub> rents [<sub>PP</sub> from [<sub>NP</sub> her brother]]]]]] [<sub>PP</sub> on [<sub>NP</sub> the lake [<sub>PP</sub> of [<sub>NP</sub> Geneva]]]]]]]]]

Recursion of the relevant sort (Fitch 2010) is not found in any other communication system (or elsewhere in nature, for that matter). Some have taken it to be the single unique characteristic of human language (Hauser et al. 2002), and it is important to understand its significance in this context. The unbounded extensibility it provides constitutes the most basic contrast with animal communication systems, which are based on a limited set of possible messages, a set that cannot be extended.

Another important property of human language is what Charles Hockett (1960) christened “Duality of Patterning.” This refers to the fact that human languages are built on two essentially independent combinatory systems: PHONOLOGY, and SYNTAX. On the one hand, phonology describes the ways in which individually meaningless sounds<sup>1</sup> are combined into meaningful units — words. And on the other, the quite distinct system of syntax specifies the ways in which words are combined to form phrases, clauses, and sentences.<sup>2</sup>

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, to something like a few hundred. As it is, however, a new word is constructed as simply 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 as new concepts and conditions require.

These structural characteristics of language are what give it its remarkable and flexible expressive capacity. As a consequence, language, and perhaps especially syntax, is unique in the animal world. No other system of communication found in nature has these or comparable properties.

Of course, the fact that no other animal deploys a system like that of human language does not by itself entail that our cognitive capacities are similarly unique: only that if another animal had a mental life similar to ours, it would be incapable of externalizing that in the way we can through our use of language. And of course, there has been a huge amount of work put in on studying the cognitive abilities of animals in the laboratory. It is certainly possible that they have capacities that are not expressed, or at least not fully expressed, in nature. A major part of that literature, at least as it relates to our questions here, is formed by reports of research on language abilities in apes, and also on parrots in one case. To review that literature in detail would greatly exceed the scope of the present article, and I will simply summarize what seem to me the conclusions of several decades of work. For a fuller review, see the discussion in Anderson 2004.

First of all, it is reasonably clear that some of these animals, including chimpanzees, bonobos, orang-utans and grey parrots, can acquire a “lexicon” of arbitrary, non-iconic symbols — manual gestures in the case of the apes, or vocalizations for at least one parrot — and use them appropriately. The number of such symbols that an animal can acquire is considerably larger than anything we find in nature — several hundred — though it seems bounded at around the same level as the number of distinct, arbitrary symbols

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<sup>1</sup>Or gestures, in the case of signed languages.

<sup>2</sup>I ignore here what is arguably a third distinct system, that of MORPHOLOGY, which characterizes the ways in which words with complex meanings combine the formal markers that signal parts of those meanings.

that can be remembered holistically by humans. Linked to this boundedness is the fact that there is no evidence at all that symbol-using primates develop a system by which these symbols are composed of individually meaningless component parts, on the lines of the second articulation (phonology) that characterizes human language. This difference is probably responsible for the fact that we can expand our vocabularies more or less arbitrarily, but they cannot.

There is also no evidence for anything beyond the most rudimentary form of combination of these symbols: stringing one after another, at best, with little or no structure and much non-significant repetition. And indeed there is virtually no evidence for any structured combination at all in production by primates. Kanzi the bonobo has apparently some capacity to understand more complex combinations, of the sort that can be characterized by a finite state grammar, but notably does nothing similar in production. Importantly, there is no evidence that any non-human animal is able to learn a system for combining symbols into larger novel units in a hierarchical, recursive fashion: syntax of the sort essential to human language.

With all due respect to the late Alex the parrot and Washoe the chimpanzee, and even Kanzi the bonobo, serious and intensive efforts to teach such a system to other animals have not succeeded. That is, there is no evidence that any other animal is capable of acquiring and using a system with the core properties of human language:

- A discrete combinatorial system,
- based on recursive, hierarchical syntax,
- and displaying two independent levels of systematic structure, one for the composition of meaningful units and one for their combination into full messages.

But really, there is no reason to expect that our means of communication should be accessible to animals with a different biology, any more than we expect ourselves to be able to catch bugs by emitting short pulses of sound and listening for the echo in the way bats do. Every species has its own specific and characteristic talents: bats do echolocation, electric fish sense perturbations in a surrounding electric field, and we have the special cognitive systems underlying the development and use of language.

