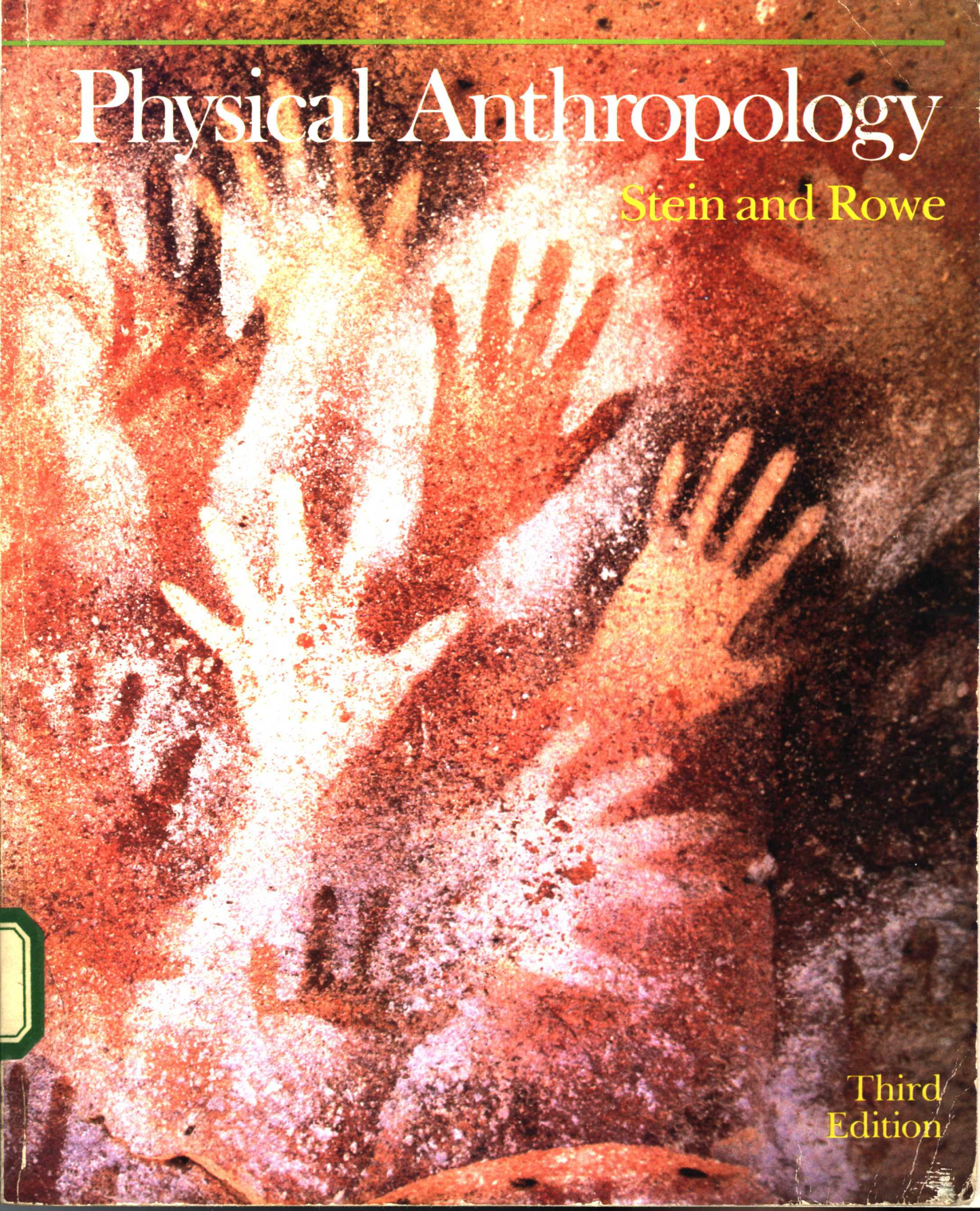
Physical Anthropology

Stein and Rowe



Third Edition

Physical Anthropology

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Preface

The people of Western cultures have traditionally seen humans as the center of a universe created for humans to occupy, utilize, and control. Recently, however, the mass media's reports of overpopulation, worldwide food and energy shortages, pollution, and social unrest have made it evident to many that humans are not above and beyond the influence of nature.

