chapter 2

The Evolutionary Setting of Human Behavior

A *brief* consideration of the behavior of a lower species will indicate some of the major differences between it and various kinds of human behavior. It will also call attention both to simpler forms of interaction and simpler modes of communication that foreshadow and form the basis of human cultural evolution.

The behavior of all animals (including human beings) is social in some degree; even among the lowest species, organisms stimulate one another and may live in some sort of group. Social groups as we know them require organization, psychological unity, a communication system, and a division of labor, however simple, whereby group members cooperate toward group goals. Another type of group, exemplified by a mass of people waiting for a train, is known as an *aggregate*, or an *assemblage;* members of the aggregate, whether it is composed of human beings or animals, do not act concertedly toward group goals or like members of social groups; they do affect one another's behavior, thereby making the behavior social to a limited degree. An aggregate is thus not a genuine social group because it involves only the most rudimentary social relations and lacks most of the features of social groups noted above.

While the emphasis in our discussion will be placed upon the evolution of forms of behavior, it is well to remember that cultural evolution presupposes and depends upon a prior biological evolution. The evolution of the human brain has been, of course, of central significance. Specialists in this area generally emphasize that the assumption of an upright posture was of critical importance in the evolution of humans because it freed the hands for the making and manipulation of tools and for other fine manipulative behavior. This, in turn, changed survival conditions and helped to produce the changes in cranial size and structure that distinguish Homo sapiens from the human-apes thought to have been our immediate predecessors. The human brain is not simply a relatively larger one than that of monkeys and other primates; it is also qualitatively and structurally different. For example, the areas associated with the thumb (and with control of the hands in general), language, speech, and with higher mental functions are proportionately much more elaborate and specialized. As will be indicated in our discussion of aphasia, in the brain of the ape there is no counterpart to the specialized left-hemisphere language center characteristic of right-handed humans. The bibliography at the end of the chapter includes a number of significant discussions of these biological aspects of the evolutionary story that constitute necessary preconditions for the evolution of culture and the development of language. (6, 7, 16, 26, 30, 32, 40, 42)

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Geologists divide geological time into eras, periods, and epochs, beginning with the appearance of the earth perhaps four to seven billion years ago. The major eras are the Archeozoic, Proterozoic, Paleozoic, Mesozoic, and Cenozoic, the most recent. Some mammalian forms of life began to appear more than one hundred million years ago in the late Mesozoic era, and all the rest, including humans, evolved during the Cenozoic era, which consists of about the last sixty-three million years. The Quaternary period of the Cenozoic era covers about the last million years, and it is subdivided into the Pleistocene (glacial) and post-Pleistocene epochs.

Primitive forms of humans are thought to have appeared between one and two million years ago and an early form of modern humans made its appearance perhaps a quarter of a million years ago. For a period of several hundred thousand years, premodern humans (Homo erectus) and archaic types of modern humans (Homo sapiens) evolved physically, becoming taller and larger, and developing larger and larger brains. At the end of this, the Pleistocene or glacial epoch, more than twelve thousand years ago, Homo erectus and earlier forms of Homo sapiens had disappeared and been replaced by modern humans essen-

tially like those of today with respect to physical appearance and intellectual potential. It is estimated that in 10,000 B.C., when the ice of the last glaciation had melted, there were fewer than one million human beings on earth. By 6000 B.C. the number is estimated at about five million, by 5000 B.C. at about ten million, and the estimated human population at about the time of Christ was a quarter billion. (44)

People of the New Stone Age (Neolithic), beginning perhaps about 10,000 B.C., gave this age its name by grinding and polishing and generally improving their stone tools. More important, they domesticated animals and plants, learned to plant seeds, to irrigate and harvest crops, and to store and transport foods, liquids, and goods. They invented the wheel and the plow and began to build houses. In contrast to humans of the Old Stone (Paleolithic) Age, those of the Neolithic Age began to live in settled, agriculturally supported, communities of considerable size, where they established cities and relatively large political units. These favored places were invariably river valleys such as those of the Tigris, Euphrates, and Nile. It was there that the first great ancient civilizations of Egypt, Sumeria, and Babylonia came into being. It is said that the city of Jericho has been continuously occupied since 7865 B.C. (plus or minus 160 years, by modern methods of dating). (6:143)

In these ancient civilizations writing was invented, number systems were developed, elaborate religious beliefs were formulated, and trade and commerce flourished. Very accurate observations of the skies led to the invention of the calendar and to the beginnings of astronomy. The calendar is a uniquely human invention. It serves as a device for bringing time and its passage into the social organization of societies. Through their calendar, human groups attach themselves to their past, and the calendar serves as a vehicle for gaining control over the future. Ceremonial calendars, which mark a yearly round of sacred and secular holidays, serve to set groups off from one another. In Egypt the pyramids were built between four and five thousand years ago, and in Babylonia, the Hammurabi code of law was promulgated about thirty-seven hundred years ago. Schools of a restricted sort were established in ancient Sumer and Egypt. In Greece during the fourth century B.C. Plato established an academy in which he taught advanced geometry, astronomy, music, literature, history, law, politics, and ethics.

In the chronology of human physical and cultural evolution, it is significant to note that while the former no doubt sets the stage for cultural evolution by providing us with our human brain and physical form, the two forms of evolution seem to be unrelated after that point. Cultural evolution or change has, in recent times, accelerated at a geometric rate without any further significant evolutionary changes in the biological equipment of humans.

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We turn next to different "levels" of organisms and behavior. To begin with, just where to draw the line between the social and nonsocial in the interorganismic contact of the very lowest animals is an indeterminate matter. H. S. Jennings (17), the well-known student of protozoa, has confessed that in his younger days he concluded that aggregates of infusoria exhibited no social characteristics; he was reprimanded later by a critic who noted that the reactions he had described actually were social relations of the protozoan kind. Although the one-celled animal requires no other to aid it in performing its vital functions, it does, nevertheless, on occasion gather together with others of its kind. Dense aggregates may be produced by convergence toward a source of light or by movement against a current. These are aggregates in the literal sense of the term; there is no division of labor, no cooperative activity.

In the lower species, W. Allee (2:147) has pointed out that the mere crowding of organisms of the same species produces beneficial results: the animals multiply faster, eat more, and enjoy better chances of survival under adverse conditions. Some animals learn more rapidly in the presence of others. Allee hesitates to call the simpler aggregates "cooperative," and he refers to them as showing "automatic mutual interdependence." He and others have remarked that various "integrative levels" are reached by different species aggregations. The existence of a simple form of group organization is shown by the synchronous behavior engendered in densely clustered insects by the transmission of tactile stimuli from one individual insect to another. Touch one individual and all react almost immediately.

Although it is certain that various forms of group organization exist among the lower species, biologists find it no easy matter to classify one as more complex or more social than another if the forms are not very similar. Allee, for example, speaks of small but real differences of group organization (1:158):

> We are confronted with a gradual development of real differences without being able to put a finger with surety on any one clearly defined break in the continuity. The slow accumulation of more and more social tendencies leads finally by small steps to something that is apparently different. If we disregard the intermediate stages, the differences may appear pronounced,

but if we focus on these intermediates, it will be only for the sake of convenience that we interrupt the connecting chain of events at some comparatively conspicuous link and arbitrarily make this the dividing point, when one is needed, between the more and the less social.

