BABOON METAPHYSICS
The Evolution of a Social Mind

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Baboon Metaphysics
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The Evolution of Mind

Origin of man now proved.—Metaphysic must flourish.—He who understands baboon would do more towards metaphysics than Locke.

CHARLES DARWIN, 1838: NOTEBOOK M

What goes through a baboon’s mind when she contemplates the 80 or so other individuals that make up her group? Does she understand their social relations? Does she search for rules that would allow her to classify them more easily? Does she impute motives and beliefs to them in order to better predict their behavior? Does she impute motives and beliefs to herself when planning a course of action? In what ways are her thoughts and behavior like ours, and in what ways—other than the obvious lack of language and tools—are they different? These are questions that also vexed Charles Darwin.

We have taken our title from one of Darwin’s most memorable remarks. He wrote it on August 16, 1838, almost two years after returning from his voyage on the Beagle and 21 years before the publication of The Origin of Species. It was a time of vigorous intellectual activity, when Darwin read voraciously on many subjects, both within and beyond the sciences, and met and talked with many different people, from family friends to prominent literary and political figures (Hodge 2003). Despite this active intellectual life, however, it seems unlikely that he or anyone else had ever combined the words “baboon” and “metaphysics” in the same sentence. What was Darwin thinking?
Mind and behavior in Darwin’s time

The Cambridge English Dictionary defines metaphysics as “the part of philosophy that is about understanding existence and knowledge.” Writing in the Westminster Review in 1840, John Stuart Mill offered a summary of views on the origin of knowledge that were being discussed by Darwin and his contemporaries. “Every consistent scheme of philosophy requires, as its starting point, a theory representing the sources of human knowledge, and the objects which the human faculties are capable of [understanding]. The prevailing theory in the eighteenth century ... was that proclaimed by Locke, and attributed to Aristotle—that all our knowledge consists of generalizations from experience” (Mill 1840). According to this theory, Mill continued, we know “nothing, except the facts which present themselves to our senses, and such other facts as may, by analogy, be inferred from these. There is no knowledge a priori; no truths cognizable by the mind’s inward light and grounded on intuitive evidence.” Locke believed that the mind acts simply to associate events that have been joined together through proximity and repetition. From these associations it generates behavior. Anything we think or do can ultimately be traced to our experience.

Mill continued: “From this doctrine Coleridge with ... Kant ... strongly dissents. ... He distinguishes in the human intellect two faculties ... Understanding and Reason. The former faculty judges of phenomena, or the appearance of things, and forms generalizations from these: to the latter it belongs, by direct intuition, to perceive things, and recognize truths, not cognizable by our senses.” In Kant’s scheme, these perceptions exist a priori but are not completely innate because they require experience for their expression. For Kant, the mind was not a blank slate on which any sort of experience can write any kind of instructions. It is, instead, biased in the way it responds to features of the world—actively organizing experiences and generating behavior on the basis of preexisting schemes. To understand our thoughts, beliefs, and behavior, therefore, we must consider not only our own individual experiences but also the preexisting nature of the mind itself.

Empiricism and rationalism were hotly debated at the time. Mill reported that “between the partisans of these two opposite doctrines there reigns a bellum internecinum [in which] even sober men on both sides take no charitable view of each others’ opinions.” Darwin followed the debate, but with a more open mind and a much more zoological perspective than many of his contemporaries. While others debated the
nature of the human mind, he also puzzled over the minds of bees, dogs, and baboons.

Darwin’s interest in metaphysics was motivated by more than just idle curiosity—it was also fueled by excitement and personal ambition. By the late 1830s and 1840s, the theory of evolution by natural selection was beginning to take shape in his mind, and his notebooks are filled with many speculations about how his work might shed an entirely new light on the study of human knowledge.

Darwin had observed that every animal species engages in repeated, “habitual” behavior. Birds build nests, squirrels hoard seeds, and dogs raise the fur on their back when they feel threatened. He believed that these behaviors recurred because they were beneficial to the individuals involved and that, over generations, habitual behavior became “instinctive,” or innate. Under the right conditions, instinctive behavior would appear automatically, even if the animal had never before had the appropriate experience. When they act by instinct, then, animals are not behaving according to Lockean reason, carefully weighing the information acquired from experience. Instead, they are governed by “hereditary tendencies” acquired over generations (Darwin 1838a; for Darwin’s views on habitual and instinctive behavior, see his other notebooks in P.H. Barrett et al. 1987).

