Doctor Dolittle's Delusion

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Animals and the Uniqueness of Human Language

Stephen R. Anderson

With illustrations by Amanda Patrick

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for the Bunnies

Already I see gray hairs showing at your temples, Tommy. If you try to write down everything the Doctor did, you'll be nearly my age before you've finished. Of course, you're not writing this book for the scientists exactly; though I often think since you are the only person so far—besides the Doctor—to talk animal languages at all well, that you ought to write something sort of—er—highbrow in natural history. Usefully highbrow, I mean, of course. But that can be done later, perhaps.

—Polynesia the parrot, from *Doctor Dolittle's Zoo*

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⤞ Preface ⤝

For invaluable information about animals and their ways of communicating, I am grateful to colleagues and students in numerous classes devoted to this material. Years ago Greg Ball, Moise Goldstein, Stewart Hulse, and I participated in a seminar at Johns Hopkins University that made me want to explore these matters and their relation to human language in greater detail.

That interest became much more focused when Letitia Naigles and I offered a course on communication and language abilities in animals at Yale University in 1996. I have benefited greatly from Letty's contributions to that class, which she will see reflected here in many places (especially in Chapter 10). Students in subsequent incarnations of that course have helped me with their insightful questions (as well as such contributions as Figure 1.1). I am also indebted to Alison Richard (for showing me how interesting lemurs are) and David Watts (for much information about monkeys, chimpanzees, and gorillas—too little of which shows up in these pages).

Nearly all of this book is drawn from the existing literature, rather than from investigations I have conducted myself. While I have tried to acknowledge in the notes particularly obvious sources on which I have drawn, a full documentation of everything here would be far too distracting for the nonspecialist reader. I must make special mention of the work of Marc Hauser, however, particularly his comprehensive survey *The Evolution of Communication.* Many of my unattributed and otherwise offhand remarks about animals draw on this work, and any potentially serious student of the subject should certainly have a copy.

My goal in this book is not comprehensive coverage of everything that

is known about animal communication. Rather, I discuss systems and species for which a comparison with human language seems productive. The reader with a broader interest in animal communication can consult such general works as Bradbury and Vehrencamp's *Principles of Animal Communication.* In-depth information about birds will be found in Kroodsma and Miller's *Ecology and Evolution of Acoustic Communication in Birds;* Gerhardt and Huber provide a current survey of research on *Acoustic Communication in Insects and Anurans.* None of these works provide much information about *human* communication, but each gives much more detail on the species that are its subjects than I could possibly cite.

I am concerned here with a specific cognitive ability in animals—communication—and I cannot do justice to the vaster literature dealing with animals' cognitive capacities in general. While it has often been fashionable to maintain that animals are purely mechanical systems with no mental lives to speak of, this view has little if anything to recommend it in light of the masses of evidence accumulated by ethologists and other students of the lives of animals. The work of Donald Griffin has been particularly influential in this regard. His book *Animal Minds* is an excellent place to explore some of the issues I cannot go into here, as is Hauser's *Wild Minds.*

This book has benefited enormously from comments by Janine Anderson-Bays, Diane Brentari, Marc Hauser, Norbert Hornstein, Paul Moore, Duane M. Rumbaugh, and three anonymous reviewers. Louis Goldstein provided some of the sound files used for analysis in Chapter 5, and Susan Fischer passed along valuable evidence to which I refer in Chapter 9.

I am grateful to Amanda Patrick for the charming drawings with which some of the more tedious stretches below are enlivened. Finally, I express my appreciation to my editors at Yale University Press. Apart from immensely helpful suggestions, including ways to leaven and generally improve my rather rigid prose, Jean Thomson Black contributed greatly by seeing this book through a number of unanticipated difficulties—and by having faith in it. It certainly would not have come into existence without her aid and advocacy. Vivian Wheeler made vast improvements in the style, for which the reader will be as grateful as I am.

1

Animals, Language, and Linguistics

"Why don't some of the animals go and see the other doctors?" I asked.

"Oh Good Gracious!" exclaimed the parrot, tossing her head scornfully. "Why, there aren't any other animal doctors—not real doctors. Oh of course there *are* those vet persons, to be sure. But bless you, they're no good. You see, they don't understand the animals' language; so how can you expect them to be of any use? Imagine yourself, or your father, going to see a doctor who could not understand a word you say—nor even tell you in your own language what you must do to get well! Poof!—those vets! They're that stupid, you've no idea!"

—*The Voyages of Doctor Dolittle*

Hugh Lofting's fictional Doctor Dolittle certainly was kindly and well-meaning—indeed a great man, and one who accomplished much for the animals he loved. Nonetheless, he must have been suffering from a serious misconception: the delusion of this book's title. Merely believing that all animals have ways of communicating with one another would have been an eminently sensible position for the renowned naturalist to take. Where he (together with his friends in the books—and all too many others, down to the present day) went off the track was in equating these abilities with the human faculty we call *language.* In pointing this out, I certainly do not mean to denigrate the good Doctor and his colleagues, but as I am sure he would have acknowledged, scientific truth cannot be ignored.

For there is indeed a science that can sensibly establish the fact of the matter: *linguistics,* a field whose relation to language and languages is every bit as principled as the relation of, say, geology to rocks, minerals, and mountains. Over the past century or so, a scientific understanding of human natural language has developed. It is specialized and technical in its relation to its subject matter, with methods and results that are not instantly apparent but are nonetheless well supported by a long tradition of inquiry. People sometimes are incredulous to hear linguists suggest that what they are doing is somehow comparable to physics, but a great deal that is known about language has a genuinely scientific character, and can be appreciated only on the basis of an understanding of the relevant science.

Every normal human being raised under normal conditions has fluent control of at least one language. It is tempting to conclude therefore that the organizing principles of language should be evident to anyone who chooses to think about them. But this is a mistake, and one that seriously underestimates the complexity of the matter. Hardly anyone would argue that golfers or baseball players, adept as they are at controlling and predicting the flight of balls, must as a consequence know everything there is to know about the physics of small round objects. The systematic study of language similarly reveals properties that are far from self-evident.