This statement brings out two aspects of evolution: one is the continuity of species and the other is the notion of distinct "levels" or the emergence of new properties. The latter has been stated in this way (36:245):

> The principle of levels has come into current usage through a recognition of important differences in the complexity, the degree of development, and the interdependent organization of behavior functions through the animal series. The evidently superior properties that appear on a new level of organization are not to be explained as due to a new kind of energy or new vital properties, but as functional properties arising from a new system of organization which differs in given ways from "lower" and "higher" systems.

The "levels" concept thus assumes the existence of continuity and of similarity among species but stresses also the emergence of new properties of organization. The differences in levels have to do with "*what kinds of processes and capacities are available* to an animal and its species mates in adapting to their environments." (37:57) Ants and bees live in organized colonies and operate at higher levels of capacity than do sponges or protozoa that live as individuals or in aggregates. Different animal aggregations reach the same general ends—such as providing food and shelter—but the organization of the aggregate, and the processes through which ends are attained, may be very dissimilar.

Interestingly enough, extreme complexity in group organization may exist together with relatively low level of capacity and operation. Some species of army ants engage in highly complex and successful expeditions in search of food. As many as thirty thousand ants may move in a column more than fifteen yards wide. The swarm continues to move as a body for some hours after it starts, but eventually divides into two or more subswarms. Despite the seeming complexity of these maneuvers, it turns out that the capacities of the individual ants are very limited and that the collective action is based on fairly simple responses to chemical and tactile stimulation. It is the "heterogeneous forest environment" that leads to the building up of the complicated swarm, for under simpler laboratory conditions no such organized behavior occurs and the "ants will run for days in an endless circular column. . . ." (37:59)

The concept of behavioral levels leads us to be on our guard against anthropomorphizing. *Anthropomorphism* (from the Greek *anthropos*, "man," and *morphe*, "form") means the projection of human traits upon things not human, and it is a fallacy to be guarded against in studying the lower animals. We are especially given to making the anthropomorphic mistake when the behavior of an animal or species seems to resemble human behavior (for example, when a pet dog does something for which it is usually punished and is then spoken of as feeling guilty or looking ashamed).

In a certain sense, however, the human vocabulary must always be anthropomorphic. Suppose one makes a statement as simple as the following: "The chimpanzee placed the box so that by standing on it, he could reach the banana." Surely this sentence does not mean that the chimpanzee has verbally formulated his purpose within the framework of English or any other language, as might be assumed by a too-literal reader. We should remember that although we apply human words to the actions of animals, the animals themselves do not.

It is not only in common speech that animal behavior is described and accounted for in human terms. Many years ago a comparative psychologist, Lloyd Morgan, attacked the then general propensity of both laypersons and scholars to find resemblances between the mental processes of human beings and those of lower animals. He enunciated a canon that has been quoted with general approval ever since by comparative psychologists (28:53):

> In no case may we interpret an action as the outcome of the exercise of a higher psychical faculty, if it can be interpreted as the outcome of the exercise of one which stands lower in the psychological scale.

At the time that Morgan was writing, it was customary to prove similarities between animals and human beings by narrating anecdotes. The anecdotal method has long since disappeared from scholarly writing, but there are numerous references to animal reasoning, generalization, hypotheses, concepts, dominance, leadership, purpose, goals, neuroses, communication, and cooperation. The terms are often used within quotation marks to indicate that the reader is not supposed to take the analogy to human behavior too seriously; that many writers and readers do take the analogies seriously, there is little doubt. Schneirla, who has attacked this kind of anthropomorphic writing, suggests that a distinction be drawn between the *description* of behavior and its causal *explanation*. We may, perhaps, speak loosely of protective behavior, food-getting, and courtship in various species, but a genuine causal description of the behavior will make clear that several processes are involved. Whereas, for example, intent and exchange of information and sentiment are involved in human courtship, none need be imputed to various of the lower species when they engage in sexual activity.

We believe that the concept of levels of behavior is a particularly fruitful one because it focuses attention both on the continuity of species and upon the differences among them. It makes mandatory that concepts and hypotheses concerning the behavior of any species be inductively

derived from the study of that particular species—rather than, as is common, by extrapolation to lower species of the principles derived from mammalian investigation, or by the explanation of human behavior in terms of principles derived from lower mammalian types (*zoomorphism*). Morgan, advocating this same view at the turn of the century, said cogently (28:282–83):

> When the doctrine of evolution was winning its way to acceptance, it was natural that its advocates should employ every means at their command to strengthen their position and to emphasize the continuity underlying diversity of aspect. But now that the position is secure, and continuity is generally admitted, it seems desirable to mark off, by restriction of the range of the use of terms we employ, the stages of differentiation.

A comparative psychology based upon this principle would be of great significance to social psychologists.

The sections that follow describe the behavior of species far removed from each other—insects and great apes. The apes are just below humans in the phylogenetic series. The "social insects" have one of the most conspicuously organized group lives known below the level of humans. As the symbolic life, and especially language, is of such import in humans, communication among insects and apes will be of special interest to us.

Entomologists have studied certain "social insects," including bees, wasps, termites, and ants. Members of these species, unlike most others, are born, live, and die as members of *societies*, or communities.

These insect groupings are often complex and highly organized, involving the cooperative and systematic efforts of great numbers of individual insects. Ant communities, for example, may consist of thousands of members, each of whom carries on specialized activities: breeding, nursing, childrearing, providing communal rations, feeding other members, engaging in group warfare, cultivating fungi as food, bequeathing "real estate" to the young, working on "engineering" projects, and "training" other insects to be docile slaves.

Such communal activities are possible only because members of the insect society are able to cooperate with one another. The care of eggs and larvae by "nurses" illustrates the cooperative and coordinated nature of activity among ants (27:154–55, 167):

> The eggs soon develop into minute larvae, fragile and helpless things that need close and constant care to preserve them. . . . From the beginning and throughout their growth . . . they must be fed and cared for. Their care is always a first consideration. . . . The nurses continually hover over them. They lick them as a cat does her kittens. The larvae learn to perk up their weak black heads and open their mouths, into which the nurses place food and drink. . . . For the most part, nurse ants take up and go through their duties in a business-like way. It is done thoroughly, and does not cease until the larvae have spun up around them their silken cocoons. Nor then; for these cocoons are constantly watched, cleaned, and cared for, and when the time comes for the young imago to escape, it is aided by the scissors-like jaws of the nurses, whose obstetrical services are aided by the efforts of the out-coming nymph.

In any insect community there exist physical differences among the individual members. Indeed, although ant communities consist mainly of the same sex (female), physical differentiation among ants is often very striking. This differentiation involves differential functions, each physical type being suited by nature for certain communal activities, and absolutely or relatively unsuited for others. The anatomical structure of a queen ant is very dissimilar to that of a worker, and her activities and social functions are correspondingly different; soldier ants, which are physically unlike queens and workers, engage in still different activities. All three ant types are genuine specialists. Bee and termite communities are similarly organized along biological lines.