We are an integral part of the natural scheme. Our survival, like that of other organisms, depends upon maintaining a balance with the environments that support us. We are dependent upon the natural world, and when we ignore this dependence—by polluting the environment, for example—our survival itself is threatened.

Through its unique viewpoint—the holistic approach—anthropology provides insights into the dynamic interrelationships of the biological, environmental, cultural, and social aspects of human existence. Humans as biological beings cannot be studied apart from humans as cultural and social beings. By examining our biological limitations and potentials, we can gain a fuller understanding of how cultural innovations affect biology and environment. By discovering our relationships to the rest of the animal world and our evolutionary history, we can appreciate more clearly our place in nature and the requirements for persistence.

The subject of anthropology is humankind, an unbelievably complex product of the evolutionary process—organisms that celebrate birth, form complex social bonds, and sometimes consider death to be a transition to a new life. With a large brain and precise hands, humans have created, destroyed, and rebuilt monuments to individuals, governments, and gods. Humans also have invented slavery, racial stereotypes, pollution, and wars.

This text is concerned with physical anthropology, the study of the biological nature of humankind. The first two chapters deal with the nature of anthropology, particularly physical anthropology, and certain basic philosophical concerns. This is followed by the development of basic concepts necessary to the proper understanding of evolutionary theory. Next,

the problems of growth and development, adaptations, and human variation are explored. Attention then focuses on humankind's relationship with the animal world, especially with our closest living relatives, the primates. Through comparative studies of these forms—prosimians, monkeys, and apes—anthropology attempts to reconstruct many aspects of human evolution. This is followed by a detailed look at the fossil record, the physical remains of human evolutionary history. The text concludes with a look at our evolutionary present and future.

The twentieth century is characterized by rapid accumulation of new information in areas of scientific investigation. It seems as if a week does not go by without a journal report of some major new data or hypothesis of relevance to physical anthropology. In the past several years new discoveries in areas such as genetics, primatology, and paleoanthropology have had major impact on our concepts of human evolution and behavior. As a result of these new ideas and data many changes and additions have been made in the third edition of this text. We have added chapters on growth and development and have expanded the discussion of human adaptation. A new chapter updates the information on molecular biology and introduces new material on the comparisons of human and chimpanzee chromosomes. The material on the fossil hominids has been greatly expanded and revised in light of new finds and concepts, many of which were first reported in the 1980s. A section has been added to the last chapter dealing with anthropology as a college major or minor and as preparation for various careers.

A book does not develop in a vacuum. We wish to acknowledge those who have counseled us, encouraged us, and aided us in the tasks of reviewing, typing, and photography. First, we would like to thank the following persons who read all or portions of the manuscripts or aided in their development: Everett and Janet Frost, Mildred Dickeman, Leslie Aiello, Rita Castellano, Glenn A. Gorelick, Van K. Hainline, Ronald Farrar, Robert L. Pence, Eleanor F. Michael, Arnold L. Freed, Gail Kennedy, Mary L. Walek, Robert L. Blakely, Karen Kovac, Roland A. Gangloff, Vinson Sutlive, Allen C. Beck, Robert L. Van Burkleo, Philip G. Grant, Douglas R. Givens, Paul E. Simonds, L. Lewis Johnson, Mark E. Harlan, Mary Jean Livingston, and Marc R. Feldesman. Second, we would like to pay tribute to the memory of the late Ronald D. Kissack, the editor of the first edition, in deep appreciation of his faith and encouragement. We also wish to thank our editors of the second edition, Lyle Linder and Laura Warner, and the editors of the third edition, Marian D. Provenzano and Stephen Wagley; our designer, Joseph Gillians; and our production supervisor, John Mancia. Finally, special thanks go to Rick Freed and Dodie Stoneburner for much of the original photography, to Carol Stein for her long hours spent in reading and typing the manuscript, and to Christine L. Rowe for the tedious job of reading proofs.