### 3 Are Animal Signals Like Human Words?

Perhaps, though, even if non-human animals do not have the capacity to control the kind of combinatory systems that are characteristic of human language, there might be a parallel to be brought out at another level. Might it be the case that animal signals are comparable to the individual words of a human language? Here too, though, there turn out to be fundamental differences.

First, 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.

Animal signals are also always bound to the here and now, produced as a consequence of the animal's immediate internal state. The interpretation of a signal is dependent on the immediate spatial and temporal context in which it is produced. In contrast, the words of a human language have meanings that are not bound to the immediate context, and so can be used to express a wide range of meaning, meanings that remain constant across contexts. 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 (2) are expressible in any non-human communication system.

- (2) 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 you see a leopard, you should climb a tree.
- d. A bird that is not an eagle is not dangerous.

In addition, the form of animal signals, as we have seen, is tightly linked to the specific biology of production and sensory systems. Furthermore, specific signals may display a non-arbitrary form related to the responses they elicit (see below). In contrast, of course, as de Saussure (1916 [1974]) stressed, the words of a human language are in general arbitrary in the links that connect form with specific content.

The area in which animal signals have been most forcefully argued to be analogous to words in a human language is that of the alarm calls given by a variety of species in response to the presence of different sorts of predators. A particularly well known and well described (Cheney & Seyfarth 1990) case is that of the predator-specific alarm calls of vervet monkeys (*Chlorocebus pygerythrus*). There are three main classes of predator that threaten these monkeys: leopards (*Panthera pardus*) and similar cat species; martial eagles (*Polemaetus bellicosus*) and crowned eagles (*Stephanoaetus coronatus*); and snakes such as cobras (*Naja* spp.), mambas (*Dendroaspis* spp.) and pythons (*Python sebae*). Each of these types of threat elicits a distinctive vocalization from a monkey perceiving it, and each vocalization produces a distinct, appropriate reaction in the other monkeys who hear it.

The three distinct calls are connected with differentiable circumstances in the external world, and differ both in their production and in the way they are interpreted, as judged by the responses they elicit. The inevitable conclusion appears to be that there are three categories of danger that are cognitively distinct for the vervets, and three corresponding messages. Much of the literature in animal behavior studies, therefore, has interpreted these alarm calls as referring to the corresponding predator types, in much the way words of a human language refer to categories of phenomena in the world (see Wheeler & Fischer 2012 for a review of the history of this understanding of alarm calls).

If these alarm calls are thought of as similar to words, they still constitute a highly restricted set, fixed and small. Furthermore, unlike words, Saussure's principle of "l'arbitraire du signe" apparently does not apply to them:

In primates, for example, alarm vocalizations produced upon encountering dangerous predators are found not to be arbitrarily structured at all, instead typically being short with abrupt onsets and broadband noisy spectra. These widely shared acoustic features are ideally suited for capturing and

manipulating listener attention and arousal through short, direct links from the auditory periphery to brainstem regions regulating whole-body arousal and activation. As a result, alarm calls elicit in listeners immediate orienting responses and movements preparatory to flight which are obviously highly functional to them in the context of predator encounters. In fact, the same basic alarm call structure and response is seen in a range of other mammals and birds [. . . , Owren & Rendall 2001], suggesting a highly conserved response system that is likely to be traceable to detection and localization functions related to predator avoidance and prey capture in early vertebrates.

— Rendall et al. 2009: 236

In addition, the set of signals and responses to them is produced and acquired more or less automatically, and no experience is necessary for the call system to develop. Such learning as we might see in ontogenetic development is restricted to details of conditions of use, not the basic calls themselves. As the vervets get older, they get more sophisticated about what threats they should worry about and so the circumstances that elicit alarms become circumscribed.

How, then, should we interpret the way in which the alarm calls of vervets (and other similar animals) convey “meaning”? We know that the vervets derive information about predators in their environment from the calls of conspecifics, but that fact by itself does not make it obvious what is going on.

Vervets produce their alarm signals automatically and spontaneously in the presence of the corresponding predators. Other vervets, upon hearing these calls (even when produced artificially by experimenters playing recordings through hidden loudspeakers) respond in ways that indicate an awareness of appropriate, predator-specific evasive actions. We need not, however, interpret this as indicating that an alarm call *means*, say, “leopard!” in the same way my utterance of that English word does on a visit to the zoo.