Members of ant and other insect communities acquire their physiological structure through hereditary transmission. Wheeler, a recognized American authority on the species, believes that ants have undergone no important structural modification for approximately fifty-five to sixty-five million years and that ant activities today are virtually identical with those carried on millions of years ago.

The physiological structure of the insect not only determines its behavior but results in activity that is largely automatic. Entomologists have described ant behavior as composed of: (1) reflexes, (2) instincts (chains or series of reflexes), and (3) modifiable behavior. Modifiable, or learned, behavior is not automatic or stereotyped, but varies according to the demands of the environment. (50:507) The point is that the behavior of each insect is largely determined by its biological structure and by its individual experiences. Learned behavior, however, is of limited importance in the organization of the insect group, *because it is not transmitted from one generation to the next.* The learning dies with the insect whose possession it is; each insect must learn for itself anew.

By contrast to human beings (whose societies are organized largely in terms of codes, laws, customs, folkways, and symbolic understandings, and whose children must learn these in order to participate properly in the community), the capacity to learn "seems to be secondary in the early adjustment of new [insect] individuals. Its functions may be largely held to a generalized approach to the colony chemical, established through early feeding." (35:69) By the latter point, Schneirla has refer-

ence to the fact that insects recognize other insects of the same species because of learning. This learning takes place so early that it appears to be automatic or instinctive, although it is not. A mixed colony of ants can be formed if ants of different species are put together immediately after they emerge from their cocoons.

The preponderance of biological factors in the insect social pattern may be emphasized by terming such a pattern *biosocial*; that of the psychological or learning factors in the human pattern, by terming it *psychosocial*. (35:69)

E T N Although insects possess neither speaking nor hearing organs comparable to those of human beings, communication of a sort does take place among them by means of certain sensory organs. Sounds are produced by several methods: by wing vibrations, through breathing tubes, and by the friction of one part of the body against another. Gestures are made by body movements. The antennae of insects are also used as sensitive instruments by which excitement, discovery, and similar "emotions" are transmitted. Ants are said to congregate swiftly around a bit of food found by one of their number because the finder produces sound through the friction of one part of its body against another. The sounds are produced involuntarily in response to the smell of the food.

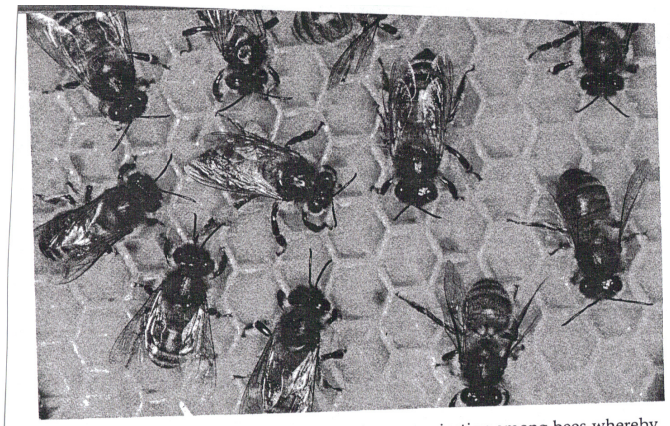
Such communication is necessary to all insect life, even among the most solitary, as some sort of sign behavior is required if individual insects are to mate. Where there are familial relationships, as between the female and her offspring, sensitivity to signs is more apparent. A biologist has suggested the important connection between elaborate insect communication and nest-building. As food must be brought back, colony members must follow one another's trails, danger signals must be responded to, and many other cooperative actions must be engaged in.

Such communication among ants—and among other social insects—should not be confused with articulate and symbol-using human communication. The language of humans consists of articulated systems of sounds—codified, conventionalized sets of symbols. Careful studies of bees, ants, termites, and other insects have not revealed the slightest shred of evidence suggesting the existence of symbolic communication among them. Moreover, although techniques of communication among young insects apparently require a simple initial process of learning, that process is in no way comparable to the complex one by which human infants acquire the use of language. The basic character of insect communication is so different from the symbolic communication of humans that Schneirla (34:391) suggests that we "use a term such as *social transmission* for interindividual arousal in insects, reserving the term *communication* for higher levels on which a conceptual process of social transmission is demonstrable."

An example of modes of communication between insects is furnished by an investigation of mosquitoes. In 1878, Hiram Maxim noted that the whine of a hotel dynamo attracted large numbers of male mosquitoes but few females. No one paid attention to this observation until relatively recently when it was discovered that mosquitoes communicate by sound and that when two cages, one containing male and the other female mosquitoes, are placed within several feet of each other the males all congregate on the side nearest the females, even when sheets are draped over the cages and the transmission of all scent is prevented. (43) The two Cornell scientists who discovered this have used the knowledge by setting up electrified cages in which loudspeakers amplify the mosquitoes' buzz five hundred thousand times. Mosquitoes fly to the cages from miles around, only to be electrocuted there.

It was found that each variety of mosquito has a characteristic pair of sounds, both emitted by the female. One of these is the "love call," which attracts males of the same variety within hearing distance of the call; the other is a "lust call," which signalizes to other females the discovery of a source of blood. (The female mosquito is the disease carrier and biter, because she must have blood to complete the process of fertilizing her eggs. The male is strictly vegetarian, living on nectar and fruit juices.) The use of both love calls and lust calls on the amplifiers thus attracts both male and female mosquitoes. It was found that more than 90 percent of the mosquitoes in a vicinity respond to the sounds unless they are too loud, in which case they repel. It is believed that the mosquitoes' antennae act as receivers for sound. The mosquitoes of Florida and those of West Africa are attuned to different frequencies and hence do not "understand" each other.

A more complicated form of communication exists among bees, and relates to the manner in which a bee signalizes to the rest of the hive the discovery of a source of honey. Knowledge of this is derived mainly from the remarkable studies of K. von Frisch (45, 46), a German investigator who specialized in the study of bees. Von Frisch found that when a bee discovers a rich source of food about fifty to one hundred yards from the hive, she at once becomes excited and liberates there a characteristic odor. When the bee returns to the hive she gives some of the nectar or syrup that she has collected to other bees and then starts a "round dance," circling alternately to the right and to the left. Other bees are excited by the dance and move in close and touch the dancer with their antennae. During pauses in the dance they are given droplets of nectar that have been regurgitated by the dancer. One by one these bees then leave the dance to fly about at random near the hive until they find the food source. This food source is identified by the clues furnished to them by



K. van Frisch has investigated complicated communication among bees whereby an individual may transmit to other members the location of a food source. Such behavior is, however, neither culturally transmitted from generation to generation nor is it culturally changeable, as a human language. (*Treat Davidson from National Audubon Society*)

the dancer. This interesting communicative process is more complex than similar behavior of the ant, which simply leaves an odor trail to the food source.