Philip L. Stein
Bruce M. Rowe

Contents

Chapter 1

Investigating the Nature of Humankind

THE NATURE OF HUMANKIND

What is it to be human? This question has been satisfactorily answered for some, has puzzled others, and has tormented many. Plato defined people as "bipeds without feathers," an amusing image but also an early attempt at classifying people as animals. Mark Twain observed, "Man is the only animal that blushes—or needs to." He recognized the human social consciousness, the ability to be embarrassed. An anonymous author wrote, "Man is the only animal that eats when he is not hungry, drinks when he is not thirsty, and makes love at all seasons."

Fundamental questions of physical anthropology are: What is it to be human and what is the nature of humankind? The attempt to solve these puzzles throws light on the even more intriguing question: What am I?

Of Termites and People

The investigation of these queries will begin with a comparison and contrast of the behavior of termites and people. Like humans, termites survive through complex patterns of social behavior. But the bases of these patterns differ.

Termites A motherless world awaits. Emerging from their pupae, termites need no pampering, no tutelage. Nature is complete in preparing the various castes of termites with all the equipment and behavior they will need to fulfill their respective functions.

No decision has to be made as to who will do what. Their division of labor is programmed from the start. Once their reproductive organs begin to function, the reproductive castes will do nothing but produce new offspring. They will not feed themselves or do any other type of work.

The egg-laying queen can attain a volume many times larger than that of her subjects (Figure 1-1). The bulkiness of this egg-laying machine will often prevent her even from moving under her own power. In times of danger the workers will roll their valuable procreator into a royal cell and seal it in order to protect her.

The soldier caste is specialized for the pro-

FIGURE 1-1 *Termite colony.* Subterranean termite queen surrounded by workers of various ages.

tection of the termite city. The blind, wingless, sterile soldiers cannot even attempt a coup d'etat, nor can they desert the citizens for whom they provide protection. Even if their lack of sight and wings did not prevent their escape, the size of their jaws would. These viselike mandibles are more than 500 times as large as those of other castes and render the soldiers incapable of feeding themselves.

The reproductive castes and the soldiers are dependent on the workers for food. The worker, like the soldier, is totally blind and incapable of reproduction. It tunnels to subterranean sources of cellulose and ingests this food. It is then digested by microscopic organisms which reside in special organs in the termite body. Upon conversion of the cellulose, the usable nutrients are regurgitated into the mouths of reproductive individuals and soldiers.

When the total population of any caste becomes too large for peak functioning of the community as a whole, the workers are programmed through inborn mechanisms to stop feeding the unwanted. Without the adult workers' help, the individuals of the other castes, along with "infant" workers, are doomed. In this manner the population size is maintained in balance.

Through their mindless efficiency the termites have done well. They have been around longer than humans, are more numerous, and are widely distributed. The problems of population control and starvation, which continue to baffle us, have been solved for the termites through inborn mechanisms. The termites' behavior pattern has proved to be one among many successful modes of survival.

People as Hunter-gatherers Children born into a Bushman society of South Africa are completely dependent on their family for food. While they are very young, their mother's milk will be the primary means of nourishment. Later their fathers, uncles, and brothers will supply them with meat, and their mothers, aunts, and sisters with wild plant foods. Not until the children are five or six, perhaps much older, will they contribute to the group's subsistence.

Children live in the camps of their parents until they marry. In the interim they learn the rules by which they must live. To survive, they must listen well to the elders who have experienced nature and its rewards and punishments (Figure 1-2).

The children grow and develop. They learn that it is the job of the males to provide the camp with meat. Skill in hunting is developed by children's games and by watching and listening to fathers and uncles. The boys also learn that it will be their responsibility as adults

