HUMAN NATURE AND THE EVOLUTION OF SOCIETY

STEPHEN K. SANDERSON

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PREFACE

For much of the twentieth century, especially after the 1930s, social science was dominated by explanations of human behavior that gave primary (and sometimes overwhelming) emphasis to the causal role of the social and cultural environment. Social scientists embraced the view of the seventeenth-century English philosopher John Locke, who claimed that the human mind was a tabula rasa, or "blank slate," on which society wrote its "script." Human behavior was therefore principally determined by the social and cultural circumstances in which people live. This is the prevailing view still today. Indeed, the Harvard psychologist Steven Pinker calls it "the official view."

But in the 1970s and 1980s an intellectual revolution began. Some social scientists, mostly anthropologists and psychologists (and a handful of sociologists), returned to the general theory of life adumbrated by Charles Darwin more than a century before. Darwin is, of course, best known for his theory of evolution by natural selection, and he focused mostly on animals. But he also thought that humans evolved from earlier animals—primates, principally the great apes—and he thought that the human mind was much more than a blank slate. It contained numerous features that were evolutionary products and continued to shape behavior. His most important book on humans was *The Expression of the Emotions in Man and Animals*, in which he argued that human emotions and their expression, principally in the human face, were universals that were innate.

The new maverick social scientists thought that Darwinian thinking held one of the keys to explaining many features of human behavior and social life. The new approaches were called, first, sociobiology, and then later evolutionary psychology. In time a major intellectual organization was formed, the Human Behavior and Evolution Society, or HBES. The evolutionary analysis of behavior was becoming a significant force. New specialized journals were founded and textbooks started to be written, sure signs that Darwinian social science was becoming institutionalized.

This book is a new contribution to the list. There are several excellent textbooks, but most of them concentrate heavily on theoretical principles and are highly technical. There is nothing wrong with this—in fact, such books are much needed—but

it is not the only way to do it. This book, intended both for students and the general reader, is different in several important ways. First, it is less technical and lighter on theory. The first chapter outlines the most basic principles of Darwinian social science, but only to the extent that they are necessary to understand what follows. Second, an effort has been made to choose topics that are highly appealing to students and general readers and to present them in lively, engaging, and highly accessible prose. Finally, it expands the coverage by adding topics that are either underemphasized in existing texts or ignored altogether. I refer in particular to the subjects of language origins, subsistence strategies, human foodways and dietary practices, gender roles and relations, race and ethnicity, religion, and the arts. The book concludes by asking whether evolutionary theory can shed any light on the perennial question of the meaning of human existence. Just to give a sample of specific topics, the book explores

- ✓ The origins of language
- ✓ Why humans invented agriculture
- ✓ Economic exchange and capitalism
- ✓ Innate tastes
- ✓ Which humans drink milk and why
- ✓ Why some men have many wives
- ✓ Why some women have many husbands
- ✓ Where there is an incest taboo
- ✓ Why men and women seek different qualities in mates
- ✓ Why some people are gay rather than straight
- ✓ Whether there is a maternal instinct
- ✓ Why infanticide occurs
- ✓ The biology of gender
- ✓ Why status strivings exist and sometimes run amok
- ✓ Why people seek power
- ✓ Why people sometimes kill each other and why it is most often men who do so
- ✓ Why war is so common
- ✓ Whether there are biological races
- ✓ Whether racism is modern or ancient
- ✓ Why ethnic groups are frequently in conflict
- ✓ Why people are religious
- ✓ Why some religions have many gods and others only one
- ✓ Why atheism is on the rise
- ✓ Why people like art, music, and stories
- ✓ Why there is something rather than nothing, and why humans are part of the something

Some critics say that evolutionary arguments are mostly "just-so stories," or made-up explanations that are provocative and interesting but are not supported by real evidence. But in fact there is a good deal of evidence, and in this book I have taken care to present some of the most important evidence for specific evolutionary claims. In the bibliography the many books that contain this evidence, and the specialized journals in which hundreds if not thousands of research articles have appeared, can be found.

To test evolutionary theories empirically it is necessary to study behavior in the full range of human societies that have ever existed. You can't just study Americans or Westerners in general, or just people in any modern society east or west. You also have to look at behavior among people who live by hunting and gathering, by one or another type of agriculture, by animal herding, or by some combination of these. A historical perspective is necessary as well. What were people doing in ancient Egypt, ancient Rome, medieval Europe, or traditional China and India? And you need to explore human action in all of the major regions of the world, where some people live in grasslands, atop tall mountains, in deserts, in tropical rain forests, in hot, humid climates or bitterly cold ones, and so on. This sort of comparative and historical perspective is essential for understanding the similarities and differences in human behavior everywhere. It is essential to understand what thoughts and behaviors may be universal, what may be common but not universal, and what may be rare or not exist at all. No general principles of human behavior and human society can be developed without collecting these sorts of data.

I started out in sociology, but even as a graduate student I knew that a comparative perspective is crucial. The sociologists whose work I respected most were doing comparative research with a heavy dose of anthropology. After my PhD, I felt increasingly attracted to anthropology. Although I am officially a member of a sociology department, I am equally comfortable in both fields and, I believe, equally knowledgeable of both. I feel that this gives me something of an advantage because it allows me to grasp the many details of behavior in the entire range of human societies.

I have presented many of the ideas contained in this book in several courses I have taught over many years. I have always found the vast majority of students to be very receptive to them. (There are of course dissenters and those who can't quite decide.) They have often said that it seems patently obvious that there should be such a thing as human nature, and they have been puzzled that many social scientists wish to deny this. In any event, you read the book and you decide.

As aids to the reader, each chapter contains a summary of the main points and a list of questions that you should be able to answer after reading the chapter. If you struggle to answer these questions, you had better go back and have another look. At the end of the book is a short list of technical terms and their definitions. These are boldfaced in the text.

I am indebted to many people who have contributed to my understanding of the ideas developed in this book, but they are far too numerous to thank individually. I would inevitably leave someone out, and then feelings would be hurt. The people who contributed most to the book's development once a first draft was finished were the reviewers solicited by the publisher: Jennie R. Brown, Franklin Pierce University; Jack David Eller, Community College of Denver; William F. McKibbin, University of Michigan–Flint; Benjamin Grant Purzycki, University of British Columbia; and Andreas Wilke, Clarkson University. I also owe a large debt of gratitude to my editor at Westview Press, Leanne Silverman. She resurrected my book proposal after the previous editor departed and it got buried, said she liked it, and solicited reviews of the book's first draft and another set of reviews of the second draft. This is my twelfth book, but I have never had an editor who got so directly involved. Leanne requested several revisions of some material, important clarifications and additions, and the removal of dubious assertions. She has undoubtedly improved the book greatly and has truly earned the title of editor. She made me work hard, but it has been a delight working with her.

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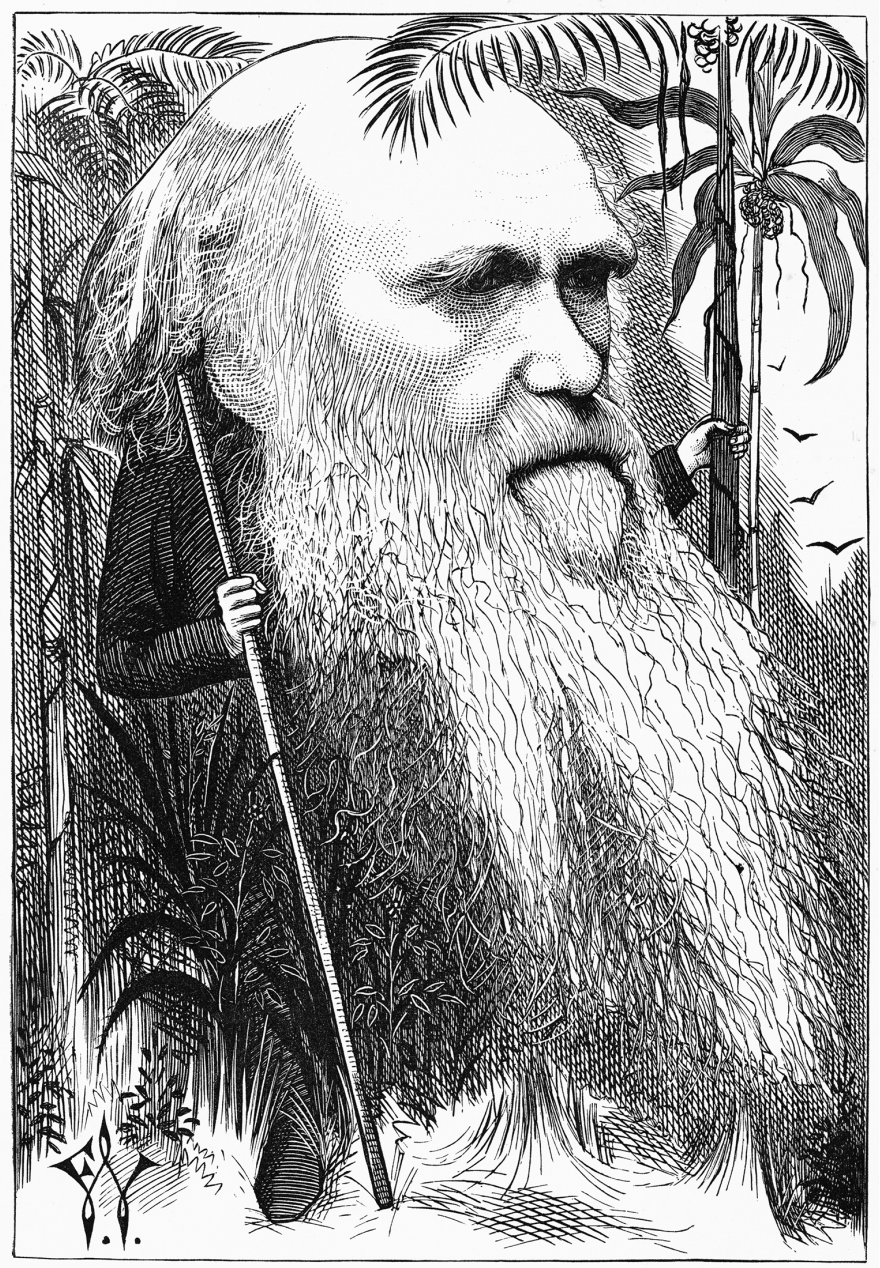
Riverside, California

NOTES ON DATING

- Dates for human evolution prior to a million years ago are given in Mya. Thus 4 Mya = 4 million years ago. Dates more recent than one million years ago are given as Kya, or thousand years ago. Thus 350 Kya = 350,000 years ago.
- Prehistoric dates refer to societies known archaeologically and without any written records. They are given in number of years ago (e.g., 8,000 years ago) or in Kya if the date is very old (e.g., 45 Kya = 45,000 years ago).
- Historical dates refer to earlier societies known primarily through the work of historians relying on written records. Historical dates are given in BCE (before the common era) and CE (common era). These dates are now widely used in place of the traditional BC and AD. Dates for historical societies that are relatively recent are given in terms of the century, for example, tenth century CE, or the precise year if known and relevant.