Because bees collect nectar and pollen from sources as much as a mile or more from the hive, the round dance with its taste and odor cues is not adequate to indicate food sources at the longer distances. Hence, when the distance exceeds fifty to one hundred yards, varying by species, the dance of the returning bee is a different one, a short straight run on the honeycomb during which the abdomen is waggled from side to side tracing a figure eight. When the distances become greater the speed of the dance is reduced. It was long thought that "estimated flying time" to the objective was indicated solely in this manner. The speed of the dance not only appeared to be roughly proportional to the distance, but it also became somewhat slower when there was a strong head wind on the way to the feeding place. Recent research has shown that the dancing bees emit trains of sound that are closely correlated in duration with distance to be traversed. (48, 49) These sounds are evidently attended to in the darkness of the hive by other bees that follow the dancer with their feelers. The direction of the source is indicated in relation to the position of the sun by the direction of the bee's straight run on the comb that hangs vertically in the hive. A downward run means away from the sun; an upward run means toward it. Bees attending the dancer are so well guided by the messages that they rarely make errors of more than about ten degrees in direction. Bees also are able to make adjustments to the changing position of the sun during the course of the day.

In other research, von Frisch (47) has reported on what he has called "dialects" in bee communication. He is careful to note that in using this expression he is speaking metaphorically. When he extended his observations to other varieties of honeybees he found that different varieties had somewhat different types of dances with varying rhythms so that when two different varieties were placed in the same hive they misinterpreted each other's signals and would, for example, go too far or not far enough to look for the indicated food source. Some types insist on doing their dance only on the horizontal, while others will do it on either a vertical or horizontal plane. In any case, the patterns of signaling are stereotypes and innate in each variety so that a newly hatched and totally inexperienced bee "understands" at once the signals of others of its kind.

It is unnecessary to indicate here the arguments for denying that honeybees possess language in the human sense. It is sufficient to note that this is not claimed even by those who study insect communication. They note that the transmission of the behavior from generation to generation is a purely biological process and that the system of communication used is determined by membership in a species, not by membership in a language community or culture. After a careful observation of various kinds of insect communication, Schneirla said (35:64): "There is no evidence . . . that it is symbolic in the sense that human words are symbolic. Rather, the insect forms are derived from biological processes characteristic of the species and are fixed in nature rather than culturally changeable."

The great apes, who of all the animals stand closest to us on the evolutionary ladder, offer perhaps the most interesting comparison with human beings, for they are unquestionably more intelligent than our usual house pets or farm animals. The great apes that have been most thoroughly studied are the chimpanzees. We shall attempt to show, first, what sociable animals they are. In describing his behavior, we shall use language that will bring out his seemingly human qualities. We shall then point to his limitations, which emerge when we compare him with the more complex human being.

GROUP SOLIDARITY. "It is hardly an exaggeration to say that a chimpanzee kept in solitude is not a real chimpanzee at all." (20:293) This statement indicates the extraordinary extent to which chimpanzees are influenced by the presence of other chimpanzees. When forcibly removed from his companions or his group, this great ape "cries, screams, rages, and struggles desperately to escape and return to his fellows. Such

behavior may last for hours. All the bodily functions may be more or less upset. Food may be persistently refused, and depression may follow the emotional orgy." (53:45) The chimpanzee will in these circumstances even risk his life in an effort to return to his group. When he rejoins it, there is great rejoicing, and the one who had been isolated displays the deepest excitement.

A chimpanzee locked alone in a cage will stretch his hands out through the bars toward his companions, wave and call to them, or push various objects through the bars in their direction. If the isolated animal's cries are audible and his gestures visible to the others, they may embrace him through the bars of the cage and otherwise give evidence of what seems to be human sympathy for their unhappy fellow. But if they cannot hear him or see him, they show no awareness of his absence. If one of their number is taken away because of illness or death, there is usually no evidence that the others grieve for their missing companion or even know that he is no longer in their midst.

Chimpanzees have a characteristic cry of distress. When this cry is emitted in connection with some action taken by the human investigator, other chimpanzees tend to rally to the support of their companion and threaten or actually attack the offender. Sometimes it is difficult to train the animals when they are in a group because of this danger of attack, particularly when the chimpanzees are adults.

COOPERATIVE BEHAVIOR. Investigators have noted numerous instances of cooperative activity among chimpanzees in the solution of problems. Each of two apes was individually trained to pull on a rope. Then a box of food was placed a short distance from a cage containing the two animals. Two ropes were attached to the box, and the rope-ends were left inside the cage. One of the chimpanzees, when he found himself unable to move the box by pulling on one of the ropes, solicited help from the other animal. He did this by such activities as pulling him toward the bars and placing his companion's hands on the second rope. Pulling in unison, the two chimpanzees succeeded in bringing the box close enough to reach for, grasp, and eat the food it contained.

Köhler has amusingly described what may be called a cooperative joke. A group of chimpanzees eating bread in a cage one day grew fond of teasing some chickens. The fowl would approach the cage, and the chimpanzees would offer them a piece of bread. The moment the chickens were about to peck at it, the bread would be withdrawn. One of Köhler's animals on his own initiative shared his piece with the chickens, watching them with an air of genial detachment. Sometimes while this was going on, another chimpanzee would poke a stick or a piece of wire at the chickens. Having hit upon this scheme, the two animals would then continue the game: one of them luring the chicken to the bars of the cage by holding out bread toward them, the other manipulating the stick or wire.

FADS AND ORNAMENTATION. Köhler also describes behavior among captive chimpanzees that bears a striking resemblance to human interest in fads and ornamentation. Thus, some chimpanzees inside a cage pushed straws through the bars, holding them among some ants just outside. When a straw was covered with ants it was withdrawn, the ants were eaten, and the performance then repeated. Other chimpanzees adopted this activity as a kind of sport. Several of the animals might be seen seated like fishermen in the yard alongside a path used by ants. Each of the chimpanzees held a straw that he lowered into the path and pulled up when it was covered with ants. After a time they evidently wearied of this game; they gave it up and turned to something else—for example, digging in the ground with a stick or jumping with a pole.

The chimpanzees' use of ornaments involved walking about with a rag, a bit of rope, some grass, or a bundle of twigs on them, or with strings dangling over their ears and around their faces. Köhler describes this as an almost daily occurrence and notes that the chimpanzees derived some kind of satisfaction from it. He also describes how the animals became interested in what we may perhaps call chimpanzee art. They smeared a white, paintlike substance over objects in their cages and sometimes over themselves. Like some young children, they did this deliberately and rather methodically, and apparently with some obscure kind of enjoyment.

RESPONSE TO MIRRORS. When Köhler first allowed Sultan to look at himself in a mirror, that gifted chimpanzee extended his hand with the palm turned inward (the typical chimpanzee gesture of greeting to a comrade). When the mirror was given to the animals they all appeared eager to obtain it, snatching it from one another and peering curiously into the glass surface. One female chimpanzee finally captured it, took it away from the others, and proceeded to examine it carefully, making repeated efforts to grasp or touch the chimpanzee that seemed to be peering at her from the mirror.

The animals began to pay attention to their reflections in shiny objects, in pieces of metal, and the like. They could sometimes be observed standing for relatively long periods of time over a pool, watching their reflections, grimacing, and swaying back and forth.

