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THE UNIQUENESS OF MAN

MAN'S opinion of his own position in relation to the rest of the animals has swung pendulum-wise between too great or too little a conceit of himself, fixing now too large a gap between himself and the animals, now too small. The gap, of course, can be diminished or increased at either the animal or the human end. One can, like Descartes, make animals too mechanical, or, like most unsophisticated people, humanize them too much. Or one can work at the human end of the gap, and then either dehumanize one's own kind into an animal species like any other, or superhumanize it into beings a little lower than the angels.

Primitive and savage man, the world over, not only accepts his obvious kinship with the animals but also projects into them many of his own attributes. So far as we can judge, he has very little pride in his own humanity. With the advent of settled civilization, economic stratification, and the development of an elaborate religion as the ideological mortar of a now class-ridden society, the pendulum began slowly to swing in the other direction. Animal divinities and various physiological functions such as fertility gradually lost their sacred importance, Gods became anthropomorphic and human psychological qualities pre-eminent, Man saw himself as a being set apart, with the rest of the animal kingdom created to serve his needs and pleasure, with no share in salvation, no position in eternity. In Western civilization this swing of the pendulum reached its limit in developed Christian theology and in the philosophy of Descartes; both alike inserted a qualitative and unbridgeable barrier between all men and any animals.

With Darwin, the reverse swing was started. Man was once again regarded as an animal, but now in the light of science rather than of unsophisticated sensibility. At the outset, the consequences of the changed outlook were not fully explored. The unconscious prejudices and attitudes of an earlier age survived, disguising many of the moral and philosophical implications of the new outlook. But gradually the pendulum reached the furthest point of its swing. What seemed the logical consequences of the Darwinian postulates were faced: man is an animal like any other; accordingly, his views as to the special

meaning of human life and human ideals need merit no more consideration in the light of eternity (or of evolution) than those of a bacillus or a tapeworm. Survival is the only criterion of evolutionary success: therefore, all existing organisms are of equal value. The idea of progress is a mere anthropomorphism. Man happens to be the dominant type at the moment, but he might be replaced by the ant or the rat. And so on.

The gap between man and animal was here reduced not by exaggerating the human qualities of animals, but by minimizing the human qualities of men. Of late years, however, a new tendency has become apparent. It may be that this is due mainly to the mere increase of knowledge and the extension of scientific analysis. It may be that it has been determined by social and psychological causes. Disillusionment with *laisser-faire* in the human economic sphere may well have spread to the planetary system of *laisser-faire* that we call natural selection. With the crash of old religious, ethical, and political systems, man's desperate need for some scheme of values and ideals may have prompted a more critical re-examination of his biological position. Whether this be so is a point that I must leave to the social historians. The fact remains that the pendulum is again on the swing, the man-animal gap again broadening. After Darwin, man could no longer avoid considering himself as an animal; but he is beginning to see himself as a very peculiar and in many ways a unique animal. The analysis of man's biological uniqueness is as yet incomplete. This essay is an attempt to review its present position.

The first and most obviously unique characteristic of man is his capacity for conceptual thought; if you prefer objective terms, you will say his employment of true speech, but that is only another way of saying the same thing. True speech involves the use of verbal signs for objects, not merely for feelings. Plenty of animals can express the fact that they are hungry; but none except man can ask for an egg or a banana. And to have words for objects at once implies conceptual thought, since an object is always one of a class. No doubt, children and savages are as unaware of using conceptual thought as Monsieur Jourdain was unaware of speaking in prose; but they cannot avoid it. Words are tools which automatically carve concepts out of experience. The faculty of recognizing objects as members of a class provides the potential basis for the concept: the use of words at once actualizes the potentiality.

This basic human property has had many consequences. The most important was the development of a cumulative tradition. The beginnings of tradition, by which experience is transmitted from one generation to the next, are to be seen in many higher animals. But in no case is the tradition cumulative. Offspring learn from parents, but they learn the same kind and quantity of lessons as they, in turn, impart: the transmission of experience never bridges more than one generation. In man, however, tradition is an independent and potentially permanent activity, capable of indefinite improvement in quality and increase in quantity. It constitutes a new accessory process of heredity in evolution, running side by side with the biological process, a heredity of experience to supplement the universal heredity of living substance.

The existence of a cumulative tradition has as its chief consequence—or if you prefer, its chief objective manifestation—the progressive improvement of human tools and machinery. Many animals employ tools; but they are always crude tools employed in a crude way. Elaborate tools and skilled technique can develop only with the aid of speech and tradition.

In the perspective of evolution, tradition and tools are the characters which have given man his dominant position among organisms. This biological dominance is, at present, another of man's unique properties. In each geological epoch of which we have knowledge, there have been types which must be styled biologically dominant: they multiply, they extinguish or reduce competing types, they extend their range, they radiate into new modes of life. Usually at any one time there is one such type—the placental mammals, for instance, in the Cenozoic Epoch; but sometimes there is more than one. The Mesozoic is usually called the Age of Reptiles, but in reality the reptiles were then competing for dominance with the insects: in earlier periods we should be hard put to it to decide whether trilobites, nautiloids, or early fish were *the* dominant type. Today, however, there is general agreement that man is the sole type meriting the title. Since the early Pleistocene, widespread extinction has diminished the previously dominant group of placental mammals, and man has not merely multiplied, but has evolved, extended his range, and increased the variety of his modes of life.