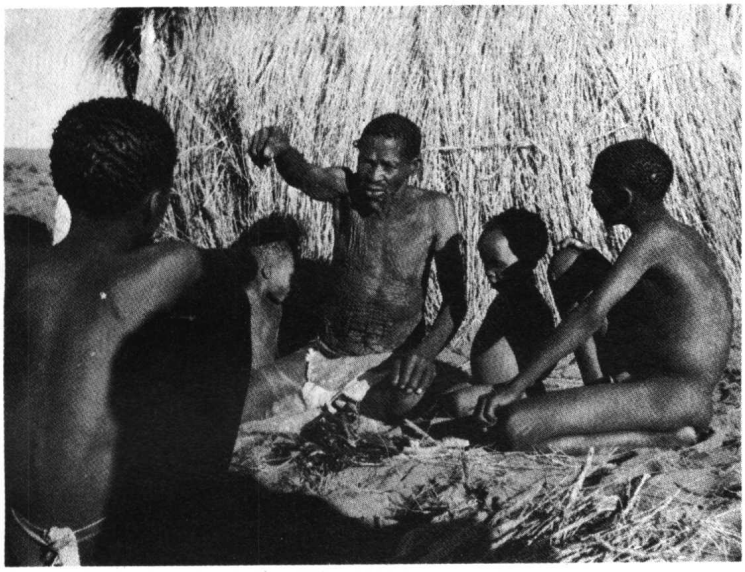

FIGURE 1-2 *Bushman family.* Human survival depends on the prolonged protection and tutelage of offspring. Family ties can last a lifetime.

to protect their groups from the wrongdoings of other groups.

The children learn that the females are the gatherers. Roots, nuts, berries, stems, and leaves are collected and brought back for the day's meal. It is the women who supply the camp with the majority of the food. Their gathering activities account for up to 80 percent of the food by weight.[1] Elizabeth Marshall Thomas describes the gathering of Bushman women in the following excerpt:

Dasino, Twikwe, Tsetchwe walked in front, each with a digging-stick thrust in her belt like an enormous knife, each wearing a heavy cape, and Tsetchwe carrying her baby, who rode, carefree and swinging his feet, on her shoulder. . . . We walked until we came to a patch of tsama melons, perhaps twenty of them lying together, shiny, smooth, and green in the grass. . . . The women stopped and began to gather up the green melons. . . . [Later, after finding evidence of a deeply buried root, Thomas observed the results of Twikwe's labor.] She had made a hole three feet deep, a foot across, and at the bottom, dim in shadow, lay an immense gray root wedged securely between two stones. . . . Again she bent over the hole, leaning over so far that her head came between her knees, and grasped the huge root with both hands. She tugged so hard that I heard her joints crack, but the root was wedged and she couldn't move it. . . . We would leave it.[2]

[1] R. B. Lee, "What Hunters Do for a Living, or How to Make Out on Scarce Resources," in R. B. Lee and I. DeVore (eds.), *Man the Hunter* (Chicago: Aldine, 1968), pp. 30–48. It is generally true that modern hunter-gatherers depend more on vegetable material, and in some cases shellfish, eggs, lizards, fish, and so on, than they do on meat—although meat is a highly valued food. The exception to this occurs in areas where vegetation is scarce, such as in the far north. It is likely that the dependence on plant material and other gathered food sources was common in the past; and, therefore, in many areas of the world women have been the major breadwinners of the family for most of human development.

[2] Elizabeth Marshall Thomas, *The Harmless People* (New York: Knopf, 1958), pp. 103–104, 108–109. Copyright 1958 by Alfred A Knopf. Used with permission of the publisher.

The Human Dimension Human life depends on technology. A person stripped of clothes, shelter, tools, and weapons has no chance in this world, where biological equipment alone is not sufficient for survival. Human beings substitute spears for long canine teeth, fire for fur, and other technological achievements to compensate for the lack of inborn adaptations.

Nevertheless, survival is only a part-time task. Humans may take time to ponder the nature of the universe or their own nature. They may paint a picture and dedicate it to their sacred spirit, or they may play magic upon it. Thoughts of awe, of understanding, fear, and contentment can occupy their minds. And their ideas are transmittable; thoughts, through language, can enter the minds of others, and there they can incubate to new heights of development.

Termites are mindless machines. They have no choice of the route through life they will travel. Nevertheless, they have been extremely successful in their adaptations to a variety of habitats. Humans, on the other hand, are almost totally dependent on learned behavior. In fact, the emergence of the human species and its continuance are dependent upon what is called culture.