ECONOMIC BEHAVIOR. In an ingenious experiment (52), chimpanzees were trained to insert poker chips of various colors into a slot machine. A blue chip yielded two grapes; a white chip, one; and a brass chip, none. The animals were also shown how to obtain chips by performing work

on a different machine. They learned to operate both machines, developed a preference for blue as against white chips, and preferred both over the brass ones. When denied access to the "chimp-o-mat," they learned to hold on to their "money" for a time. When shown a chip, they often responded to it by extending their lips and smacking them as they did when they were offered grapes.

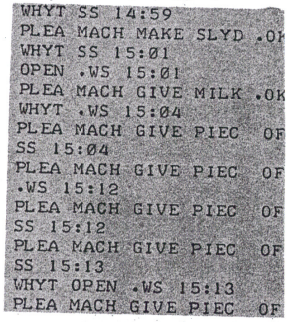
BEHAVIOR TOWARD HUMAN BEINGS. On one occasion Köhler inadvertently ran a splinter into his finger. He called it to the attention of a chimpanzee. The animal immediately assumed the mien and expression characteristically assumed in mutual skin grooming among apes: he examined the wound, placed two fingernails on each side of the splinter, and skillfully squeezed it out. Then he examined the finger very closely and allowed his hand to drop as though he were satisfied with a job well done.

Other interesting instances of quasi-human behavior toward people have been reported. Investigators have noted repeatedly that apes in captivity make sexual advances toward human beings as well as toward other animals, such as dogs. Some visitors have been greeted with something suspiciously like a "Bronx cheer." Sultan, Köhler's chimpanzee "genius," tried to enforce disciplinary action in Köhler's absence. Frequently, apes that have been scolded or punished seem to ask their human master for forgiveness by whimpering and throwing their arms around the master's neck.

Chimpanzees often display what may be characterized as a willingness to accept a human being as one of them. Köhler, for example, describes his participation in a chimpanzee dance around a pole. The apes seemed to relish his part in their sport and showed obvious "disappointment" when he withdrew. It is also notable that chimpanzees—particularly, it would seem, the adult females—show a kind of special and "benevolent" interest in human children.

When we consider the collective achievements of civilized humans, we are overwhelmingly impressed by the vast gulf between them and the apes. Chimpanzees do not weep. Although they have various ways of indicating pleasure, they do not laugh. Nor do they seem to have the slightest appreciation of human laughter; they tend to respond to it with bewilderment or rage. One could go on almost indefinitely enumerating specific kinds of human behavior that are beyond the ape. It is not so easy, however, to determine the exact sources of the chimpanzees' limitations or to define the precise limits of their accomplishments. This is a problem whose solution depends upon further experimental and observational investigation of animals. Here we can indicate only some of the

Chimpanzees have been trained to "economic" behavior. Here Lana ir the "chimp-o-mat" to obtain milk, apple. (*J. P. Lafont/Sygma*)



main types of differences between human and subhuman behavior that are to a degree substantiated by the work of comparative psychologists.

ANIMALS ARE LIMITED TO THE "HERE" AND "NOW." All subhuman behavior is sharply, although not absolutely, limited to the immediate, concrete situation. This limitation is one of time and space. Thus, Köhler states that a major difference between humans and chimpanzees is that the time in which the chimpanzees live stretches back and forth only a little way. The ability of chimpanzees to solve problems appears to be determined principally, Köhler says, by their "optical apprehension of the situation." Sticks and other instruments are most readily used as tools when they are in the immediate proximity of the problem situation. If they are moved away from it—as, for example, to the rear of the cage or into an adjoining room or corridor—the apes virtually cease to perceive them as potential tools, even though they may be perfectly familiar with these items and see them daily. Similarly, as we have noted, a

group of chimpanzees may react violently when one of their number is removed, particularly if he cries out or struggles. But once the animal has been taken out of sight and hearing, the group appears to forget about him almost at once, although the solitary animal continues for some time to seek the company of his fellows.

The assertion that animals are limited to the "here" and "now" requires some qualification: the limitation is not absolute, nor does it warrant overemphasis. Thus, if chimpanzees in a cage see bananas buried in the sand outside and are not allowed out of the cage until the next day, when they are released they run quickly to the approximate spot to search for the buried fruit. Other experiments clearly indicate that delayed responses of this type are well within the range of the chimpanzee's abilities. Moreover, a chimpanzee separated from a human being to whom he has become accustomed will give unmistakable signs of recognition when he sees him or her again after months of separation. But, by and large, one may regard chimpanzees as limited to the "here" and "now."

WORKING TOGETHER BUT NOT IN COMMON. That there are very distinct limits to cooperation among chimpanzees is evident from a highly significant experiment. Several animals were trained individually to build structures consisting of three boxes placed upon one another in order to obtain bananas hung up out of reach. Later, when the animals were given the same problem to solve collectively, each one proceeded to build as though he were alone. Thus, a chimpanzee in search of a second box would appropriate one already being used by another animal and become involved in a fight for its possession. When only two of the boxes were placed upon each other, a few of the animals usually attempted to climb the uncompleted structure simultaneously, thus upsetting it and necessitating a fresh start. Constant fighting and repeated failures to complete the three-box structure eventually exhausted all the animals but one. This chimpanzee then completed the structure and obtained the prize without permitting the others to share it. Repetition of this experiment always produced the same results with the same animal outlasting the others and winning the reward.

The vain attempts of four chimpanzees to build a three-box structure are described by Köhler as "building together but not in common." We may understand what he means if we compare the building activities of the chimpanzees with those of humans. Obviously, if each worker on the job sought to build for himself or herself without regard to the activities of fellow workers, the results would hardly be satisfactory. The activities of workers are organized and coordinated according to a plan or a blueprint that is passed around from one to the other, discussed by them, and at least generally understood by all of them. In other words,

each worker subordinates individual activity to the purpose or plan that they all have in common. By virtue of possessing this common plan, each worker can and often must engage in an activity different from that of his or her fellows, but each worker will and must contribute to the final result.

Keeping the foregoing illustration in mind, we may say by way of contrast that the cooperative behavior of lower animals is determined by inherited mechanisms rather than by goals and plans collectively comprehended. The sex act may be taken as an illustration of this type of unlearned cooperative behavior. Apart from such an instinctive response, however, it is exceedingly difficult to train a number of animals to work cooperatively on any but the simplest project. If the task requires each animal to do only what he would do if he were working alone, an apparently cooperative solution may be reached. Two chimpanzees may, for example, team up to lift or pull an object that is too heavy for either to manage alone. But when the project requires that the animals learn to perform dissimilar but coordinated tasks (as in building a tower with boxes in order to obtain suspended fruit) they fail because success would require some degree of verbal formulation of purposes and plans, and apes cannot make verbal formulations. We shall see soon the further consequences of this inability.

Although chimpanzees can use various kinds of objects as tools and can even construct certain types of tools, they show almost no tendency to store the tools for future use or to transport them systematically from place to place. Moreover, chimpanzees show practically no disposition to store or hoard food against future contingencies. At this point one may note that other animals, especially certain insects, do store and transport food in very complex and systematic ways. Such behavior, however, does not have to be learned; it is biologically determined.