Artist's Caricature of Charles Darwin Darwin was the greatest biologist of all time. His theories of natural and sexual selection have had enormous impact on evolutionary biology, biological anthropology, sociobiology, evolutionary psychology, and several other academic disciplines.

(Courtesy of the Archives, California Institute of Technology)

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Theoretical Foundations

Darwinian Social Science Redux

Anthropologists and sociologists have spent about a century and a half trying to figure out the principles governing the operation of human society. Success has been rather modest, especially when compared to our bigger cousins in the physical and natural sciences, but some progress has nonetheless been made. There are several reasons why progress has not been greater, but one stands out above all the others: the failure to take seriously the notion that there is such a thing as human nature and that this nature plays a major role in human action. Anthropologists and sociologists have for many decades operated under one or another version of what has come to be called the **Standard Social Science Model**,* or **SSSM**.[1] This model assumes that behavior is determined almost entirely by various features of the social and cultural environment. Actually, the SSSM is a broad umbrella term encompassing a variety of approaches that vary in some of their details. The best known version of the SSSM was set forth early in the twentieth century by the anthropologist Franz Boas and has been carried forward by anthropologists and sociologists down to the present day.[2] The idea is that what separates humans from all other animals is **culture**, or the sum total of learned traditions, beliefs, values, and norms that people have created and acquired as members of a particular society. Culture was made possible by the evolution of the large and highly complex human brain, but once the capacity for culture emerged culture overrode human biology as the principal determinant of human behavior and social life.

Other versions of the SSSM include what might be called **role theory** and, more recently, **social constructionism**. Beginning in the 1930s the celebrated sociologist Talcott Parsons formulated the idea that social roles were central elements of social life.[3] Roles were scripts designed by society that prescribed certain courses of action

*Terms in boldface are given more extensive definition in the Technical Terms section that appears after the bibliography. Italics are used only for emphasis.

as appropriate or inappropriate. Through a process of **socialization**—direct teaching of juniors by their elders, as well as imitation of elders by juniors—people learned what was expected of them and acted accordingly. (Or, if they failed to act accordingly, they were subjected to sanctions designed to bring them back into line.) This kind of perspective gained wide traction in sociology and is still a major theme even today. Social constructionism is a reaction against what are called **essentialist** explanations of behavior. These are explanations that rely on the idea that certain social categories, such as gender or race, have "essential" characteristics that make them what they are. Essential characteristics are those that are a kind of defining essence of a category. For social constructionists, there are no defining essences. Social categories are cultural inventions or "constructions" created by particular groups of people at particular times. For the constructionists, an essence would be a type of biological essence, and this they reject emphatically. Social constructionism is probably the one version of the SSSM that denies the importance of human biology completely.

Things were not always this way. In the early years of social science, the late nineteenth and early twentieth centuries, a Darwinian evolutionary perspective was often employed. In sociology the leading Darwinian was a Finn by the name of Edward Westermarck. Westermarck wrote a series of books, the most important of which were a fat three-volume work on the history of human marriage and an equally fat two-volume work on the origin of the human moral sense.[4] Westermarck's contemporaries considered him to be one of the leading sociologists of the day and, indeed, we now know that he was far, far ahead of his time. Unfortunately, Westermarck's star began to fade in the 1920s, and by the time of his death in 1939 his ideas had passed out of favor. The reason is that the tide had turned against Darwinian social science, with its emphasis on an evolved human nature, and sharply toward social and cultural explanations. Darwinism became a dead letter in social science for half a century, and the SSSM stole the show. If such a thing as a biologically determined human nature even existed, social scientists thought, it had to be of minor importance.

Why did things change in this way? The intellectual historian Carl Degler has argued persuasively that the reason was not new research or the discovery of new facts.[5] At this time there was a great debate between "hereditarians" and "environmentalists." Existing research could have been interpreted in a convincing way from either perspective. The most defensible interpretation would have emphasized the complex interplay of the genetic or biological and the social or cultural. And, indeed, some scholars drew this conclusion. Degler contends that the tide turned because of a new emerging ideology and social philosophy of *egalitarianism*. A new emphasis was being placed on social equality, and the new egalitarians fervently promoted this goal. Even some hereditarians got swept up in the tide and changed sides. Emphasis on heredity and individual differences, it was thought, undermined the quest for equality, whereas an emphasis on the role of the social and cultural environment promoted it. And thus the SSSM prevailed.

Nevertheless, important developments in theoretical biology in the 1960s and 1970s, especially in evolutionary biology, provided a basis for reconsidering biology's relevance for human behavior. Major theoretical innovations by such eminent scholars as William Hamilton, Robert Trivers, and John Maynard Smith laid new foundations for the study of animal behavior, and human applications were quickly envisioned.[6] As a result, Darwinism reawakened in social science in the 1970s and 1980s, being revived by people calling themselves sociobiologists or evolutionary psychologists.[7] As Westermarck had done three-quarters of a century earlier, they used as their starting point the Darwinian theory of evolution by natural selection to understand the most fundamental features of human social behavior and social organization. This has led to a quantum leap in our understanding of how human social life works.

Darwinian Foundations

Before outlining the basic assumptions and principles of the new Darwinian social science, we first need to understand their general Darwinian foundations. Charles Darwin wrote his great book, *On the Origin of Species*, in 1859. His ideas have been modified and updated over the past century and a half, but most of the core ideas remain intact. He was not the first to introduce the idea of evolution as a way of explaining the wide diversity of species, but he introduced the mechanism that could explain how the evolutionary process worked. This mechanism is known as **natural selection**, and it is one of the simplest processes in nature. Here is how it works. In any population of organisms there are always more offspring produced than there are resources to support. Not all can survive and prosper. A "struggle for existence" is therefore going on all of the time, and organisms are unequally endowed for success in this struggle. Those organisms that have the characteristics that are most useful in adapting to a particular environment will have both a survival and a reproductive advantage. Being more likely to survive, they are also more likely to reproduce and thus leave copies of their **genes** in future generations. (Darwin didn't know about genes, the science of genetics not yet having been developed, but he knew that organisms had traits that were passed on through reproduction, and that this was very important.)

Evolution by natural selection is a two-step process. It starts with variation, which we today know as genetic variation. There is always variation within any population of organisms. This variation arises through both genetic recombination (sexual reproduction) and, most importantly, through mutations, or small changes in single genes. Mutations provide the raw material essential for evolution to occur. Most mutations are harmful and often lethal. They may kill the organism outright, or prevent it from surviving to reproductive age. Some mutations are neutral in their effects, and a few are beneficial, which means that they contribute to survival and reproduction.

The second step is a selection process in which beneficial genes are favored and harmful genes are disfavored. Organisms with beneficial mutations are more likely than those with harmful mutations to survive and reproduce, and thus to pass their beneficial mutations to offspring, who in turn pass them along to their offspring, and so on. Harmful mutations get weeded out as a result of the earlier death and low reproductive rates of organisms containing them. Over very long periods of time, the large-scale accumulation of beneficial or favorable mutations produces changes in populations of organisms, and it is these changes that we call evolution.

Because the mechanism by which evolution occurs is natural selection, it is "nature" that is doing the selecting. By nature we mean the environments in which organisms live. Darwin and modern-day evolutionists have stressed that natural selection is an *adaptive* process, or one that fits organisms to their environments. Let's take a simple example. Imagine a species of organisms called wuzzies, small mammals which have fur that is rather thin. Imagine also that the warm environment in which the wuzzies have been living has been getting colder and that the wuzzies do not have enough fur to protect them from the changing conditions. They start to die off. But a genetic mutation for thicker fur happens to arise in one of the wuzzies, and this mutation gives it a survival and reproductive advantage. It is a beneficial mutation. This wuzzy mates and passes its beneficial mutant gene along to the next generation. Many of its furrier offspring have the same advantage with the same reproductive results. Eventually, thin-furred wuzzies are replaced by thick-furred wuzzies. This is an evolutionary event, but on a rather small scale. Over millions or tens of millions of years much more evolution is possible. The evolving wuzzies may eventually give rise to new species, much like themselves in some ways but also distinct.

For natural selection to occur, organisms must do more than survive. They must also *reproduce*. This is the only way copies of their genes can remain in the gene pool and be passed along to descendants. An organism's success, or **fitness**, is measured in terms of its degree of **reproductive success**. The fittest organisms are those that leave the most offspring and thus the greatest number of genes in future generations. This is the precise meaning of fitness, and in fact is the *only* meaning of fitness. In evolutionary terms, fitness cannot be measured or assessed in any other way.

A variation on the concept of fitness known as **inclusive fitness** was developed in the 1960s and 1970s.[8] You can measure any organism's inclusive fitness by counting its number of descendents, but you can also do it by enumerating its relatives in the same generation. Parents share half of their genes with offspring, but these offspring also share half of their genes with each other. Therefore, it came to be recognized that an organism can promote its genetic representation in a population by showing favoritism toward siblings, and also to some extent toward cousins. You can promote your inclusive fitness by producing offspring, but if you have brothers and sisters you can also do it by helping them reproduce. Favoring kin in this way is often called **kin selection**. The sum total of the copies of your genes in present and

descendant generations is your inclusive fitness. It is this idea of inclusive fitness that became the conceptual foundation of what was to be called sociobiology and later evolutionary psychology.