Biology thus reinstates man in a position analogous to that conferred on him as Lord of Creation by theology. There are, however differences, and differences of some importance for our general out-

look. In the biological view, the other animals have not been created to serve man's needs, but man has evolved in such a way that he has been able to eliminate some competing types, to enslave others by domestication, and to modify physical and biological conditions over the larger part of the earth's land area. The theological view was not true in detail or in many of its implications; but it had a solid biological basis.

Speech, tradition, and tools have led to many other unique properties of man. These are, for the most part, obvious and well known, and I propose to leave them aside until I have dealt with some less familiar human characteristics. For the human species, considered as a species, is unique in certain purely biological attributes; and these have not received the attention they deserve, either from the zoological or the sociological standpoint.

In the first place, man is by far the most variable wild species known. Domesticated species like dog, horse, or fowl may rival or exceed him in this particular, but their variability has obvious reasons, and is irrelevant to our inquiry.

In correlation with his wide variability, man has a far wider range than any other animal species, with the possible exception of some of his parasites. Man is also unique as a dominant type. All other dominant types have evolved into many hundreds or thousands of separate species, grouped in numerous genera, families, and larger classificatory groups. The human type has maintained its dominance without splitting: man's variety has been achieved within the limits of a single species.

Finally, man is unique among higher animals in the method of his evolution. Whereas, in general, animal evolution is divergent, human evolution is reticulate. By this is meant that in animals, evolution occurs by the isolation of groups which then become progressively more different in their genetic characteristics, so that the course of evolution can be represented as a divergent radiation of separate lines, some of which become extinct, others continue unbranched, and still others divergently branch again. Whereas in man, after incipient divergence, the branches have come together again, and have generated new diversity from their Mendelian recombinations, this process being repeated until the course of human descent is like a network.

All these biological peculiarities are interconnected. They depend on man's migratory propensities, which themselves arise from his

fundamental peculiarities, of speech, social life, and relative independence of environment. They depend again on his capacity, when choosing mates, for neglecting large differences of colour and appearance which would almost certainly be more than enough to deter more instinctive and less plastic animals. Thus divergence, though it appears to have gone quite a long way in early human evolution, generating the very distinct white, black, and yellow subspecies and perhaps others, was never permitted to attain its normal culmination. Mutually infertile groups were never produced: man remained a single species. Furthermore, crossing between distinct types, which is a rare and extraordinary phenomenon in other animals, in him became normal and of major importance. According to Mendelian laws, such crosses generate much excess variability by producing new recombinations. Man is thus more variable than other species for two reasons. First, because migration has recaptured for the single interbreeding group divergences of a magnitude that in animals would escape into the isolation of separate species; and secondly because the resultant crossing has generated recombinations which both quantitatively and qualitatively are on a far bigger scale than is supplied by the internal variability of even the numerically most abundant animal species.

We may contrast this with the state of affairs among ants, the dominant insect group. The ant type is more varied than the human type; but it has achieved this variability by intense divergent evolution. Several thousand species of ants are known, and the number is being added to each year with the increase of biological exploration. Ways of life among ants are divided among different sub-types, each rigidly confined to its own methods. Thus even if ants were capable of accumulating experience, there could exist no single world-wide ant tradition. The fact that the human type comprises but one biological species is a consequence of his capacity for tradition, and also permits his exploitation of that unique capacity to the utmost.

Let us remind ourselves that superposed upon this purely biological or genetic variability is the even greater amount of variability due to differences of upbringing, profession, and personal tastes. The final result is a degree of variation that would be staggering if it were not so familiar. It would be fair to say that, in respect to mind and outlook, individual human beings are separated by differences as profound as those which distinguish the major groups of the animal kingdom. The difference between a somewhat subnormal member

of a savage tribe and a Beethoven or a Newton is assuredly comparable in extent with that between a sponge and a higher mammal. Leaving aside such vertical differences, the lateral difference between the mind of, say, a distinguished general or engineer of extrovert type and of an introvert genius in mathematics or religious mysticism is no less than that between an insect and a vertebrate. This enormous range of individual variation in human minds often leads to misunderstanding and even mutual incomprehensibility; but it also provides the necessary basis for fruitful division of labour in human society.

Another biological peculiarity of man is the uniqueness of his evolutionary history. Writers have indulged their speculative fancy by imagining other organisms endowed with speech and conceptual thought—talking rats, rational ants, philosophic dogs, and the like. But closer analysis shows that these fantasies are impossible. A brain capable of conceptual thought could not have been developed elsewhere than in a human body.

The course followed by evolution appears to have been broadly as follows. From a generalized early type, various lines radiate out, exploiting the environment in various ways. Some of these comparatively soon reach a limit to their evolution, at least as regards major alteration. Thereafter they are limited to minor changes such as the formation of new genera and species. Others, on the other hand, are so constructed that they can continue their career, generating new types which are successful in the struggle for existence because of their greater control over the environment and their greater independence of it. Such changes are legitimately called "progressive." The new type repeats the process. It radiates out into a number of lines, each specializing in a particular direction. The great majority of these come up against dead ends and can advance no further: specialization is one-sided progress, and after a longer or shorter time, reaches a biomechanical limit. The horse stock cannot reduce its digits below one; the elephants are near the limits of size for terrestrial animals; feathered flight cannot become aerodynamically more efficient than in existing birds, and so on.