Chimpanzees have what seems to be an "innate destructive impulse," Yerkes states, that expresses itself in their tendency to break down into its constitutent elements any complex object made up of various movable or removable parts. Chimpanzees explore, pull, poke, and otherwise manipulate the object; they do not rest until it has been taken apart and the pieces strewn about. In this respect they are like small children. When chimpanzees do actually construct a tool—for example, by fitting two sticks together to make one long one—their action seems remarkable because it contrasts so sharply with their usual mode of behavior.

Moreover, unless they are continuously trained, there is a strong tendency for the animals soon to slough off most of the new behavior they have learned in the experimental training situation. As Köhler says:

> If one is able to produce a—very temporary—type of behavior which is not congenial to the chimpanzee's instincts, it will soon be necessary to use compulsion if he is to keep it. And the slightest relaxation of that compulsion will be followed by a "reversion to type."

Yerkes exclaimed over the remarkable manner in which the chimpanzees of his laboratory colony learned certain human activities. Thus, when push-button drinking fountains were installed in their cages, only some animals were shown how to use them. The others learned from watching their fellows. Yerkes also observed that each generation became more tractable as experimental animals, certain of the activities required by the experiments being passed on from ape to ape "by imitative process" and from one generation to the next "by social tradition." These effects mentioned by Yerkes are the result of constant contact with human beings, and with an environment arranged by human beings. If the entire colony were returned to its native habitat, in a very short time probably few if any traces of human influence would remain; a new generation would not profit from the older generation's contact with civilization. This is particularly so, as drinking fountains, hammers, keys, and the like are not usually found in the ape's native environment. It is clear too that such transmission as may occur among trained chimpanzees is not the result of language communication as humans know it.

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Apes never learn to speak like human beings. Little success has been achieved in training them to imitate the sounds of human speech, although many investigators have tried. Relevant to this point are the reports of two experiments in which young chimpanzees were reared for a time in the homes of psychologists (14, 19). The Kelloggs (19) report that they were entirely unable to train their chimpanzee, Gua, to utter any words or to imitate human speech. The Hayeses (14), on the other hand, report that their animal, Vicki, acquired a vocabulary of three words—"mama," "papa," and "cup." From a demonstration witnessed by the authors, it was clear that the imitation was so crude that the sounds could hardly be identified, and could be called words only by a stretch of the imagination. It was also clear that Vicki used them in a mechanical and uncomprehending manner.

Psychologists continue to be preoccupied with the attempt to teach language to apes. Allen and Beatrice Gardner (10) have taught a chimpanzee to communicate in the American Sign Language, while Ann and David Premack recently taught one of their chimpanzees, Sarah, a vocabulary of about 130 "words" which consisted of brightly colored plastic

shapes that could be readily placed in various combinations ("sentences?") on a magnetized language board. (29) These recent endeavors do not seem to us to have created a new situation or to have in any way discredited the idea that humans are the only animals capable of learning a language. They have, however, once more demonstrated the remarkable capabilities of one of our closest and most captivating primate relatives.

The Premacks (29) trained their chimp Sarah by rewarding her when she chose the right plastic "symbols" in a given context. For example, in order to obtain and eat a banana, she was required to put the plastic "word" for banana on the language board. In later phases of her learning, the plastic symbols were combined to form "sentences," as for example, "Give apple Sarah." When Sarah did this correctly she was given a piece of apple. Sarah was also taught the names of various trainers who wore their plastic symbol-names on string necklaces. On one occasion when she put on the board, "Give apple Gussie," the trainer promptly gave the apple to another chimp named Gussie—and Sarah never again made the same mistake. In the more advanced phases of her training, Sarah became able, as the Premacks said, to make complex assertions and judgments such as the following: "Sarah take apple, if/then Mary give chocolate Sarah," "Red color of apple," and "Red no color of banana." She was able to match the plastic word for apple with a real apple, and the plastic name for Mary (a trainer) with a picture of Mary.

The authors cautiously conclude that "Sarah had managed to learn a code, a simple language that nevertheless included some of the characteristic features of natural language." (29:99) They warn against asking from Sarah what one would require of an adult, but argue that Sarah holds her own in language ability when compared with a two-year-old child. The Premacks are able to say that Sarah has a language, because their definition of language is too broad. They use it to refer to systems of communication in general, viewing human languages as particular "albeit, remarkably refined forms of language." (29:92) *They have thus conferred language upon chimpanzees by the very nature of their definition.*

Closer consideration of the highly interesting accomplishments of Sarah casts doubt even on the Premack comparison of Sarah with an ordinary two-year-old child. For example, children even at this early age use their language to talk with each other, while Sarah talked only with human beings. In contrast to how children acquire vocabularies (see Chapter 12), Sarah acquired her vocabulary exclusively or mainly in a laborious learning process, motivated by material rewards. While the Premacks say that Sarah mastered about 130 words, they also observe that her level of reliability was about 75 percent to 80 percent. This raises the question as to how well humans, even two-year-olds, would be able to

communicate if, in the process, they said approximately the opposite of what they intended to about 20 to 25 percent of the time. One may further wonder how much a colony of chimps in their natural habitat, all trained to Sarah's level and equipped with plastic words and language boards, would be likely to use this language.

In general, as we have already indicated, it seems improbable that the work of the Premacks and Gardners will result in any need to revise the belief that humans are the only animals capable of learning a language. The significance of this work is more likely to be felt in other areas, such as those that attempt to specify the basic points of difference that exist between human language and the lower-order system of communication. An anthropologist, G. W. Hewes, has recently reviewed this material in connection with a proposal he has made concerning the possible origin of human language. (15) In the process of doing so, however, it seems clear that Hewes is not overly impressed with the idea that at least two chimpanzees in the world now have language, although they cannot talk to each other, since each uses a different one. While Sarah uses plastic symbols, the Gardners' chimp Washoe was trained by them to use the American Sign Language. We are more impressed by the ingenuity and creativity of the teachers than we are by that of their pupils.

Who is imitating whom? Although at least two chimps in the world now have language, the ingenuity and creativity of the teachers are more impressive than that of the students. (*Magnum*)

Apes, of course, emit characteristic sounds of their own, but these do not constitute language in a genuine sense. This may easily be shown by considering three features of so-called ape language. First, the sounds are unlearned. This point has been proved conclusively by Boutan (5), who raised an ape wholly isolated from other apes from birth until its fifth year. It uttered the same cries as those made by other apes. Second, the sounds emitted by apes, as various investigators have noted, are "subjective": that is, they merely express emotions; they do not designate or describe objects. In the words of one writer (21:85): "Chimpanzees can exclaim *kha* or *nga* over their food just as humans delightedly cry *yum-yum*, but they cannot say *banana, today*." Their cries of enthusiasm are responses to an immediate situation: such cries "cannot be used between meals to talk over the merits of the feast." And third, ape sounds do not constitute a system of symbols. Yerkes has summarized this lack of system (53:189–90):

> Certainly chimpanzees communicate effectively with one another by sounds, gestures, facial and bodily expression, postures, and visible attitudes which function as meaningful signs. Symbols probably are rare and play a subordinate, if significant, role in their linguistic expression. Therefore, the composite language of the chimpanzee differs greatly from our own. They, for example, have no system, or even assemblage, of sounds which may properly be termed speech, and nothing remotely like a written language.