This is not to say that Darwin believed animals were slaves to their instincts, wholly devoid of learning or reason. Some of his contemporaries did hold such views, and used them to draw a sharp distinction between humans and other animals. The naturalist Edward Blyth (1837), for example, wrote that “whereas the human race is compelled to derive the whole of its information through the medium of its senses, the brute is, on the contrary, supplied with an innate knowledge of whatever properties belong to all the natural objects around.” Darwin disagreed—both with the conclusion that animals’ thoughts and behavior are entirely based on instinct and with the view that human thought and behavior are governed entirely by reason. “[I]t is] hard to say what is instinct in animals & what [is] reason, in precisely the same way [it is] not possible to say what [is] habitual in men and what reasonable. ... as man has hereditary tendencies, therefore man’s mind is not so different from that of brutes” (Darwin 1838a). Like many of his contemporaries, Darwin was searching for an explanation of mind and behavior that would combine innate, inherited tendencies (a bit of rationalism from Kant) with reasoning based on experience (a bit of empiricism from Locke) (Richards 1987). In this as in so much else, Darwin was a man ahead of his time.
Darwin also realized that, whatever the exact balance between innate behavior and reason in any particular instance, his theory of evolution had important implications for the study of metaphysics. After all, thoughts and instincts came from the mind, and the mind could be studied like any other biological trait. It was different in different species, reflecting the particular adaptations of each, and it could change gradually over time, being transmitted from one generation to the next. In his notebook M (M for metaphysics), Darwin wrote: “We can thus trace causation of thought ... [it] obeys [the] same laws as other parts of structure” (Darwin 1838b).

With growing excitement, Darwin began to see that his theory might allow him to reconstruct the evolution of the human mind and thereby resolve the great debate between rationalism and empiricism. The modern human mind must acquire information, organize it, and generate behavior in ways that have been shaped by our evolutionary past. Our metaphysics must be the product of evolution. And just as the key to reconstructing the evolution of a whale’s fin or a bird’s beak comes from comparative research on similar traits in closely related species, the key to reconstructing the evolution of the human mind must come from comparative research on the minds of our closest animal relatives. “He who understands baboon would do more towards metaphysics than Locke.”

Twentieth-century views: behaviorists and their critics

In the first half of the 20th century, research on the mind and behavior was dominated by modern-day empiricists like E. L. Thorndike, J. B. Watson, and B. F. Skinner, who together developed the doctrine of behaviorism. Like Locke, they believed that organisms come into the world with little a priori knowledge: behavior is the product entirely of experience. As an animal moves through its world, it encounters stimuli and responds to them. If its response is followed by something pleasant, like food, the response will be repeated whenever the animal encounters the same stimulus again. In this way, the animal quickly develops an array of behaviors that are well suited to its needs.

As the intellectual descendants of Locke, behaviorists believed that the mind is concerned primarily with the formation of associations: mechanical principles of attachment that develop as a result of experience. They saw the mind not as an active “thinking” organ, predisposed to organize incoming stimuli in certain ways, but instead as a rather
passive arena in which stimuli from the environment are combined according to simple rules, thereby producing behavior. The behaviorists concluded that a few simple but powerful laws, like Pavlov’s Law of Association and Thorndike’s Law of Effect, could account for all behavior, in every species and every circumstance. They believed in the principle of *equipotentiality*. As Skinner famously remarked, “Pigeon, rat, monkey, which is which? It doesn’t matter ... once you have allowed for differences in the ways they make contact with the environment, what remains of their behavior shows astonishingly similar properties” (Skinner 1956:230–231).

The behaviorists saw little point in considering mental activities like thoughts, feelings, goals, or consciousness, for reasons that were both methodological and deeply philosophical. On the practical side, mental states like thoughts or emotions are private. They cannot be observed or measured, nor can one predict how they might be changed by experience. Under these circumstances, the mental activities of animals can hardly play a role in any scientific discipline. Even in humans, where introspection prompted some behaviorists to admit—grudgingly—that mental states might exist, the exact nature of these states are unknowable because they can never be verified by more than one person. Once again, this makes mental states unsuitable for scientific study. Some behaviorists went even further. In his 1974 book *About Behaviorism*, Skinner distinguished between “methodological behaviorists” who accepted the existence of mental states but avoided them because they could not be studied scientifically, and “radical behaviorists” like himself, who believed that “so-called mental activities” were an illusion—an “explanatory fiction.” For Skinner, thoughts, feelings, goals, and intentions played no role in the study of behavior because they did not, in fact, exist.

Although behaviorism dominated 20th-century psychology, it was not without its critics. Perhaps the best way to understand them is to consider some classic observations and experiments that challenged the behaviorists’ worldview.