The Culture Concept

Culture is one of those words which everyone uses and almost everyone uses differently. A person may say, "Those people belong to the Art Society; they certainly are cultured." To the anthropologist there is one thing culture is not, and that is a level of sophistication or an amount of formal education. Culture is not something that one society or person has and another does not.

Culture has been defined by anthropologists in hundreds of ways. Fortunately, most definitions have points in common, and these points will be included in our definition. They are the facts that culture is learned, nonrandom, systematic behavior that can be transmitted from person to person and from generation to generation.

Culture Is Learned First, culture is learned behavior as opposed to *innate*. By innate is meant biologically determined, coded by the hereditary material. When termites emerge from their pupae, workers, soldiers, and queens crawl away to their respective predetermined tasks. They are innately equipped to brave the hazards of their environment. Humans do not function in this manner. A baby abandoned at birth has *no* chance of surviving by itself. In fact, most six- or seven-year-olds would probably perish if left to their own resources.

What would we be without culture? There are people without culture who can be observed in back wards of mental institutions.[3] They have virtually no mental functions. We refer not to persons with such afflictions as schizophrenia or paranoia, but to those individuals who have virtually no potential to learn. They cannot speak or feed themselves. Nor can they be toilet-trained or taught to dress. From one day to the next they do not recognize people they have lived with for years. A person without culture is not like a nonhuman animal. Without the potential for culture, such a person is an incomplete being with the body of a person, even the somewhat damaged brain of one; what is lacking is a functioning mind.

Culture Is Nonrandom, Systematic Behavior Culture is patterned in two ways. First, it is nonrandom behavior. That is, specific actions or thoughts are usually the same for particular

[3] C. MacAndrew and R. Edgerton, "The Everyday Life of Institutionalized 'Idiots,'" *Human Organization*, 23 (1964), 312–318.

situations. For example, in Western societies when two people meet, they usually shake hands. A specific behavioral pattern, such as shaking hands, in a particular situation, such as two people meeting, is called a *norm.* A norm is the most frequent behavior that the members of a group will show in a specific situation.

Culture also is patterned in the sense that it is systematic. That is, one aspect of behavior is related to all the others, and taken together, they form a *system.* A system can be defined as a collection of parts which are interrelated so that a change in any one part may bring about changes in the others. In addition, a group's cultural traditions and the way they relate to each other reflect certain underlying principles about the basic characteristics of people and nature.

Culture Is Transmittable Culture is transmittable; it spreads. You can teach Fido to respond to his name and other verbal commands, but this newly acquired "vocabulary" is not going to be used to discuss world problems with the other dogs on the block. The dog has certainly learned something but has learned it as a response to a stimulus which was rewarded in some way. Probably no great mental processes, no interpretations, were involved. With humans, information can be learned, stored in the cortex of the brain, interpreted, and then transmitted to other people. The person doing the transmitting may accomplish this directly, or, for that matter, may even be dead. These ideas and accomplishments are passed on through those who knew the dead person or through written and other records. This process continues, so that knowledge builds on the basis of past generations. In societies with writing, each generation can continue to influence following generations indefinitely. A particular culture is the result, therefore, of its history as well as its present state. Although there is now evidence that certain animals also possess some ability to pass on acquired behavior (Chapter 12),[4] none have developed this to the same degree as humans.

Two Aspects of Culture There are two aspects of the cultural phenomenon. First, culture is an *extrasomatic* adaptation to an environment. On the other hand, a culture is an environment.

Nonhuman animals usually adapt to their environments through changes in their *somatic* form. Somatic means "bodily," and a somatic change would be an alteration in the body. So an extrasomatic change would be a change in behavior.

Of course, somatic changes also have been important in human evolution and partially account for why we no longer look like our distant ancestors. More than the human body evolved, however; the mind also developed to the point where it was sometimes able to substitute cultural innovation for biological alteration. If you were to transplant a group of temperate-zone animals to an arctic environment, they might all die, or conceivably only those who were somewhat different from the average, perhaps by having more fur, might survive. Put people in the same environment, and they could build an igloo, start a fire, or kill a polar bear to make a coat.