Sometimes all the branches of a given stock have come up against their limit, and then either have become extinct or have persisted without major change. This happened, for instance, to the echinoderms, which with their sea-urchins, starfish, brittle-stars, sea-lilies, sea-cucumbers, and other types now extinct had pushed the life that

was in them into a series of blind alleys: they have not advanced for perhaps a hundred million years, nor have they given rise to other major types.

In other cases, all but one or two of the lines suffer this fate, while the rest repeat the process. All reptilian lines were blind alleys save two—one which was transformed into the birds, and another which became the mammals. Of the bird stock, all lines came to a dead end; of the mammals, all but one—the one which became man.

Evolution is thus seen as an enormous number of blind alleys, with a very occasional path of progress. It is like a maze in which almost all turnings are wrong turnings. The goal of the evolutionary maze, however, is not a central chamber, but a road which will lead indefinitely onwards.

If now we look back upon the past history of life, we shall see that the avenues of progress have been steadily reduced in number, until by the Pleistocene period, or even earlier, only one was left. Let us remember that we can and must judge early progress in the light of its latest steps. The most recent step has been the acquisition of conceptual thought, which has enabled man to dethrone the non-human mammals from their previous position of dominance. It is biologically obvious that conceptual thought, could never have arisen save in an animal, so that all plants, both green and otherwise, are at once eliminated. As regards animals, I need not detail all the early steps in their progressive evolution. Since some degree of bulk helps to confer independence of the forces of nature, it is obvious that the combination of many cells to form a large individual was one necessary step, thus eliminating all single-celled forms from such progress. Similarly, progress is barred to specialized animals with no blood-system, like planarian worms; to internal parasites, like tapeworms; to animals with radial symmetry and consequently no head, like echinoderms.

Of the three highest animal groups—the molluscs, the arthropods, and the vertebrates—the molluscs advanced least far. One condition for the later steps in biological progress was land life. The demands made upon the organism by exposure to air and gravity called forth biological mechanisms, such as limbs, sense-organs, protective skin, and sheltered development, which were necessary foundations for later advance. And the; molluscs have never been able to produce efficient terrestrial forms: their culmination is in marine types like squid and octopus.

The arthropods, on the other hand, have scored their greatest successes on land, with the spiders and especially the insects. Yet the fossil record reveals a lack of all advance, even in the most successful types such as ants, for a long time back—certainly during the last thirty million years, probably during the whole of the Tertiary Epoch. Even during the shorter of these periods, the mammals were still evolving rapidly, and man's rise is contained in a fraction of this time.

What was it that cut the insects off from progress? The answer appears to lie in their breathing mechanism. The land arthropods have adopted the method of air-tubes or tracheae, branching to microscopic size and conveying gases directly to and from the tissues, instead of using the dual mechanism of lungs and bloodstream. The laws of gaseous diffusion are such that respiration by tracheae is extremely efficient for very small animals, but becomes rapidly less efficient with increase of size, until it ceases to be of use at a bulk below that of a house mouse. It is for this reason that no insect has ever become, by vertebrate standards, even moderately large.

It is for the same reason that no insect has ever become even moderately intelligent. The fixed pathways of instinct, however elaborate, require far fewer nerve-cells than the multiple switchboards that underlie intelligence. It appears to be impossible to build a brain mechanism for flexible behaviour with less than a quite large minimum of neurones; and no insect has reached a size to provide this minimum.

Thus only the land vertebrates are left. The reptiles shared biological dominance with the insects in the Mesozoic. But while the insects had reached the end of their blind alley, the reptiles showed themselves capable of further advance. Temperature regulation is a necessary basis for final progress, since without it the rate of bodily function could never be stabilized, and without such stabilization, higher mental processes could never become accurate and dependable.

Two reptilian lines achieved this next step, in the guise of the birds and the mammals. The birds soon, however, came to a dead end, chiefly because their forelimbs were entirely taken up in the specialization for flight. The sub-human mammals made another fundamental advance, in the shape of internal development, permitting the young animal to arrive at a much more advanced stage before it was

called upon to face the world. They also (like the birds) developed true family life.

Most mammalian lines, however, cut themselves off from indefinite progress by one-sided evolution, turning their limbs and jaws into specialized and therefore limited instruments. And, for the most part, they relied mainly on the crude sense of smell, which cannot present as differentiated a pattern of detailed knowledge as can sight. Finally, the majority continued to produce their young several at a time, in litters. As J. B. S. Haldane has pointed out, this gives rise to an acute struggle for existence in the prenatal period, a considerable percentage of embryos being aborted or resorbed. Such intra-uterine selection will put a premium upon rapidity of growth and differentiation, since the devil takes the hindmost; and this rapidity of development will tend automatically to be carried on into postnatal growth.