When examined scientifically, human language is quite different in fundamental ways from the communication systems of other animals. Still, there are interesting and sometimes quite detailed similarities and we can learn important things about the one by studying the other. In the end, though, the differences are so important that we must not obscure them. What other animals do is not just their own variant of our human talk, in the way Japanese is a variant of what English is. Pursuit of that analogy

makes it impossible to understand the basic nature of human language or to see animal communication systems in their fascinating richness rather than as some pale imitation of English.

Indeed, the central question of this book might be: To what extent is our use of natural language a uniquely human ability? In answering I want to convey some of what the modern science of linguistics teaches us about the basic properties of language. To put the result of that inquiry into some sort of perspective, I take other communication systems seriously as well in presenting what is known about their basic properties. I explore two fascinatingly rich and detailed areas of inquiry: animal communication and cognition on the one hand and human natural language on the other. Although they differ in fundamental respects, we can learn a great deal by comparing them.

For much of human history, use of language has been cited as a characteristic that defines human beings and sets us apart from all other animals. Since the 1970s, though, the purported uniqueness of this capacity has come under attack. It seems fair to say that the current understanding in the popular press is that the conception of language as an ability limited to humans is not only outmoded but even a kind of prejudice that science has shown to be wrong—along with many other supposed differences between humans and nonhumans such as the use of tools and the cultural transmission of knowledge and behavior. Other animals, this opinion holds (specifically various higher apes, such as chimpanzees), can be taught a human language and can use it to communicate. And anyone who says otherwise is a rank species-ist.

Consider a review article that appeared in the *New York Times Book Review* not so very many years ago. Its thrust is that we humans ought to be kinder to our ape cousins, and I have no quarrel with that. But throughout are casual references to the notion that chimpanzees, gorillas, and perhaps other apes "have become fairly fluent . . . in sign language, . . . certainly seem capable of using language to communicate," and so on. The bonobo Kanzi, of whom we will hear more later in this book, "remembers and describes" a spot in the woods. One of the several books covered in this review, the novel *Jennie,* involves a chimp who is taught sign language, and "learns to express herself."

All of this takes for granted that, with proper training, some nonhuman primates (and perhaps other animals as well) can be provided with the gift of language, even if their species has not yet figured it out. The notion is

certainly not unique to this reviewer, Douglas Chadwick: a 1996 novel, *The Woman and the Ape* by Peter Høeg (the author of *Smilla's Sense of Snow*), involves an ape who is brought to language school. The wife of the experimenter comes to feel that the ape is being exploited. She takes up with him, and they run off together to have an extremely expressive relationship.

Many readers will recall George Orwell's classic *Animal Farm,* where the animal characters are fully fluent in English: they even manipulate one another by manipulating the language. When I was a child, I read a series of "Freddy the Pig" books (by Walter R. Brooks) that also involve a barnyard full of talking animals. While Orwell's book is allegorical, and I did not take Freddy and his colleagues all that seriously, Chadwick's review and Høeg's novel are not meant to be allegory, childish fantasy, or science fiction. Presented as having a basis in current science, they are intended as novelistic treatments of possible situations. Chadwick certainly thinks, for instance, that the author of *Jennie* "seems thoroughly versed in ape research and in the debates surrounding it, and for readers unfamiliar with the subject, his well-intentioned novel makes a fine introduction."

To the extent that Chadwick's assessment is shared, the ability of suitably trained apes to converse with us in a natural language (at least with proper training) has become a more or less accepted fact. It gets worse: as the article shown in Figure 1.1 makes clear, the vanishing distinction between the abilities of humans and of other primates to use language may even be something for naive Web surfers to worry about . . .

Yet, as Chadwick puts it, a proper appreciation of animals' cognitive capacities in this domain is threatened by a band of unsympathetic characters who are "intent on preserving language and reason for the exclusive use of humans." These are the so-called linguistics experts—folks such as the present author. Intent on defending the exclusivity of our scientific turf, we comprise curmudgeons, romantics, and/or elitists who cling to human uniqueness with respect to language in the face of the apparent facts.

Actually, as David Pesetsky pointed out in his response to Chadwick's review, published in a later issue of the *New York Times Book Review,* linguists would be "delighted and intrigued to discover" language in the relevant sense in other primates—or in cockroaches, for that matter. When we look closely, however (and experimenters have tried *awfully* hard), that is not what we find. It appears to be an empirical result, not merely an anthropocentric prejudice, that human language is *uniquely* human, just as many

So you think you've met the love of your life through your computer? Think again!

Your Internet dream gal may be a CHIMP!

Trained apes are surfing the Web — posing as women!

INTERNET expert George Leriger.

By SANDRA LEE / Weekly World News

DETROIT, Mich. — If you're looking for love on the Internet, you'd better be careful — chimpanzees are surfing the Web and some of them even have the ability to type short words and simple sentences!

"Many gentlemen who are trying to find romantic companionship on the Internet fear that their dream girl is really a dirty old man pulling a mean trick on them," said Internet expert George Leriger.

"But it could be far worse and more embarrassing than that. It may well be a chimp on the other end of your computer connection."

Computer users often spend hours at a time in Internet "chat rooms" where they can "talk" directly to another user by typing in their responses.

The computer-savvy chimps have been trained in special programs in the United States, Canada and Europe. Animal experts have worked with the clever primates to teach them to distinguish words on a computer screen and type in short responses.

"It's much like Koko, the famous gorilla who learned to use sign language to communicate with humans," Leriger said.

"There will be many practical uses for society if chimps can successfully be trained to respond to computers."

Leriger said the chimps can't type in long, complex sentences but they can respond with yes, no and simple phrases. One of the phrases a few of the chimps have mastered is "I Love U."

"It seems impossible that 'yes' and 'no' responses and an occasional show of affection could be enough to make a person on the other end of the computer think they've found a love interest," he said. "But we have looked at transcripts from the chimps' computers and it's clear that has happened quite a few times."

The chimps have full access to computers for up to 14 hours a day during their training.