Virtually all anthropologists and sociologists readily agree that evolution has occurred, and that natural selection is the principal mechanism responsible for it.[9] They do not doubt that it is this process that produced humans from their prehuman ancestors. But most balk at the claim that natural selection applies to human *behavior* as well as to human anatomy and physiology. They say no, it doesn't apply to behavior. But this book says yes. You are not being asked to accept this on faith, and evidence will be provided to support this claim. But that will take time and thus has to be postponed to later discussions. Indeed, that is mostly what this book is about.

If human behavior evolved just as the human body did, and if evolution is an adaptive process, then it stands to reason that many features of human behavior must be adaptive. As mentioned previously, this means that there must be something called human nature, which is the sum total of these adaptive behavioral tendencies. (More precisely, human nature is the sum total of the *brain mechanisms* that, in interaction with environmental contingencies, generate adaptive behaviors.) From a Darwinian point of view, the task is therefore to figure out what this human nature is like and how it evolved. What is inside the organism that drives its behavior? In this book we will figure that out and apply it to understand how people throughout the world behave and how societies work.

Sociobiology and Evolutionary Psychology

The term **sociobiology** came into general use in 1975 when the Harvard University biologist Edward O. Wilson published a huge book entitled *Sociobiology: The New Synthesis*.[10] Most of it was about animal behavior, but the final chapter was about humans. Some social scientists paid close attention to that chapter and began to use some of its ideas. A decade later several anthropologists and psychologists started to think in Darwinian terms and introduced a very similar approach that they called **evolutionary psychology**. In the most general sense, sociobiologists and evolutionary psychologists seek to understand the biological foundations of human behavior and social life. More precisely, they argue that the human brain evolved to adapt itself to both the challenges of nature and the challenges imposed by interacting with other people. Humans' evolved species-specific nature interacted with the natural and social environments to shape particular social behaviors and modes of social life.

Some say that evolutionary psychology is basically just a new name for sociobiology. E. O. Wilson, for example, has said that they are the same thing. Evolutionary psychologists see it differently, sometimes very differently. But first we need to consider where the representatives of the two approaches agree. Both agree that

human nature evolved in what is called the **Environment of Evolutionary Adaptedness (EEA)**, more often called the **ancestral environment**. This is the environment that existed prior to 10,000 years ago when humans everywhere subsisted by hunting and gathering and most often lived in relatively small bands or camps. Both approaches also agree that human nature evolved as a package of traits that were adaptive in solving the most important problems of human living. Human nature, in other words, consists of a package of **evolutionary adaptations**. In Darwinian terms, a trait is an evolutionary adaptation if it directs behavior that promotes the survival and reproductive success of any organism with the trait.

As for the differences, there are two principal bones of contention. Although agreeing with the evolutionary psychologists that human nature evolved in the ancestral environment, sociobiologists generally assume that what was adaptive back then continues to be adaptive today despite major changes in the nature of social life. Sociobiologists try to infer the content of human nature by looking at the consequences of any given behavior, especially its reproductive consequences. They try to assess whether any given behavior is fitness promoting, regardless of the type of society or environment in which people are living.

Evolutionary psychologists, by contrast, insist that what was adaptive in earlier environments may not be adaptive in novel modern environments. This has an important methodological implication. Evolutionary psychologists suggest that it is of no use to evaluate the reproductive consequences of a behavior in modern environments because a novel environment often deflects behavior in different directions. It doesn't matter whether or not a behavior maximizes reproductive success in modern environments because "the key issue is not whether or not a given phenotypic feature influences reproductive success, but rather whether **differential reproductive success** *historically influenced* the form of the phenotypic feature."[11] (A phenotypic feature is the outward expression of a gene or set of genes. Brown eyes, for example, are phenotypic. The underlying genetic structure is the genotype. A person with brown eyes may carry two genes for brown eyes, or one for brown and another for blue. The brown/brown and brown/blue combinations are genotypic features.) Rather than trying to measure reproductive success in modern environments (or in any society other than the ancestral environment), we should instead be looking for evidence of **adaptive design** in brain mechanisms.

A second difference between the two approaches is evolutionary psychologists' emphasis on the *modular* nature of the brain. They contend that the brain is not a general purpose mechanism, as is claimed by most anthropologists and sociologists (adherents of some version of the SSSM), but an organ that contains a large number of highly specialized mechanisms, usually known as **domain-specific mechanisms**. Each domain-specific mechanism carries out a highly specialized task. These tasks would be things like being alert to predators, sizing up whether someone is a friend or an enemy, or evaluating the reproductive value of a potential mate. Evolutionary psychologists provide several reasons why the brain must be modular.[12] First, the

adaptive problems confronted by our ancestors were not general but very specific. An all-purpose brain would be too clumsy and inefficient to solve these problems, and a clumsy and inefficient brain would do a very poor job of promoting survival and reproductive success. Organisms with a general purpose brain would have been at a severe competitive disadvantage and would likely have been extinguished long ago. They would have become no one's ancestors. As John Tooby and Leda Cosmides suggest, "Many adaptive problems that humans routinely solve are simply not solvable by any known general problem-solving strategy, as demonstrated by [such things as] formal solvability analyses on language acquisition."[13]

In addition, because a great deal of (reproductively) successful behavior depends on highly variable environmental conditions requiring behavioral flexibility, such flexibility requires highly specialized brain mechanisms. As Donald Symons points out, "Extreme behavioral plasticity implies extreme mental complexity and stability; that is, an elaborate human nature. Behavioral plasticity for its own sake would be worse than useless, random variation suicide. During the course of evolutionary history the more plastic hominid behavior became the more complex the neural machinery must have become to channel this plasticity into adaptive action."[14]

Finally, there is an important analogy between the brain and the body. The body is not a highly general structure, but rather a complex composite of many highly specialized organs, tissues, and cells, each with a specific function. The heart just pumps blood, the kidneys just filter blood, and so on. The intestines don't process food, pump blood, and take in oxygenated air all at the same time. They just extract nutrients from food and eliminate what cannot be processed. Therefore, since the body directs survival through specialization, the brain must direct behavior through specialization.

The evolutionary psychologists' emphasis on the modular brain seems right, but their point about eschewing the study of reproductive success in modern environments is problematic. So is their idea that the objective should be to find evidence of adaptive design. This is indeed the ideal approach, but it is a great challenge. It is easy to see that the eye reveals evidence of complex adaptive design, but much more difficult to find adaptive design in the mental modules that direct behavior. One way would be to actually locate a brain module and study its design in microscopic detail. But no one has yet found such a module. The existence of brain modules therefore has to be *inferred*. But how? The evolutionary biologist Richard Alexander points out that design cannot be studied except by reference to behavior. "One studies behavioral and other outcomes, judges their reproductive significance, . . . and then infers the underlying physiological and morphological designs. Information about psychological and physiological mechanisms can be gained only by observing ultimate expressions of the phenotype."[15]

Moreover, it is likely that most evolutionary adaptations that arose ancestrally continue to promote adaptive behavior in the modern world. After all, if we say that history has unfolded to produce a series of different types of societies, and if

Darwinian adaptationist assumptions are correct, then later and newer societies should have been built within the framework of those adaptations.[16] It seems highly unlikely that modern societies radically inconsistent with deep human motivations would ever have evolved. (Social experiments attempting to establish radically different communities or societies almost always fail because they are designed in ways that are completely at odds with natural human inclinations.) In modern societies people still favor kin over non-kin, strive for status, and seek high-quality mates, just as they did in the ancestral environment.

Of course, there is no denying that *some* behaviors that were once adaptive will not be adaptive in the modern context. For example, in earlier times everyone sought to reproduce, but in modern times some people choose to remain childless. We therefore need to be sensitive to the evolutionary psychologists' point. However, if we study the reproductive consequences of certain behaviors in modern environments and find that many people are not maximizing their reproductive success, then an important opportunity is presented. We can ask why they are failing to do this, which will give us additional information about underlying psychological mechanisms.[17] As another example, we find that men in all societies seek to mate with many women, a variety of women, and young women. This is just as true in modern times as it was in earlier times. In modern times men are not seeking to produce more offspring by way of mating with many young women, but it is easy to conclude that *they are still acting in accordance with an evolved adaptation that would be reproductively adaptive in the absence of modern contraception.*

A sensible conclusion may be to split the difference between sociobiologists and evolutionary psychologists. The evolutionary psychologists' point about novel environments must be taken seriously, but it seems unwise to completely eschew the study of reproductive success in modern societies. Splitting the difference may seem like having our cake and eating it too, but in this case I think it is justifiable because the approaches are complementary rather than competing. As for terminology, this book uses the term "evolutionary psychology" because it is widely preferred and strongly established. But since sociobiologists and evolutionary psychologists are united in their commitment to Darwinian principles, the term **Darwinian** is also useful and appropriate. Thus one can speak of evolutionary psychological explanations, but also of **Darwinian evolutionary** explanations. In this book the terms are considered equivalent.[18]

Qualifiers

There are several important qualifications to what has been said thus far. Perhaps most importantly, it is crucial to stress that sociobiology and evolutionary psychology are not forms of **biological determinism**, a charge often made by critics. Biological determinism, a viewpoint that hardly anyone has ever advocated, assumes that human behavior is entirely or almost entirely the product of human biology.

The evolved adaptations of the human brain are anything but rigid instincts and do not operate in a vacuum. They operate within a context and the specifics of this context play an important role in determining how they are expressed. A good name for this is **socioecological context**, which is the total set of environmental conditions to which people must adjust or adapt. Socioecological context includes the natural or physical environment, as well as the economic, political, social, and cultural environments, indeed all of the external contingencies that constrain and enable people. Most adaptations are *facultative* in nature. A **facultative adaptation** is one in which individuals assess the socioecological contexts in which they live and adjust their behavior accordingly in order to achieve the objectives that the adaptation is designed for. Sometimes maximizing reproductive success means having numerous children. This might be the case, for example, if infant mortality is high and a substantial number of children are expected to die before they reach reproductive age. But in other contexts maximizing reproductive success can best be done by having fewer children and investing more resources in each. This might be the best strategy when most children are expected to survive to adulthood.

