I

From animal ecology to human history

Whether any higher animals other than man are self-conscious is a matter for speculation; but it is safe to say that man alone has an idea of himself, which plays an important part in his behaviour.

LORD BRAIN[1]

We need to recognize from the outset that animals of any species can only survive and reproduce thanks to their skills in exploiting their environments. As A. W. Thorpe,[2] founder Professor of Animal Ethology at Cambridge, has reminded us, animals are most plainly distinguished from plants by their capacity to move. They owe their success in obtaining food and mates to their ability to detect and secure them by traversing space and appropriating them at the correct time. This is reflected not only in their behaviour but also in their morphology. Animals that move under their own power rather than being carried passively by currents of air or water tend to assume elongated forms. Further, their most acute sense organs and the orifices needed to engulf their prey are most often situated in some kind of head located in the forepart of their bodies.

The prime dimension in which animals move is that of space. They are attuned to exploring their spatial environments in order to locate the most favourable opportunities of satisfying their appetites. On the other hand, as Thorpe went out of his way to emphasize, animals also depend on memories of past time. This is particularly evident from the movement of fish and birds in the course of their breeding cycles. The development of marking techniques, followed by the systematic recovery of individuals, has provided a wealth of data. In the case of fish, we

know beyond doubt that salmon habitually return to spawn in the same rivers and sometimes even in the same parts of the river in which they had been born and where they spent their earliest years. It has been shown in the case of steelhead trout (*Salmo gairdneri*) that no fewer than 97.5 per cent returned to their parent stream and that another 2.1 per cent found their way to streams within four miles of that in which they began life. Moreover, they seem to have found their way back with little hesitation. Salmon have been timed to travel up to a hundred miles a day on their return run for spawning. Others were found to have maintained a daily average of around sixty miles over a period of twelve days. It is important to point out that these fish were returning to home waters for spawning after absences of from two to six years. For fish to have retraced their passages with such accuracy after spending their adult lives so far away suggests that they can only have done so as a result of memorizing their past experiences. Among the kinds of features in the environment to stimulate their memories were variations in the density and temperature of the water on their route, the precise nature of river beds, and such features as the sounds of waterfalls and rapids. Whatever clues they followed, it appears that fish returning to spawn in their original home waters relied on information gathered in the course of their previous experiences. In bringing these to bear on their breeding behaviour, salmon returning to spawn in home waters were not merely traversing great distances, but were also acting by reference to past time, their memories triggered directly by features of the external environment.

Even more remarkable experiments have been made on migrant birds. Many species in the northern hemisphere migrate south-west during the autumn and return in spring. During the day they are able to rely on the sun to maintain direction while operating some kind of internal check to compensate for diurnal changes. By night, on the other hand, they apparently rely on the stars for guidance, as one can see from the disorientation they suffer when the sky is overcast by cloud. Experiments have proved the ability of birds to traverse great distances and make landfall with notable precision. Shearwaters removed from Skokholm off the coast of Pembrokeshire and then transported to Cambridge in blacked-out boxes flew the return distance of 290 miles in six hours. Another consignment, this time flown

from Boston Harbour in the United States of America, returned to their Skokholm burrows, a distance of some 3,050 miles, within thirteen days. Experiment has tested an even longer flight, in this case by Layson albatrosses, which traversed distances of some 4,120 miles from the Philippines to Midway Island in a matter of thirty-two days. Again, birds of the same species managed to fly from Whidbey Island, Washington, a distance of over 3,000 miles in only ten days. Although, as Thorpe admitted, knowledge of how such feats were accomplished is still incomplete, it seems fairly clear that the birds relied above all on observation of the sky. By attaching minute radio transmitters to migrating birds it has been possible to show that they flew astonishingly accurate courses. Thus, a Swanson's thrush observed in Wisconsin was shown to have travelled a distance of 450 miles, while actually taking a course totalling no more than 453 miles. Such a standard of economy would be the envy of many human navigators, even when allowance is made for the bird's experience of flying in the opposite direction.

Thorpe quotes a further instance, this time from the insect world, of the use of memory (in the sense of recollection of past experience) as a guide to movements in the present. The hunting wasp immobilizes caterpillars by stinging and then stores them in its burrows to feed the young from the eggs it will subsequently lay. The wasp will need to locate its original burrow in order to accommodate additional caterpillars. It does so by recognizing the relation of the burrow to familiar objects or markers. Experiment shows that it can do this even when the most obvious landmarks are removed. If a beehive is shifted at night, it is found that next morning the foragers will circle the hive long enough to learn a new set of landmarks as a guide to their return. Once more, Thorpe maintained, it is a case of profiting from past experience through memory activated by the environment.

