



Animal Psychology and Criteria of the Psychic

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PSYCHOLOGY AND SCIENTIFIC METHODS

ANIMAL PSYCHOLOGY AND CRITERIA OF THE PSYCHIC¹

IN the brief discussion of criteria of consciousness which follows it has been my purpose to distinguish between the philosophical and the naturalistic attitudes toward such criteria, to arrange systematically those criteria which are already in use, and to call attention to certain aspects of the values of various signs or tests of mental life. I have nothing new in either material or method to contribute to the subject, but I do wish to emphasize the importance in comparative psychology of the use of all available signs or criteria of mind rather than the selection of any one as the sufficient and final proof of consciousness. Whatever justification this discussion may need will have to be found, therefore, in the fact that it brings together a number of well-known facts which seldom are considered collectively in their relations to the study of psychic processes.

Quite apart from philosophical arguments concerning the nature of consciousness, and the epistemological or logical implications of the concept, the natural scientist is able to search out and make use of certain signs of mental life which he recognizes as criteria of consciousness. The logician in his attitude toward these criteria is chiefly concerned with their relations to the large number of concepts which constitute for him a self-consistent system; he is interested in what is necessarily true on the basis of certain assumptions. The naturalist is concerned with the practical validity of his inferences; he deals with a narrower range of relationships than the logician. The logician studies the necessary forms of criteria; the naturalist notes whether certain signs, which he has discovered by observation, serve as satisfactory guides for action. One asks 'must it be true'? the other asks, 'does it work'? Let me illustrate my meaning by reference to the positions taken by two well-known thinkers. Münsterberg,² with his avowed purpose to satisfy the demands of a logical system, holds that 'acknowledgment' is our only criterion of consciousness in the brutes. By this he means that only those

¹ Criteria is used here in the sense of signs or tests, rather than proofs.

² 'Grundzüge der Psychologie,' Bd. I., S. 98-99.

animals are conscious which we treat as conscious beings. Loeb,³ from an entirely different position, which I should call the naturalistic in contrast with the philosophical position of Münsterberg, asserts that evidence of ability to profit by experience is the criterion of associative memory, which in turn is the criterion of consciousness.

The logician and the naturalist do not necessarily disagree in their definition of consciousness; for both it may be the subjective, individual fact, which can be known directly only by the individual whose experience it helps to constitute, and who, in turn, is constituted an individual by the totality of states which are spoken of severally as states of consciousness. For the natural scientist this subjective fact is material of science because it can be studied in its relations to the facts of anatomy, physiology, anthropology. Human purposes well may be material of science, albeit we know only our own directly; and in precisely similar fashion the mental life of an insect, a fish or a monkey may be studied indirectly. In all these cases we have to depend upon inferences. We carefully note the order of physical (more exactly physiological) and psychic events in the individual, and then, on the basis of similarity of the physical order in another individual, we infer similar psychic processes. Certainty of the truth of these inferences there is none, nor can there be; but neither is there certainty of the truth of any of our inferences concerning the states of consciousness of our fellow beings. I infer that you are conscious; can I ever be more than practically certain of it? Here, if anywhere, we see the striking difference between logical and practical certainty. The former is that which satisfies the rational mechanism; the latter is that which suffices for the guidance of action. A moment's consideration, and we are convinced that inference plays a far more important rôle in human life than is usually suspected. In all things we make use of signs. Inference is the framework of science. Take from the natural scientist all that he does not know directly, all that he accepts with no more than practical certainty, and he is left with a colorless consciousness which can not even be described as self-consciousness. The criteria or signs upon which our scientific inferences rest are selected according to their serviceableness; they survive, as the pragmatist would say, because inferences based upon them are satisfactory determinants of action.

Wherever inference is necessary in thought it is desirable to study its basis; nowhere is this more important than in connection with consciousness. It is therefore worth our while to examine carefully the group of signs which have been selected by psychologists and physiologists as criteria of consciousness in order to learn

³ 'Comparative Physiology of the Brain and Comparative Psychology,' p. 218.

whatever we may concerning their values. It should be noted at once that all of the criteria proposed apply as well to human consciousness as to that of the brute, for too often we think that whereas we know human consciousness fairly well that of lower animals is quite beyond the limits of our knowledge. Now, as a matter of fact we know both by inference; hence, the only difference in our knowledge of the two is due to the somewhat greater perfection of our ability to apply our criteria in case of man. That you are a human being is no more proof that your consciousness is the same as that of your companion than is the fact that you have eyes similar to his proof that you see colors as he does. Consciousness must always be indirectly known, except in introspection; consequently our knowledge of the mental life of animals must vary, for all practical purposes, with our knowledge of their anatomy, physiology, habits, instincts and reactions.

