LECTURE II. INSTINCT AND HABIT

In attempting to understand the elements out of which mental phenomena are compounded, it is of the greatest importance to remember that from the protozoa to man there is nowhere a very wide gap either in structure or in behaviour. From this fact it is a highly probable inference that there is also nowhere a very wide mental gap. It is, of course, POSSIBLE that there may be, at certain stages in evolution, elements which are entirely new from the standpoint of analysis, though in their nascent form they have little influence on behaviour and no very marked correlatives in structure. But the hypothesis of continuity in mental development is clearly preferable if no psychological facts make it impossible. We shall find, if I am not mistaken, that there are no facts which refute the hypothesis of mental continuity, and that, on the other hand, this hypothesis affords a useful test of suggested theories as to the nature of mind.

The hypothesis of mental continuity throughout organic evolution may be used in two different ways. On the one hand, it may be held that we have more knowledge of our own minds than those of animals, and that we should use this knowledge to infer the existence of something similar to our own mental processes in animals and even in plants. On the other hand, it may be held that animals and plants present simpler phenomena, more easily analysed than those of human minds; on this ground it may be urged that explanations which are adequate in the case of animals ought not to be lightly rejected in the case of man. The practical effects of

these two views are diametrically opposite: the first leads us to level up animal intelligence with what we believe ourselves to know about our own intelligence, while the second leads us to attempt a levelling down of our own intelligence to something not too remote from what we can observe in animals. It is therefore important to consider the relative justification of the two ways of applying the principle of continuity.

It is clear that the question turns upon another, namely, which can we know best, the psychology of animals or that of human beings? If we can know most about animals, we shall use this knowledge as a basis for inference about human beings; if we can know most about human beings, we shall adopt the opposite procedure. And the question whether we can know most about the psychology of human beings or about that of animals turns upon yet another, namely: Is introspection or external observation the surer method in psychology? This is a question which I propose to discuss at length in Lecture VI; I shall therefore content myself now with a statement of the conclusions to be arrived at.

We know a great many things concerning ourselves which we cannot know nearly so directly concerning animals or even other people. We know when we have a toothache, what we are thinking of, what dreams we have when we are asleep, and a host of other occurrences which we only know about others when they tell us of them, or otherwise make them inferable by their behaviour. Thus, so far as knowledge of detached facts is concerned, the advantage is on the side of self-knowledge as against external observation.

But when we come to the analysis and scientific understanding of the facts, the advantages on the side of self-knowledge become far less clear. We know, for example, that we have desires and beliefs, but we do not know what constitutes a desire or a belief. The phenomena are so familiar that it is difficult to realize how little we really know about them. We see in animals, and to a lesser extent in plants, behaviour more or less similar to that which, in us, is prompted by desires and beliefs, and we find that, as we descend in the scale of evolution, behaviour becomes simpler, more easily reducible to rule, more scientifically analysable and predictable. And just because we are not misled by familiarity we find it easier to be cautious in interpreting behaviour when we are dealing with phenomena remote from those of our own minds: Moreover, introspection, as psychoanalysis has demonstrated, is extraordinarily fallible even in cases where we feel a high degree of certainty. The net result seems to be that, though self-knowledge has a definite and important contribution to make to psychology, it is exceedingly misleading unless it is constantly checked and controlled by the test of external observation, and by the theories which such observation suggests when applied to animal behaviour. On the whole, therefore, there is probably more to be learnt about human psychology from animals than about animal psychology from human beings; but this conclusion is one of degree, and must not be pressed beyond a point.

It is only bodily phenomena that can be directly observed in animals, or even, strictly speaking, in other human beings. We can observe such

things as their movements, their physiological processes, and the sounds they emit. Such things as desires and beliefs, which seem obvious to introspection, are not visible directly to external observation. Accordingly, if we begin our study of psychology by external observation, we must not begin by assuming such things as desires and beliefs, but only such things as external observation can reveal, which will be characteristics of the movements and physiological processes of animals. Some animals, for example, always run away from light and hide themselves in dark places. If you pick up a mossy stone which is lightly embedded in the earth, you will see a number of small animals scuttling away from the unwonted daylight and seeking again the darkness of which you have deprived them. Such animals are sensitive to light, in the sense that their movements are affected by it; but it would be rash to infer that they have sensations in any way analogous to our sensations of sight. Such inferences, which go beyond the observable facts, are to be avoided with the utmost care.