Song sparrows (*Melospiza melodia*) and swamp sparrows (*Melospiza georgiana*) are two closely related North American birds with very different songs. Males in both species learn their songs as fledglings, by listening to the songs of other males. But this does not mean that the mind of a nestling sparrow is a blank slate, ready to learn virtually anything that is written upon it by experience. In fact, as classic research by Peter Marler and his colleagues has shown, quite the opposite is true. If a nestling male song sparrow and a nestling male swamp sparrow are
raised side-by-side in a laboratory where they hear tape-recordings of both species’ songs, each bird will grow up to sing only the song of its own species (Marler and Peters 1989).

The constraints that channel singing in one direction rather than another cannot be explained by differences in experience, because each bird has heard both songs. Nor can the results be due to differences in singing ability, because both species are perfectly capable of producing each other’s notes. Instead, differences in song learning must be the result of differences in the birds’ brains: something in the brain of a nestling sparrow prompts it to learn its own species’ song rather than another’s. The brains of different species are therefore not alike. And the mind of a nestling sparrow does not come into the world a tabula rasa—it arrives, instead, with genetically determined, inborn biases that actively organize how it perceives the world, giving much greater weight to some stimuli than to others. One can persuade a song sparrow to sing swamp sparrow notes, but only by embedding these notes into a song sparrow’s song (Marler and Peters 1988). It is almost impossible to persuade a swamp sparrow to sing any notes other than its own (Marler and Peters 1989). Philosophically speaking, sparrows are Kantian rationalists, actively organizing their behavior on the basis of innate, pre-existing schemes.

In much the same way, human infants have their own sensory and cognitive biases. From the first days of life, they attend more readily to faces than to other visual stimuli and more readily to speech than to other auditory stimuli. This latter bias can apparently be traced to a preference for the intonation contours in spoken language: two-day-old babies show distinctive cerebral blood flow when they hear a normal sentence but not when the same sentence is played backward (Dehaene-Lambertz et al. 2002; Peña et al. 2003). Humans and sparrows are not alone in preferring their own species’ sounds: when a rhesus macaque monkey (Macaca mulatta) hears a call given by a member of its own species, its brain exhibits activity that is markedly different from that shown in response to other sounds. Indeed, rhesus calls activate in the rhesus brain the same areas activated by human speech in the human brain (Gil da Costa et al. 2004).

Some of the most striking evidence for an innate predisposition to learn one’s own species’ communication comes from children who are born blind or deaf. Although they cannot see the objects in the world to which spoken words refer, blind children develop language at roughly the same age and in the same manner as children who can see (Landau and Gleitman 1985). Data from children born deaf are even more strik-
ing. Lila Gleitman, Susan Goldin-Meadow, and their colleagues studied several deaf children born to hearing parents who did not themselves know ASL, the American Sign Language for the deaf. Although raised in loving, supportive environments, these children were deprived of any exposure to language. Nonetheless, they spontaneously invented a sign language of their own, beginning with single signs at roughly the same age that single words would ordinarily have appeared. And during the following months and years, as they developed more complex sentences, the children produced signs in a serial order according to their semantic role as subject, verb, and object (see Goldin-Meadow 2003 for review).

The songs of sparrows, the calls of monkeys, and the language of human children could hardly be more different, yet they all lead to the same conclusion: each species has a mind of its own that, like its limbs, heart, and other body parts, has evolved innate predispositions that cause it to organize incoming sensations in particular ways. The mind arrives in the world with constraints and biases, “prepared” by evolution to view the world, organize experiences, and generate behavior in its own particular way (Pinker 2002). And because each species is different, the behavior of different species is unlikely to be explained by a few general laws based entirely on experience. Although there may well be some general features of learning that are shared by many species, the behaviorists’ principle of equipotentiality (“pigeon, rat, monkey...”) is understandable but incorrect.

But what of the behaviorists’ second major premise, that the “mind” and “mental states”—if they exist at all—are private and unmeasurable, and cannot be studied scientifically? This view was also challenged, most prominently by the psychologist Edward C. Tolman (1932), who argued that learning is not just a mindless link between stimulus and response. Instead, animals acquire knowledge as a result of their experiences.

In 1928, Otto L. Tinklepaugh, a graduate student of Tolman’s, began a study of learning in monkeys. His subjects were several macaques who were tested in a room in the psychology department at the University of California at Berkeley (sometimes the tests were held outdoors, on the building’s roof, which the monkeys much preferred). In one of Tinklepaugh’s most famous experiments, a monkey sat in a chair and watched as a piece of food—either lettuce or banana—was hidden under one of two cups that had been placed on the floor, six feet apart and several feet away. The other cup remained empty. Once the food had been placed under the cup, the monkey was removed from the room for several minutes. Upon his return, he was released from the chair and
allowed to choose one of the cups. All of Tinklepaugh’s subjects chose the cup hiding the food, though they performed the task with much more enthusiasm when the cup concealed banana.