The sounds emitted by apes, or by any other animal, clearly do not constitute systematized animal languages similar to human languages. Neither may one refer to animal sounds as words, for if one does, one is forced to recognize that human children also communicate their needs to one another and to their elders by means of cries—cries as natural for them as are chimpanzee cries to the chimpanzee. One would thus be led to say that children have language before they learn a language, and that they speak words immediately after birth. It is more in accord with accepted usage to restrict the term "language" to such conventionalized systems of sounds or words as those designated as the English, French, German, Spanish, and other languages. All such systems have to be learned, and they vary by communities, rather than by species.

The biologist J. Bierens de Haan has clearly and conclusively summarized the arguments against the possible existence of unknown animal languages. He notes, first of all, that human language has six characteristics (4:249):

> . . . The sounds used in it are *vocal*, *articulate*, and have some *conventional meaning*, they *indicate something*, are uttered with the *intention* of communicating something to somebody else, and are *joined* together to form new combinations, so that phrases of various and different content are formed.

Bierens de Haan reasons that animals possess at best "pseudo-languages," since human language is of a decisively different order. We may summarize the evidence he offers for this judgment and invite the reader to compare this analysis with that of linguist Hockett presented in Chapter 5:

1. *Vocal.* The great majority of animals—including most of the vertebrates—are mute.
2. *Articulate.* Syllables are joined together. This is impossible when sounds are produced by organs other than the mouth. Among the higher animals that possess voices, there is generally no joining together of syllables. Humans combine syllables into words.
3. *Conventional meaning.* There is, with few exceptions, no direct relation between meaning and the nature of the sound. Even among the higher animals, sounds are innate and typical of the whole species.
4. *Indication.* With the aid of conventional meaning it becomes possible to indicate something—an object, situation, and so forth. Among the animals, sounds do not name objects or situations, but express "sentiments" and "emotions."
5. *Intention.* Animal sounds are generally uttered without reference to other beings. Although not made with intent to influence others, these sounds may be responded to by other animals.
6. *Joined together to form new combinations.* Combining words into phrases does not occur among animals; only humans do this.

We do not assert that there is no communication among the infra-human species. Quite the contrary. It is obvious even to the superficial observer that there is such communication. If communication is erroneously equated with language, then it is necessary to attribute language behavior to many lower species. But equating communication with language does violence to the usual meanings attached to these words and neglects the fact that there are many forms, or levels, of communication and that language is only one of these. If it is contended that lower animals have language like that of humans, it becomes necessary to explain the absence of behavioral effects of this fact upon them as compared to the many profound effects of language on human behavior.

Just as there is no doubt of the existence of communication among the lower animals, there is also, it seems to us, no doubt that humans are the only animals capable of language. Recent success in teaching chimps sign language and the use of plastic symbols does not challenge this conclusion. We shall be concerned with the nature of language behavior in the next chapter, but we may anticipate our discussion of it here by noting briefly that conversation is the fundamental form of linguistic intercommunication. Any intelligent person, given the proper training, can learn to converse with any other person on earth. However, one cannot converse with lower animals. Despite this fact, it should also be constantly kept in mind that as one ascends the evolutionary scale, sign behavior and communication become increasingly subtle.

The fundamental difference between human and animal behavior, basic to and in a sense determining all other differences, is that humans can talk and animals cannot. Human possession of language symbols and our ability to produce them voluntarily enables us to overcome the time and space limits in which, as we have noted, subhuman organisms may be said to be enclosed. Indeed, it may be more accurate to say that the possession of language has enabled human beings to "invent" time and space—past, present, and future. Humans have the capacity to respond to events that took place hundreds or even thousands of years ago, to predict or conceive future events, and to imagine objects and events that are remote in space or entirely nonexistent. This capacity involves nothing more mysterious than the ability to formulate propositions and to make statements about such objects and events, and in turn to be influenced by those propositions and statements.

As Köhler significantly remarks (20:277), chimpanzees' reactions to a situation are determined by their "optical apprehension" of that situation. Similarly, one may also say that the crucial difference is not that animals lack purposes but that they do not make or formulate propositions about their purposes. It is this fact, coupled with the ape's inability to make verbal responses to the physical environment, that probably accounts for the animal's failure to store food and tools or to transport them systematically for future use. The same may perhaps be said of what we described above as the tendency of chimpanzees to destroy complex objects rather than to preserve them, as they may react impulsively to features of those objects that momentarily attract their attention.

It is sometimes said that animals also have concepts in the sense that they can be trained, for example, to discriminate between triangles and circles, responding positively to one and negatively to the other. Experimental proof of this is in a sense unnecessary, as it is perfectly obvious that the lower animals are capable of such discriminations. They make them constantly when reacting differentially to other species, to sex differences, and to food as opposed to what is not edible. One does not ordinarily say, because of this, that animals have conceptions of sexual differentiation or of themselves as members of species. Closer examination of experimental findings invariably reveals that the animal alleged to have the concept of triangularity, for example, or the ability to count to three, actually acts only in a special situation, and then only as a consequence of laborious training and repetition. Rats have been trained to

leap against the one of three doors on which there are two marks rather than one or three marks. An unwary observer may conclude from this that the rat had learned to count to three. However, if the sizes and widths of the marks are varied so that large, heavy marks are mixed with small, light ones, the rat becomes confused and must be retrained in the new situation. The animal that is supposed to possess an idea of triangularity is similarly confused if a minute corner is cut off one of the tips, thereby converting the triangle into a trapezoid, or if one of the sides is slightly curved.

Experiments with concept formation in the lower animals have not been carried to the point where the essential idea, or *connotation*, of the concept is grasped, free from involvement in a particular concrete situation. When the child learns to understand the number 2, for example, the number becomes a positional point between 1 and 3 in an infinite series, and has no necessary reference to anything of a concrete nature. No one who teaches geometry would agree that a student who could sort out only triangles and circles had an intellectual grasp of triangularity and circularity. If this claim were made, one would be unable to explain what happens when the child learns about these matters in the way required to get high grades in his or her geometry examination.

An essential feature of the human concept is that it involves a general formulation and an explicit focal awareness of essentials. This means that concepts are both exact and communicable, and that individuals are able to specify to themselves, and therefore to others, the exact features of the situation to which they are responding. Also, as our earlier discussion indicated, the fact that concepts form parts of a system of communicable ideas means that as abstract ideas they may be moved about, manipulated, applied to new situations, and made to interact with other ideas. Different conceptual systems may also be applied to the same situation as one shifts perspectives. None of these features is noticeable in the so-called concepts formed by animals.

We shall be concerned more or less throughout this book with human behavior that is not duplicated, although it is sometimes foreshadowed, in the behavior of lower animals. The extent and significance of the range of behavior opened up by language can be suggested by referring to religion, morality, science, philosophy, and art; by noting the immense volume of printed matter in the world; or by calling attention to the existence in human beings of reflective self-consciousness, conscience, reason, imagination, and conceptual thought.