Others have argued that some time clocks are innate. For instance, bees have been shown to be endowed with a sense of time which enables them to visit their best feeding-places at the most favourable junctures. When the bees have been drugged to speed up their metabolisms they arrive too early and when they have been cooled they are too late. In the case of cockroaches, the site of the internal clock has been located and it has been shown that their activities can be manipulated by the experimental removal and grafting of cells. Again, oysters, whose

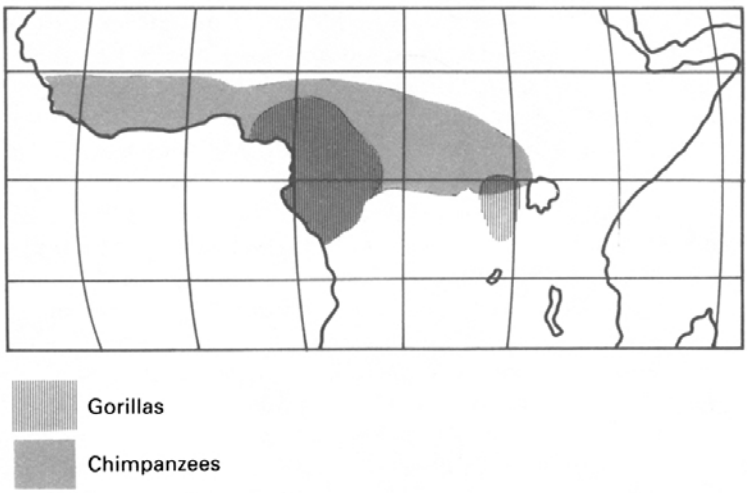

Figure 1 Map showing territories occupied by the man-like apes of equatorial Africa (After A. H. Schultz, *The Life of the Primates*, 1969)

temporal clocks are regulated by the tides, continue when they are transferred elsewhere to conform for a considerable time to the timetable prevailing in their native habitat. In either case the apprehension of time, whether innate or based on memory, is quite distinct from the conscious adjustments to time effected in human societies. Yet human beings still have biological clocks, even if they only become conscious of them when their routines are disturbed, for instance when they cross zones of longitude in the course of flight. The sense of disorientation we experience in jet lag is a reminder that, like other organisms, we have built-in clocks of which we are normally unaware, another reminder that we belong to the natural world.

The ethology of the non-human primates is of more relevance to human beings than that of other animals[3] for the very good reason that they are our closest living relatives, though the divergence of the hominid line took place some millions of years ago. So long as observers of primate behaviour confined their attention to animals subject to the artificial restraints and frustrations of captivity, their message to anthropologists remained limited and subject to critical discount. It is only since they addressed themselves to primates living at large in their

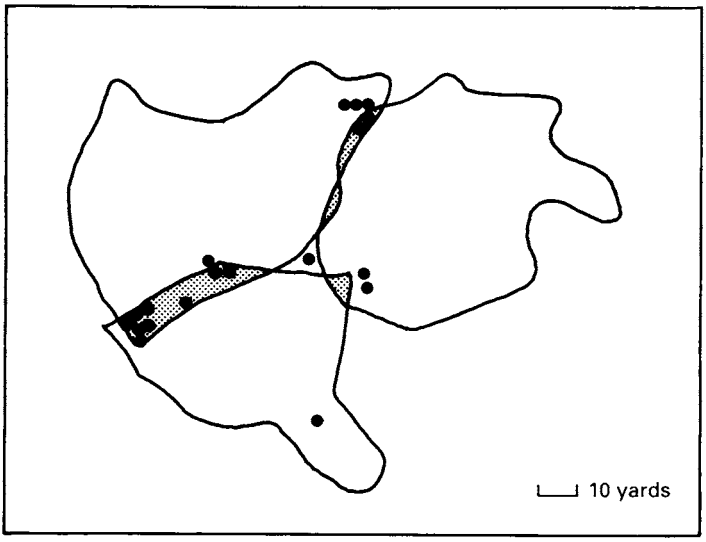

Figure 2 Adjacent, only marginally overlapping, territories of the South American Callicebus moloch monkeys, showing conflict areas in marginal zones (From Hans Kummer, *Primate Societies*, 1971)

natural environments and interacting with their fellows that primatologists have been able to contribute positively to the study of human behaviour. They have shown that non-human primates are narrowly restricted in relation to space.[4] By contrast with the ubiquity of human beings they are adapted to comparatively restricted ecological niches. Thus in present-day Africa, while humans are likely to occur in any zone capable of supporting life, the various species of non-human primate appear to be restricted to environments to which they are naturally adapted. While the rain forest shelters several species and the savannah two or three, the semi-desert supports only one. As Adolph Schultz[5] noted, those occupying territories with open vegetation need more extensive ones than forest dwellers (Figure 1). Terrestrial baboons, geladas and patas monkeys might wander some distance in their daily foraging, whereas most forest-dwelling species rarely move over more than one or two kilometres (Figure 2). In either case, they do not exceed the limits necessary for collecting sufficient food to satisfy their hunger. While apes and monkeys possess a remarkably accurate