Animals, including primates, are quite skilled at interpreting their environment, and that includes the behavior of other animals. 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). Other behavior is rather less informative in itself: while attention has focused on the alarm calls of the vervets, these monkeys also produce a number of other vocalizations, under rather more general circumstances than those governing the alarm calls (Cheney & Seyfarth 1990: 113–128 *et alibi*).

Indeed, most animal signals are not so constrained as the alarm calls of the vervets, but they can still be quite informative if the precise context in which they are observed is taken into account, and this is something animals appear to be quite good at. Excellent examples studied under carefully controlled circumstances are provided by Cheney & Seyfarth’s (2007) study of a group of chacma baboons (*Papio hamadryas ursinus*). These animals live within a rigidly structured hierarchy of dominance relations; they are also quite good at identifying the individual producing a given vocalization, even when out of sight, on the basis of vocal characteristics. Among their vocalizations are some that often indicate threats toward another animal, and others that signal general deference and submissiveness.

Cheney and Seyfarth played sequences of these calls through loudspeakers in the presence of other members of the group. When a sequence consisted of a threatening call by a dominant animal followed by a submissive vocalization by an animal known to

be subordinate to the first, the performance elicited no particular reaction. But when a threatening call by a subordinate was followed by a submissive vocalization on the part of the dominant animal, the reaction was one of great surprise. The dominance hierarchy is extremely resistant to change, and submissive behavior on the part of an animal known to outrank an aggressor on this scale would be quite unexpected. The observed difference here is not due to any difference in the “meaning” of the calls in the two occasions: it represents the ability of the animals to take into account the context in which a given behavior occurs, and to derive information from the occurrence of that behavior in that context.

Once we recognize that vervet monkey alarm calls are only produced in very narrowly constrained contexts, and their import therefore requires very little effort of interpretation, there is nothing further we need to say about the way they furnish information to other animals. Recognition of this fact leads to an abandonment of the interpretation of these calls as ‘functionally referential’ (Wheeler & Fischer 2012).

Indeed, the ability of animals to observe and interpret the behavior (including vocal and other signals) of others is not at all limited to their conspecifics. Cheney & Seyfarth (1990: 158ff.) describe the ability of vervets to derive information from the alarm calls of other species with which they share territory. This includes those of the superb starling (*Spreo superbus*), which has distinct alarm calls (acoustically quite unlike anything in the vervets’ own repertoire) for terrestrial and aerial predators. While the set of predators of concern to the starlings includes ones that are dangerous to vervets, it also includes a number of others (including the vervets themselves) that of no concern to them. Accordingly, when the vervets hear a starling alarm, they pay some attention, distinguishing terrestrial sources of danger from aerial on the basis of which call they have heard. Their response, however, has somewhat less urgency than when they hear the alarm calls of their own species, especially in the case of the starlings’ terrestrial predator alarm.

Many other instances in which members of one species make use of the behavioral signals of another are to be found in the literature, and it is clear that this ability, as opposed to an animal’s innate response to the signals of conspecifics, arises on the basis of observation. One example that demonstrates this involves ringtailed lemurs (*Lemur catta*) and another lemur species, Verreaux’s sifaka (*Propithecus verreauxi verreauxi*). The two have distinct, species-specific alarm calls for aerial and terrestrial predators; in Madagascar, where they live sympatrically, each responds to the calls both of their own and of the other species. In a Japanese animal park where there is a population of ringtailed lemurs but no sifakas, however, the playback of sifaka alarm calls elicits no reaction from the ringtails (Oda & Masataka 2010).

There has long been a tendency to try to treat animal signals as information-bearing symbols like the words of our language, but it seems more productive to see communication as relying on the ability of one animal to interpret the behavior of another in its observed context. Animal signals do not have the character of symbols, comparable to words in a human language, but observers can still derive information from them by taking into account the context in which they are produced. This in turn suggests that the ‘meaning’ conveyed by these signals is a matter of *pragmatics* rather than *semantics*. The difference between these two ways of understanding communication is succinctly described by Zufferey & Moeschler (2012: 10):

la sémantique étudie la *signification* des *mots* et des *phrases hors contexte* et la pragmatique étudie le *sens* des *mots* et des *énoncés en contexte*. [...] le point de séparation entre sémantique et pragmatique est l’intégration ou non

du contexte dans l'étude du sens.

