

On the Importance of the  
PSYCHOLOGICAL FACTOR IN EVOLUTION:-  
with a Critical Account of  
RECENT INVESTIGATIONS IN ZOOLOGICAL PSYCHOLOGY.

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1. General Purport of Thesis:

It is only within recent years that the subject of Psychology has been freed from the age-long domination of Metaphysics and placed on a separate footing as an Experimental Science.

It was but natural that in the infancy of Philosophy it should seek to embrace under its metaphysical side the phenomena of mind which are the concomitants of our physical being. And, as was also to be expected, Materialism was the basis on which Philosophy sought to explain these Phenomena.

Beginning with Plato we get that Dualism which has exerted so great an influence that it is today a powerful force. This, to be brief, asserts that

the soul with its consciousness is imprisoned in the material body - that they are both separate entities, being merely loosely connected through the medium of the brain. Aristotle tried to reconcile the apparent discordance of this theory with his observations by pointing out that the mind is the creator and originator of all organic matter, and until we come to Descartes, on the whole the views of Aristotle dominated.

The Cartesian Philosophy took within its scope Animal Psychology which was now beginning to occupy some little attention, and in his pronouncement that animals are purely automatic creatures from a psychological point of view Descartes may be said to have stimulated the enquiry into Zoological Psychology which has occupied unceasing attention up to the present time.

Man is the only being who thinks - who indeed has consciousness - satisfied this Cartesian School, Animals were automatic only. And up to a comparatively recent date this opinion was generally held. That not only was the difference of the mentality of man from that of brutes one of degree, but so differing in kind as to admit of no comparative analogy whatever.

Darwin's great Hypothesis had not yet revolutionised the prevailing system of Zoological doctrine, and the possibility of man's descent, even from a morphological point of view, in Evolutional Continuity from beings of a lower order had not disturbed the complacent serenity of the special Creation believers.

When this did come so great was the change of view imposed upon Biologists, so largely did the structural and physiological loom on their mental horizon that for a time the psychological equivalent was lost sight of or regarded as a mere side issue. Evolution by Natural Selection became an accepted fact.

But the realm of Biology embraces the animal life in all its aspects - morphological and psychological, and for a time there was danger that the part played by the mental factor in the biological end of racial preservation might be lost sight of. But though he did not follow it to its logical conclusion Darwin really laid the foundation of the Psychological side of Evolution.

The fetters of Metaphysics were still close upon the mind of man however, and many thinkers of note, while in complete agreement with the theory of man's morphological evolution from beings of a



lower order, held strongly that the mentality of man was a thing apart, having no Ancestral line in Evolution direct or indirect.

S / In the establishment of a scientific Psychology the separation of the problem of Metaphysics is absolutely necessary, and if we are to regard the phenomena of mind as coming within the pale of scientific enquiry at all we must vigorously disown the Metaphysical and deal only with facts observed and logically enforced. Huxley, in his zealous support of Evolution from a Materialistic point of view, would not admit that consciousness - or more generally the mental factor was of any biological value, and from his demonstration of the purposive and to him equally purposeful actions of the brainless frog concluded that animal consciousness was no other than a mere accompaniment of molecular changes in the brain.

"The consciousness of brutes" he said, would appear to be related to the mechanism of their bodies, simply as a collateral product of their working, and to be as completely without power of modifying that working as the steam whistle which accompanies the work of a locomotive engine is without influence on its machinery." (a)

But as Lloyd Morgan points out Huxley was carried too far in this matter. For, whereas the

the frog from which the physical centres of consciousness have been removed sits crouched and motionless and will sooner starve than feed itself - although food put into its mouth is swallowed - the unutilated frog behaves in a very different manner.

If the consciousness, admitted to be present, has no effect upon behaviour, "how" asks Lloyd Morgan, "can an Evolutionist who accepts this conclusion account on Evolutionary grounds for the existence of a useless adjunct to neural processes?"(a)

This extreme view Huxley would carry into human mentality as well, but this does not immediately concern us here.

The crucial point of this discussion on the Evolutionary Continuity of the mind of man and brute is the important part played by consciousness, whether we are dealing with the dimmest sentience - which we assume to be present in some of the most lowly invertebrates - or of the highest product of human Intellection.

Putting aside Huxley's view, I hope to show that consciousness has a role to play in Evolution, and that a very important one, and shall endeavour as far as my knowledge of recent researches goes to trace

(a) Lloyd Morgan. "Animal Behaviour" p 308.

its continuity from the more lowly forms of animal life to its beginnings, at least, in man.

It is a matter beset with many difficulties and the different conclusions arrived at by experienced investigators do not render a study of the subject any easier. It is a practically hopeless study for any but a mind trained to the laws of general Psychology. A sound if narrow basis having been obtained, however, from ~~introspective~~ study, the comparison and correlation of results thus obtained broaden the conclusions of the psychologist and prepare him for the more difficult study of a comparative method of Zoological Psychology.

Every ~~inference~~ we draw as to the psychical processes of our fellow being has to be by analogy, for for any more direct acquaintance with psychical processes other than our own is inexorably denied us.