"The chimps enjoy the chat rooms because there is so much going on in them," Leriger said. "A lot of words flash by on the screen and chimps enjoy that."

Figure **1.1** Vanishing distinctions bring new threats

complex behaviors of other species are uniquely theirs. Doctor Dolittle, despite his good intentions, was laboring under a misapprehension.

Chadwick's review inverts the usual logic of the literature about the behavioral and cognitive abilities of animals. What we more often hear is that "apes (chimpanzees, gorillas, . . .) are a lot like us. Therefore, there is no reason in principle why they could not control a language, just as we do."

Chadwick's argument goes the other way: he suggests that since apes really can express themselves and communicate in a language, they must be a lot like us; therefore we should be more considerate of them. Surely, though, we do not need this argument to arrive at the conclusion that considerate and humane treatment of animals is warranted. It is a good thing we do not, because when we look at the evidence, there *do* seem to be significant differences in the language-using abilities of humans and other apes.

Of course, we do have much in common, and it is meaningful to study and understand these commonalities. Their existence, though, does not mean we have (or could have) *everything* in common. For instance, no one denies that humans and bats share a great deal by virtue of being mammals. But even the most dedicated and brightest of human children could hardly be trained to fly by vigorously moving their arms about, or to use echolocation to catch insects. That we are clever enough to build airplanes and sonar systems to accomplish similar ends in different ways does not alter this fact: there are genetically determined differences between humans and bats that establish the limits and possibilities for each.

It seems likely that the human capacity for learning, speaking, and understanding languages is determined by our innate cognitive and neural organization, and as such is uniquely accessible to organisms that have the same specific organization. This capacity develops in the course of human maturation, in the presence of relevant experience—much as other cognitive systems, such as vision, have been shown to do in more limited ways. In the absence of the appropriate biologically based organization, the experience that gives rise to our knowledge of language cannot have that effect, no matter how carefully structured.

Aha, you say, the bat analogy misrepresents the issue. We can't fly because we don't have wings, and we can't catch bugs for lack of the right sensory organs for echolocation. Since language is a kind of behavior, not a physical organ, the argument from genetics fails. Humans and, say, chimpanzees both have brains, mouths, and ears, and those brains, mouths, and ears are quite analogous in their overall structure. Furthermore, humans do not develop language uniformly, the way bats of a given species all come to catch bugs the same way. Rather, we each learn the particular language that happens to be spoken by the community surrounding us; surely that proves that language could not be innate.

But consider this estimate cited by Steven Pinker: "Half of our 100,000 genes are expressed primarily in the brain, [and certainly] species differ

from one another innately, [and] humans differ from one another innately on every quantitative trait, and . . . human cognitive accomplishments are solutions to remarkably difficult engineering problems, [so] I myself don't doubt that much of neural organization is innate. Of course that leaves open the question of what aspects of language in particular are innate." With the recent mapping of the human genome, we now know that the actual number of genes is probably less than half the number Pinker cites. Nonetheless, the estimate of the proportion of genetic material devoted to the brain and nervous system continues to "range from 'a fair chunk' to '40%' to 'most.'"

There are excellent reasons to see much of behavior and cognition as closely related to the genetically determined organization of the organism, and thus at least adequate reasons to speak of a human language "organ," with a structure determined by human genetics. Organisms with this organ acquire and use languages of the human sort, whereas organisms without it do not (and cannot), any more than we can fly or catch mosquitos by echolocation in the absence of the relevant species-specific equipment.

How much of language is determined by our uniquely human genetics? To address the question, I need to clarify what we mean by *language.* This goal, in turn, requires distinguishing a specific sense of *language* from a much more general sense that is close to the broad notion of *communication.*

We commonly talk about all sorts of things as language—the language of dreams or of films, body language, even the language of traffic lights. Common to all of these is that they involve communication: one individual (or the film, or the traffic light) emits some kind of signal from which other individuals can derive information. Surely it is not *that* sense of language which is at stake. Everyone grants that organisms a lot less complex than chimpanzees communicate. We would not want to say, though—because organisms of all sorts can determine information from olfactory, visual, or other signs about when an individual of the opposite sex is interested in mating—that no fundamental distinctions can be made, and that language is really universal. The issue is not whether communication takes place in all these circumstances, but rather *how* that communication takes place, and what sort of system it is based on. When we make these inquiries about human communication, a rather special and much more specific sense of "language" emerges.

What I am talking about, more specifically, is the use of systems such as English, French, Japanese, or Potawatomi. Just what *is* a natural language? The definition is at bottom what linguistics is all about, and any

snappy, aphoristic definition is virtually bound to fail. In general, every science starts from a presystematic notion of its subject matter, and its results serve to provide a more systematic reconstruction of the properties of the object of inquiry: rocks, molecules, organisms, political systems and economies—or languages. If we could sum up the significant aspects of any of these items in a few sentences, the scientists who study them could leave for the beach, their labors complete.

Short of a completed science, though, treating natural language the way the U.S. Supreme Court has sometimes treated pornography ("I know it when I see it") moves us quite a distance. We know that English, French, and others are natural languages in ways that traffic lights or cinematic symbolism or Fortran, for example, are not. We may not always know what *a* language is (witness the Ebonics discussion of the late 1990s), or when one language is the same as another (consider the sense of "Serbian" as opposed to "Croatian" or "Bosnian," three largely similar forms of what used to be called "Serbo-Croatian," before the breakup of the former Yugoslavia in 1991–92). Nonetheless, we know there is a difference between *language* and other forms of communication.

For generations, philosophers have agreed that the remarkable feature that gives human language its power and its centrality in our life is the capacity to articulate a range of novel expressions, thoughts, and ideas, bounded only by our imagination. Using our native language, we can produce and understand sentences we have never encountered before, in ways that are appropriate to entirely novel circumstances. We will see in Chapter 8 that human languages have the property of including such a discrete infinity of distinct sentences because they are *hierarchical* and *recursive.* That is, the words of a sentence are not just strung out one after another, but are organized into phrases, which themselves can be constituents of larger phrases of the same type or other types, and so on without any boundary.