And, as evolutionary psychologists stress, socioecological context can compromise adaptations by deflecting them. This has led the sociologist Joseph Lopreato to formulate what he calls the **modified maximization principle**.[19] This principle speaks to the idea that human nature consists of more than just one thing. People have many goals, and these goals frequently conflict with each other. For example, some people in affluent societies are so concerned with gratifying hedonistic desires that they find children a nuisance and choose not to have any. Consider also mother-infant bonding. Much evidence suggests that mothers and infants are biologically predisposed to bond to each other, but in some instances bonding may be weak or may fail completely. Some women show no interest in becoming mothers because they are pursuing goals that conflict with motherhood. Or, even though people have strong religious propensities, in modern societies in which science plays a major role some people may become persuaded that religious ideas are false and give up religious beliefs and practices altogether. There are many atheists in modern industrialized societies, but they would have been few and far between in past societies.

It is also necessary to distinguish between the conscious and the unconscious origins of behavior. People usually have a very limited understanding of what drives their behavior. If they understood their behavior, there would be no need for social scientists, let alone clinical psychologists or psychiatrists. We could just ask people why they did this or that, and they would tell us. Freud stressed that much human behavior is driven by unconscious motives. Although his overall understanding of these motives has left much to be desired, and has therefore been abandoned by all but a very small number of faithful adherents, he did get that part right. Do people know that in seeking status or promoting their children's well-being they are trying to promote the representation of their genes in the gene pool? Not likely. And if we told them that is what they were doing, most would probably look at us with utter

consternation or laugh us out of the room. So none of the mechanisms driving behavior necessarily depend on any conscious understanding on people's part.

Finally, there is an important distinction between the **proximate** and the **ultimate causes** of behavior. Proximate causes are immediate things, often consciously recognized, that induce us to act in a certain way. Humans, for example, like sweet foods. If you are served apple strudel and you like the taste, a proximate explanation of your liking for apple strudel is straightforward: apple strudel is sweet and you, like most people, like sweet things. But another question remains: why do most people like sweets? To answer that question is to provide an explanation in terms of ultimate causes. Darwinian thinking provides us with a two-step ultimate explanation. Step one says that eating a lot of sweet foods in the ancestral environment contributed to survival, good health, and by extension reproductive success. Step two says that evolution crafted the human brain to like sweet things so people will eat more of them and thus be healthier and leave more progeny. And we can say that this explanation is very likely correct. A large part of the human diet in ancestral environments was highly nutritious fruit, and fruit is sweet. And thus the human brain evolved to like sweet foods.

Or take a college student in a classroom sitting next to an attractive young woman. He gets to know her and, unsurprisingly, feels sexual interest. Why does he want sex with this particular woman? At the proximate level, the cause of his behavior is simply that he, like almost all men, finds women who are attractive, young, and well proportioned very desirable. But what would be the ultimate cause of his behavior? The answer is that young, attractive women with certain kinds of body shapes tend to be healthier, have greater fecundity (the ability to conceive), and give birth to healthier offspring than older, less attractive women with body shapes that display lower fecundity. Evolution has sculpted men's brains for such preferences because of the payoff in reproductive success. Like the ultimate explanation of the human fondness for sweet foods, this is a Darwinian evolutionary explanation—it identifies the ultimate causes underlying human motivation and behavior.

Similarly, consider a woman who chooses a physician or a lawyer as her mate rather than a starving artist. We can understand the logic underlying her preference as one for a man with status and resources. Identifying her preference in these terms is a proximate explanation for her choice of a mate. But there is still the question why this woman (and many other women) have such a preference. Why does she prefer a man with status and resources to a man without them (above and beyond the obvious creature comforts that status and resources can provide)? Answering this question requires an understanding of the brain mechanisms that make choosing men with status and resources reproductively adaptive. To identify these mechanisms, which constitute evolved adaptations, is to provide an ultimate explanation that, once again, is a type of Darwinian evolutionary explanation.[20]

The Contents of Human Nature

If our subject is **human nature**, what then does it consist of? What is inside the organism? The following may be suggested as the most important features.[21]

- Humans are self-interested organisms in the sense that they give priority to their own interests over those of others. Being *self-interested* is not the same as being *selfish*. Giving priority to your own interests—being self-interested—cannot be equated with being inconsiderate of others, refusing to share or cooperate, and so on—in other words, being selfish. The promotion of self-interest often involves behavior that is highly cooperative and helpful to others, and thus not really selfish at all.
- Humans are highly sexed and the vast majority prefer heterosexual sex. Powerful sex drives increase the desire to mate and reproduce. People of each sex seek the most favorable mates, which are the ones who will provide their offspring with the best genes. In the mating game, males give priority to females who are young and sexually attractive, whereas females give priority to males who demonstrate that they can be good resource providers.
- Humans are designed to favor kin over non-kin because they share genes in common with kin. Because people can promote the representation of their genes in the gene pool through both their own reproduction and by helping relatives be reproductively successful, kin will be favored over non-kin and close kin over more distant kin. Kinship and the family therefore rest on a natural foundation.
- The most important kinship bond is the parent-child bond, especially the mother-child bond. Appropriate parental behavior is essential for people to promote the representation of their genes. But what constitutes appropriate parental behavior—the most adaptive parental behavior—depends on the kinds of environmental conditions people face. Parental behavior is highly contingent on circumstances.
- Because there are two sexes that contribute in different ways to reproduction, all societies are naturally sexually differentiated. And because sex is related to gender, individuals everywhere have a strong sense of gender identity, which is the most fundamental of all human identities.
- Humans are naturally competitive, and they compete most vigorously for status and resources. Status or social rank is useful and often necessary for acquiring resources and attracting good mates. Although there is natural variation among individuals in the strength of the desire for status and resources, this desire is found in nearly all people in all societies. It is fundamental to how people interact and to how every society is structured.

- Closely tied to status and resource seeking is power seeking. In general, people desire to control situations and influence others, which in many instances takes the form of dominating them in coercive ways. The innate desire to influence, control, or dominate allows humans to try to structure situations so they can gain advantages or benefits for themselves. However, as in the case of status and resource seeking, there is variation in the extent to which particular individuals seek power or influence.
- People not only compete; they also cooperate. They are strongly attached to their fellow humans and feel such natural emotions as affection, sympathy, love, and friendship. They cannot develop normally without social bonds, and they find these bonds necessary to a fulfilling life. The cooperation that makes society possible rests, like competition, on a natural foundation. Nevertheless, people are most likely to cooperate when others can benefit them, or when the failure to cooperate is disadvantageous or injurious. In all known societies, cooperation is most likely to occur among kin, somewhat less likely to occur among friends and close acquaintances, and least likely to be found among distant acquaintances or strangers.
- People are primed for complex learning, which may take one of two principal forms. One form is the direct teaching of juniors by elders. The other involves imitating what others are saying or doing. Most learning likely occurs in the second way; humans are extraordinarily imitative animals. Humans are primed to learn because, given the very wide range of natural and social environments to which they must adapt, learning is essential to human survival and reproduction.[22]
- People everywhere strongly identify with others who share the same culture and language. Ethnic identification arose in ancestral environments because it was adaptive in promoting the interests of the members of groups engaged in competition with other groups.
- Humans have an innate propensity for religious understanding and experience. Religion has many functions, but most importantly it offers people comfort and security, release from anxiety, and the like. People who are more religious tend to be healthier, to live longer, and to leave more offspring than less religious people.

Conclusion

Does evolutionary psychology have all the answers? Can it replace traditional anthropology and sociology? Certainly not. It is not necessary to throw all of standard anthropology and sociology out, because these fields have produced many insights. Although evolutionary psychologists include socioecological context in their explanations, they often do not go far enough. But socioecological context is the stock and trade of traditional anthropology and sociology. We can draw on many of the

insights of these fields and combine them with evolutionary psychology to produce more thorough and complete explanations.

Moreover, there are numerous features of social life that have at best a tenuous connection to human biology. If we want to understand why societies have evolved over time as they have—the subject of Chapter 3—human nature may be relevant, but it is only part of the story. Other factors apart from human nature are critical. (In Chapter 3 we will see what these factors are.) And if we want to understand such things as rebellions or revolutions, biology is of almost no help at all. And then take religion. If humans have a biological propensity for religious experience, this alone will hardly tell us why some societies have shamans, why some have priesthoods and others don't, why some practice animal sacrifice and others forbid it, or why some have many small gods and others just one big one. Obviously the entire social, cultural, economic, and political environments in which people find themselves are crucial in understanding the many different forms of religion, and in fact the different forms that all other human institutions take.

SUMMARY

1. Anthropology and sociology have had only limited success because for nearly a century they have largely rejected the notion of human nature and have consequently failed to inquire into the biological foundations of behavior and society. In the late nineteenth and early twentieth centuries human nature was taken seriously, but this concept dwindled in significance and all but disappeared after the 1930s. The social sciences came to be dominated by the so-called Standard Social Science Model, or SSSM. The SSSM exists in various guises, but all versions emphasize that human behavior is predominantly a social and cultural creation.

2. The triumph of the SSSM was largely the result of the triumph of a new social philosophy and ideology of egalitarianism rather than of new facts. However, new developments in theoretical biology in the 1960s and 1970s paved the way for a revival of the human nature concept and a major theoretical shift in the thinking of some social scientists.

3. In the 1970s and 1980s it came to be seen that the most useful way of thinking about human nature is by using key concepts from Darwinian evolutionary biology. Darwinian approaches use the concept of natural selection to explain not only animal (including human) anatomy and physiology but also behavior. Natural selection is the process whereby organisms compete with each other for survival and mates, with those having the genes that are most adaptive in particular environments out-surviving and out-reproducing those with genes that are less adaptive or non-adaptive.

4. For evolution to occur there must be genetic variation within animal and human populations. One of the main sources of variation is genetic mutation. Most mutations are harmful or neutral in their effects, but some are beneficial. When environments change, beneficial mutations will be favored and will spread throughout the gene pool by way of the greater survival and reproductive success of the organisms containing the beneficial genes.

5. The basic currency of adaptation is reproductive success. Organisms can promote the representation of their genes in the gene pool by mating and leaving offspring, but also by favoring relatives who themselves will be better able to leave more offspring. Favoring relatives and helping them reproduce is known as kin selection. Kin selection leads to inclusive fitness, which is the total representation of an organism's genes in the gene pool.