As everyone knows, man is characterized by a rate of development which is abnormally slow as compared with that of any other mammal. The period from birth to the first onset of sexual maturity comprises nearly a quarter of the normal span of his life, instead of an eighth, a tenth or twelfth, as in some other animals. This again is in one sense a unique characteristic of man, although from the evolutionary point of view it represents merely the exaggeration of a tendency which is operative in other Primates. In any case, it is a necessary condition for the evolution and proper utilization of rational thought. If men and women were, like mice, confronted with the problems of adult life and parenthood after a few weeks, or even, like whales, after a couple of years, they could never acquire the skills of body and mind that they now absorb from and contribute to the social heritage of the species.

This slowing (or "foetalization," as Bolck has called it, since it prolongs the foetal characteristics of earlier ancestral forms into postnatal development and even into adult life) has had other important byproducts for man. Here I will mention but one—his nakedness. The distribution of hair on man is extremely similar to that on a late foetus of a chimpanzee, and there can be little doubt that it represents an extension of this temporary anthropoid phase into permanence. Hairlessness of body is not a unique biological characteristic of man; but it is unique among terrestrial mammals, save for a few desert creatures, and some others which have compensated for loss of hair by developing a pachydermatous skin.

In any case, it has important biological consequences, since it must have encouraged the comparatively defenceless human creatures in their efforts to protect themselves against animal enemies and the elements, and so has been a spur to the improvement of intelligence.

Now, foetalization could never have occurred in a mammal producing many young at a time, since intrauterine competition would have encouraged the opposing tendency. Thus we may conclude that conceptual thought could develop only in a mammalian stock which normally brings forth but one young at a birth. Such a stock is provided in the Primates—lemurs, monkeys, and apes.

The Primates also have another characteristic which was necessary for the ancestor of a rational animal—they are arboreal. It may seem curious that living in trees is a prerequisite of conceptual thought. But Elliot Smith's analysis has abundantly shown that only in an arboreal mammal could the forelimb become a true hand, and sight become dominant over smell. Hands obtain an elaborate tactile pattern of what they handle, eyes an elaborate visual pattern of what they see. The combination of the two kinds of pattern, with the aid of binocular vision, in the higher centres of the brain allowed the Primate to acquire a wholly new richness of knowledge about objects, a wholly new possibility of manipulating them. Tree life laid the foundation both for the fuller definition of objects by conceptual thought and for the fuller control of them by tools and machines.

Higher Primates have yet another prerequisite of human intelligence—they are all gregarious. Speech, it is obvious, could never have been evolved in a solitary type. And speech is as much the physical basis of conceptual thought as is protoplasm the physical basis of life.

For the passage, however, of the critical point between subhuman and human, between the biological subordination and the biological primacy of intelligence, between a limited and a potentially unlimited tradition—for this it was necessary for the arboreal animal to descend to the ground again. Only in a terrestrial creature could fully erect posture be acquired; and this was essential for the final conversion of the arms from locomotor limbs into manipulative hands. Furthermore, just as land life, ages previously, had demanded and developed a greater variety of response than had been required in the water, so now it did the same in relation to what had been required in the trees. An arboreal animal could never have evolved

the skill of the hunting savage, nor ever have proceeded to the domestication of other animals or to agriculture.

We are now in a position to define the uniqueness of human evolution. The essential character of man as a dominant organism is conceptual thought. And conceptual thought could have arisen only in a multicellular animal, an animal with bilateral symmetry, head and blood system, a vertebrate as against a mollusc or an arthropod, a land vertebrate among vertebrates, a mammal among land vertebrates. Finally, it could have arisen only in a mammalian line which was gregarious, which produced one young at a birth instead of several, and which had recently become terrestrial after a long period of arboreal life.

There is only one group of animals which fulfils these conditions—a terrestrial offshoot of the higher Primates. Thus not merely has conceptual thought been evolved only in man: it could not have been evolved except in man. There is but one path of unlimited progress through the evolutionary maze. The course of human evolution is as unique as its result. It is unique not in the trivial sense of being a different course from that of any other organism, but in the profounder sense of being the only path that could have achieved the essential characters of man. Conceptual thought on this planet is inevitably associated with a particular type of Primate body and Primate brain.

A further property of man in which he is unique among higher animals concerns his sexual life. Man is prepared to mate at any time: animals are not. To start with, most animals have a definite breeding season; only during this period are their reproductive organs fully developed and functional. In addition to this, higher animals have one or more sexual cycles within their breeding seasons, and only at one phase of the cycle are they prepared to mate. In general, either a sexual season or a sexual cycle, or both, operates to restrict mating.

In man, however, neither of these factors is at work. There appears to be indications of a breeding season in some primitive peoples like the Eskimo, but even there they are but relics. Similarly, while there still exist physiological differences in sexual desire at different phases of the female sexual cycle, these are purely quantitative, and may readily be overridden by psychological factors. Man, to put it briefly, is continuously sexed: animals are discontinuously sexed. If we try to imagine what a human society would be like in which the sexes

were interested in each other only during the summer, as in song-birds, or, as in female dogs, experienced sexual desire only once every few months, or even only once in a lifetime, as in ants, we can realize what this peculiarity has meant. In this, as in his slow growth and prolonged period of dependence, man is not abruptly marked off from all other animals, but represents the culmination of a process that can be clearly traced among other Primates. What the biological meaning of this evolutionary trend may be is difficult to understand. One suggestion is that it may be associated with the rise of mind to dominance. The bodily functions, in lower mammals rigidly determined by physiological mechanisms, come gradually under the more plastic control of the brain. But this, for what it is worth, is a mere speculation.