Roughly, the signs of the psychic, which seem to me worthy of constant use, may be classified as the structural and the functional. From structure we infer the possibility of certain modes of behavior; and behavior is accepted as evidence of certain structural conditions. Both serve as signs of consciousness. In all cases in which mental life is in question, man serves as the basis of comparison.

I present the following six criteria in what seems to me in general the order of increasing importance. The functional signs are of greater value as a rule than the structural; and within each of the categories the particular sign is usually of more value than the general. In certain cases, however, it might be maintained that neural specialization is of greater importance than modifiability.⁴

I. *Structural Criteria.*

1. General form of organism. (Organization.)
2. Nervous system. (Neural-organization.)
3. Specialization in the nervous system. (Neural-specialization.)

II. *Functional Criteria.*

1. General form of reaction. (Discrimination.)
2. Modifiability of reaction. (Docility.)⁴
3. Variableness of reaction. (Initiative.)

In parentheses I have suggested single words for the designation of these criteria. The terms 'discrimination,' 'docility' and 'initiative' have been taken from Royce's⁵ excellent discussion of the

⁴Modifiability, as here used, includes the several types of learning which are usually distinguished as unconscious(?) adaptation, associative learning, imitative learning and rational learning.

⁵'Outlines of Psychology,' pp. 20-57.

physical signs of mind in his text-book of psychology. Inasmuch as we speak of these criteria as physical signs of mind, it has seemed to me preferable to use language which was free from implication of the psychic; for this reason I use modifiability and variableness rather than docility and initiative.

Suppose, now, for the purpose of defining our criteria in more practical detail, we attempt to apply them to some organism of simple development—say, the sea anemone. (1) The general *organization* of the animal is so strikingly different from our own and from that of any other organism which we acknowledge as intelligently or rationally conscious that we are unable to give positive value to this test. It is true, however, that although similarity of form is presumptive evidence of similarity of function and of psychic processes, structural difference does not necessarily involve psychic difference. (2) No more satisfactory basis of inference is furnished by the *neural organization* of the sea anemone, for the nervous system is not sufficiently similar in form to those of undoubtedly conscious animals to warrant inference. (3) And finally, on the structural side, of *neural specialization* there is far too little to justify inference of more than mere sentiency. It must then be admitted that the structural criteria do not furnish a basis for the inference of anything except the lowest grade of consciousness.

Passing now to the functional criteria: (1) We find, as the neural specialization would lead us to expect, a number of differentiated reactions. *Sensory discrimination* appears as an important feature of the life of the organism. In fact there is evidence of both of Royce's discriminative signs: 'feeling' (liking and disliking), and different types of sensory disturbance, for the animal reacts differently to difference in quality of stimulation, as well as to difference in intensity. There is in this a slight sign of adaptation which may or may not prove to be in some degree intelligent. (2) But thus far there have been no careful studies of the *modifiability* of the reactions of the sea anemone. As a matter of fact, the observations of the animal under natural conditions have furnished no evidence of any form of ability to profit by experience; yet it would be foolish to conclude that the animal can not learn, for a systematic study of the subject in all probability will demonstrate the existence of modifiability of the associative type. (3) With *variableness* the case is similar, for too little work has been done to enable one to say much with assurance. So far as observed, the animal's reactions are uniform, there is no indication of sudden, apparently spontaneous, adaptation to the demands of situations. In other words, there is no sign of mental initiative.

As a result of this application of our criteria we should have to

say that the sea anemone probably possesses consciousness of the sensory-discriminative grade, but that there are no signs of either intelligent or rational consciousness.

This distinction which I have thus made of three grades or levels of consciousness—the discriminative, the intelligent and the rational—leads us directly to the consideration of the relative values of the three functional criteria, for it will be noticed at once that each of the three criteria corresponds to one of the grades of consciousness.⁶

By a number of investigators ability to profit by experience has been used as the all-sufficient criterion of mental processes. That the use of this criterion alone is undesirable, or even absurd, needs no further proof than that some form of modifiability or ability to learn is a characteristic of protoplasm. The more highly organized, the less stable the organic substance, the more readily it is modified by environing conditions it would seem. Hence, unless one is ready to start with the assumption that consciousness itself is a property or accompaniment of protoplasm (in which event there is no need of criteria of the sort we are discussing) this criterion is valueless when used alone. The fact that the crayfish needs a hundred or more experiences for the learning of a type of reaction that the frog would learn with twenty experiences, the dog with five, say, and the human subject with perhaps a single experience, is indicative of the fundamental difficulty in the use of this sign. Animals differ in rapidity of learning, but it has not been shown that any organism exists whose reactions can not be modified in adjustment to environmental conditions. We find marked differences in permanency of modifications among organisms, as well as in rapidity of adjustment. Moreover, several kinds of modifiability may be distinguished. But this involves us in a difficulty, for although one might naturally expect that animals differ merely in degree of docility, many students of the subject see fit to maintain that there are differences in kind as well as in degree.