6. These principles apply to humans just as they apply to other animals. In the past forty years two approaches have emerged that use evolutionary principles to understand human behavior. The first, sociobiology, emerged in the 1970s, whereas the second, evolutionary psychology, emerged in the late 1980s. Both approaches seek to understand how a species-specific human nature evolved to promote human survival and reproductive success.

7. Human nature consists of evolutionary adaptations contained in the brain. Sociobiologists and evolutionary psychologists seek to understand the nature of these adaptations. There is debate concerning how similar or different sociobiology and evolutionary psychology are. Both agree that these adaptations arose in the human ancestral environment, which was the period prior to 10,000 years ago in which humans lived in small groups devoted to hunting and gathering. Sociobiologists seek to identify an evolutionary adaptation for a particular behavior by looking to see if that behavior promotes inclusive fitness. Evolutionary psychologists contend that this is a misleading strategy because a behavior that promoted inclusive fitness in the ancestral environment may not do so in modern environments, which are highly novel. Therefore they do not seek to measure reproductive success but look for evidence of adaptive design in the brain.

8. This book takes no strong position on the disagreement between sociobiologists and evolutionary psychologists. It is true that some behaviors that were adaptive in ancestral environments may no longer be adaptive in modern environments, but the issue should be addressed on a case-by-case basis. It is likely that many evolutionary adaptations will continue to be adaptive in modern contexts. The most important point is that sociobiology and evolutionary psychology are far more similar than different. They are united in their emphasis on an evolved human nature as the foundation of much behavior, and as such should be seen as partners rather than competitors. They are Darwinian evolutionary approaches.

9. Evolutionary psychologists stress that the brain is not a general purpose organ; instead, it consists of many highly specialized modules that are domain specific. A module may be specialized for assessing the reproductive value of a potential mate. That is all it does. Or a module may be specialized for rapid language learning. The argument in favor of domain-specific modules is based on the recognition that a general purpose brain would be too clumsy and inefficient to allow people to cope with the various and sundry challenges of human life.

10. Darwinian evolutionary approaches are not forms of biological determinism. They stress that all of the evolutionary adaptations of the brain operate within a socioecological context, or a total set of characteristics of the natural and social environments. Evolutionary adaptations are highly sensitive to this context and adjust themselves to it. For example, people's decisions about how many children to have are highly dependent on several features of the human environment.

11. An important evolutionary principle is the so-called modified maximization principle: people generally strive to maximize reproductive success, but under some circumstances this goal may be deflected by competing goals. In modern societies, for example, some people focus so intensely on their careers that they choose not to have children, fearing that parenthood would interfere with their ability to do their job.

12. Darwinian theory distinguishes between the proximate and the ultimate causes of behavior. Proximate causes are immediate or direct and include such things as natural human preferences (whether conscious or unconscious) and sex hormones. If we explain the human desire for wealth by saying that wealth brings pleasure, we have given a proximate explanation of the desire for wealth. But there is still the question why wealth brings pleasure. If we say that the brain evolved in ancestral environments to associate wealth with pleasure because wealth contributed to reproductive success, then we have given an ultimate explanation of the desire for wealth.

13. Human nature has many dimensions, but the most important are : (a) humans are self-interested organisms who favor their own interests over the interests of others; (b) humans are highly sexed and generally prefer heterosexual sex; (c) humans favor kin over non-kin and close kin over more distant kin; (d) humans are primed for optimal parental behavior; (e) humans are naturally competitive and compete most vigorously for status, resources, and dominance; (f) humans cooperate as well as compete and have natural emotions such as affection, sympathy, love, and friendship; (g) humans are primed to learn because adaptive behavior requires an understanding of socioecological context; (h) humans have an innate propensity for religious understanding and experience; (i) human males and females have a natural sense of gender identity; and (j) humans strongly identify with co-ethnics, or those with whom they share a common culture and language.

QUESTIONS FOR DISCUSSION

- ✓ What is the Standard Social Science Model, or SSSM, and how has it affected social scientists' receptivity to Darwinian thinking? What are some of the different versions of the SSSM?
- ✓ Why did the SSSM triumph in the early twentieth century?
- ✓ What led the late-twentieth-century challenge to the dominance of the SSSM?
- ✓ Darwinian thinking assumes that human nature is a product of evolution by natural selection. Explain how natural selection works. What key concepts are necessary to explain this process?
- ✓ Explain the concepts of adaptation and fitness. How is fitness measured in Darwinian terms?
- ✓ What does it mean to call something an evolutionary adaptation?
- ✓ What are the similarities and differences between sociobiology and evolutionary psychology as Darwinian approaches to human behavior? Is it necessary to choose one over the other?
- ✓ What does it mean to say that the brain is not a general purpose organ but consists of a wide range of domain-specific mechanisms? Why do evolutionary psychologists emphasize domain specificity?
- ✓ What are kin selection and inclusive fitness as evolutionary processes?
- ✓ What is socioecological context and why is it important to Darwinian social science?
- ✓ What is the so-called maximization principle? Why is it qualified by calling it the modified maximization principle?
- ✓ What is the difference between proximate and ultimate causes? Which type of cause is emphasized in Darwinian approaches?
- ✓ What is meant by human nature? Describe some of its most important dimensions.

References and Notes

1. Tooby and Cosmides 1992.
2. See reprinted articles in Boas 1940.
3. Parsons 1937.
4. Westermarck 1906–1908, 1922a, b, c.
5. Degler 1991.

6. Hamilton 1964; Trivers 1971, 1972, 1974; Maynard Smith 1964, 1974, 1978; cf. Chagnon 2013.

7. E. O. Wilson 1975; Van den Berghe 1978; Daly and Wilson 1978; Chagnon and Irons 1979; Lopreato 1984, 1989; Badcock 1991; Barkow, Cosmides, and Tooby 1992; Nielsen 1994; Betzig 1997; Crawford and Krebs 1998; Lopreato and Crippen 1999; Cronk, Chagnon, and Irons 2000; Segerstråle 2000; Pinker 1997, 2002; Gaulin and McBurney 2003; Buss 2007; Cartwright 2008.

8. Hamilton 1964; Maynard Smith 1964; Alexander 1974.

9. Darwin actually identified another mechanism of evolution that he called *sexual selection*. Discussion of this mechanism is taken up in Chapter 5.

10. E. O. Wilson 1975.

11. Symons 1989, p. 137; emphasis added.

12. Thornhill and Palmer 2000; Tooby and Cosmides 1992.

13. Tooby and Cosmides 1992, p. 111.

14. Symons 1987, p. 127; quoted in Thornhill and Palmer 2000.

15. Alexander 1990, p. 247.

16. Turke 1990, p. 316.

17. Turke 1990.

18. Some evolutionary social scientists use the term *human behavioral ecology* (HBE). Behavioral ecologists study how behavioral variation both within and between societies is the result of evolved mental adaptations interacting with specific features of the ecological environment. Whether this is a distinct approach or simply another name for sociobiology remains unclear. Irons and Cronk 2000 point out that the work of some contemporary scholars who call themselves human behavioral ecologists is based on the same theoretical principles as those calling themselves human sociobiologists. Hames 2001 provides a brief sketch of HBE and some of its major research findings. E. A. Smith 2000 and Winterhalder and Smith 2000 provide a similar sketch, but also explicitly compare HBE and evolutionary psychology. They suggest that it is most productive to see these as complementary rather than competing approaches even though some of their assumptions differ. HBE has proved to be especially useful in the study of dietary practices and is used in the analysis of foodways in Chapter 4.

19. Lopreato 1984, 1989.

20. It is worth pointing out that not all proximate causes involve people's preferences, whether conscious or unconscious (many preferences are unconscious). A proximate cause of the higher levels of aggressiveness found in males relative to females is the male hormone testosterone. There are many such proximate causes of many behaviors.

21. A partially overlapping but much longer list is found in Arnhart 1998.

22. A good discussion of the importance of imitative learning can be found in Boyd and Richerson 1985.

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Beginnings

Humans are distinguished from all other animal species in a variety of ways, but in particular by large and extremely powerful brains, by the ability to create and learn language and engage in rapidly articulated speech, and by having abstract culture. Humans are most closely related genetically to chimpanzees, and the two species shared a common ancestor some 5–6 million years ago. Modern chimpanzees, which evolved along their own separate line, never developed language or abstract culture or brains anywhere near the size and complexity of the modern human brain.

This chapter tells the story of human evolution after the chimpanzee-human split. Species of humans after that split, previously called hominids, are now known as *hominins*.[1] We will trace the overall transition from one hominin species to another and look at the major changes that occurred, especially in bodies and brains and in the ability to make and use tools. At some point in the development of the brain, humans acquired the capacity for language. When this occurred is still poorly understood. It could have been as recently as 50,000 years ago, as some would have it, but in all likelihood it was earlier, possibly 200,000 years ago, or perhaps even hundreds of thousands of years before then. Whenever language emerged, it is very unlikely that it arose all of a sudden. In all probability language developed gradually over a long period of time and was increasingly perfected. In any event, we will explore the nature of language and explain why it is a safe bet that there is a "language instinct."

Human culture has many components. Material, or technological, culture consists of tools, techniques, and information that people use to make a living and fight wars. Culture also includes socially patterned ways of thinking and acting that the members of a community or society have developed and that persist into subsequent generations, whether by direct teaching or processes of imitation. For most of human history and prehistory, cultures were simple and only started to become highly developed about 50,000 years ago, when a sort of "cultural big bang" was initiated. Culture at this level required complex language and a capacity for highly abstract thought. We will consider the nature of this development at the end of the chapter.

African Genesis, African Exodus

Humans were born in Africa and left it for elsewhere at least three times. Although the first fossils thought to be human were discovered in the nineteenth century, it has been mostly in the past forty years that major discoveries have been made and a much more complete understanding of human evolution has been achieved.