Another of the purely biological characters in which man is unique is his reproductive variability. In a given species of animals, the maximum litter-size may, on occasions, reach perhaps double the minimum, according to circumstances of food and temperature, or even perhaps threefold. But during a period of years, these variations will be largely equalized within a range of perhaps fifty percent either way from the average, and the percentage of wholly infertile adults is very low. In man, on the other hand, the range of positive fertility is enormous—from one to over a dozen, and in exceptional cases to over twenty; and the number of wholly infertile adults is considerable. This fact, in addition to providing a great diversity of patterns of family life, has important bearings on evolution. It means that in the human species differential fertility is more important as a basis for selection than is differential mortality; and it provides the possibility of much more rapid selective change than that found in wild animal species. Such rapidity of evolution would, of course be effectively realized only if the stocks with large families possessed a markedly different hereditary constitution from those with few children; but the high differential fertility of unskilled workers as against the professional classes in England, or of the French Canadians against the rest of the inhabitants of Canada, demonstrates how rapidly populations may change by this means.

Still another point in which man is biologically unique is the length and relative importance of his period of what we may call "post-maturity. If we consider the female sex, in which the transition from reproductive maturity to non-reproductive post-maturity is more sharply defined than in the male, we find, in the first place, that in

animals a comparatively small percentage of the population survives beyond the period of reproduction; in the second place, that such individuals rarely survive long, and so far as known never for a period equal to or greater than the period during which reproduction was possible; and thirdly, that such individuals are rarely of importance in the life of the species. The same is true of the male sex, provided we do not take the incapacity to produce fertile gametes as the criterion of post-maturity, but rather the appearance of signs of age, such as the beginnings of loss of vigour and weight, decreased sexual activity, or greying hair.

It is true that in some social mammals, notably among ruminants and Primates, an old male or old female is frequently found as leader of the herd. Such cases, however, provide the only examples of the special biological utility of post-mature individuals among animals; they are confined to a very small proportion of the population, and it is uncertain to what extent such individuals are post-mature in the sense we have defined. In any event, it is improbable that the period of post-maturity is anywhere near so long as that of maturity. But in civilized man the average expectation of life now includes over ten post-mature years, and about a sixth of the population enjoys a longer post-maturity than maturity. What is more, in all advanced human societies, a large proportion of the leaders of the community are always post-mature. All the members of the British War Cabinet are in their post-maturity.

This is truly a remarkable phenomenon. Through the new social mechanisms made possible by speech and tradition, man has been able to utilize for the benefit of the species a period of life which in almost all other creatures is a mere superfluity. We know that the dominance of the old can be over-emphasized; but it is equally obvious that society cannot do without the post-mature. To act on the slogan "Too old at forty"—or even at forty-five—would be to rob man of one of his unique characteristics, whereby he utilizes tradition to the best advantage.

We have now dealt in a broad way with the unique properties of man both from the comparative and the evolutionary point of view. Now we can return to the present and the particular and discuss these properties and their consequences a little more in detail. First, let us remind ourselves that the gap between human and animal thought is much greater than is usually supposed. The tendency to project familiar human qualities into animals is very strong, and

colours the ideas of nearly all people who have not special familiarity both with animal behaviour and scientific method.

Let us recall a few cases illustrating the unhuman characteristics of animal behaviour. Everyone is familiar with the rigidity of instinct in insects. Worker ants emerge from their pupal case equipped not with the instincts to care for ant grubs in general, but solely with those suitable to ant grubs of their own species. They will attempt to care for the grubs of other species, but appear incapable of learning new methods if their instincts kill their foster children* Or again, a worker wasp, without food for a hungry grub, has been known to bite off its charge's tail and present it to its head. But even in the fine flowers of vertebrate evolution, the birds and mammals, behaviour, though it may be more plastic than in the insects, is as essentially irrational. Birds, for instance, seem incapable of analysing unfamiliar situations. For them some element in the situation may act as its dominant symbol, the only stimulus to which they can react. At other times, it is the organization of the situation as a whole which is the stimulus: if the whole is interfered with, analysis fails to dissect out the essential element. A hen meadow-pipit feeds her young when it gapes and squeaks in the nest. But if it has been ejected by a young cuckoo, gaping and squeaking has no effect, and the rightful offspring is neglected and allowed to die, while the usurper in the nest is fed. The pipit normally cares for its own young, but not because it recognizes them as such.

Mammals are no better. A cow deprived of its calf will be quieted by the provision of a crudely stuffed calf-skin. Even, the Primates are no exception. Female baboons whose offspring have died will continue carrying the corpses until they have not merely putrefied but mummified. This appears to be due not to any profundity of grief, but to a contact stimulus: the mother will react similarly to any moderately small and furry object.