Loeb, for example, accepts associative memory as the criterion of consciousness, and then adds, quite safely, "The criteria for the existence of associative memory must form the basis of a future comparative psychology. It will require more observations than we have made at present to give absolutely unequivocal criteria." So far we can agree and in part sympathize with him, but he goes on to commit himself to what we may call the assumption of a critical point—"For the present we can say that if an animal can learn, that

⁶ The three grades of consciousness here mentioned correspond very closely, I believe, to Morgan's sentiency, effective consciousness, and self-consciousness. See Morgan's 'Animal Behavior,' pp. 42 ff.

is, if it can be trained to react in a desired way upon certain stimuli (signs), it must possess associative memory."⁷ To say that animals exist which can not be trained to react in a desired way upon certain stimuli implies that modifiability is not a characteristic of protoplasm. If protoplasm is not always modifiable, which I do not grant, there must be a critical point in organic development at which Loeb's 'ability to learn' becomes possible. Now it is this assumption that some animals can not learn that appears unwarrantable. In the first place experience teaches us that animals do learn, and we therefore treat them as if they could until we are convinced that they can not (this is the purely practical aspect of the situation). No organism, I believe, has thus far been proved incapable of profiting by experience. The burden of proof rests with those who assume that only certain animals can learn, for it would be far more reasonable to ask for a demonstration of the inability of some one organism to profit by experience than to demand that the docility of all animals be proved. But of far greater importance for the support of our contention are the positive facts. Omitting mention of the well-known facts of modifiability in more complex organisms, we may refer at once to the evidences of modifiability in unicellular organisms.

Jennings, in a series of investigations remarkable alike for their admirable scientific character, their value and interest, has shown that the behavior of certain of the unicellular organisms is complex and modifiable. *Stentor*, for example, exhibits several forms of reaction, and also adaptation to conditions.⁸ Further evidences of what Jennings himself considers incipient intelligence in lower organisms are presented in his recent volume of studies.⁹ In this volume he writes, "Memory has as its basis the general phenomenon that a stimulus received or a reaction performed leaves a trace on the organism, or modifies its conditions in such a way that it later reacts differently to the same stimulus. This basis of memory is, of course, clearly present in *Stentor*" (p. 126). And again, "This [referring to a series of reactions in *Stentor*] is clearly the method of trial and error passing into the method of intelligence, but the intelligence lasts for only very short periods. To really modify the life of the organisms in any permanent way, as happens in higher animals, the method of reacting discovered to be successful by the method of trial and error should persist for a long time. Apparently this is not the case for unicellular organisms, but further work is needed on this point" (p. 251).

⁷ 'Comparative Physiology of the Brain and Comparative Psychology,' p. 218.

⁸ Jennings, 'American Journal of Physiology,' 1902, VIII., pp. 42 ff.

⁹ Jennings, 'Contributions to the Study of the Behavior of Lower Organisms,' published by the Carnegie Institution of Washington, pp. 112, 126, 251.

It is furthest from my purpose to argue in opposition to Loeb that there are no crises in organic development; on the contrary, I should admit that it is practically certain that sudden changes do occur, that Nature does make leaps, that gradual development in one direction suddenly makes possible some apparently new process of change. But mere ability to learn, as defined by Loeb, what is called modifiability in this paper, is not, so far as I can determine, something which appears suddenly as a mark of a critical point in organic development. I wish to maintain that Loeb makes a mistake in his choice of a criterion, that he should lay stress upon the manner of learning instead of upon the mere fact of learning. Associative memory is a particular kind of modifiability; hence, although it implies modifiability, modifiability of reaction does not necessarily imply associative learning. If this be true we should study the way in which animals learn, determine the various modes of profiting by experience, classify them, and thus ascertain not merely which animals learn or even which learn associatively, but also precisely how they learn.

On the basis of the studies of animal behavior which are now on record we may safely say that mere ability to learn is common to all animals, and that it is indicative of a low grade of consciousness; ability to learn associatively, on the other hand, is restricted to certain animal phyla and is a sign of a higher grade of consciousness. This is in disagreement with Loeb, for he holds, first, that associative memory is *the* criterion of consciousness, and, second, that ability to learn is *the* criterion of associative memory. In contrast with this I wish to defend the view that ability to learn is *a* criterion of consciousness, and that the different kinds of learning (associative, imitative, rational) which we distinguish are criteria of different grades of consciousness. There is no one criterion of the psychic which can be accepted as a sign of all forms and conditions of consciousness. Each grade of mental development has its own appropriate signs or criteria: discrimination indicates a less complex form of psychic processes than associative learning, and this in turn is a sign of a lower grade than that which is indicated by inventiveness or initiative or variableness of reaction. If a single criterion is imperatively demanded we might agree to accept rapidity of learning as a measure of the complexity of the psychic.