The oldest hominins, known as the australopithecines, first appear in the fossil record around 4–4.5 million years ago (Mya), their remains having been discovered in southern Africa. The australopithecines are identified as humans rather than apes primarily because of their way of getting around and the shape of their dentition. Apes are quadrupeds and have a predominantly pronograde ("hunched over") posture. They walk on all four limbs, usually on their knuckles. The australopithecines, by contrast, had a largely orthograde (upright) posture and were bipedal—they walked only on their legs.[2]

As for teeth and jaws, apes have an elongated, U-shaped dental arcade, whereas the australopithecine arcade was less elongated and had a softly rounded, more V-like shape. In addition, the australopithecine canine teeth were a lot smaller and their molars much larger. Smaller canines suggest a lower level of aggression, and the larger molars indicate a diet consisting primarily of tough plant foods, probably nuts, seeds, and hard fruits. Molars are grinding teeth and large ones are useful for masticating these plants into a digestible form.[3]

The australopithecines were small creatures. Males stood less than five feet tall and weighed about a hundred pounds, whereas females stood barely three and a half feet tall and weighed only about sixty-five pounds. They were not very smart by modern standards. The braincase of modern humans averages about 1,350 cubic centimeters (cc's), but *Australopithecus* had a tiny braincase by comparison. Fossils show that its size varied from 380 to 540 cc's, with an average of about 450.[4]

Artists have tried to reconstruct the appearance of the australopithecine face and, if this reconstruction is reasonably accurate, anyone looking at it would almost certainly say, "this is an ape" (the name *Australopithecus* means "southern ape"). And there are other apelike characteristics: a prominently prognathic (projecting rather than straight) face, an apelike nose and ribcage, and long arms. It is likely that *Australopithecus* was not fully bipedal and did a lot of climbing. In the words of the biological anthropologist Richard Klein, "The australopiths were essentially bipedal apes, who still spent considerable time feeding, sleeping, or avoiding predation in trees."[5]

Some australopithecines may have survived until about a million years ago, but a new hominin species evolved well before this time: *Homo habilis*, meaning "handy man." It is more clearly a hominin. *H. habilis* fossils were first found in the Olduvai Gorge region of eastern Africa, with other fossils being discovered somewhat later in the Lake Turkana region. The various fossils are dated between 2.3 and 1.8 Mya. The differences between *H. habilis* and *Australopithecus* were not pronounced but

are important nonetheless. *H. habilis* was less apelike, probably fully bipedal, and somewhat more intelligent, with a cranial capacity in the range of 510–750 cc's. *H. habilis* ate meat and was likely the first hominin to use tools. Fossil remains have been found in association with a variety of stone tools, which were specialized primarily for hammering, butchering carcasses, and scraping hides. Interestingly, *H. habilis* was slightly smaller than *Australopithecus.* Males stood just over four feet and weighed about eighty pounds, whereas females were closer to three feet and seventy pounds.[6]

Next in the evolutionary line is *Homo erectus*, whose fossilized remains begin to show up in the archaeological record some 1.8 Mya. With *H. erectus* we see a large increase in size, with males at about 5 feet 9 and 145 pounds, and females 5 feet 2 and 125 pounds. This shows a reduction in sexual dimorphism—differences in size between the sexes—compared to *H. habilis* and especially to *Australopithecus. H. erectus* had a robust build with heavy bones and a large supraorbital (brow) ridge. There was a pronounced increase in brain size, with some fossilized crania measuring 1,000 cc's or slightly larger. A bigger brain allowed *H. erectus* to make better and more specialized tools. *H. erectus* was likely a big game hunter for whom meat was a major part of the diet. *H. erectus* may have been relatively hairless and, if so, probably developed dark skin as a protection against the high levels of ultraviolet radiation that occur in Africa.[7]

H. erectus was the first hominin to leave Africa, doing so at least a million years ago and possibly as early as 1.5 Mya. *H. erectus* fossils have been found in China and Java, some dated to about 800,000 years ago (800 Kya). *H. erectus* may have continued to evolve in east Asia and have been present as recently as 50 Kya, eventually being displaced by in-migrating modern humans.[8]

We are now on the cusp of the Neanderthals, the best-known prehistoric humans to both biological anthropologists and the public at large. Neanderthal remains were the first hominin fossils to be discovered (in 1859 in the Neander valley of Germany, for which they were named), and they are by far the most numerous and complete of all prehistoric human fossils. More recently fossils similar to those of the Neanderthals have been discovered, the best known of which belong to *Homo heidelbergensis*, so named because they were discovered near Heidelberg, Germany. *H. heidelbergensis* probably originated in Africa and later migrated to Europe, eventually evolving into the Neanderthals between about 600 and 400 Kya. Heidelbergers who stayed in Africa later evolved into modern *Homo sapiens*, but that is getting ahead of the story.[9]

The Neanderthals inhabited a wide territory extending from western Asia through most of Europe. They were ruggedly built and heavily muscled, with thick chests, broad trunks, large heads and faces, and short limbs. These are features signifying adaptation to very cold climates, and the climate throughout their range was indeed extremely cold during most of their time on earth. The Neanderthals had improved greatly on the tool kit of earlier hominins, with many more highly

specialized and much more efficient tools. They also hunted large game with spears, such as wooly mammoth, wild horses and cattle, and deer. They were probably the first hominins to wear clothing. And their intelligence approximated that of modern humans, with braincases averaging about 1,435 cc's.[10]

Until recently the Neanderthals were thought to be directly ancestral to modern humans and were therefore classified as *Homo sapiens neanderthalensis*, a subspecies of *Homo sapiens*. But we now know that the Neanderthals were an evolutionary dead end, and so they have been assigned to their own species, *Homo neanderthalensis*. The Neanderthals became extinct between about 25 and 30 Kya, and the extinction was rapid. What happened? It is now fairly certain that the Neanderthals had to cope with waves of modern humans entering their territories from Africa and that they simply could not compete on level terms with the moderns. Modern humans were smarter, technologically superior, and better hunters. After they appeared, Neanderthal numbers began to dwindle and within perhaps 10,000 years they had disappeared. They were driven to extinction by the new arrivals. As Richard Klein tells us:

> It is not difficult to understand why the Neanderthals failed to survive. The archaeological record shows that in virtually every detectable aspect—artifacts, site modification, ability to adapt to extreme environments, subsistence, and so forth—the Neanderthals lagged their modern successors, and their more primitive behavior limited their ability to compete for game and other shared resources.[11]

These newcomers were *anatomically modern humans*, who belong to the same species as present-day humans, *Homo sapiens*. Anatomically modern humans evolved in Africa (Ethiopia) sometime around 200 Kya and some groups migrated out of Africa approximately 50–60 Kya. Actually, "migration" is not quite the right word, since modern humans were not necessarily trying to leave Africa and settle in a new region. In all likelihood they were simply dispersing their settlements little by little until they found themselves somewhere else. In any event, they would eventually fill up the entire habitable world.[12]

The exodus is thought to have proceeded through a narrow corridor between northeast Africa and southwest Asia. From Asia groups moved in several directions. Some traveled east through central Asia and then into China. Others moved through the Indian subcontinent and eventually to southeast Asia. From there some populations ended up in Indonesia, Papua New Guinea, and Australia. Some may also have turned north from southeast Asia and entered China from that direction. Northeast Siberia was eventually occupied, and from there some of the Siberians crossed the Bering land bridge into Alaska and gradually occupied North and South America, previously home to no hominin species. There was also, of course, a major

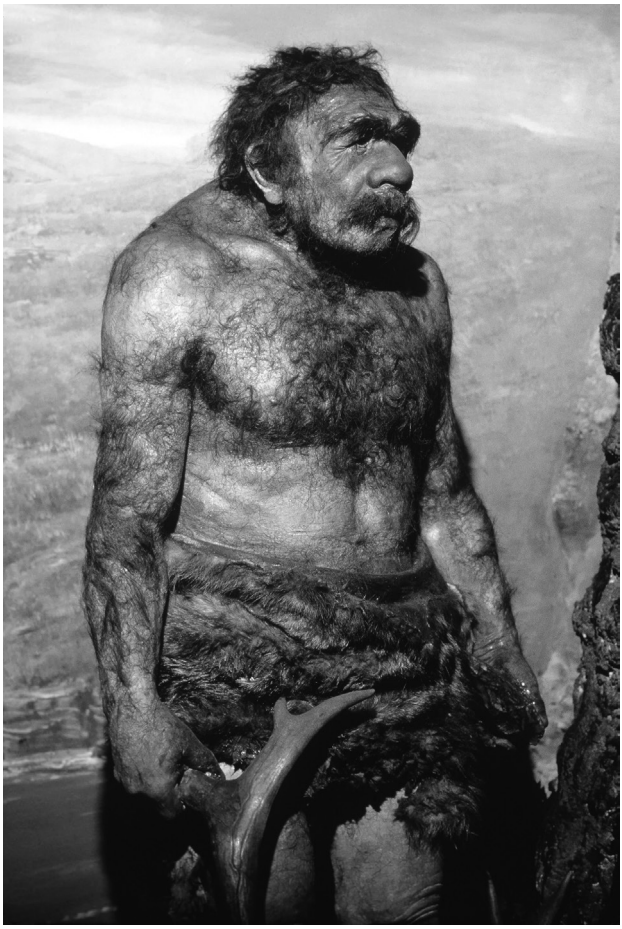

Figure 2.1 Neanderthal Man Based on evidence from skeletal remains, a Neanderthal man might have looked something like this. Note the robust body, large head, and forward projecting face.
(Tom McHugh. Reproduced by permission of Getty Images.)

expansion from southwest Asia to the north and west through western Asia and on into eastern and western Europe, the land of the Neanderthals. This particular expansion and its consequences is the best understood.[13]

As for when modern humans arrived in these various regions, estimates vary, but it was probably after 40 Kya in the Asian regions and Australia, and perhaps after about 35 Kya in Europe. The northeast Siberians crossed into Alaska probably between 15 and 20 Kya and moved rapidly throughout the Americas. They are thought to have arrived at the tip of South America by 10 Kya.