Birds and especially mammals are, of course, capable of a certain degree of analysis, but this is effected, in the main, by means of trial and error through concrete experience. A brain capable of conceptual thought appears to be the necessary basis for speedy and habitual analysis. Without it, the practice of splitting up situations into their components and assigning real degrees of significance to the various elements remains rudimentary and rare, whereas with man, even when habit and trial and error are prevalent, conceptual thought is of major biological importance. The behaviour of animals

is essentially arbitrary, in that it is fixed within narrow limits. In man it has become relatively free—free at the incoming and the outgoing ends alike. His capacity for acquiring knowledge has been largely released from arbitrary symbolism, his capacity for action, from arbitrary canalizations of instinct. He can thus rearrange the patterns of experience and action in a far greater variety, and can escape from the particular into the general.

Thus man is more intelligent than the animals because his brain mechanism is more plastic. This fact also gives him, of course, the opportunity of being more nonsensical and perverse: but its primary effects have been more analytical knowledge and more varied control. The essential fact, from my present standpoint, is that the change has been profound and in an evolutionary sense rapid. Although it has been brought about by the gradual quantitative enlargement of the association areas of the brain, the result has been almost as abrupt as the change (also brought about quantitatively) from solid ice to liquid water. We should remember that the machinery of the change has been an increase in plasticity and potential variety: it is by a natural selection of ideas and actions that the result has been greater rationality instead of greater irrationality.

This increase of flexibility has also had other psychological consequences which rational philosophers are apt to forget: and in some of these, too, man is unique. It has led, for instance, to the fact that man is the only organism normally and inevitably subject to psychological conflict. You can give a dog neurosis, as Pavlov did, by a complicated laboratory experiment: you can find cases of brief emotional conflict in the lives of wild birds and animals. But, for the most part, psychological conflict is shirked by the simple expedient of arranging that now one and now another instinct should dominate the animal's behaviour. I remember in Spitsbergen finding the nest of a Red-throated Diver on the shore of an inland pool. The sitting bird was remarkably bold. After leaving the nest for the water, she stayed very close. She did not, however, remain in a state of conflict between fear of intruders and desire to return to her brooding. She would gradually approach as if to land, but eventually fear became dominant, and when a few feet from the shore she suddenly dived, and emerged a good way farther out—only to repeat the process. Here the external circumstances were such as to encourage conflict, but even so what are the most serious features of human conflict were minimized by the outlet of alternate action.

Those who take up bird-watching as a hobby tend at first to be surprised at the way in which a bird will turn, apparently without transition or hesitation, from one activity to another—from fighting to peaceable feeding, from courtship to uninterested preening, from panic flight to unconcern. However, all experienced naturalists or those habitually concerned with animals recognize such behaviour as characteristic of the subhuman level. It represents another aspect of the type of behaviour I have just been describing for the Red-throated Diver. In this case, the internal state of the bird changes, presumably owing to some form of physiological fatigue or to a diminution of intensity of a stimulus with time or distance; the type of behaviour which had been dominant ceases to have command over the machinery of action, and is replaced by another which just before had been subordinate and latent.

As a matter of fact, the prevention of conflict between opposed modes of action is a very general phenomenon, of obvious biological utility, and it is only the peculiarities of the human mind which have forced its partial abandonment on man. It begins on the purely mechanical level with the nervous machinery controlling our muscles. The main muscles of a limb, for instance, are arranged in two antagonistic sets, the flexors bending and the extensors straightening it*. It would obviously be futile to throw both sets into action at the same time, and economical when one set is in action to reduce to the minimum any resistance offered by the other. This has actually been provided for. The nervous connections in the spinal cord are so arranged that when a given muscle receives an impulse to contract, its antagonist receives an impulse causing it to lose some of its tone and thus, by relaxing below its normal level, to offer the least possible resistance to the action of the active muscle.

Sherrington discovered that the same type of mechanism was operative in regard to the groups of muscles involved in whole reflexes. A dog, for instance, cannot very well walk and scratch itself at the same time. To avoid the waste involved in conflict between the walking and the scratching reflex, the spinal cord is constructed in such a way that throwing one reflex into action automatically inhibits the other. In both these cases, the machinery for preventing conflicts of activity resides in the spinal cord. Although the matter has not yet been analysed physiologically, it would appear that the normal lack of conflict between instincts which we have just been dis-

cussing is due to some similar type of nervous mechanism in the brain.

When we reach the human level, there are new complications; for, as we have seen, one of the peculiarities of man is the abandonment of any rigidity of instinct, and the provision of association-mechanisms by which any activity of the mind, whether in the spheres of knowing, feeling, or willing, can be brought into relation with any other. It is through this that man has acquired the possibility of a unified mental life. But, by the same token, the door is opened to the forces of disruption, which may destroy any such unity and even prevent him from enjoying the efficiency of behaviour attained by animals. For, as Sherrington has emphasized, the nervous system is like a funnel, with a much larger space for intake than for outflow. The intake cone of the funnel is represented by the receptor nerves, conveying impulses inward to the central nervous system from the sense-organs: the outflow tube is, then, through the effector nerves, conveying impulses outwards to the muscles, and there are many more of the former than of the latter. If we like to look at the matter from a rather different standpoint, we may say that, since action can be effected only by muscles (strictly speaking, also by the glands, which are disregarded here for simplicity's sake), and since there are a limited number of muscles in the body, the only way for useful activity to be carried out is for the nervous system to impose a particular pattern of action on them, and for all other competing or opposing patterns to be cut out. Each pattern, when it has seized control of the machinery of action, *should be* in supreme command, like the captain of a ship. Animals are, in many ways, like ships which are commanded by a number of captains in turn, each specializing in one kind of action, and popping up and down between the authority of the bridge and the obscurity of their private cabins according to the business on hand. Man is on the way to achieving permanent unity of command, but the captain has a disconcerting way of dissolving into a wrangling committee.