knowledge of the resources of their home environments, they are as a rule extremely averse to venturing beyond their accustomed territories so long as these supply them with sufficient food.[4,5] In other words their perception of space is limited to their biological needs, whereas men regard space as a dimension for meeting their socially and ultimately their ideological requirements. Again, where other primates depend on their own limbs to explore space, human beings have, in the course of time, invented artificial devices to assist them to explore increasingly remote zones of space and move about them with more accurate directional control and at an ever more rapid pace.

Observers of the non-human primates have also consistently noted that they possess only a most restricted awareness of past and future time, as well as lacking articulate speech. Although his studies were confined to captive animals, Wolfgang Köhler[6] was clear from his work on the mentality of apes that, despite any appearance to the contrary, these animals did not have a consciousness of time. Gaston Viaud[7] expressed it neatly when he wrote that chimpanzees 'are more or less trapped in the present'. And chimpanzees are not unique in this respect. Study of macaque monkeys has shown that 'their mental activities and processes . . . are limited almost entirely to the present. Even when they are related to past experience, or refer to a very limited and immediate future, they appear always to be linked to sensory stimuli in the environmental present'. This restricted awareness of time is accompanied by a lack of articulate speech. The non-human primates are under no pressure to speak because they have little to talk about beyond what can be expressed by emotive grunts and cries. Conversely, it may well be asked in what a human conversation deprived of reference to past and future could consist. It is precisely men's and women's awareness that they exist in time that stamps them as human. Just as in the arboreal phase of primate existence the development of stereoscopic vision made possible the precise awareness of the three-dimensional space without which life in the trees would hardly have been possible, so in the case of human beings it was a sense of temporal perspective that made possible a way of life in which culture rather than mere instinct played a predominating role. That is what Ortega y Gasset meant when he exclaimed: 'Man has no nature; what he has is History'. It is hardly surprising that one of the ways in which he has used his powers of speech has

been to transmit oral traditions about the way he lived in the past.

The conscious awareness that they exist in time which helps to distinguish human beings from other animals necessarily extends from the past to the future. Concern for the future is inherent in material culture, the medium on which archaeologists have mainly to rely in seeking to understand prehistory, and which is predicated upon the accumulation of capital. While many kinds of animal from birds to apes have been observed to use things in order to achieve immediate results, hominids alone have shown the foresight to make tools and other equipment for unspecified use in the future. From a remote stage in their prehistory they have shaped stone to serve immediate purposes, like detaching meat from the carcasses of dead animals. Yet for at least 2 million years they have displayed their humanity by making stone implements to standard, culturally defined and socially transmitted patterns intended for use on occasions yet to arise. In doing so they were investing against future contingencies. Frequently indeed they had to anticipate the manufacture of stone tools by securing, sometimes from a distance, the raw materials from which they were made. When they came to practise metallurgy, notably bronze-smithing, this frequently meant that they had to combine substances derived from more than one source, often from a distance. Another major investment against future contingencies involved the provision of devices to ease the movement of goods and people. On land these were not developed to any notable extent until the animals capable of drawing them had been domesticated. By sea it was another matter. Even prehistoric peoples equipped with elementary technologies showed themselves willing to devote arduous and often highly skilled labour to the production of sea-going craft designed for use on future occasions. It was the use of sea-going craft which opened up distant resources and for the first time made people aware of the extent of the world and of the place of their own communities within it. One may indeed conclude that the more advanced the material culture the greater the investment required to sustain, let alone improve it. The more insistent the needs and expectations the more pressing the necessity of anticipating the future. Conversely, the greater the requirements of the technology the greater the pressure on natural resources. It is no wonder that the vast increase in

population and the greater impact made by modern technology should have led people to think more intently about the future of the environment itself, including even climatic and geological change.

One advantage of drawing upon animal and above all on primate ethology is that it reminds us that we are engaged in exploring aspects of behaviour which are in some respects common to all living creatures. Yet it is vitally important to be clear about one thing. Darwin, Huxley, Lyell, Lubbock and others have shown beyond cavil that our forebears have emerged in the course of the last few million years as species distinct from those which preceded them. One of their most important legacies is the question of what it is that nevertheless distinguishes human beings from their nearest primate relatives. A succinct answer is that supplied by Lord Brain in his book *Science and Man* and quoted at the head of this chapter.