It is customary to divide human movements into three classes, voluntary, reflex and mechanical. We may illustrate the distinction by a quotation from William James ("Psychology," i, 12):

"If I hear the conductor calling 'all aboard' as I enter the depot, my heart first stops, then palpitates, and my legs respond to the air-waves falling on my tympanum by quickening their movements. If I stumble as I run, the sensation of falling provokes a movement of the hands towards the direction of the fall, the effect of which is to shield the body

from too sudden a shock. If a cinder enter my eye, its lids close forcibly and a copious flow of tears tends to wash it out.

"These three responses to a sensational stimulus differ, however, in many respects. The closure of the eye and the lachrymation are quite involuntary, and so is the disturbance of the heart. Such involuntary responses we know as 'reflex' acts. The motion of the arms to break the shock of falling may also be called reflex, since it occurs too quickly to be deliberately intended. Whether it be instinctive or whether it result from the pedestrian education of childhood may be doubtful; it is, at any rate, less automatic than the previous acts, for a man might by conscious effort learn to perform it more skilfully, or even to suppress it altogether. Actions of this kind, with which instinct and volition enter upon equal terms, have been called 'semi-reflex.' The act of running towards the train, on the other hand, has no instinctive element about it. It is purely the result of education, and is preceded by a consciousness of the purpose to be attained and a distinct mandate of the will. It is a 'voluntary act.' Thus the animal's reflex and voluntary performances shade into each other gradually, being connected by acts which may often occur automatically, but may also be modified by conscious intelligence.

"An outside observer, unable to perceive the accompanying consciousness, might be wholly at a loss to discriminate between the automatic acts and those which volition escorted. But if the criterion of mind's existence be the choice of the proper means for the attainment of a supposed

end, all the acts alike seem to be inspired by intelligence, for APPROPRIATENESS characterizes them all alike."

There is one movement, among those that James mentions at first, which is not subsequently classified, namely, the stumbling. This is the kind of movement which may be called "mechanical"; it is evidently of a different kind from either reflex or voluntary movements, and more akin to the movements of dead matter. We may define a movement of an animal's body as "mechanical" when it proceeds as if only dead matter were involved. For example, if you fall over a cliff, you move under the influence of gravitation, and your centre of gravity describes just as correct a parabola as if you were already dead. Mechanical movements have not the characteristic of appropriateness, unless by accident, as when a drunken man falls into a waterbutt and is sobered. But reflex and voluntary movements are not ALWAYS appropriate, unless in some very recondite sense. A moth flying into a lamp is not acting sensibly; no more is a man who is in such a hurry to get his ticket that he cannot remember the name of his destination. Appropriateness is a complicated and merely approximate idea, and for the present we shall do well to dismiss it from our thoughts.

As James states, there is no difference, from the point of view of the outside observer, between voluntary and reflex movements. The physiologist can discover that both depend upon the nervous system, and he may find that the movements which we call voluntary depend upon higher centres in the brain than those that are reflex. But he

cannot discover anything as to the presence or absence of "will" or "consciousness," for these things can only be seen from within, if at all. For the present, we wish to place ourselves resolutely in the position of outside observers; we will therefore ignore the distinction between voluntary and reflex movements. We will call the two together "vital" movements. We may then distinguish "vital" from mechanical movements by the fact that vital movements depend for their causation upon the special properties of the nervous system, while mechanical movements depend only upon the properties which animal bodies share with matter in general.

There is need for some care if the distinction between mechanical and vital movements is to be made precise. It is quite likely that, if we knew more about animal bodies, we could deduce all their movements from the laws of chemistry and physics. It is already fairly easy to see how chemistry reduces to physics, i.e. how the differences between different chemical elements can be accounted for by differences of physical structure, the constituents of the structure being electrons which are exactly alike in all kinds of matter. We only know in part how to reduce physiology to chemistry, but we know enough to make it likely that the reduction is possible. If we suppose it effected, what would become of the difference between vital and mechanical movements?