It is this structural property that gives language its expressive power, so it is reasonable to ask of any candidate for comparable status that it display recursiveness as well. We will see that there is much more to the characteristic syntactic structure of human languages than just recursion, but this is incontestably a core property, sine qua non.

The central issue of this book comes down to a pair of related questions. To what extent do animal communication systems share essential properties with those of human language? (For the reasons just described, pay particular attention to the question of whether these systems display the

characteristic properties of unboundedness, hierarchical organization, and recursion.) And if there do indeed remain significant areas of nonoverlap, can any animals other than humans be *taught* to use a communication system with the essential properties of a human natural language?

These questions define my agenda here: to arrive at an understanding of the way animals communicate in nature, to show how the properties of animal communication systems relate to those of human natural languages, and to determine whether the differences we find can be bridged by training. In the process I survey a number of different animal systems, and also provide enough of an introduction to the characteristics linguists have found in human languages to make the comparisons scientifically meaningful.

Chapter 2 begins by discussing briefly what "communication" is, together with attempts to define language in terms of a set of necessary and sufficient conditions on communication systems more generally. Checklists of this sort invariably end by misrepresenting the object they attempt to characterize, and cannot substitute for a more detailed and nuanced exploration of its properties.

Chapter 3 addresses two sides of a basic problem in studying cognition. In some instances we tend to overinterpret what seems complex to us, while in others we take too much for granted about behavior that appears simple and straightforward. I discuss some of the classic pitfalls in trying to answer questions about animal cognition. If we want to be neither tryingly skeptical nor irrationally exuberant about animals' abilities, subtle questions must be taken into account in interpreting their behavior, especially when that behavior seems strikingly flexible and appropriate to a situation as we interpret it. The other side of this coin is the likelihood that the apparent simplicity and ease with which we deploy our own skills as language users belies the complexity of the system involved, a complexity rooted in human biology. Neither the fundamental intricacy of a behavioral pattern nor its essential simplicity can necessarily be read from its immediate appearance.

Continuing the exploration of the way one investigates cognition, especially in nonhumans, I turn in Chapter 4 to one of the best-known examples in the animal communication literature, the dances performed by forager honeybees. These dances provide information that fellow bees *could* use to locate the desiderata of apian life: pollen, nectar, and potential locations for new colonies. However, that fact alone does not determine the correct

interpretation of the dance behavior. In the process of studying this system, I make another methodological point: a good story is not necessarily self-validating, although in the end it may turn out to be true.

I then touch on matters more specifically related to the nature of language. In Chapter 5 I discuss some fundamental properties of sound, the medium in which most linguistic transactions occur. Understanding the acoustical structure of the sounds organisms produce, how they produce those sounds, and how sounds are dealt with by the brain and the auditory system is essential to any account of communicative behavior. I begin with a system that is comparatively simple, the calls of frogs. The frog's production and perception systems are closely attuned, making the animal especially adapted to respond appropriately to the specific sounds that are ecologically important to it. This lesson is applicable to a broader understanding of perception, including the analysis of speech in humans that occupies the bulk of the chapter.

In Chapter 6 I look at an even more elaborate acoustic system, that of birds (especially of oscine songbirds). Interesting parallels exist with some properties of human language, though many fundamental differences are present as well. One intriguing possibility that emerges from the study of birds is that of tracing connections between the systems of song production and perception in much greater neurological detail than can be done in other organisms, suggesting conclusions that dovetail nicely with proposals about human speech. Again, biologically determined systems that specialize in the processing of ecologically important signals emerge. The most significant human parallel, however, is probably with the development of a bird's song system, an area that has been the object of enormous research. Similarities between the acquisition of song by birds and of speech patterns by human infants are strong enough to merit a fairly extended discussion.

Primates are the focus of Chapter 7, where I consider some of our knowledge about the communicative behavior of prosimians, monkeys, and apes in nature. This discussion centers on the set of alarm calls that a variety of primates produce in the presence of predators. These raise important questions about the extent to which we should ascribe meaning to animal signals in the sense that words of a human language refer to objects in the world external to the speaker. Besides alarm calls, primates produce a variety of other vocalizations that have communicative importance. We can learn from these calls, but the range of their external expressions turns out

to be rather restricted. If writers pessimistic about the mental life of non-humans are to be believed, the animals might just have very little to say—but the evidence for sophisticated thought processes is hardly negligible.

What does account for the massive differences in expressive capacity between human languages and the communicative systems of other animals? As already suggested, the answer turns out to be a central (if often misunderstood) property of language: the system of syntax, with its hierarchical and recursive structure. For those whose only systematic exposure to grammatical analysis came in high school English classes, syntax may seem only a perverse, prescriptive fixation. That is not at all the case. In Chapter 8 I sketch a few of the remarkable syntactic properties of human language, and some of the reasons to believe that this organization is a genetically determined capacity specific to our species.

In Chapter 9 I build a foundation for addressing another of the questions posed above, concerning efforts to teach our languages to other species. To this end, a consideration of the properties of manual (or signed) languages is in order. These have been the basis of the best-known and most ambitious experiments of this sort to date. Contrary to popular opinion (including that of the cat's-meat man quoted at the start of Chapter 9), science has shown that manual languages such as American Sign Language, or ASL, have all the essential structural characteristics of natural languages such as English or Arabic, even though they involve gestures other than those of speech.

If an ape really could learn to use ASL, that would count as learning a natural language. It was in that direction that researchers concentrated their efforts in the 1960s and 1970s. I survey a number of those projects (Washoe, Nim, Koko, Chantek) in Chapter 10, along with other studies that abandoned all similarity to the actual modality of human natural language (speech or sign) in favor of purely arbitrary symbols played out on a keyboard or plastic tokens arranged on a board. For a variety of reasons, all fall far short of demonstrating language abilities in other species.