The human biological potential for culture allows people to adapt to environments through culture as well as biology. This is one reason why the human species is one of the most widely dispersed on earth. Humans have climbed to the top of the highest mountains with the aid of bottled oxygen and other supplies; they have descended to the deepest parts of the ocean by using bathyspheres; they have occupied every climatic zone by using the appropriate clothing, shelter, and temperature-controlling devices. The flexibility that culture allows has recently been displayed to the ex-

[4] Topics to be developed later are indicated by parenthetical references to subsequent chapters.

treme. In space travel, humans, who like other animals need air to breathe, food to eat, and water to drink, can rocket to an airless, foodless, waterless environment. Somatic features do not need to change to accomplish this. Instead, biological potential responds to the desires of a conquering mind.

Culture is a means of adaptation, but a *particular* culture is also an environment. Examine the area in which you are reading this book. If it is your room, you may be surrounded by curtains, glass windows, plaster walls, light fixtures, and so on, all of which are cultural innovations. Even if you are reading outdoors, the bench you are sitting on, the buildings around you, the smog in the air are all parts of the cultural environment. Even the grass and trees, if transplanted or sown by humans, are where they are because learned behavior allowed them to be put there. In either case, the room or the courtyard, your surroundings are basically made by human hands. In the room, you may not even be able to hear or see or smell the natural environment.

The Relationship of Brain to Mind

The human *mind* consists of internalized cultural elements organized into an original personality. The mind has the potential to combine these elements into unique configurations which allow for the creativity and innovational ability of human thought.

The formation and development of mind depend on the brain, specifically the *cerebral cortex*. It is here that complex thought takes place and here that the highly efficient communication system, language, resides. Through the use of the symbolic logic of language and other appropriate mechanisms, such as memory and mental images, things can be thought about which are not directly present or obvious (Chapter 12).

The brain is responsible for *all* levels of behavior beyond reflexes. One of these levels is that of awareness. There is some evidence that a chimpanzee can recognize itself in a mirror. What it is most likely aware of, as Jane Goodall has said, is that the body reflected in the glass is its own.[5]

Human awareness goes far beyond this. An individual looks in the mirror and sees "a person with great potential in the business world." In other words, human awareness is not restricted to recognition of a physical entity. It also includes the concept of the uniqueness of self and the relationship of self to others and to the environment.

The concept of self is one attribute of the mind, an attribute that creates a power that can exert control over the body. If people imagine themselves to be sick, even when there is no organic cause, the very conception can produce physical symptoms of illness. Certain types of backaches, headaches, and asthma are among the many known *psychosomatic illnesses*, and some people maintain that nearly all illnesses have a mental aspect.[6]

The mind can cause more than discomfort: it can kill. A sorcerer points a bone at a man. The victim's face distorts with fear. His eyes glaze. He attempts to cry out, but the sounds do not come. He trembles and twitches uncontrollably. He falls to the ground. His arms sway as if to ward off the poison that he believes is entering his body. He crawls back to his hut. A couple of weeks later he is dead.

Cases like this one, based on the observations of Herbert Basedow,[7] occur in a wide range of societies. What happens is this: the victim believes so strongly in the powers of the

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[5] J. van Lawick-Goodall, *In the Shadow of Man* (Boston: Houghton Mifflin, 1971), pp. 250–251.

[6] W. B. Cannon, "Voodoo Death," *American Anthropologist*, 44 (1942), 169.

[7] H. Basedow, *The Australian Aboriginal* (Adelaide: Preece, 1925).

sorcerer that his mind, in a state of fear, triggers the biological processes that kill him. There is no need for the sorcerer to harm the victim physically. The actual cause of death is a lowering of blood pressure caused by prolonged activity of the *sympathicoadrenal* system. In situations of fear, this system is activated for the purpose of preparing the body for extreme physical activity, such as warding off an attack. When the crisis is over, the system usually shuts down and the body is returned to a more stable state. If the fear persists, the sympathicoadrenal system continues to work, eventually causing death.

Understanding the relationship of mind to body will become increasingly important to us in the future. Fear is but one thing which can lead to biological breakdown; frustration and confusion also play a part. As our cities become more crowded, and as life becomes generally more difficult, mental illness appears to be increasing (Chapter 20).