In an important sense, animal signals do not have a meaning apart from the context in which they are produced: this becomes clear when we take into account the wide range of communicative signals such as the grunts, screams, whrrs, chutters and other vocalizations of primates beyond the specific case of alarm calls. Of course, in the case of signals like predator alarms that are only produced under a narrowly restricted set of circumstances, it is perfectly possible to provide a truth-conditional formal semantic analysis that attributes apparently independent meaning to the signal, as is done by Schlenker et al. (2014) for the alarm calls of Campbell's monkeys (*Cercopithecus campbelli*). This does not mean, however that the semantic analysis provides an accurate account of what is going on in the production and interpretation of such alarm calling behavior.

Schlenker et al. (2014) discuss the alarm calling behavior of two populations of Campbell's monkeys, one living in an area (the Tai forest of Ivory Coast) where both eagles and leopards are dangerous predators, and the other in an area (Tiwai island, Sierra Leone) where there are eagles but no leopards. No significant genetic distinctions appear to differentiate the two groups. Both groups have an inventory of calls including one ("hok") that is used by both when eagles are spotted, and another ("krak") that is used in Tai when leopards are identified, but in Tiwai simply as a general alarm.<sup>3</sup> Two analyses are offered, on one of which "krak" has different lexical meanings in the two areas, and on the other where a pragmatic scale is invoked for the monkeys in Tai, by which "krak" refers to a more serious danger, in the form of a terrestrial predator (a leopard).

A simpler account, however, arises if we say that both "hok" and "krak" are calls that are evoked under situations including those in which dangerous predators are identified, with some innate bias toward "krak" when the danger is more imminent. Since leopards constitute a more imminent threat than eagles, in areas where these are encountered the result will be more "krak" calls in those situations, and the monkeys will have the opportunity to associate those calls with the relevant threat. In areas where there are no leopards, however, no such predator-specific associations can develop, just as ringtailed lemurs with no exposure to Verreaux's sifakas have no opportunity to learn to associate the calls of that species with dangerous situations. While either the lexical semantic analysis or the alternative with a pragmatic scale based on meanings can give a descriptive account of the differences in sensitivity to various calls between the two populations, neither seems to be called for as opposed to a more direct interpretation in terms of different learned associations with varying conspecific behavior in differing contexts: a purely pragmatic matter.

## 4 Conclusion

What, then, should we conclude about the relation between the characteristics of human language and those of the communicative behaviors of other animals? It seems clear that the ways in which other animals communicate in nature do not have the most important structural properties of human language, contrary to the hopes and claims of Doctor Dolittle. Among these are the combinatory possibilities provided by a hierarchical,

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<sup>3</sup>Both "hok" and "krak," as well as elaborations of these, are also used in some non-predation contexts, but the focus of Schlenker et al.'s (2014) analysis is on their association with predators. These facts are difficult to reconcile with any claim that "hok" and "krak" have lexical meanings that refer to predators, however.

recursive syntax; the capacity for lexical expansion provided by a phonology based on recurrent combination of members of a small set of individually meaningless elements; and the association of arbitrary learned context-independent meanings with individual elements (the words) of the communication system. No non-human system, so far as is known, displays these essential properties of human language.

Furthermore, this cannot be seen as a mere accident, a failure of other species to seize on the adaptive value of these properties and invent communicative behavior similar in its possibilities to our own. Intensive experimentation has inevitably led to the conclusion that no other species has the cognitive capacity to acquire and use such a system. This is true even when a strong system of incentives is in place to encourage such learning: chimpanzees in the laboratory will do a remarkable number of otherwise less than natural things to earn rewards such as M&M's, but that has not enabled genuine language learning.

As stressed above, this should not be seen as an unusually perplexing result. Human language, like the communication system of any species, is essentially grounded in the biology of the species that employs it — *Homo sapiens*. By this I do not intend to suggest that the communicative behavior of other species is uninteresting compared to human language, or that it is inferior for the purposes to which it is put in a diverse range of ecological circumstances. It is necessary, however, to recognize that human language is fundamentally different from these other systems, and that it is quite misleading to speak of animal “languages.”

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