Some analogies will make the difference clear. A shock to a mass of dynamite produces quite different effects from an equal shock to a mass of steel: in the one case there is a vast explosion, while in the other

case there is hardly any noticeable disturbance. Similarly, you may sometimes find on a mountain-side a large rock poised so delicately that a touch will set it crashing down into the valley, while the rocks all round are so firm that only a considerable force can dislodge them What is analogous in these two cases is the existence of a great store of energy in unstable equilibrium ready to burst into violent motion by the addition of a very slight disturbance. Similarly, it requires only a very slight expenditure of energy to send a post-card with the words "All is discovered; fly!" but the effect in generating kinetic energy is said to be amazing. A human body, like a mass of dynamite, contains a store of energy in unstable equilibrium, ready to be directed in this direction or that by a disturbance which is physically very small, such as a spoken word. In all such cases the reduction of behaviour to physical laws can only be effected by entering into great minuteness; so long as we confine ourselves to the observation of comparatively large masses, the way in which the equilibrium will be upset cannot be determined. Physicists distinguish between macroscopic and microscopic equations: the former determine the visible movements of bodies of ordinary size, the latter the minute occurrences in the smallest parts. It is only the microscopic equations that are supposed to be the same for all sorts of matter. The macroscopic equations result from a process of averaging out, and may be different in different cases. So, in our instance, the laws of macroscopic phenomena are different for mechanical and vital movements, though the laws of microscopic phenomena may be the same.

We may say, speaking somewhat roughly, that a stimulus applied to the nervous system, like a spark to dynamite, is able to take advantage of the stored energy in unstable equilibrium, and thus to produce movements out of proportion to the proximate cause. Movements produced in this way are vital movements, while mechanical movements are those in which the stored energy of a living body is not involved. Similarly dynamite may be exploded, thereby displaying its characteristic properties, or may (with due precautions) be carted about like any other mineral. The explosion is analogous to vital movements, the carting about to mechanical movements.

Mechanical movements are of no interest to the psychologist, and it has only been necessary to define them in order to be able to exclude them. When a psychologist studies behaviour, it is only vital movements that concern him. We shall, therefore, proceed to ignore mechanical movements, and study only the properties of the remainder.

The next point is to distinguish between movements that are instinctive and movements that are acquired by experience. This distinction also is to some extent one of degree. Professor Lloyd Morgan gives the following definition of "instinctive behaviour":

"That which is, on its first occurrence, independent of prior experience; which tends to the well-being of the individual and the preservation of the race; which is similarly performed by all members of the same more or less restricted group of animals; and which may be

subject to subsequent modification under the guidance of experience." *

* "Instinct and Experience" (Methuen, 1912) p. 5.

This definition is framed for the purposes of biology, and is in some respects unsuited to the needs of psychology. Though perhaps unavoidable, allusion to "the same more or less restricted group of animals" makes it impossible to judge what is instinctive in the behaviour of an isolated individual. Moreover, "the well-being of the individual and the preservation of the race" is only a usual characteristic, not a universal one, of the sort of movements that, from our point of view, are to be called instinctive; instances of harmful instincts will be given shortly. The essential point of the definition, from our point of view, is that an instinctive movement is in dependent of prior experience.

We may say that an "instinctive" movement is a vital movement performed by an animal the first time that it finds itself in a novel situation; or, more correctly, one which it would perform if the situation were novel.* The instincts of an animal are different at different periods of its growth, and this fact may cause changes of behaviour which are not due to learning. The maturing and seasonal fluctuation of the sex-instinct affords a good illustration. When the sex-instinct first matures, the behaviour of an animal in the presence of a mate is different from its previous behaviour in similar circumstances, but is not learnt, since it is just the same if the animal has never previously

been in the presence of a mate.

* Though this can only be decided by comparison with other members of the species, and thus exposes us to the need of comparison which we thought an objection to Professor Lloyd Morgan's definition.

On the other hand, a movement is "learnt," or embodies a "habit," if it is due to previous experience of similar situations, and is not what it would be if the animal had had no such experience.

There are various complications which blur the sharpness of this distinction in practice. To begin with, many instincts mature gradually, and while they are immature an animal may act in a fumbling manner which is very difficult to distinguish from learning. James ("Psychology," ii, 407) maintains that children walk by instinct, and that the awkwardness of their first attempts is only due to the fact that the instinct has not yet ripened. He hopes that "some scientific widower, left alone with his offspring at the critical moment, may ere long test this suggestion on the living subject." However this may be, he quotes evidence to show that "birds do not LEARN to fly," but fly by instinct when they reach the appropriate age (ib., p. 406). In the second place, instinct often gives only a rough outline of the sort of thing to do, in which case learning is necessary in order to acquire certainty and precision in action. In the third place, even in the clearest cases of acquired habit, such as speaking, some instinct is required to set in motion

the process of learning. In the case of speaking, the chief instinct involved is commonly supposed to be that of imitation, but this may be questioned. (See Thorndike's "Animal Intelligence," p. 253 ff.)