Even on the new basis, however, mechanisms exist for minimizing conflict. They are what are known by psychologists as suppression and repression. From our point of view, repression is the more interesting. It implies the forcible imprisonment of one of two conflicting impulses in the dungeons of the unconscious mind. The metaphor is, however, imperfect. For the prisoner in the mental dungeon can

continue to influence the tyrant above in the daylight of consciousness. In addition to a general neurosis, compulsive thoughts and acts may be thrust upon the personality. Repression may thus be harmful ; but it can also be regarded as a biological necessity for dealing with inevitable conflict in the early years of life, before rational judgment and control are possible. Better to have the capacity for more or less unimpeded action, even at the expense of possible neurosis, than an organism constantly inactivated like the ass between the two bundles of hay, balanced in irresolution.

In repression, not only is the defeated impulse banished to the unconscious, but the very process of banishment is itself unconscious. The inhibitory mechanisms concerned in it must have been evolved to counteract the more obvious possibilities of conflict, especially in early life, which arose as byproducts of the human type of mind.

In suppression, the banishment is conscious, so that neurosis is not likely to appear. Finally, in rational judgment, neither of the conflicting impulses is relegated to the unconscious, but they are balanced in the light of reason and experience, and control of action is consciously exercised.

I need not pursue the subject further. Here I am only concerned to show that the great biological advantages conferred on man by the unification of mind have inevitably brought with them certain counterbalancing defects. The freedom of association between all aspects and processes of the mind has provided the basis for conceptual thought and tradition; but it has also provided potential antagonists, which in lower organisms were carefully kept apart, with the opportunity of meeting face to face, and has thus made some degree of conflict unavoidable.

In rather similar fashion, man's upright posture has brought with it certain consequential disadvantages in regard to the functioning of his internal organs and his proneness to rupture. Thus man's unique characteristics are by no means wholly beneficial

In close correlation with our subjection to conflict is our proneness to laughter. So characteristic of our species is laughter that man has been defined as the laughing animal. It is true that, like so much else of man's uniqueness, it has its roots among the animals, where it reveals itself as an expression of a certain kind of general pleasure and thus in truth perhaps more of a smile than a laugh. And in a few animals—ravens, for example—there are traces of a malicious

sense of humour. Laughter in man, however, is much more than this, There are many theories of laughter, most of them containing a partial truth. But biologically the important feature of human laughter seems to lie in its providing a release for conflict, a resolution of troublesome situations.

This and other functions of laughter can be exaggerated so that it becomes as the crackling of thorns under the pot, and prevents men from taking anything seriously; but in due proportion its value is very great as a lubricant against troublesome friction and a lightener of the inevitable gravity and horror of life, which would otherwise become portentous and overshadowing. True laughter, like true speech, is a unique possession of man.

Those of man's unique characteristics which may better be called psychological and social than narrowly biological spring from one or other of three characteristics. The first is his capacity for abstract and general thought: the second is the relative unification of his mental processes, as against the much more rigid compartmentalization of animal mind and behaviour: the third is the existence of social units, such as tribe, nation, party, and church, with a continuity of their own, based on organized tradition and culture.

There are various by-products of the change from pre-human to the human type of mind which are, of course, also unique biologically. Let us enumerate a few: pure mathematics; musical gifts; artistic appreciation and creation; religion; romantic love.

Mathematical ability appears, almost inevitably, as something mysterious. Yet the attainment of speech, abstraction, and logical thought, bring it into potential being. It may remain in a very rudimentary state of development; but even the simplest arithmetical calculations are a manifestation of its existence. Like any other human activity, it requires proper tools and machinery. Arabic numerals, algebraic conventions, logarithms, the differential calculus, are such tools: each one unlocks new possibilities of mathematical achievement. But just as there is no essential difference between man's conscious use of a chipped flint as an implement and his design of the most elaborate machine, so there is none between such simple operations as numeration or addition and the comprehensive flights of higher mathematics. Again, some people are by nature more gifted than others in this field; yet no normal human being is unable to perform some mathematical operations. Thus the capacity for

mathematics is, as I have said, a by-product of the human type of mind.

We have seen, however, that the human type of mind is distinguished by two somewhat opposed attributes. One is the capacity for abstraction, the other for synthesis. Mathematics is one of the extreme by-products of our capacity for abstraction. Arithmetic abstracts objects of all qualities save their enumerability; the symbol π abstracts in a single Greek letter a complicated relation between the parts of all circles. Art, on the other hand, is an extreme by-product of our capacity for synthesis. In one unique production, the painter can bring together form, colour, arrangement, associations of memory, emotion, and idea. Dim adumbrations of art are to be found in a few creatures such as bower-birds; but nothing is found to which the word can rightly be applied until man's mind gave the possibility of freely mingling observations, emotions, memories, and ideas, and subjecting the mixture to deliberate control.