To illustrate the difference between behaviorist and cognitive theories of learning, pause for a moment to consider the monkey as he waits outside the experimental room after seeing, for example, lettuce placed under the left-hand cup. What has he learned? Most of us would be inclined to say that he has learned that there is lettuce under the left-hand cup. But this was not the behaviorists’ explanation. For behaviorists, the reward was not part of the content of learning. Instead, it served simply to reinforce or strengthen the link between a stimulus (the sight of the cup) and a response (looking under). The monkey, behaviorists would say, has learned nothing about the hidden food—whether it is lettuce or banana. His knowledge has no content. Instead, the monkey has learned only the stimulus-response associations, “When you’re in the room, approach the cup you last looked at” and “When you see the cup, lift it up.” Most biologists and laypeople, by contrast, would adopt a more cognitive interpretation: the monkey has learned that the right-hand cup is empty but there is lettuce under the left-hand cup.

To test between these explanations, Tinklepaugh first conducted trials in which the monkey saw lettuce hidden and found lettuce on his return. Here is his summary of the monkey’s behavior:

Subject rushes to proper cup and picks it up. Seizes lettuce. Rushes away with lettuce in mouth, paying no attention to other cup or to setting. Time, 3–4 seconds.

Tinklepaugh next conducted trials in which the monkey saw banana hidden under the cup. Now, however, Tinklepaugh replaced the banana with lettuce while the monkey was out of the room. His observations:

Subject rushes to proper cup and picks it up. Extends hand toward lettuce. Stops. Looks around on floor. Looks in, under, around cup. Glances at other cup. Looks back at screen. Looks under and around self. Looks and shrieks at any observer present. Walks away, leaving lettuce untouched on floor. Time, 10–33 seconds.

It is impossible to escape the impression that the duped monkey had acquired knowledge, and that as he reached for the cup he had an expectation or belief about what he would find underneath. His shriek reflected his outrage at this egregious betrayal of expectation.

Many years later, Ruth Colwill and Robert Rescorla (1985) carried out a more controlled version of the same experiment. They began by train-
ing rats to make two responses, pressing a lever and pulling a chain. When the rats pressed the lever they received a small food pellet; when they pulled the chain they received liquid sucrose. By the behaviorist view, the rats had learned only to press the lever or pull the chain whenever they saw them. By the cognitive view, the rats had formed some kind of mental representation of the relation between a particular act and a specific type of food. To test between these hypotheses, Colwill and Rescorla made either the food pellet or the water unpalatable by adding lithium chloride, a substance that makes rats sick. If the rats had learned which food type was associated with which behavioral act, then those for whom the food pellet had been devalued would avoid the lever but continue to pull the chain, whereas those for whom the water had been devalued would do the opposite. This is exactly what happened.

The results of these experiments challenge the more extreme behaviorists’ view that mental states like knowledge, beliefs, or expectations cannot be studied scientifically and may even be an illusion. Instead, they support Tolman’s view that learning allows an animal to form a mental representation of its environment. Through learning, animals acquire information about objects, events, and the relation between them. Their knowledge has content, and this content can be studied scientifically.

This conclusion from the laboratory is important, because it encourages us to believe that Darwin was right: we can trace the causation of thought in different species, study its structure, and reconstruct its evolution. But while the scientific study of mind is an exciting prospect, a large dose of humility is in order. For all of their failings, the behaviorists did understand that, whereas behavior can be unambiguously observed and measured, knowledge and the content of mental states are abstract, hard to measure, and difficult even to define. Once you accept the existence of mental states and ascribe causal power to them, you have opened Pandora’s box, releasing a host of fundamental questions that are difficult if not impossible to answer.

When we say that a song sparrow’s brain “predisposes” it to attend to song sparrow song in a way that it attends to no other, what precisely do we mean? When we claim that a rat has formed an association between bar pressing and a particular type of food, what exactly is the nature of its knowledge? Does the rat think that the bar somehow stands for that food? Does it believe that pressing the bar causes the food to appear? Can rats distinguish between the relations A represents B and A causes B? When Pavlov’s dog salivated at the sound of a metronome, was this an automatic, unthinking reflex, or did it occur because the metronome
brought to mind an image of meat? None of these questions is easy to answer.

Why baboons?