In spite of these qualifications, the broad distinction between instinct and habit is undeniable. To take extreme cases, every animal at birth can take food by instinct, before it has had opportunity to learn; on the other hand, no one can ride a bicycle by instinct, though, after learning, the necessary movements become just as automatic as if they were instinctive.

The process of learning, which consists in the acquisition of habits, has been much studied in various animals.* For example: you put a hungry animal, say a cat, in a cage which has a door that can be opened by lifting a latch; outside the cage you put food. The cat at first dashes all round the cage, making frantic efforts to force a way out. At last, by accident, the latch is lifted and the cat pounces on the food. Next day you repeat the experiment, and you find that the cat gets out much more quickly than the first time, although it still makes some random movements. The third day it gets out still more quickly, and before long it goes straight to the latch and lifts it at once. Or you make a model of the Hampton Court maze, and put a rat in the middle, assaulted by the smell of food on the outside. The rat starts running down the passages, and is constantly stopped by blind alleys, but at last, by persistent attempts, it gets out. You repeat this experiment day after day; you measure the time taken by the rat in reaching the food; you find that

the time rapidly diminishes, and that after a while the rat ceases to make any wrong turnings. It is by essentially similar processes that we learn speaking, writing, mathematics, or the government of an empire.

* The scientific study of this subject may almost be said to begin with Thorndike's "Animal Intelligence" (Macmillan, 1911).

Professor Watson ("Behavior," pp. 262-3) has an ingenious theory as to the way in which habit arises out of random movements. I think there is a reason why his theory cannot be regarded as alone sufficient, but it seems not unlikely that it is partly correct. Suppose, for the sake of simplicity, that there are just ten random movements which may be made by the animal--say, ten paths down which it may go--and that only one of these leads to food, or whatever else represents success in the case in question. Then the successful movement always occurs during the animal's attempts, whereas each of the others, on the average, occurs in only half the attempts. Thus the tendency to repeat a previous performance (which is easily explicable without the intervention of "consciousness") leads to a greater emphasis on the successful movement than on any other, and in time causes it alone to be performed. The objection to this view, if taken as the sole explanation, is that on improvement ought to set in till after the SECOND trial, whereas experiment shows that already at the second attempt the animal does better than the first time. Something further is, therefore, required to account for the genesis of habit from random movements; but I see no reason to suppose

that what is further required involves "consciousness."

Mr. Thorndike (op. cit., p. 244) formulates two "provisional laws of acquired behaviour or learning," as follows:

"The Law of Effect is that: Of several responses made to the same situation, those which are accompanied or closely followed by satisfaction to the animal will, other things being equal, be more firmly connected with the situation, so that, when it recurs, they will be more likely to recur; those which are accompanied or closely followed by discomfort to the animal will, other things being equal, have their connections with that situation weakened, so that, when it recurs, they will be less likely to occur. The greater the satisfaction or discomfort, the greater the strengthening or weakening of the bond.

"The Law of Exercise is that: Any response to a situation will, other things being equal, be more strongly connected with the situation in proportion to the number of times it has been connected with that situation and to the average vigour and duration of the connections."

With the explanation to be presently given of the meaning of "satisfaction" and "discomfort," there seems every reason to accept these two laws.

What is true of animals, as regards instinct and habit, is equally true of men. But the higher we rise in the evolutionary scale, broadly

speaking, the greater becomes the power of learning, and the fewer are the occasions when pure instinct is exhibited unmodified in adult life. This applies with great force to man, so much so that some have thought instinct less important in the life of man than in that of animals. This, however, would be a mistake. Learning is only possible when instinct supplies the driving-force. The animals in cages, which gradually learn to get out, perform random movements at first, which are purely instinctive. But for these random movements, they would never acquire the experience which afterwards enables them to produce the right movement. (This is partly questioned by Hobhouse*--wrongly, I think.) Similarly, children learning to talk make all sorts of sounds, until one day the right sound comes by accident. It is clear that the original making of random sounds, without which speech would never be learnt, is instinctive. I think we may say the same of all the habits and aptitudes that we acquire in all of them there has been present throughout some instinctive activity, prompting at first rather inefficient movements, but supplying the driving force while more and more effective methods are being acquired. A cat which is hungry smells fish, and goes to the larder. This is a thoroughly efficient method when there is fish in the larder, and it is often successfully practised by children. But in later life it is found that merely going to the larder does not cause fish to be there; after a series of random movements it is found that this result is to be caused by going to the City in the morning and coming back in the evening. No one would have guessed a priori that this movement of a middle-aged man's body would cause fish to come out of the sea into his larder, but experience shows that it