But it is not enough here to enumerate a few special activities. In point of fact, the great majority of man's activities and characteristics are by-products of his primary distinctive characteristics, and therefore, like them, biologically unique.

On the one hand, conversation, organized games, education, sport, paid work, gardening, the theatre; on the other, conscience, duty, sin, humiliation, vice, penitence—these are all such unique by-products. The trouble, indeed, is to find any human activities which are not unique. Even the fundamental biological attributes such as eating, sleeping, and mating have been tricked out by man with all kinds of unique frills and peculiarities.

There may be other by-products of man's basic uniqueness which have not yet been exploited. For let us remember that such by-products may remain almost wholly latent until demand stimulates invention and invention facilitates development. It is asserted that there exist human tribes who cannot count above two; certainly some savages stop at ten. Here the mathematical faculty is restricted to numeration, and stops short at a very rudimentary stage of this rudimentary process. Similarly, there are human societies in which art has never been developed beyond the stage of personal decoration. It is probable that during the first half of the Pleistocene period, none of the human race had developed either their mathematical or their artistic potentialities beyond such a rudimentary stage.

It is perfectly possible that to-day man's so-called supernormal or extra-sensory faculties are in the same case as were his mathematical faculties during the first or second glaciations of the Ice Age—barely more than a potentiality, with no technique for eliciting and developing them, no tradition behind them to give them continuity and intellectual respectability. Even such simple performances as multiplying two three-figure numbers would have appeared entirely magical to early Stone Age men.

Experiments such as those of Rhine and Tyrrell on extra-sensory guessing, experiences like those of Gilbert Murray on thought transference, and the numerous sporadic records of telepathy and clairvoyance suggest that some people at least possess possibilities of knowledge which are not confined within the ordinary channels of sense-perception. Tyrrel's work is particularly interesting in this connection. As a result of an enormous number of trials with apparatus ingeniously designed to exclude all alternative explanation, he finds that those best endowed with this extra-sensory gift can guess right about once in four times when once in five would be expected on chance alone. The results are definite, and significant in the statistical sense, yet the faculty is rudimentary: it does not permit its possessor to guess right all the time or even most of the time—merely to achieve a small rise in the percentage of right guessing. If, however, we could discover in what this faculty really consists, on what mechanism it depends, and by what conditions and agencies it can be influenced, it should be capable of development like any other human faculty, Man may thus be unique in more ways than he now suspects.

So far we have been considering the fact of human uniqueness. It remains to consider man's attitude to these unique qualities of his. Professor Everett, of the University of California, in an interesting paper bearing the same title as this essay, but dealing with the topic from the standpoint of the philosopher and the humanist rather than that of the biologist, has stressed man's fear of his own uniqueness. Man has often not been able to tolerate the feeling that he inhabits an alien world, whose laws do not make sense in the light of his intelligence, and in which the writ of his human values does not run. Faced with the prospect of such intellectual and moral loneliness, he has projected personality into the cosmic scheme. Here he has found a will, there a purpose; here a creative intelligence, and there a divine compassion. At one time, he has deified animals, or

personified natural forces. At others, he has created a superhuman pantheon, a single tyrannical world ruler, a subtle and satisfying Trinity in Unity. Philosophers have postulated an Absolute of the same nature as mind.

It is only exceptionally that men have dared to uphold their uniqueness and to be proud of their human superiority to the impersonality and irrationality of the rest of the universe. It is time now, in the light of our knowledge, to be brave and face the fact and the consequences of our uniqueness. That is Dr. Everett's view, as it was also that of T. H. Huxley in his famous Romanes lecture. I agree with them; but I would suggest that the antinomy between man and the universe is not quite so sharp as they have made out. Man represents the culmination of that process of organic evolution which has been proceeding on this planet for over a thousand million years. That process, however wasteful and cruel it may be, and into however many blind alleys it may have been diverted, is also in one aspect progressive. Man has now become the sole representative of life in that progressive aspect and its sole trustee for any progress in the future.

Meanwhile it is true that the appearance of the human type of mind, the latest step in evolutionary progress, has introduced both new methods and new standards. By means of his conscious reason and its chief offspring, science, man has the power of substituting less dilatory, less wasteful, and less cruel methods of effective progressive change than those of natural selection, which alone are available to lower organisms. And by means of his conscious purpose and his set of values, he has the power of substituting new and higher standards for change than those of mere survival and adaptation to immediate circumstances, which alone are inherent in pre-human evolution. To put the matter in another way, progress has hitherto been a rare and fitful by-product of evolution. Man has the possibility of making it the main feature of his own future evolution, and of guiding its course in relation to a deliberate aim.

But he must not be afraid of his uniqueness. There may be other beings in this vast universe endowed with reason, purpose, and aspiration: but we know nothing of them. So far as our knowledge goes, human mind and personality are unique and constitute the highest product yet achieved by the cosmos. Let us not put our responsibilities on to the shoulders of mythical gods or philosophical absolutes, but shoulder them in the hopefulness of tempered pride. In

the perspective of biology, our business in the world is seen to be the imposition of the best and most enduring of our human standards upon ourselves and our planet. The enjoyment of beauty and interest, the achievement of goodness and efficiency, the enhancement of life and its variety—these are the harvest which our human uniqueness should be called upon to yield.