The most interesting—and also the most scientific—work of this sort that has been done involves apes of a different species, bonobos (often misleadingly called pygmy chimpanzees), and particularly the justly celebrated Kanzi. These animals appear to come somewhat closer than other apes to what we might call genuine linguistic ability. Kanzi's interpretation of certain spoken English sentences is particularly seductive. The ultimate conclusion nonetheless seems to be that when we look at the parts of the system

apes can learn to control, the crucial distinguishing properties of language (especially recursive syntax) are still missing.

It is worth stressing once more that this negative conclusion is not the reflection of some presumed species-centrism on the part of linguistic science. If we were to find that other species (say, bonobos) could truly learn the significant parts of a human language, the result would fascinate linguists, not repel them. On the available evidence, though, no such claim seems warranted.

Short of actually learning a language, some of the animals in these studies have demonstrated abilities involving the use of arbitrary symbols for rather abstract concepts. Were we to think of language exclusively in terms of symbolic communication, that would suffice. The actual richness of the expressive capacity of human language, though, depends on further elaborations of exactly the sort that animals do not achieve. Exploring the abilities they display in these studies (but not, apparently, in nature) is certainly relevant; but that is a separate issue from whether or not they have the capacity to learn and use a language in the specific sense that refers to human languages.

By using the expression "human language" repeatedly, I do not of course mean to exclude a priori anything a nonhuman might do. The properties of language that I discuss in the chapters to come are abstract enough to be dissociable from the activities of human vocal tracts and ears, hands, and eyes. They would be directly identifiable in the behavior of other animals if they were indeed found there. Nothing about language in the sense intended here is intrinsically limited to systems with our specific physical organization—though as a matter of empirical fact, the capacity for language *does* seem to be limited to organisms with our specific neurological and cognitive organization.

Research that has been conducted with an African grey parrot named Alex supplies a cautionary note concerning our lack of success in teaching human language to animals. Alex does some remarkable things, more impressive in many ways than the linguistic accomplishments of the widely touted chimpanzees. That should give us pause in interpreting the research done with primates, because common sense would seem to tell us that chimpanzees are smarter than parrots. Still, even Irene Pepperberg's fascinating work falls short of what it would take to demonstrate a capacity for something with the essential properties of human language in another animal species.

On the basis of the available evidence, language as it appears in humans seems inescapably to be a uniquely human faculty with its own unique characteristics, part of the biological nature of our species. If that is the case, language must have arisen in the course of our evolution, separate from that of other primates. In Chapter 11 I survey the little that is known about the precise course of those developments. In the end, I return to the conclusion that the distinctly human ability that has arisen in us is not, as often assumed, the capacity to use arbitrary meaningful symbols, but rather the ability to combine those symbols syntactically.

I do not discuss many of the other animals whose communicative abilities have been the object of various studies. We do not really know what the structure of such systems might be. For instance, the communicative behavior of elephants has evoked a good deal of interest in both scientists and the general public. It seems likely that elephants produce very low frequency sounds with considerable energy, acoustic waves that can be detected by other elephants at great distances. There is little doubt that listening elephants can derive information from these sounds, and that this may influence their behavior. So is there a language of the elephants? In the sense of a language of traffic lights, obviously there is. But until we have some understanding of just what messages this system can convey, what aspects of the signal's structure are relevant to determining those messages, or how much the elephants "sending" the message intend to communicate some particular meaning, we cannot say much about it.

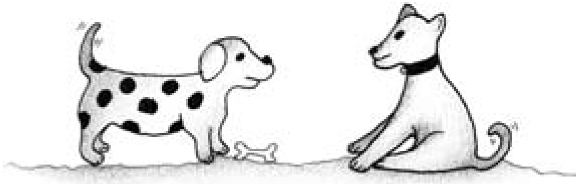
The same is true of other, even more famous cases, such as the vocalizations of whales and dolphins. It is abundantly clear that these animals are highly intelligent and that they engage in communicative behavior. The structure of their communications, however, is simply not understood. While it would certainly be interesting if it turned out that way, there is no reason beyond wishful thinking to believe that when we do come to understand the nature of cetacean vocalizations, they will have the essential structural properties of human languages—whatever fascinating specific properties they *do* have.

Part of my intention is to convey a sense of the remarkable diversity of the species-specific means of communication used by the world's animals. If some of the irreducible particularity we find has the consequence of setting off human language from other systems, that is no more surprising than the discovery that other biological specializations lead to equally

particular, indeed unique, abilities in many animals. These differences are not a matter of philosophy, theology, or misplaced humanist sympathies; they are empirical features of nature. We may not be able to take flight by flapping our upper extremities, but we are the only species known that can rationally discuss our inability to do so. As Bertrand Russell famously put it, "A dog cannot relate his autobiography; however eloquently he may bark, he cannot tell you that his parents were honest though poor."

2

Language and Communication



At tea-time, when the dog, Jip, came in, the parrot said to the Doctor, "See, HE's talking to you."

"Looks to me as though he were scratching his ear," said the Doctor.

"But animals don't always speak with their mouths," said the parrot in a high voice, raising her eyebrows. "They talk with their ears, with their feet, with their tails—with everything. Sometimes they don't WANT to make a noise. Do you see now the way he's twitching up one side of his nose?"

"What's that mean?" asked the Doctor.

"That means, 'Can't you see that it has stopped raining?'" Polyne-

> sia answered. "He is asking you a question. Dogs nearly always use their noses for asking questions."
>
> —*The Story of Doctor Dolittle*

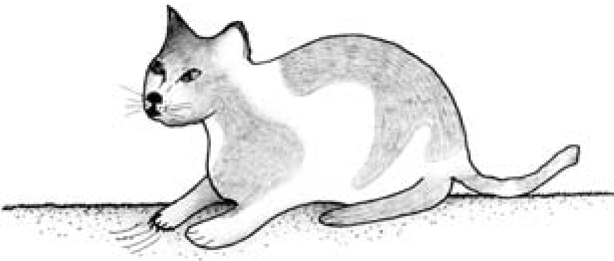
Communication is virtually universal among living things. Even bacteria communicate. Some classes of bacteria secrete distinctive organic molecules, for which they have specialized receptors. This apparatus allows the bacteria to detect the presence of others of the same species, a system known in the literature as quorum sensing. "Bacteria, it turns out, are like bullies who will not fight unless they are backed up by their gang. An attack by a small number of bacteria would only alert the host's immune system to knock them out. So bacteria try to stay under the radar until their numbers are enough to fight the immune system." The molecules secreted by one bacterium serve to communicate its presence to the others. Yet surely not all communication is of a piece with all other communication: the use of the word *talk* in the title of the *New York Times* story about quorum sensing is simply the journalist's effort to be clever.