On first—and perhaps even further—inspection, baboons might seem less than ideal subjects for a study of the mind. Among other failings, they are not as closely related to humans as some other nonhuman primates. Baboons are members of the genus *Papio*, Old World monkeys that shared a common ancestor with humans roughly 30 million years ago (Steiper et al. 2004). Baboons are more closely related to humans than monkeys of the New World, but they are much less closely related than the African apes—especially chimpanzees (*Pan troglodytes*)—which diverged from our own ancestors roughly five to seven million years ago. Moreover, the conservation status of baboons confers neither glamour nor prestige on those who study them. Far from being endangered, baboons are one of Africa’s most successful species. They flourish throughout the continent, occupying every ecological niche except the Sahara and tropical rain forests. They are quick to exploit campsites and farms and are widely regarded as aggressive, destructive, crop-raiding hooligans. Finally, baboons are not particularly good-looking—many other monkeys are far more photogenic. Indeed, through the ages baboons have evoked as much (if not more) repulsion than admiration.

Baboons are interesting, however, from a social perspective. Their groups number up to 100 individuals and are therefore considerably larger than most chimpanzee communities. Each animal maintains a complex network of social relationships with relatives and nonrelatives—relationships that are simultaneously cooperative and competitive. Navigating through this network would seem to require sophisticated social knowledge and skills. Moreover, the challenges that baboons confront are not just social but also ecological. Food must be found and defended, predators evaded and sometimes attacked. Studies of baboons in the wild, therefore, allow us to examine how an individual’s behavior affects her survival and reproduction. They also allow us to study social cognition in the absence of human training, in the social and ecological contexts in which it evolved.

In Darwin’s theory of evolution by natural selection, necessity is the mother of invention. Traits arise or are maintained because they help the individuals who possess them to solve a problem, thereby giving those individuals an advantage over others in survival and reproduction. A
blunt, heavy beak allows a finch to crush hard, dry seeds and survive a withering dry season; antlers enable a stag to defeat his rivals and mate with more females. The finch’s beak and the stag’s antlers did not arise at random; they evolved and spread because of their adaptive value. To understand the evolution of a trait, therefore, we need to understand how it works, and what it allows an individual to do that might otherwise be impossible.

And brains, Darwin realized, were biological traits like any other. To understand how they evolved, we must understand the problems they were designed to solve. In recent years, studies of the brain, intelligence, and evolution in animals have produced two general conclusions that will guide our study of baboon metaphysics.

First, natural selection often creates brains that are highly specialized. Arctic terns (Sterna paradisaea) migrate each year from one end of the earth to another, Cataglyphis ants navigate across the featureless Sahara, bees dance to signal the location of food, and Clark’s nutcrackers (Nucifraga columbiana, a member of the crow, or corvid, family) store and recover tens of thousands of seeds during the fall and winter. Yet despite these specialized skills, there is no evidence that terns, ants, bees, or nutcrackers are generally more intelligent than other species. Instead, they are more like nature’s idiots savants: brilliant when it comes to solving a specific, narrowly defined problem, but pretty much average in other domains.

Specialized intelligence may be widespread in animals because brain tissue is costly to develop and maintain. The human brain uses energy at a rate comparable to that used by the leg muscles of a marathon runner when running (Attwell and Laughlin 2001). If brain tissue is energetically expensive, the cheapest way to evolve a specialized skill may be through a small number of especially dedicated brain cells rather than a larger, general-purpose brain. For arctic terns, the ability to fly from pole to pole in the spring and fall is adaptive because it allows the birds to live in perpetual summer. As a result, selection has favored individuals with the neural tissue needed to navigate great distances using the sun, the stars, and the earth’s magnetic field. But it has done so in the cheapest, most energy-efficient way possible—by selecting specifically for navigational skills.

The second general conclusion to emerge from recent research is that the domain of expertise for baboons—and indeed for all monkeys and apes—is social life. Most baboons live in multimale, multifemale groups that typically include eight or nine matrilineal families, a linear dominance hierarchy of males that changes often, and a linear hierarchy
of females and their offspring that can be stable for generations. Daily life in a baboon group includes small-scale alliances that may involve only three individuals and occasional large-scale, familial battles that involve all of the members of three or four matrilines. Males and females can form short-term bonds that lead to reproduction, or longer-term friendships that lead to cooperative child rearing. The result of all this social intrigue is a kind of Jane Austen melodrama, in which each individual must predict the behavior of others and form those relationships that return the greatest benefit. These are the problems that the baboon mind must solve, and this is the environment in which it has evolved.

Social problems, of course, are not the only challenges. Baboons also need to solve ecological problems, like finding food and avoiding predators. But these problems are also overwhelmingly social. One of the most difficult aspects of finding food arises from the fact that as many as 100 other individuals in your group also want the food for themselves. And the best way to avoid being taken by lions, leopards, crocodiles, or pythons is to live in a group, with all of the opportunities and compromises that group life entails. Any way you look at it, most of the problems facing baboons can be expressed in two words: other baboons.