The differences between humans and the lower animals may be summarized by saying that the lower animals do not have a culture. The term *culture* is generally used to refer to behavior patterns including beliefs, values, and ideas, that are the shared possession of groups and that are symbolically transmitted. A culture also includes artifacts or products that are handed down in a physical sense, but whose significance resides in their relationships with human behavior. As language is both an integral part of culture and the indispensable vehicle for its transmission, the assertion that animals do not possess it is a far-reaching one for comparative psychology.

Although one may say that the lower animals are able to communicate with one another and that they exhibit a surprising range of social behavior, in the sense that they form aggregates at many levels, they do not reach the level of sociality that is embodied in conventional symbols and the shared, or common, purposes of humans. Even among the anthropoids, the significance of the behavior that the young learn from adults is limited, and animals reared in relative isolation from their own kind are not much handicapped or changed thereby. It should, however, be noted that young chimps deprived of their real mothers and provided with substitutes made of terrycloth are considerably retarded in their later sexual development. (11, 12) As the term *social* has been used in this context, it is clearly a broader term than *cultural*, as it refers to interstimulation of acting organisms in general. It should be remarked that *social* is sometimes used in a more restricted sense to apply only to interpersonal relations. In this latter sense, too, it is not identical with *cultural*, as there are many aspects of interpersonal relationships that are learned but that are not transmitted from generation to generation as part of the cultural heritage.

The absence of language in the lower species is intimately connected with the size and nature of animal groupings. As we shall see later, the complex, large-scale cooperative enterprises in which humans are continuously engaged are made possible by interlocking sets of systems of communication and transportation. The latter are themselves extremely complex instances of cooperative endeavor, linking as they do virtually all the nations and peoples of the world so that, for example, information may be disseminated throughout the world in a matter of minutes. The complexity of this intercommunication process and the varied array of physical apparatus, establishments, and agencies involved in the transmission, analysis, and storage of information is in turn directly linked with the complexity of the human mind.

In contrast to humans, lower animals form fewer and simpler groups that are limited by the means of communication, locomotion, and other factors inherent in the biological nature of each species. Animal groups are invariably actual physical aggregates that can be directly perceived. Their structure, size, and movements tend to be determined by influences such as those connected with availability of food, climatic conditions, sexual expression and reproduction, and protection against predators. While one can point to certain similarities between animal and primitive human groups—such as the allocation of social functions

according to sex, age, and territoriality—anthropologist Marshall D. Sahlins (33:198) observes that there is not a single trait of human society "even in its most rudimentary state that is in both form and functioning a direct survival of some specific trait of primate social behavior." Needless to say, there are no libraries, telephones, computers, newspapers, schools, jet airplanes, television sets, or any other external apparatus of communication and transport in the worlds of lower animals.

If we try to visualize a human being living in an animal's world and limited to the kinds of experience available to that particular species, we can readily comprehend that interaction at such a level would neither generate nor sustain the complex intellectual functions that we take for granted. Lest we permit considerations of this sort unduly to inflate our sense of importance as the highest form of life, we should remember that the present complexity of our social environment and of our mental processes is the result of a long and laborious evolutionary process extending back tens of thousands of years before the beginnings of recorded history. This evolutionary process may be thought of as originating at the remote and hypothetical point in time when the cultural aspects of the evolutionary process began to be differentiated from the physical aspects, or perhaps when the first language was invented.(32)

During the nineteenth century, when the evolutionary doctrine was being formulated, Alfred Russell Wallace, puzzled over mankind's place in the evolutionary scheme, observed that "natural selection could only have endowed the savage with a brain a little superior to that of the ape, whereas he actually possesses one but very little inferior to that of the average member of our learned society." (8:606) In a book devoted entirely to field studies of the behavior of primates in their natural habitats, Jarvis Bastian suggested that the solution to this puzzle "is very much tied up with the nature and uses of man's languages." (8:606) Elsewhere in the same volume, Peter Marler (8:584), concerning himself with the change from genetic control of vocal behavior as seen in the apes to transmission by a learned tradition, remarked that "only by the study of primate social systems in the natural state, still exposed to the kinds of selective forces that shaped the early history of man, can one hope to discover why this all-important change first came about. . . ."

Another type of animal that has received considerable publicity in recent years is the dolphin, or porpoise. (18, 22) The adaptability of this creature has been amply demonstrated, but the rash suggestions that it can talk and that it has a language are obvious examples of the way in which enthusiasm about the accomplishments of a given animal leads people to endow it with human qualities. It has been remarked that while humans may have some success in communicating with dolphins in "dolphin language," dolphins will probably have difficulty communicating with us in human language.

In this chapter we have briefly sketched the chronology of human evolution, noting that after a certain point in time, biological and cultural evolution cease to be closely correlated. The enormous acceleration of cultural evolution in recent times is linked with language and especially with the invention of writing. The social and communicative behavior of a number of subhuman species, especially of chimpanzees, is considered in comparison with that of human beings.

The study of subhuman behavior has two general purposes for the social psychologist. First, it provides a picture of response mechanisms and adaptive devices that generally increase in complexity, sensitivity, and variability as one ascends the evolutionary scale to humans. The social insects live in societies based on principles altogether different from those that form the foundations of human groups; and these principles are instructive chiefly in a negative way, showing us what human behavior is not, rather than what it is. The second main purpose in studying subhuman behavior is to bring into sharper focus the differences among organisms of various degrees of complexity. As the organisms develop to more complex and more specialized levels, new behavioral possibilities and properties emerge. These new behavioral possibilities and properties, if they are to be investigated as such, must be conceived of as related to the previous possibilities and properties from which they have evolved. This does not mean, however, that they are to be identified with that from which they have been evolved.

With reference to understanding human social behavior, the study of subhuman organisms enables us to form tentative conceptions of (1) similarities (common features) of human and subhuman behavior, and (2) differences (unique elements) that distinguish human behavior from that of other living forms. We must not neglect to give adequate attention to both of these two aspects. Experimental and comparative psychologists frequently stress the similarities and underplay or altogether disregard the differences between humans and other animals; theologians and philosophers, on the other hand, often stress the differences to the point of failing to recognize that humans are, after all, animals themselves.

Social scientists are concerned largely with political, economic, legal, moral, religious, and other specific forms of behavior that are found almost exclusively in human beings living in groups. They are concerned, in other words, with analyzing the unique phases of human behavior; therefore it is inevitable that they should seek explanations of this behavior in terms of something that human beings have and that other organisms lack. Such expressions as culture, cultural heritage, mores, institutions, traditions, laws, politics, economics, philosophy, religion, science, art, literature, and mathematics all point to unique attributes of human behavior. These differences between humans and apes

cannot be logically explained by referring to things that human beings and animals have in common.

Social psychology as the study of the influence of groups on the behavior of individuals is, in a sense, merely a part of the broader comparative study of species, each of which presents its own particular problems, but all of which share certain attributes in the sense that they are all living forms. It is unnecessary to insist either that only the differences be investigated and emphasized or that exclusive attention be focused on the similarities. It is understandable that such disciplines as economics, political science, and sociology, dealing as they do with behavior which is for the most part not found except in human society, should not directly concern themselves with subhuman behavior. As social psychology is in a way a part of comparative psychology, it must concern itself to some degree with the behavior of lower animals in order to understand the evolutionary emergence of civilization, culture, reason, and intelligence.

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