To determine the true issue here, consider an example. One evening I returned home to find my wife correcting papers for her French class. When I asked her what we were doing for dinner, she said, "I want to go out." That is, she produced a certain sequence of sounds, and as a result I knew that she wanted us to get in the car and drive to a restaurant, where we would have dinner.

When I came home the following night, I found my cat in the kitchen. She looked at me, walked over to an oriental rug in the next room, and began to sharpen her claws on it. She knows I hate that . . . and as I came after her, she ran to the sliding glass door that leads outside. I yelled at her, but my wife said, "Don't get mad; she's just saying, 'I want to go out.'"

We conclude that both my wife and my cat can say "I want to go out." Do we want to assert that they both have language? Surely that is at best an oversimplification, although it is clear that both can communicate. Each can behave in such a way as to convey (somewhat similar) information to me.

Here is a sketch of how "real" communication takes place: One organism has a message in mind that he or she wants to communicate to another organism. He or she emits some behavior (makes a noise, scratches the carpet) that encodes that message. The other organism (me, for example) per-



ceives the behavior, identifies it in terms of the meaning encoded, and treats the result of that decoding as the meaning of the message.

Sometimes called the Message Model of Communication, this description may seem fairly obvious, but is it a valid general definition of communication? Communication can take place even when there is no evident basis for saying the communicator "intends" to communicate anything. Think of our bacteria above, or a blush, or the visible signs in many species when a female is in estrus and receptive to mating: there is no intention on the part of the signaler, but a message is communicated all the same.

On the other side, it may be that the recipient interprets the message only in part on the basis of its literal content and relies also on various non-overt contextual or social factors. Consider "Can you pass me the salt?" Here the literal content is an inquiry about the listener's physical capacity to perform an action, but the message usually conveyed is a request that the salt indeed be passed. Or perhaps I ask my colleague what she thinks of the candidate we have just interviewed for a job, and she says "He seems very diligent." In an academic context, this implies a very negative recommendation. If a candidate's best quality is diligence, it is *not* creativity, imagination, or inspirational teaching. In both examples, clearly the linguistic content of what we say may be quite different from what we communicate.

The little story about my wife and my cat illustrates the characteristics of any communication system. First, what is the nature of the behavior or other signal? The cat scratches the carpet and runs to the door to convey a message we might interpret as similar to one my wife conveys by moving her vocal organs to produce sound. Second, what is the range of messages the system can convey? Evidently, my cat can say fewer things than my wife: what is the basis of this difference in expressivity? Third, what relation, if any, is there between the message expressed and the communicator's intentions? The cat certainly intends *something,* but her behavior

actually reflects her internal state; my wife can say what she does even if she doesn't really want to go out. Finally, what is involved on the receiving end? Obviously, you have to know the code in order to get the message, but what else? My wife and I understand the cat's scratching behavior as attention seeking in the context of my evident and constant displeasure at it, but is there some kind of underlying code that all three of us share?

Another important aspect of communication systems (not significant in this case) is how the communication system came into being. Did it evolve gradually out of something else, or did it spring into operation fully formed? My cat scratches the carpet basically to sharpen her claws; whatever additional meaning may accrue to that action has grown up ad hoc between us. Most systematic means of communication have more interesting and far longer histories.

This is an area of inquiry where the questions that can be raised are potentially more interesting than the answers currently available. Historical evidence for the sounds of language is minimal; even the soft tissue of tongues, ears, and brains leaves no trace in the fossil record.

The original nineteenth-century constitution of the Société linguistique de Paris is famous for explicitly prohibiting the discussion of matters concerning the origin of language at the society's meetings. This was no mere quirk of the founders: they introduced this limitation for precisely the reason that there could apparently *be* no real science that bore on the topic. Since the late 1990s, interest among linguists and others has reawakened, and conferences are now regularly devoted to the subject. To my mind, this revival is not based on additional data, but rather on the mistaken impression that if we can *pose* an important question, we ought in principle to be able to find an answer. Fortunately, we need not resolve this vexatious problem before studying communication systems and communicative abilities *comparatively* across animal species. We will return to these matters in Chapter 11.

Notions of Language and Communication

How might we distinguish between "language" and "communication"? One way of approaching the distinction is to note that communication is something we *do,* whereas language is a *tool* we can use. We can, of course, communicate without language, though the range of material we can transmit is limited in significant ways. Most of the amusement value of the game of charades, for instance, lies in trying to circumvent these limitations. In fact,

a desirable skill in this game consists in referring to words without actually using them (using gestures interpreted as "short word," "sounds like," and so on).

For comparison, the activity of building houses is also something we do, and we use particular tools to do it. Without hammers, nails, saws, and levels, we could not practice the construction trade as we know it. Yet that does not mean we could not construct shelters. We can do a certain amount of building without tools, or using different tools, as other societies do. Still, the structure of the tools makes certain sorts of construction easy and natural. We can study the structure of the hammers and saws and ask where they come from. We see, of course, that there is a close connection between the structure of the tools and what we can do with them, but we should not confuse the activity of carpentry or construction with the tools we use in pursuing it.

Suppose we want to open a nut. We do it by exerting force on the shell through a hard object—either with leverage, using a nutcracker, or by hitting it, for instance with a hammer. Chimpanzees in the wild open nuts by putting them on one rock, then hitting them with another rock—a technique similar to one used by humans. The tools are not identical, but they have the same structure in the relevant respects. There is an activity, and similar means are used in carrying it out. As far as communication is concerned, we do a lot with facial expressions, grunts, and the like. Again, considerable similarity among human and nonhuman primates exists in the activity and in the means for executing it.