The Characteristics of Humankind

Biologically people are not as different from other animals, especially other *primates*, as many of us would like to believe. We share some characteristics with all animals, more with all *vertebrates*, and even more with all *mammals*. It is not surprising that people should be quite similar to our primate relatives (Chapter 11).

The anatomical differences between people and the chimpanzee are, to a degree, matters of size and proportion. Not only does the chimpanzee have the same bones and muscles as humans, but most of these structures are found in nearly the same places and in most cases serve the same or similar functions. The internal organs of both types of animal are similar. Even the body fluids, such as blood, are alike. Genetic similarities, which are reflected in the outward manifestation of the characteristics mentioned, are also striking. For instance, the genetic material in chimps is remarkably close to that of people (Chapter 14).

Nevertheless, all populations of organisms display some differences from all others. The following discussion presents a few human biological idiosyncrasies. Note, however, that even these are mostly matters of *degree* rather than type. Here we will simply say a few words about each of these characteristics, for all of them will be considered in later chapters.

The Human Brain and Its Ability to Symbolize One important characteristic of humans is the development of the brain in a way that provides the potential for cultural behavior. One of the things that makes the human brain a revolutionary instrument is the potential for speech. Other animals can create and respond to a limited number of *signals* and, in some cases, *symbols*. Chimpanzees can be taught to communicate to a limited degree in systems similar to language (Chapter 12). Yet, the human cortex has the greatest ability to organize symbols into an effective system that can relate and create experiences and ideas. Note, however, that this is a matter of degree. It also must be emphasized that the great potential to use symbols is but one way to accomplish the task of survival and has nothing to do with "superiority."

A symbol is anything, whether it be *visual*, *oral*, *tactile*, or *olfactory*, that represents something else that is distant in time and space from it. A word, for instance, is a symbol of what it refers to. In order to understand the meaning of the symbol, the thing that it refers to need not be present. Such things as stop signs, trademarks, Morse code, and braille are all symbolic. At a higher level of abstraction, a symbol can be substituted physically for its object. For example, a general's insignia not only represent the general and his or her authority, they

are authority. Similarly, some people consider an attack on the flag to be an attack on the country or on its people.

The symbol itself is arbitrary. That is, there is no intrinsic relationship between the symbol and what it represents. For instance, the word "pen" denotes the object it refers to only because in English it has been designated to do so. To an Italian, a Bushman, or another non-English speaker, the sound "pen" might have no meaning or a different meaning. Since each culture codes its unique complex of knowledge and experiences into different sets of symbols, its conception of itself and the world which surrounds it differs. This is one main reason for the different configurations that culture takes.

Bipedalism Habitual *bipedalism* is another human trait, yet other animals are bipedal. Bipedalism serves several functions. For one, it frees the hands for use in activities other than movement. In time of danger the young monkey clings quickly to the furry belly of its mother as she flees, but the human baby is snatched into the arms of an adult and carried to safety. Second, food can easily be carried back to the camp; it need not be carried in the mouth or eaten where it is acquired. This allows people to protect their food from scavengers that could otherwise steal it from their larger-brained but weaker neighbors. By transporting food to a home base, a person can share it with those who were not along during the search for food. Third, a dog cannot throw a spear. A human's dangling arms and grasping hands make it possible to throw weapons. This arm-hand combination also aids in unparalleled manipulation of the environment.

Birds walk on two legs, yet their upper limbs have been modified into wings and are useless for manipulating objects. A kangaroo moves on three "legs"; its tail acts as an efficient locomotor device. Bears, dogs, monkeys, and apes, among others, often rear up on their hind legs and even walk a short distance on them. But people are habitually bipedal, and their upper limbs are highly efficient structures for grasping, holding, and manipulating objects (Figure 1-3).