The study group and data collection

The focus of our research is a group of chacma baboons (*Papio hamadryas ursinus*) living in the Moremi Game Reserve in the Okavango Delta of Botswana. We began our study in 1992, but before our arrival the group had been observed more or less continuously for 14 years by W. J. Hamilton III and his students at the University of California at Davis. Because the baboons have endured interlopers for three decades, they are completely habituated to humans walking among them and tolerate our presence with diffident aplomb, if not affection. Even the oldest female in the group, the curmudgeonly and mean-spirited Sylvia, has had to put up with human observers since her birth in 1982. Between 1992 and 2006, group size averaged 80 individuals, with fluctuations depending on rates of infanticide, predation, and male immigration. The number of adult females has varied from 18 to 28 and the number of adult males from 3 to 12.

When following the baboons, we and our colleagues collect three sorts of data. First, each day we note all demographic changes in the group, including births, deaths, immigrations, emigrations, and sexual consortships. Second, we conduct 10 minute-long “focal animal sam-
ples” (Altmann 1974) on each individual following a systematic rotation. These samples supply us with a continuous record of the baboons’ interactions and social partners and provide the data to document the continuous soap opera that constitutes baboon life. We also note specific other events—like fights, alliances, interactions between groups, and encounters with predators—on an ad libitum basis, whenever they occur. Third, we make audio recordings of the baboons’ vocalizations, for both acoustical analysis and “playback” experiments. We describe these experiments in detail in Chapters 5 and 6. Finally, between 2002 and 2005 we have collected weekly fecal samples from all adult males and females for the extraction of testosterone (from males) and glucocorticoids (from males and females). Glucocorticoids are a class of steroid hormone associated with stress.

The beauty of a fecal sample—if that is the appropriate term—is that it allows us to measure a biological response that cannot be observed. It can also be collected without itself inducing stress, as would certainly happen if we tried to extract blood. The data from fecal samples allow us to look beneath the surface of baboon society and ask, “Who is under stress? Why? And how it is alleviated?” Like humans, baboons have families, seek mates, form friendships, and suffer fear and anxiety from events both social and environmental. Unlike humans, though, baboons cannot explain the causes of their anxiety to us; indeed, as we will see, they may not even be explicitly aware of feeling anxious or depressed. Like their behavior and vocalizations, the baboons’ hormonal profiles allow us to ask them, indirectly, what they think and how they feel.

How this book is organized

In writing this book, we had to decide whether to include material from our earlier book on vervet monkeys (Cercopithecus aethiops), How Monkeys See the World (Cheney and Seyfarth 1990). We knew that we could not operate under the conceit that our readers would remember anything from that volume, but at the same time we wanted to avoid The Bride of How Monkeys See the World. We also had to resolve how exhaustively we would review the vast literature on animal cognition. In the end, we decided that we would focus primarily on research that was directly relevant to our work on baboons. We therefore discuss vervet monkeys only sparingly and make no attempt to consider, for instance, whether animals have “cognitive maps” of their environment, can represent numerical quantities, or make optimal foraging decisions. This is not due
to laziness, nor is it because we believe that baboons simply stumble about their habitat with no inkling about where they are, where they are going, or what they are eating. Instead, we avoid these and many other important questions because we were unable to investigate them directly (two good reviews of animal cognition are Shettleworth 1998 and Tomasello and Call 1997).

The link between primates’ intelligence and the complexity of their social behavior may seem obvious, but this has not always been the case. In Chapter 2, we take a historical perspective and examine a curious fact about our ancestors’ knowledge of their closest animal relatives. For centuries people have known that, of all the creatures in the world, monkeys and apes are most like us. Ironically, however, scholars reached this conclusion without knowing anything at all about the characteristics of primates that make them most human: their social life. Because Western scientists learned about primates by examining corpses or observing single animals brought home as pets, few if any ever learned what can be discovered only through long, patient observation: that the most human features of monkeys and apes lie not in their physical appearance but in their social relationships.

In Chapter 3 we describe the ecological setting in which our work takes place and the predators that so affect baboons’ lives. In Chapters 4 and 5 we introduce the protagonists with a discussion of social behavior and life histories among males (Chapter 4) and females (Chapter 5), in all of their familial complexity, friendships, alliances, stress, and Machiavellian intrigue. As part of this description we introduce, in Chapter 5, the method of field “playback” experiments that we use to explore what baboons know about the relations that exist among others. In doing so, we present one of our central arguments—that even though baboons lack language, their vocal communication is rich enough in meaning to tell us a great deal about how they think. Primate vocalizations, in fact, provide the key that unlocks the primate mind.