Orangutans in nature do not use tools equivalent to those of human carpentry. But if we give an orangutan a claw hammer, and he knows that something good to eat is inside a wooden box that is nailed shut, he can use the claw hammer to remove the nails and open the box, much as a human would. Provide him with the tool, and his cognitive abilities are certainly adequate for using it in some of the ways humans do—ways that depend on the essential structure of the tool.

I imagine that chimpanzees can learn fairly quickly to open nuts with a nutcracker by utilizing the structure of the tool, which is novel to them but suited in form to the task. Yet if we give a chimpanzee a small tape recorder, I seriously doubt that the ape could use it to record grunts and send them to be replayed for another chimpanzee in order to communicate a message. The principal use of a tape recorder might be to serve as the base on which to put a nut in order to smash it.

These distinctions are important when asking whether another species (say, monkeys or apes) can use language. Provided with the proper tools, an ape can use them to engage in at least some "carpentry." What about language and communication? When we ask whether animals other than humans can engage in communication, the answer is, obviously. What is the structure of the means they use to that end, and how closely does their communicative activity resemble human natural language? If we supplied an ape with a human natural language, how much communication could he or she achieve? We need to know a certain amount about the structure of human natural language if we are to make these questions precise; the more we know, the more precise we can be.

In nature, the range of ways in which animals (especially other primates) communicate with one another is certainly not limited to vocalization. Smell (particular substances, such as those secreted by specialized scent glands in both lemurs and rhesus monkeys, as well as normal smells), sight (facial expression, posture), and touching (grooming behavior), among other modalities, also supply information, sometimes intentionally on the part of the communicator and sometimes not.

In terms of the structure of the tools involved, none of these systems seem to fall within a range that might usefully be compared to language. Signals in media such as smell and touch typically are individually simple (that is, they lack a relevant internal structure such that parts of the signal correspond to distinct parts of the message), and in some cases (especially olfactory communication) they are not very flexible in their temporal pattern. There are exceptions: the chemical signals produced and perceived by lemurs may include substances from multiple individuals, deposited at different times; the animals are apparently sensitive to this complexity. Chemical signals in the insect world can be even more complicated. But even where some internal organization is present in the signal, these systems appear to be rather different from human languages.

Characteristics of Language

> Now when I speak of "talk" between animals and myself, you who read this must understand that I do not always mean the usual kind of talk between persons. Animal "talk" is very different. For instance, you don't only use the mouth for speaking. Dogs use the tail, twitchings of the nose, movements of the ears, heavy breathing—all sorts of

things—to make one another understand what they want. Of course, the Doctor and I had no tails of our own to swing around. So we used the tails of our coats instead. Dogs are very clever; they quickly caught on to what a man meant to say when he wagged his coat-tail.

—*Doctor Dolittle and the Secret Lake*

What are the essential properties of human language, and how does it differ from other communications? On the face of it, it ought to be possible to generate criteria that would make the difference clear. It turns out, though, that this task is harder than it appears.

One well-known attempt to specify just what properties define a "language" in the human sense was made by the linguist Charles Hockett in the 1950s. Some of Hockett's Design Features of Language may also be found in nonhuman communication systems, but he argued that the whole set is found together only in human languages. Ultimately, the effort to define language in this way poses more problems than it solves, but at least it provides a basis for discussion.

Vocal-Auditory Channel

Language is expressed and perceived in sound. This property is not unique to human language: many species use auditory signals to communicate. Hockett suggests, though, that the particular acoustic spectral features that differentiate messages in human languages really are unique. Vowel color (the property that distinguishes the vowels of *beet, bat, boot* from one another), for instance, is a characteristic of acoustic signals that does not appear to be exploited by the system of any other animal. That is not just coincidental: the development of a vocal tract capable of making distinctions of vowel color is one of the physical specializations for speech that appeared in the course of human evolution. This point is developed at some length in various works by Philip Lieberman and his colleagues.

Just as humans are not the exclusive users of sound for communicative purposes, the vocal-auditory channel is not the only one in which communication occurs. Many others are used as well: signals can be visual, tactile, olfactory, chemical, electrical, . . . In fact, humans communicate with one another (intentionally or not) in most of these ways, though we do not usually confuse that communication with language.

In part because of this diversity, it is vital to distinguish one system from another, so that we speak of a single species as employing multiple

communication systems rather than just as "communicating." Each system has its own internal coherence, which can be studied independently of the other systems. Sometimes a single behavior may involve multiple systems in complementary ways. Think of the role played by facial expression in understanding the messages conveyed by accompanying language. The messages conveyed by facial expressions can be explored systematically in one way, language in another. The totality of the communication results from both taken together, but nothing is gained (and coherence is lost) if we attempt to study both at the same time by the same methods.

Indeed, the same channel can convey information from more than one system at the same time. The pitch of the voice on individual syllables serves in many languages (such as those of China and most of the languages of Africa, known as *tone languages*) to distinguish words from one another, in the same way that the difference between one vowel or consonant and another serves this function. Voice pitch is also an aspect of the expressive system of paralanguage (about which I will say more in Chapter 4), which conveys a variety of information about our emotional state, attitude, and so on. The fact that a speaker of Cantonese distinguishes words by tone does not alter the fact that other aspects of the overall contour of that speaker's voice quality and pitch serve simultaneously as paralinguistic cues to excitement or boredom, contempt or admiration.

Separating language from paralanguage is critical to achieving a coherent understanding of the way both systems work. Every time we say something, we communicate much more (or sometimes less) than the literal content. Paralinguistic features (pitch range, loudness, breathiness) have very different properties from sentence structure and meaning. The way pitch is used paralinguistically is inseparable from the way it is used linguistically, even though the two are quite distinct logically.