With these few thoughts concerning the theoretical aspects of the problem of criteria clearly in mind, let us examine for a moment the practical application of ability to learn as a criterion. Bethe, as well as Loeb, selected this as the one available and sufficient criterion, and, fortunately for our purposes, he has through his experimental

work furnished us with results of its application that may now be taken as indications of its serviceableness.

After a study of the crab, in the course of which it was shown that five or even more experiences(!) did not enable the animal to learn to avoid a dangerous object, Bethe concluded that the animal does not possess psychic processes.¹⁰ In similar fashion he made experiments with ants and bees which convinced him that these animals are merely reflex machines, incapable of profiting by experience, and therefore lacking psychic processes.¹¹

Even if experiments since made by other investigators¹² had not proved the falsity of Bethe's conclusions, his attitude toward the subject would still be curiously contradictory from the naturalistic as well as from the logical standpoint, for the animal which did not learn with five experiences might give very definite signs of consciousness if it were given ten trials. Who is to fix the number of chances that the poor brute is to have to demonstrate its psychic processes?

These few instances of the working of the Bethe-Loeb criterion clearly indicate its fundamental weakness. It is absurd to say that it is of more value for us to discover that an animal does not perceptibly profit by a few experiences and from this conclude that it has no psychic life, than to discover by a thorough study of its behavior how its reactions are modified by often-repeated experiences, —in other words, in what manner and with what degree of rapidity it is able to profit by experience. Surely it is of vastly more importance for us to know how an animal learns than simply that it learns.

It is not enough to rest with pointing out the weaknesses of the criterion which has been most used. We must now ask ourselves what criteria and what method of application seem likely to yield the most valuable results for comparative psychology. To this question I should return the answer that is suggested by the classification of criteria that is presented at the beginning of this paper. In the study of the mental life of an animal no one of the six criteria, or however many there may be, should be used to the neglect of the others. In certain cases it may be best to apply each in turn, as was attempted in case of the sea anemone; in others it may be necessary to use only variableness, or modifiability and variableness. Each criterion has its own particular value, yet all are signs of psychic processes. It should be clearly understood that I do not in the least wish to suggest that these six criteria are the only ones pos-

¹⁰ Bethe, 'Arch. f. mikr. Anat.,' 1898, LI., S. 447.

¹¹ 'Arch. f. d. ges. Physiol.,' 1898, LXX., S. 85.

¹² Yerkes, 'Biological Bulletin,' 1902, III., p. 241. Yerkes and Huggins, 'Harvard Psychological Studies,' 1903, I., p. 565. Fielde, 'Proc. Acad. Nat. Science of Phila.,' 1901, p. 529.

sible; on the contrary, there are probably much better ones still unthought of, which it is our task to discover and apply.

Undue emphasis of the structural criteria is unsafe and unprofitable, for it is likely to lead us to deny consciousness to animals which, although strikingly different in most ways from us, exhibit such complex forms of behavior, such complex modes of discrimination, adaptation, and communication that we can scarcely conceive of them as unconscious. Who shall say that the ant or bee has not a highly complex mental life? Certainly those who know them most intimately incline to ascribe to them psychic processes. All we can safely say then is, that the careful, systematic application of all available criteria, with good judgment and reasonable emphasis, may be expected to yield us the best available basis of inference from the physical to the psychic.

The problems of comparative psychology now appear to center about the course of the development of reactions, and the relations of the various types of activity. The genetic formula for reactions is the kind of description that makes strong appeal to all natural scientists. Too many of them, it must be admitted, seem to think it the only form of description possible. The evolution of activity is the all-engrossing subject. Action systems are rapidly being worked out for various animals, and the forms, relations and modifications of reactions are being studied with a minuteness that promises soon to put us in a position to trace with profit the course of the development of activity in the race as well as in the individual.

Meanwhile our criteria of consciousness are increasing in number, and our ability to use them is becoming greater by reason of increased knowledge of the facts of animal behavior. Perhaps when we succeed in ridding ourselves of certain prejudices that physical science fosters we shall agree with those who know the ant and bee most intimately. For may we not reasonably believe on the basis of just such signs as we have been discussing, that the ant with its complex organization, however different from ours, its highly developed and complexly differentiated nervous system, its manifold forms of sensory discrimination, its docility, and its extremely varied social life, possesses a form of consciousness which is comparable in complexity of aspect and change with the human?

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