Whereas Chapters 1 through 5 are introductory, historical, and descriptive—designed to introduce readers unfamiliar with baboons to the monkeys’ habitat, behavior, and social structure—Chapters 6 through 11 delve more deeply into the scientific questions that guide our research. In Chapter 6 we describe experiments designed to test baboons’ knowledge of their social companions. The results show that baboons are good psychologists: they recognize their companions as individuals, observe their behavior, and create, in their minds, a hierarchical representation of society based on matrilineal kinship and dominance rank. The social knowledge of baboons is too varied and complex to
be explained by simple learning mechanisms. Instead, we propose that natural selection has led to the evolution of a mind innately predisposed to search for the patterns and rules that underlie other baboons’ behavior.

In Chapter 7 we examine baboons’ knowledge of their companions in light of the “social intelligence” hypothesis, which argues that the demands of living in large social groups have placed strong selective pressure on the evolution of the primate mind. The average value for relative brain size in primates exceeds the average value for other mammals, and primate brains contain many areas specialized for dealing with social stimuli. Baboons and other monkeys recognize each other’s ranks and kin relations, and their reproductive success and ability to overcome stress depend on their skill in forming social relations. Similar social skills, however, are also found in nonprimate species that live in large social groups, including dolphins, hyenas, and pinyon jays. Furthermore, even relatively asocial species appear to monitor other individuals’ social interactions. It therefore remains unclear whether social intelligence in animals depends on taxonomic affiliation, group size, or some other combination of factors.

In How Monkeys See the World, we concluded that, for all their intriguing similarities, the societies of nonhuman primates were fundamentally different from our own because monkeys and apes lack a “theory of mind”—the ability to attribute mental states like knowledge and belief to others. In Chapter 8 we reconsider this conclusion in light of experiments conducted over the past 15 years by ourselves and many others. In Chapter 9 we consider the related question of whether baboons or any other primates are aware of their own mental state—that is, whether they have anything like our concept of self.

We take it for granted that human words express thoughts and that language provides a window onto the mind. Surprisingly, however, few people have ever applied this idea to animals. In Chapter 10 we review what is known about the vocal communication of baboons and confront directly one of the questions that behaviorists—perhaps wisely—avoided: What does one baboon’s vocalization “mean” to another? We also consider the complex relation between language and thought, but from a perspective not usually found among those who work exclusively on humans: we ask what thought is like in a creature without language. In Chapter 11 we consider what our work has to say about the evolution of language. Finally, in Chapter 12 we return to the challenge posed by Darwin’s famous quotation—that an understanding of baboon metaphysics can shed light on the evolution of human mind and behavior.
The Primate Mind in Myth and Legend

Our descent, then, is in the origin of our evil passions!! The Devil under form of Baboon is our grandfather! CHARLES DARWIN, 1838: NOTEBOOK M

[Ahla, the baboon] is not only eager but really a maniac when it comes to putting back the lambs with the mothers. She can’t wait until the door between the two enclosures is opened.

WALTER HOESCH, 1961: ON GOAT-HERDING BABOONS

The baboon in Egypt: god, scribe, and policeman

Baboons range widely throughout the African continent, so it is perhaps not surprising that they appear often in ancient Egyptian mythology and art. Beginning in at least the fourth millennium B.C., baboons were associated with the underworld and considered to be embodiments of the dead, no doubt in part because they resembled humans so closely. The word “baboon” may derive from the baboon god Baba, or Babi, a supernaturally aggressive deity who was revered during the Predynastic Period. Perhaps because the ancient Egyptians could not help but notice male baboons’ sexual zeal and prominent genitalia, the baboon god ensured that the dead would not suffer from impotence in the afterlife. Indeed, baboon feces were used as an ingredient in aphrodisiacs.

By the time of the Old Kingdom, around 2400 B.C., baboons had become associated with Thoth, the god of wisdom, science, writing, and measurement. In tomb paintings
and sculptures, baboons instructed scribes in their tasks and weighed the hearts of the deceased. Baboons also came to be identified with the sun god Re, probably because the loud dawn choruses of male baboons’ wahoo calls were taken as a sign that they were worshiping the sun. In addition to associating with Thoth, baboons were believed to stand by Re in his boat as he traveled across the sky. Even into the late Ptolemaic periods, baboons were still regarded as sufficiently sacred to be mummified and kept in colonies at temples (Budge 1969; David 1998; Redford 2002).