does, and the middle-aged man therefore continues to go to the City, just as the cat in the cage continues to lift the latch when it has once found it. Of course, in actual fact, human learning is rendered easier, though psychologically more complex, through language; but at bottom language does not alter the essential character of learning, or of the part played by instinct in promoting learning. Language, however, is a subject upon which I do not wish to speak until a later lecture.

* "Mind in Evolution" (Macmillan, 1915), pp. 236-237.

The popular conception of instinct errs by imagining it to be infallible and preternaturally wise, as well as incapable of modification. This is a complete delusion. Instinct, as a rule, is very rough and ready, able to achieve its result under ordinary circumstances, but easily misled by anything unusual. Chicks follow their mother by instinct, but when they are quite young they will follow with equal readiness any moving object remotely resembling their mother, or even a human being (James, "Psychology," ii, 396). Bergson, quoting Fabre, has made play with the supposed extraordinary accuracy of the solitary wasp Ammophila, which lays its eggs in a caterpillar. On this subject I will quote from Drever's "Instinct in Man," p. 92:

"According to Fabre's observations, which Bergson accepts, the Ammophila stings its prey EXACTLY and UNERRINGLY in EACH of the nervous centres. The result is that the caterpillar is paralyzed, but not immediately killed, the advantage of this being that the larva cannot be injured by

any movement of the caterpillar, upon which the egg is deposited, and is provided with fresh meat when the time comes.

"Now Dr. and Mrs. Peckham have shown that the sting of the wasp is NOT UNERRING, as Fabre alleges, that the number of stings is NOT CONSTANT, that sometimes the caterpillar is NOT PARALYZED, and sometimes it is KILLED OUTRIGHT, and that THE DIFFERENT CIRCUMSTANCES DO NOT APPARENTLY
MAKE ANY DIFFERENCE TO THE LARVA, which is not injured by slight movements of the caterpillar, nor by consuming food decomposed rather than fresh caterpillar."

This illustrates how love of the marvellous may mislead even so careful an observer as Fabre and so eminent a philosopher as Bergson.

In the same chapter of Dr. Drever's book there are some interesting examples of the mistakes made by instinct. I will quote one as a sample:

"The larva of the Lomechusa beetle eats the young of the ants, in whose nest it is reared. Nevertheless, the ants tend the Lomechusa larvae with the same care they bestow on their own young. Not only so, but they apparently discover that the methods of feeding, which suit their own larvae, would prove fatal to the guests, and accordingly they change their whole system of nursing" (loc. cit., p. 106).

Semon ("Die Mneme," pp. 207-9) gives a good illustration of an instinct

growing wiser through experience. He relates how hunters attract stags by imitating the sounds of other members of their species, male or female, but find that the older a stag becomes the more difficult it is to deceive him, and the more accurate the imitation has to be. The literature of instinct is vast, and illustrations might be multiplied indefinitely. The main points as regards instinct, which need to be emphasized as against the popular conceptions of it, are:

(1) That instinct requires no prevision of the biological end which it serves;

(2) That instinct is only adapted to achieve this end in the usual circumstances of the animal in question, and has no more precision than is necessary for success AS A RULE;

(3) That processes initiated by instinct often come to be performed better after experience;

(4) That instinct supplies the impulses to experimental movements which are required for the process of learning;

(5) That instincts in their nascent stages are easily modifiable, and capable of being attached to various sorts of objects.

All the above characteristics of instinct can be established by purely external observation, except the fact that instinct does not require

prevision. This, though not strictly capable of being PROVED by observation, is irresistibly suggested by the most obvious phenomena. Who can believe, for example, that a new-born baby is aware of the necessity of food for preserving life? Or that insects, in laying eggs, are concerned for the preservation of their species? The essence of instinct, one might say, is that it provides a mechanism for acting without foresight in a manner which is usually advantageous biologically. It is partly for this reason that it is so important to understand the fundamental position of instinct in prompting both animal and human behaviour.