Three years later in 1969 the Smithsonian Institution dedicated a symposium at Washington to the theme 'Man and Beast'.[8] Susanne Langer began by attacking those popular writers who specialized in 'applying ethnological terms metaphorically to animals'. Her strictures are hardly impaired by the practices of pre-scientific peoples. The ancient Egyptians, for instance, included animals among their deities and on occasion depicted them with human bodies and animal heads. Again, the totemic tribes of Australia were happy to trace their ancestry to animals or even plants. What Langer deplored was the damage to scientific discourse done by the writers of some popular works. We should not be misled by the undoubted fact that human beings may appear to behave like other animals in achieving biological ends. In reality the difference may be profound. Language may serve some of the same purposes as animal communication, but it differs in being conceptual and conveying a variety of meanings through the use of symbols designed to uphold values and proclaim differences inherited by virtue not of biology but of history. Human beings, according to Langer, owe their special position to existing at a level of awareness too intense to find adequate expression in immediate action: the world, the society to which they belong and their very sense of identity are all conceptual products. For Louis J. Halls, a fellow-contributor to the Washington symposium, great importance attaches to language as the medium for expressing self-conscious

thought. Speech not merely establishes contact with other people but also conveys values as well as information and desires. The very use of language expresses the speaker's humanity and the essence of language is tense. A third contributor, Robin Fox, summed things up very clearly when he wrote, 'We are obviously part of nature, and in particular we are part of the animal world, and yet we are set apart from nature by the very fact of knowing we are part of it'.

In seeking the origins and early development of the conscious perception of space and time as dimensions, the obvious source is primitive man. The problem is where to find him. Our predecessors, still dazzled by the idea of evolution, had little room for doubt. The peoples encountered by ethnologists beyond the industrialized world were accepted as survivors of a primitive stage through which modern people had passed in the course of prehistoric times. It was assumed that ethnologists could gain direct access to primitive man by observing and interrogating such people. Yet in reality, as we have long recognized, the peoples studied by ethnologists lived on precisely the same level of time as their interrogators. They could not by any stretch of the imagination be accepted as representing pristine or primitive man. In many cases they had been modified in quite recent times by contact with traders and missionaries from the west and in others had almost certainly been influenced by earlier civilizations. Again, it should be remembered that the so-called primitives in fact stood at widely differing stages of development. For instance, when the inhabitants of the Pacific Islands and of much of the New World were technically still living in the Stone Age, others, notably in different parts of Africa, were already working iron. Again, while in many parts of the world the native peoples still lived in small, more or less egalitarian communities, many African and Polynesian peoples lived in societies to a greater or less degree stratified, with chiefs and in some cases with something like state organization. Furthermore, the anthropologists who recorded such peoples themselves had different interests and priorities. In many cases they made only passing references to perceptions of time and space. Evans-Pritchard's allocation of an entire chapter to this topic in his monograph on the Nuer was a rare exception. Yet there is a fair measure of agreement among anthropologists that the simpler communities living beyond the range of the modern

industrial world invariably thought of space and time, not as abstract concepts, but in terms strictly relevant to their own ways of life.

Truly primitive people in fact lived a very long time ago. They can only be approached through a study of prehistory. Prehistorians are unable to interrogate or observe their subjects directly and truly primitive people were invariably preliterate. They can be approached only indirectly through a study of their archaeological structures and residues and these are likely to be most exiguous precisely for the early periods about which we would most like to be informed. Even so, the problem of interpreting archaeological data from remote periods is complicated by the fact that this has to be done in the light of more or less anachronistic analogies drawn from ethnology or history. The clues most likely to survive are those most remote from primitive peoples and in many instances reflect influences stemming from ancient civilizations. Nevertheless, despite its limitations, prehistoric archaeology offers the best prospect of spanning the gap between animal ethology and the historical records of the earliest civilizations.

The information recovered by ethnologists by observing peoples living until recently beyond the margins of modern civilization, when taken in conjunction with that inferred by archaeologists from the traces of prehistoric communities, nevertheless suggests that preliterate peoples had only a limited apprehension of space and time. As the French sociologist Emile Durkheim[9] once wrote, 'It is the rhythm of social life which is the basis of the category of time: the territory occupied by the society furnished the material category of space'. It follows that we may expect to find, as indeed we do, that the notions entertained by preliterate peoples about time and space related primarily to the nature of their economies and the structure of their societies.

The converse is no less true. If we aim to trace the development of ideas of space and time further, we need to turn to literate societies. Although we were right to begin with the smaller, relatively closed societies of the preliterate era, which reflect, however incompletely, the emergence of *Homo sapiens* as a distinct species of primate, in the long run the only point of doing so is to see what he has gone on to achieve in this regard since the beginning of written records. When people first became