What was happening in eastern Asia is not well understood. One view is that *H. erectus* populations evolved over hundreds of thousands of years into a more advanced form of *H. erectus,* and that later *H. erectus* evolved into anatomically modern humans in this region without being replaced by modern humans migrating from elsewhere (central or southeast Asia). On the other hand, some hold that the later *H. erectus* populations were replaced by in-migrating modern humans.[14]

The overall theory that modern humans evolved in Africa and eventually left that continent to populate the rest of the world is known as the "Out of Africa" theory. Thirty years ago it was basically a hypothesis advocated by a minority of biological anthropologists, but enough evidence has now accumulated for it to have gained wide acceptance. Most biological anthropologists think that this theory, or something very much like it, is a good description of what happened.[15]

Big Brains

The human brain tripled in size in the evolution from *Australopithecus* to anatomically modern humans, from about 450 cc's to approximately 1,350. However, increasing brain size alone does not tell the whole story and can be somewhat misleading. What is critical is the *encephalization quotient* (EQ), which expresses the ratio of brain size to body size.[16] Richard Klein calculates that the hominin EQ increased from approximately 2.5 in *Australopithecus* to 5.3 in modern humans. *H. habilis* is estimated to have had an EQ of 3.6, late *H. erectus* and *H. heidelbergensis* 4.0, and the Neanderthals 4.8. Note that the Neanderthal EQ is lower than that for modern humans even though the Neanderthals had greater brain volume, which is why we can say confidently that modern humans are "brainier."[17] (Chimpanzees, incidentally, have an EQ of 2.0, which makes them a smart animal species but not nearly as smart as the least intelligent early humans.)

Clearly intelligence has been strongly selected for in human evolution, and thus it must have conferred a large adaptive advantage. This is especially true when we consider that the human brain is extremely costly in energetic terms. It makes up only about 2–3 percent of body weight but uses 20 percent of the energy (calories) the average human consumes. But what was this advantage? For many decades it has been widely assumed that nature imposed the main challenges hominin species faced. Humans had to get enough food to survive and then process it into edible form. This meant understanding where and how the best plants grew, what animals could be pursued and killed most efficiently, and how to obtain sufficient shelter and protection from the elements. Moreover, because environments change over time, one needs to know how to deal with such changes so that one's family or tribe doesn't go extinct. A powerful brain is an extremely useful thing to have in meeting these challenges.

Of critical importance in coping with the demands of nature throughout human evolution was the invention of tools. The australopithecines did not make tools.

Tools only appear in the prehistoric record with the transition to the genus *Homo*, and they were gradually improved over time. Anatomically modern humans were much more technologically sophisticated than *H. habilis* or *H. erectus* (and somewhat more sophisticated than the Neanderthals). Krist Vaesen has delineated the cognitive abilities that were necessary for inventing and improving tools.[18] These include good hand-eye coordination, fine motor control, inferential causal reasoning, an ability to conceptualize a particular tool as having a specialized function rather than a range of possible functions, foresight and planning, the ability to monitor whether one's actions are leading to the goal being sought, imitative learning, social intelligence (especially the ability to read the intentions of others), and, for the more sophisticated forms of tool construction and use, language. Thus tool making and cognitive ability go hand in hand.

This argument, sometimes known as the *ecological hypothesis*, seems sensible enough and, indeed, may seem so obvious that it hardly needs to be stated. No doubt coping with nature's demands is an important part of the story of hominin brain evolution. But more recently a different theory has emerged, the so-called *social brain hypothesis*.[19] Advocates of this hypothesis contend that most of the increase in brain size was not for the purpose of negotiating the environment but rather for negotiating *other people*. Humans seek not only to survive and to live as well as possible, but also to acquire social status and mates, who are vitally important to reproductive success. Because everyone in a community is attempting to achieve many of the same things, social competition ensues. Collaboration with other people is usually needed for success in this competition, and therefore it is important to understand the intentions of others. Is this person an ally or an enemy? Is he going to help me achieve status and acquire a good mate, or is he going to thwart me in my efforts so he can advance his own position? In the words of Mark Flinn, David Geary, and Carol Ward, humans had to deal with a "mental chess game" in which life centered around being able to predict "future moves of a social competitor-cooperator, and [formulate] appropriate countermoves, amplified by networks of multiple relationships, shifting coalitions, and deception."[20] The stage was set for a process of runaway selection or an evolutionary arms race[21] "whereby the more cognitively, socially, and behaviorally sophisticated individuals are able to outmaneuver and manipulate other individuals."[22]

One of the most important dimensions of human cognition is what is known as Theory of Mind (ToM). This involves the ability to understand the minds of other individuals, especially to know what their goals and intentions are. For example, ToM allows a person to understand the following: "Mary thinks that John believes that Jill is romantically interested in Roger but not in him." The earliest hominins may have had a ToM, but it would have been poorly developed compared to the highly sophisticated ToM possessed by modern humans.[23] We know that the principal part of the brain that expanded in human evolution was the neocortex. Evidence suggests that the regions of the neocortex that grew proportionately larger over time

were those associated with attention, spatial competencies, a sense of body position, visual perception, speech perception, and, in particular, behavioral control, executive functions, highly developed self-awareness, social problem solving, ability to recall personal interactions, and an ability to mentally project oneself into the future ("mental time travel").[24]

In general, these cognitive skills are less useful for hunting or coping with changing environments than they are for forging alliances with people who can advance one's interests, and in successfully engaging competitors.[25] Often the most successful individuals are those who are good at using deceptive tactics, and it has been shown that those who are most skilled in the use of such tactics are people who are not truly aware they are using them.[26] A critical human cognitive skill is the ability to read human facial expressions. Many people who attempt to deceive by lying are not very good at it because their facial expression or tone of voice gives them away. But deceivers who are not really conscious of their lying and manipulative behavior are able to maintain facial expressions and tones of voice that suggest they are being truthful. In such individuals the brain is somehow capable of compartmentalizing these thoughts and behaviors so they do not come into contact. They mislead, prevaricate, and lie without realizing they are doing so; they actually believe what they are saying. In short, the best deceivers are self-deceivers.[27]

Both of these hypotheses have been subjected to empirical scrutiny. A study by Jessica Ash and Gordon Gallup tests the ecological hypothesis that growing brain size was largely due to increasingly successful adaptation to the demands of nature and survival. Ash and Gallup used a sample of 109 fossilized hominin skulls drawn from the main representatives of the genus *Homo*. Working from the assumption that survival is more difficult in colder climates at higher latitudes, the authors found a very strong **correlation coefficient** between brain volume and temperature—bigger brains at lower temperatures—and a weaker but still strong correlation between brain volume and latitude—bigger brains at higher latitudes. These findings seem to support the ecological hypothesis.[28]

However, Ash and Gallup's study fails to consider the variables making up the social brain hypothesis and to control for their effects. In other words, they do not test the competing hypotheses against each other. Such a test has been carried out by Drew Bailey and David Geary. They concede that at least some of brain evolution has been the result of increasing skills at negotiating nature, but contend nonetheless that it was increasing social competition and social competence that was the main driving force. Their study used 175 hominin crania spanning the period between 1.9 Mya and 10 Kya. Like Ash and Gallup, they included a measure of temperature to assess the ecological hypothesis, but also included a measure of temperature variation, since environmental changes create selective pressure for higher intelligence. To assess the social brain hypothesis, the authors used a proxy measure of population density, reasoning that in larger, denser populations the number of interactions is greater and thus people are forced to cooperate and compete with more

individuals. They used a multivariate statistical analysis in which the independent effect of each variable could be determined. Their results showed that population density was a much better predictor of cranial capacity than either temperature or temperature variation. The authors therefore concluded that increasing brain size throughout human evolution has been determined mainly by social competition.[29]

Yet, as an old adage says, "Correlation is not causation." Two variables can be highly correlated, but it is often difficult to determine what is causing what. To demonstrate causation, a researcher must show that the cause precedes the effect in time. Experimental psychologists can do this by the way they set up their experiments, but in biological anthropology such experiments are virtually impossible. Consequently Bailey and Geary cannot actually demonstrate that increasing population density is causing increasing brain size. It is just as plausible to argue that because hominins with bigger brains have both better survival chances and higher levels of reproductive success, greater population densities will be an *effect* rather than a cause of bigger brains.

Obviously the matter cannot be settled without additional research. A provisional conclusion might simply be that increases in cranial capacity have been driven by both the demands of subsistence *and* those of social cooperation and competition. Those who like definitive conclusions may find this disappointing. But most of the time uncertainty is the normal condition in all of the sciences. Caution is often the wisest choice, since many a hypothesis considered strongly supported has been disconfirmed by later research.

The Language Instinct

Language is a human monopoly. Only humans can invent and use symbols that arbitrarily represent the physical and biological world, other people, one's inner feelings and intentions, and so on, and combine these symbols into larger systems of representation that have syntax—word order and sentence structure—and grammatical rules. But not so fast, some investigators say. The capacity for language also exists among some of humans' primate relatives.

Beginning in the 1960s some psychologists tried to teach the rudiments of language to apes, chimpanzees in particular, and these experiments picked up steam in the 1970s and 1980s as enthusiasm for them grew. A central figure in this research, Sue Savage-Rumbaugh of Emory University in Atlanta, taught two young male chimps named Sherman and Austin a system of symbolic communication requiring them to make responses on a computerized keyboard. However, Savage-Rumbaugh's greatest success was with the bonobo (pygmy chimpanzee) Kanzi. Kanzi was able to go far beyond Sherman and Austin; he could use symbols at an earlier age than his predecessors, and he was much more likely to make spontaneous rather than prompted or imitated utterances. Astonishingly, Kanzi showed an apparent capacity to understand spoken English. Among other things, he could respond accurately to

spoken requests and even seemed to understand conversations between people that did not involve him.[30]

Kanzi's achievements are very impressive, and bonobos in general are often regarded as the most intelligent creatures on earth next to humans, thus making them even smarter than our closest biological relative, the common chimpanzee *Pan troglodytes*. However, greater scrutiny revealed that Kanzi was not using true language but what the linguist Derek Bickerton has called *protolanguage*. Protolanguage is characteristic of four categories of speakers: apes trained to use symbols, children under the age of two, adults deprived of language use in their early years, and speakers of pidgin languages. Protolanguage allows for the communication of arbitrarily represented meanings, but it lacks two critical features of true language: grammatical rules and syntax. Also, neither Kanzi nor any other ape has produced protolanguage spontaneously. The capacity is there but remains totally unrealized in the absence of human intervention.[31]

So it appears that language is a unique human trait after all. But where did it come from? How did we acquire it? Some of the best recent thinking has come from the Harvard cognitive and evolutionary psychologist (and psycholinguist) Steven Pinker, who contends that language is almost certainly a biological adaptation that evolved by natural selection.[32] Pinker points out that, compared to protolanguage or the even more-primitive sign systems of animals other than primates, language is an extremely efficient mode of communication and thus extraordinarily useful. Any gene predisposing toward language use would thus confer enormous survival advantage on its bearer. Our hunting and gathering ancestors, it is now clear, had detailed knowledge of their environment, especially the life cycles and behavior of plants and animals. Since this hard-won knowledge would have taken many generations to acquire, any communication system that could transmit it reliably would be enormously useful. As Pinker wryly remarks, "It makes a difference whether a far-off region is reached by taking the trail that is in front of the large tree or the trail that the large tree is in front of. It makes a difference whether that region has animals that you can eat or animals that can eat you. It makes a difference whether it has fruit that is ripe or fruit that was ripe or fruit that will be ripe. It makes a difference whether you can get there if you walk for three days or whether you can get there and walk for three days."[33]

If language is an evolutionary adaptation, then it must be innate. Or the capacity to produce it must be innate, since the particular content of any language is obviously a social product. No one is born knowing how to speak French, Tamil, or Mandarin Chinese. But everyone is born knowing how to imitate the sounds, meanings, and combinations of sounds and meanings used by those who already speak and understand the language to which young children are exposed. Darwin recognized as much when he commented that language involves "an instinctive tendency to acquire an art."