A fourth advantage of bipedalism is the increase in the range of the visual field that

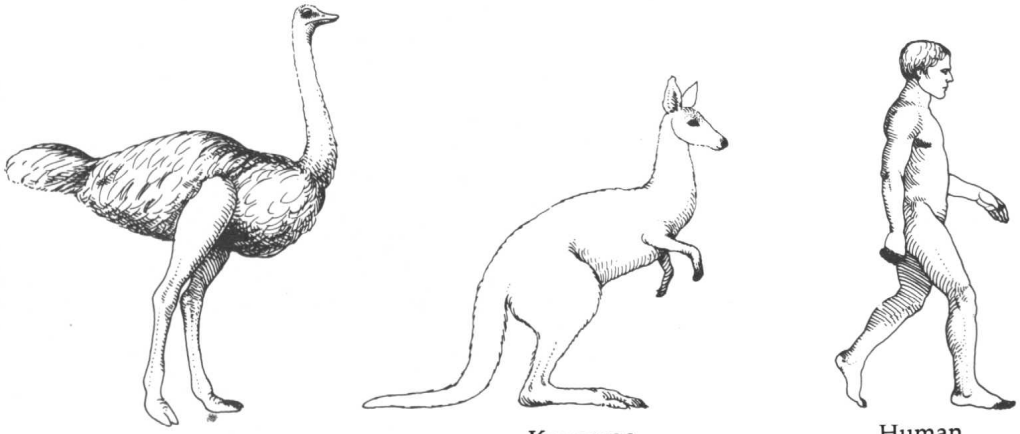

FIGURE 1-3 *Bipedal animals.* Although many animals are bipedal, human posture is structured for more efficient use of the arms and hands than is true in other animals.

results from the elevation of the eyes. A crocodile may weigh as much as a human, but its eyes are only a short distance from the ground. Even though some quadrupeds, such as the giraffe, have eyes off the ground, most animals must be content to stare into a field of grass or a clump of bushes. The human two-legged posture allows people to see over those bushes and grasses. This has great significance because it permits sighting predators from a distance.

Advantages in one area often mean disadvantages in others. With the development of human bipedalism certain structural weaknesses developed. For instance, humans cannot run as fast as many other animals. In addition, the bipedal configuration of the human body has meant a weakening of the back and abdomen, problems in circulation, and a loss of manipulatory abilities of the toes, as well as other structural alterations.[8]

Human Reproduction In nonhuman mammals, the female is usually receptive to males during certain times of the year. Because of this, for most mammals births peak within specific seasons, such as the onset of spring or of the rainy season. People have the biological potential to mate and produce offspring the year around. This difference between humans and other animals is recognized by most people. It is no wonder that early explorers were amazed to find that births among the Yurok Indians of California occurred predominantly in one season. They thought they had found a biologically primitive people whose mating behavior was closer to apes than to humans. What was actually occurring was a cultural phenomenon. The explorers did not realize that the Yuroks' ideas of marriage and cohabitation were completely different from the European model. For reasons seeded in tradition, the Yurok men spent most of the year living together, apart from their wives, in a men's sweathouse and clubhouse. It was there that they kept all their possessions. During the summer couples slept together outside. Nine months later babies abounded.[9]

Not only are humans biologically able to breed in all seasons, but their *reproductive risk* is low. In fish, the number of eggs produced must be phenomenal to promote the continuance of the population. Because of the harshness of the marine environment, the hazards of external fertilization and development, and the always present predators, a single codfish must generate 30 million eggs, of which 50,000 might hatch and only two reach maturity. More than two might overpopulate and lead to the degeneration of the environment; fewer would eventually shrink the population to a level at which extinction would be probable. An average of two offspring per two adults is the magic number for animal populations that are in equilibrium with their environments. The greater the hazards of birth and life, the greater the number of eggs needed to assure that two offspring will survive to reproduce.

As we progress from fish to amphibians, to reptiles, and finally to mammals, the number of eggs needed to assure two offspring diminishes. Human reproduction is among the least risky systems, with an average of five births resulting in two individuals who will reproduce. This represents the number for nonindustrial societies. Today in countries with advanced medical procedures and relatively stable food supplies the ratio is even more favorable.

This low risk is due to the fact that in hu-

[8] For further information, see W. M. Krogman, "The Scars of Human Evolution," *Scientific American*, 185 (December 1951), 54–57.

[9] A. L. Kroeber, *Handbook of the Indians of California* (Berkeley: California Book, 1953), p. 44.