But the ancient Egyptians did not just depict baboons as deities. They also portrayed them in many other guises, not only as scribes but also as musicians, sailors, shipwrights, fishermen, and even vintners. Most, if not all, of these depictions were doubtless fanciful—it seems unlikely that baboons ever tended grapes or built ships. More credibly, baboons were depicted as captives brought from the south, as pets on leashes, or as dancers or jesters. Some paintings show them climbing trees to collect figs and dates for their master, and—even more plausibly—pilfering fruit from baskets (Wilkinson 1879; Janssen and Janssen 1989). Hieroglyphics from tombs of the New Kingdom accompany some of these pictures with remarks like “A monkey carries a stick (for dancing), though its mother did not carry it,” suggesting the artist’s appreciation for the baboon’s ability to learn. Other hieroglyphics comment on baboons’ capacity to understand words (Janssen and Janssen 1989). Baboons even appear in the role of police assistants. One illustration from the Old Kingdom mastaba of Tepemankh at Saqarrah shows two baboons on leashes—one a female carrying an infant and the other an adult male—grabbing thieves in the marketplace (Fig. 1). The accompanying

Figure 1. An Egyptian tomb painting from the Old Kingdom depicts two baboons acting as police assistants, attacking a thief in the marketplace.
hieroglyphic reads, “Fear for this baboon” (Smith 1946; Janssen and Janssen 1989).

The Egyptians probably derived much of their knowledge about baboons from pets, temple colonies, and stories emanating from Nubia or other remote areas. Although most of these portrayals probably served a religious or humorous function, they also show that the Egyptians were not entirely ignorant of baboons’ natural social behavior: male baboons do, for example, participate in loud wahoo contests in the early morning. If any early Egyptian ever did take the time to observe the baboons’ natural social interactions, however, he left no record of his observations.

European and Japanese attitudes

No clear record exists of the first contact between a European scientist and a nonhuman primate (Janson 1952). As far as we can tell from Aristotle’s Historia Animalium and other Classical texts, the first primatological subjects to be studied by western scientists were baboons and the Barbary macaques (Macaca sylvanus) that inhabited the southern shores of the Mediterranean (Spencer 1995). These animals came to scientists either as corpses to be dissected or as single animals to be held in cages and observed.

Classical speculation about the mind and behavior of primates was part of a more general curiosity about all animals, and about the fundamental differences between animals and human beings. Aristotle believed that, when it came to emotions, the difference between animals and humans was only a matter of degree. In both humans and animals, tameness graded into wildness, docility into stubbornness, boldness into cowardice or fear, and confidence into anger (Sorabji 1993). By contrast, in matters of intellect Aristotle drew a sharp distinction between humans and all other creatures, including the nonhuman primates. Unlike humans, he argued, animals were completely lacking in reason, intellect, thought, belief, and, as a consequence, language. How, then, did they manage to deal with the world? To make up for their lack of intellect, Aristotle argued, animals have an elaborate, expanded, but intellectually limited, form of perception (Sorabji 1993). Dogs (Canis familiaris) are extremely skilled at identifying and tracking scents, but they know only how to detect and react to an olfactory stimulus. They have no true knowledge or beliefs about scents, nor about the causal
relations that link a particular scent with its owner. Dogs, in Aristotle’s view, just react; humans understand.

_Scapegoat and trickster_

Were monkeys and apes any different? The Greeks and Romans recognized clearly that, among all animals, nonhuman primates were the creatures most similar to human beings. But their anatomy did not elevate their status; instead, quite the reverse occurred. Convinced, like Aristotle, that all animals were fundamentally different from humans on intellectual grounds, Classical scholars ignored both the anatomical evidence and Aristotle’s argument for continuity in emotions. Instead, they adopted a kind of “reverse Darwinism” in which the more an animal resembled a human, the more it was shunned, made into an object of ridicule, and declared to be fundamentally different. The general view is summarized by the dictum of the Roman poet Quintus Ennius: “Simia quam similis turpissima bestia nobis” (“How like us is that ugly brute, the ape”). As the art historian H. W. Janson points out, “the ape was turpissima bestia precisely because it was quam similis nobis. As an unworthy pretender to human status, a grotesque caricature of man, the ape became the prototype of the trickster, the sycophant, the hypocrite, [and] the coward,” as well as the symbol of extreme physical ugliness. Or as Plato put it, “The most beautiful of apes is ugly compared to man and the wisest of men is an ape beside God” (Janson 1952:14–15; McDermott 1938; Corbey 2005).

In Japan, where humans have coexisted with Japanese macaques (Macaca fuscata) for thousands of years, monkeys played a similarly ambiguous role in everyday life and legend. In Japanese legends monkeys were often portrayed as foolish and vain creatures whose servitude to their master gods eventually earned them courage, generosity, wisdom, and loyalty. Many of these legends arrived with Buddhism from India, where the monkey god Hanuman is still revered as a loyal and intelligent servant to the mythical King Rama. The Japanese recognized that monkeys were obviously the most humanlike of all animals: even today, the monkey is the only creature referred to in the Japanese language by the term _san_, the address form used for humans. As a “special” animal, monkeys were regarded as mediators between humans and deities and were thought to have the power to maintain the health and

1. In early writings, no distinction was made between monkeys and apes.