Hockett took it as self-evident that true language is executed in the vocal-auditory medium. By this he meant to distinguish spoken language especially from writing, which he regarded (correctly) as secondary and parasitic on the spoken language. In fact, not all language (even disregarding writing) *does* involve the vocal-auditory channel. The signed languages used and acquired natively among hearing-impaired individuals have the structural properties of a language such as Chinese or Kiswahili, although they involve the visual channel. Understanding of the richness of the structure of signed languages, and their basic similarities to spoken languages,

did not really develop (among linguists, at least) until after Hockett's paper appeared. Chapter 9 is devoted to the properties of these languages.

Broadcast Transmission, Directional Reception

Signals travel generally to any potential receiver, and their properties can help to determine the location of the originating source. This characteristic seems at first glance to apply to just about any communication system, if we disregard the fact that communication can take place even when we cannot locate the source. Think of a disembodied voice backstage in a play, for instance. Of course, in some cases the nature of the medium makes broadcast transmission rather narrow. One example is tactile signals, such as tapping a dancer on the shoulder to indicate a desire to cut in. But not all communication shares this property even in a limited way. Consider the marking of an animal's territory by olfactory signals. At the time the communication takes place—when another animal perceives the scent—the source is not necessarily present, but the signal nevertheless plays its role perfectly well.

Rapid Fading

Many kinds of communication are transitory, in the sense that the signal is not available for inspection for very long after it is produced. Even if you are in a cave with a remarkably persistent echo, the sound fades away within a few seconds. The same is true of signed language or any system of visually perceived gestures; there is not even any obvious analogue of an echo. For logical purposes we can disregard the modern possibility of recording sound or images for later playback, as well as that of writing down what we have heard. Under those circumstances we could consult the transcribed record at leisure, but these special cases are in no way intrinsic to the way speech (or sign) communication works. In this way the modalities of natural languages (both spoken and signed) differ from those of chemical or olfactory signals, or from outwardly visible physical changes that communicate one animal's internal state to another.

Interchangeability

Competent language users both produce and comprehend the same range of signals, at least under normal conditions and barring pathology (such as deafness or blindness). In this respect human language is different from some other systems. Birdsong, for instance, is typically produced by the

male and not by the female (although there are species in which both sexes sing) and comprehended by male and female (but in different ways). The honeybee dance is interchangeable among the workers in that these bees both dance and understand the dances of others. The situation is different for queens and drones, who do not dance but do understand the dances—at least to the extent that these indicate possible sites for a new hive and not the location of a food source.

This connection between production and perception of the signals may seem adventitious, but it turns out to be rather important, at least according to some theories. The motor theory of speech perception claims that the way we perceive the speech of others involves a direct reference to what we might have done ourselves. If our perceptual system is truly organized in this way, the fact that hearers are also talkers (and vice versa) is no accident. Humans and songbirds appear to provide strong evidence for this claim.

Total Feedback

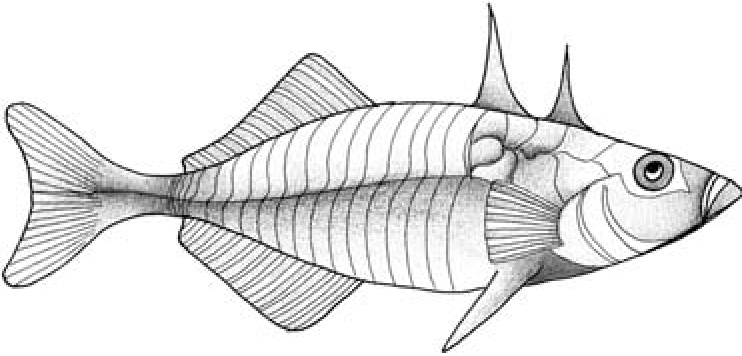
Senders can monitor their own signals. Some nonlinguistic signals do not have this property: consider physical changes in an organ outside the range of the individual's vision but visible to others, such as a blush. Blushing certainly conveys information to the viewer, but without a mirror not to the one who blushes.

Some famous instances of communication do not allow for feedback. The stickleback (a fish that was an object of great interest to ethologists in the 1950s) communicates about mating through a characteristic change of color in the belly and eyes of the male and a characteristic distension of the female's belly. But neither can see his or her own belly or eyes.

With respect to human languages, we might feel that feedback, while usually present, is not necessary. Even in the case of deaf speakers or blind signers, though, there is feedback from other modalities (kinesthetic, proprioceptive). Feedback of this sort seems to be significant in learning; both birds and humans (the only well-studied cases of learned communicative behavior) get seriously off the track when it is not available. In normal speech, laboratory conditions that disrupt, distort, or prevent proper feedback can make fluent speech virtually impossible to produce.

Specialization

Hockett's definition of this property refers to the fact that the communicative activity involved in human language does not serve any other func-



tion: "the direct energetic consequences of an act of communication serve no other biological purpose." Compare this concept, for instance, with the fact that we can derive information from events that *do* have other functions, perhaps more basic than communication. When a dog pants with his tongue hanging out, he is cooling off through evaporation, but he may also be supplying information (especially to other dogs) about the location, state, and identity of the panter. The female stickleback's distended belly, which communicates to the male her readiness to breed, is the result of the development of roe, not of any intent to communicate.

Specialization for communication is tied up with the range of uses for the organs involved. It is sometimes claimed that there are no true speech organs: the organs we use for speech production all have other functions (vegetative, respiratory), and the ears that perceive much besides speech are what we use to hear. The notion that this multifunctionality excludes a specialization for speech overlooks a great deal. In fact, the vocal organs have changed over the course of evolution in the direction of greater functionality in speaking, even at the cost of being less suited to their other tasks.

For example, the natural position of the human larynx is considerably lower in the throat than in other primates, or in mankind's earlier ancestors, or indeed in newborn babies. Among other differences, the tongue is large and rounded, as opposed to the short, flat tongues of other primates; and the vocal tract makes a 90-degree turn, as opposed to the nearly straight vocal tracts of others. Because of its construction, the human vocal tract has a portion that is necessarily involved in the transfer of food and drink, on the one hand, and of air on the other. In our primate relatives (as well as in babies) it is possible to isolate the digestive channel from the respiratory, making it possible to eat or drink and breathe at the same time—but