If you remain unconvinced that humans possess a language instinct, consider the following:[34]

- Children acquire language with remarkable speed in all societies and cultures beginning at about the same age: eighteen to twenty-four months.
- What children acquire is an ability to create an infinite number of phrases and sentences they have never heard before. The vast majority of sentences a person utters or understands is a brand new combination of words. Therefore the brain must contain a recipe or program capable of building an unlimited set of sentences out of a finite list of words.
- When very young children say things like "We holded the rabbits" or "John goed to town," it cannot be a simple act of imitation by a brain with no biasing tendencies because no adult or older child says such a thing; rather, it is a child's use of a grammatical rule in English—add "-ed" to form the past tense of verbs—that obviously does not apply to every verb.
- The three-year-old is a grammatical genius, obeying rules far more often than flouting them. Since children are notoriously incompetent at many other activities, the basic organization of grammar must be wired into the child's brain.
- The same basic design features of language are found everywhere.
- There is a critical period for language learning, coming in the first six years of life; language learning is more difficult after this age, and notoriously more difficult for adults.
- When children learn to speak a language, they learn not only vocabulary, grammar, and syntax, but also *pronunciation*. Anyone learning a foreign language in late adolescence or adulthood knows how difficult it can be to pronounce foreign words accurately, and many never acquire accurate pronunciation. Languages contain *phonemes*—elementary sound units that get combined into words. Native speakers of Chinese and Japanese have difficulty distinguishing between *r* and *l,* so that "lots of luck" sometimes comes out "rots of ruck" and "Cleveland Clinic" "Creverand Crinic." The French have trouble pronouncing the *th* sound in English. "This" often comes out "zees." In Dutch, there is a kind of *v* sound that is not quite the same as the English *v,* but not exactly the English *f* sound either. It seems to be somewhere between a *v* and an *f.* English speakers trying to pronounce a Dutch word beginning in *v* are frequently corrected by their Dutch interlocutors. Most children learn to pronounce words correctly by imitating the sounds they hear, not by direct instruction. And in order to pronounce words correctly, they must know how to position their lips and tongue to make the sound. That is rarely taught, except, perhaps, in the case of speech impediments or adults taking instruction in foreign languages. Children must therefore possess an innate tendency to

know how to position their mouth, tongue, and lips in order to reproduce the sounds they are hearing.

- Then there is the related matter of *accent*. Accents are acquired almost entirely unconsciously. It is again a question of knowing how to imitate what one hears or thinks they hear. Accents are virtually never taught. One picks them up automatically. New Englanders drop many of their final r's, which are known as postvocalic r's. They say, "I pawked my caw in Hawvawd Yawd." In parts of the American South, *I* often comes out as *Ah,* as in "Ah see what y'all mean." Like pronunciation, accent is a matter of positioning lips and tongue in certain ways. Children seem to know automatically how to do this without anyone telling them how. It has to be part of a language instinct and carried out in an unconscious way by child speakers.

But many linguists who accept the innateness of language still resist the idea that it is an evolved adaptation. The world's most famous linguist, Noam Chomsky, was the first to argue that the human brain contains an innate language processing device, but he has explicitly denied that language evolved by means of natural selection, or even that it is adaptive. Chomsky contends that language is nothing more than a by-product of other cognitive functions, especially those associated with the expansion in brain size and complexity.[35] Rather startlingly, Chomsky even claims that the main function of language is not communication; rather, it is an aid to internalized thought.

But this is belied by almost everything we know about language. For example, language is crucial to social interaction: gossiping, informing others of one's intentions, misleading others about one's intentions, and so on. The ability to mislead often requires considerable subtlety and sophistication in the use of language.[36] Along Chomskyan lines, Massimo Piatelli-Palmarini says that language cannot be an adaptation because it could be both better than it is and different than it is.[37] But no evolutionary argument assumes that any adaptation is perfect, and indeed the vast majority of adaptations are not.[38] The human pelvis is an evolutionary compromise between bipedal locomotion and the successful birth of infants; it is far from perfect because the pelvic opening is so narrow that infants and their mothers often died during the birth process prior to the development of modern medicine. Moreover, the peacock's tail is a compromise between attracting mates and escaping predators. If the tail is too small and lacking in color, fewer mates are acquired, and if it is too large and elaborate the peacock is more likely to be eaten. And of course almost any adaptation could be different than it is, since there are different adaptations everywhere in nature that have the same or a very similar function.[39] Bats, for example, fly with membranes attached to their forelimbs, whereas birds fly with wings made up of feathers.

The best way to determine whether a trait is an evolutionary adaptation is to look for evidence of complex design. The vertebrate eye has such complex design that

there can be no doubt that it is an adaptation whose functional benefits are obvious. Pinker and Paul Bloom suggest that language also reveals evidence of complex design and that such design can only be explained in adaptationist terms. They discuss many of the features of language that reveal complex design, but consider just the following:

> Major phrasal categories (noun phrase, verb phrase, etc.) start off with a major lexical item, the "head," and allow it to be combined with specific kinds of affixes and phrases. The resulting conglomerate is then used to refer to entities in our mental models of the world. Thus a noun like dog does not itself describe anything but it can combine with articles and other parts of speech to make noun phrases, such as those dogs, my dog, and the dog that bit me, and it is these noun phrases that are used to describe things. Similarly, a verb like hit is made into a verb phrase by marking it for tense and aspect and adding an object, thus enabling it to describe an event. In general, words encode abstract general categories and only by contributing to the structure of major phrasal categories can they describe particular things, events, states, locations, and properties. This mechanism enables the language-user to refer to an unlimited range of specific entities while possessing only a finite number of lexical items.[40]

If this seems complicated, that's because it is! (If you don't get it, do not fret; the point is *not* to get it, at least not completely!) It is difficult to imagine that something this complicated—something consisting of all of these elements, properties, and their complex combinations—can simply be a by-product or side effect of something else.[41]

If there is a language instinct, then we should find evidence of it in the genes. Recently such evidence has been discovered. In the early 1990s scientists became aware of a family, which came to be called KE, half of whose members suffered from a severe form of language impairment, known generally as verbal dyspraxia. The affected individuals were unable to speak intelligibly, had difficulty processing words according to grammatical rules, understanding complex sentences, and moving the lower part of the face.[42] A search for a genetic basis of the disorder resulted in the identification of a mutation in a single gene, FOXP2.[43] Genetic testing of the KE family showed that all of the affected individuals possessed the mutated version of the gene, compared to none of the unaffected individuals.[44] Later several other geneticists did genetic screening of three members of another family who had been diagnosed with a type of verbal dyspraxia, two siblings and their mother. They found a mutation at another location within the FOXP2 gene. All three individuals displayed speech difficulties closely resembling those of the affected members of the KE family.[45]

FOXP2 is a regulatory gene that affects the expression of numerous other genes. A slightly different version of FOXP2 has been found in chimpanzees, and the human version of the gene differs from the chimp version by only two amino acids. Wolfgang Enard and colleagues suggest that one or both of the two changes in the gene after the evolutionary separation of chimps and humans may have been critical for the development of human speech. The research team has attempted to determine when the human FOXP2 gene became fixed in human populations and estimate that it was sometime within the past 200,000 years. They point out that this is approximately the time of the transition to anatomically modern humans, and that their expansion may have been due to the development of a spoken language that was more proficient than any earlier language.[46]

These recent findings have generated great excitement among geneticists and cognitive scientists, who see them as "opening a molecular window into speech and language."[47] The discovery of the role of FOXP2 in language also has implications for the debate over whether language is an adaptation or a by-product. Pinker and Ray Jackendoff point out that the sequencing of the gene shows "that the normal version of the gene is universal in the human population, that it diverged from the primate homologue subsequent to the evolutionary split between humans and chimpanzees, and that it was a target of natural selection rather than a product of genetic drift or other stochastic [probabilistic] evolutionary processes."[48] They add that the findings "support the notion that language evolved piecemeal in the human lineage under the influence of natural selection, with the selected genes having pleiotropic effects [effects on many other genes] that incrementally improved multiple components."[49]

The Cultural Big Bang

The discovery and analysis of the FOXP2 gene also has potential implications for the development of human culture. The period from about 35 Kya until 15 Kya, the Upper Paleolithic, was a time of dramatic changes, the so-called Upper Paleolithic cultural revolution. The most important new developments were:[50]

- Improved hunting tools, such as spear throwers, bows and arrows, and boomerangs
- Systematic use of grinding and pounding tools
- The use of bone, antler, and ivory for tools and ritual objects
- First evidence of fishing
- Exchange networks involving stone and other raw materials transported over scores or hundreds of miles
- Distinct spatial organization of habitations (e.g., kitchen areas, butchering spaces, sleeping areas, and discard zones)
- First appearance of art, especially paintings in caves, rock shelters, and exposed rocky surfaces