To a still greater extent must we stretch the argument by Analogy in an investigation in the field of Zoological Psychology. We have, in fact, to interpret the objective phenomena of animal psychology - and these are all that are open to us - in the very terms which we use for the explanation of conceptual thoughts. This is an insuperable obstacle and it is magnified ten-fold by the fact that many observers would seek to derive the re-

sults of experiments in Zoological Psychology from the more complicated of our intellectual functions instead of; when possible, explaining them in terms of a lower mental grade. Lloyd Morgan's dictum in this question is worth remarking, he says:-

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

This is a very different thing from Wundt's erroneous statement that we should always have recourse to the simplest explanation, which he remarks is the approved maxim of the exact sciences. But is this so? Is the simplest explanation of phenomena accepted by scientists? As a matter of fact in this case the simplest explanation of the psychical activities of animals would be to credit them with Reflection and Conceptual Thought. It is a much more simple thing to assume that man's mentality is a thing sui generis and by isolated creation - sprung as Athene from the head of Zeus - than it is to arrive logically at the conclusion that it has reached its present stage along the slow and tortuous pathway of Evolution.

Lloyd Morgan's definition seems a fair one and its advantages in pruning the exuberant imagination in our dealings with the mentality of animals more

(a) Lloyd Morgan. Introduction to Comparative Psychology. p 53.



than counterbalances its apparent injustice to the possible explanation of their objective mental phenomena.

For if comparative psychology has suffered much in the noxious jungle of Metaphysics it has suffered much more at the hands of some of its investigators. The study of the subject moreover has been rendered more difficult by the existing confusion of terminology. Each observer has a different interpretation to offer of the same mental process, thus, Reflex Action; Instinct; Intelligence; Inference and Reason have definitions varying with the investigator, and so, on many points, come into grievous collision. This is unfortunate but it would seem to be inevitable, simply because the observers are different observers, and also because in Nature there can be no doubt that in the mental life of man and of the higher animals many of these factors - notably Instinct and Intelligence cross and re-cross in the most perplexing manner. As I shall point out later no hard and fast line can be drawn as to where the one begins and the other ends. The basal factor of the mental life of a man may be pure instinct for a whole day or it may be marked by intellectual processes of the highest order. The explanation and definition of the mental factors mentioned above

which I propose to adopt. I shall refer to in the next paragraph.

Biology has accepted Evolution on the lines of Natural Selection as its guide and Comparative Psychology, which is a part of Biology, in its widest interpretation, it seems to me is bound to do so also. And I shall hope to point out some of the landmarks of the path along which Psychological Evolution has advanced parallel with Biological Evolution, noting also the apparent continuity of the process in all its essentials from brute to man, up to a certain point.

When we consider that Zoological Psychology has only of late years been placed upon a scientific footing as an experimental Science the contributions of investigators, up to the present time, have been full of suggestiveness and value.

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## 2. Phenomena to be interpreted and their Definition.

It may be stated at once that only Phenomena which can come within our mental purview objectively can be the subjects of experiment in Zoological Psychology. In other words only those mental processes accessible to physical influences can be dealt with. These are doubtless a small share of the whole of the psychical processes of animals



but for a working hypothesis they would seem to be sufficient. These phenomena come under the generic names of Reflex Action; Instinct; and Intelligence; which embrace between them much that will be referred to more in detail later on. It would be well at this point, as far as possible, to define the respective spheres of these great classes of nervous reaction.

### Reflex Action.

The rather loose use of terms descriptive of neural reaction is an unfortunate fault which is altogether too common in text books on Comparative Psychology. Wundt, for instance, in discussing the reflex nature of the reaction to stimuli of Protozoa, speaks of Protozoa as giving evidence of "voluntary movement". Now this is misleading, for a voluntary action, properly so-called, implies reflection and choice and is necessarily only present in beings of highly organised nervous system. The word "voluntary" has to be sharply defined from the differential reaction to stimulus which lowly organised animals possess in place of a nervous system, but which, as we shall see, no less surely serves a biological end.

Strictly speaking, Reflex Action, as stated by Marshall Hall, implies a differentiated nervous

and requires a sensory or afferent nerve connection, a nerve centre, and a motor or efferent nerve connection. If we give the terms a more extended usage as Hobhouse seems disposed to do, it can be made to include the response to stimulus of many of the lowest organisms, and even of certain plants, notably, *Drosera* and the Sensitive *Oxalis*, which have, so far as we know, no essential nervous system whatever.

In this broader definition of the term it might be stated on the lines of Hobhouse's view as an invariable and uniform reaction to stimulus. In the case of neither plant or Protozoa is there any evidence of intelligence - in other words, no conscious guidance. The reaction is a certain and invariable result of an external stimulus; the basal fact probably being the irritability of protoplasm. The reaction is no more purposive in the case of the *Paramecium* than in the case of the Venus fly-trap.

It would be well, however, to restrict the use of the term to a nervous system so far differentiated as to possess an afferent nerve, a centre, and an efferent nerve. If we admit its functions as so far purposive its structure is undoubtedly mechanical. All parts of the mechanism react together in perfect harmony and without any adaptation on

the part of the reflex mechanism itself - "qua reflex act" - it re-acts inevitably for the benefit of the organism. As Hobhouse puts it, it is so attuned that "the manner of reaction adopted for each stimulus is under ordinary circumstances beneficial to the organism. Of the structure we may perhaps say with certain reservations that it has grown up because it is useful to the organism." (a)

In man and in the higher animals these reflexes also persist but under different conditions. They vary with the condition of the organism as a whole and are markedly dependent upon their connection with the higher nerve centres. These reflexes in man reside in the lower nerve centres and are in great part controlled and controllable by the conscious guiding centres in the brain. Their purpose to the complex organisation of man being of not nearly so vital importance as it is to the more lowly organised animals.

### Instinct.

There is probably none of the mental instincts of animals and their expression in action around which so much controversy has raged and from which so many divergent conclusions have been arrived at as Instinct. The term has undoubtedly been used as a confession of ignorance of many of the psychical

activities of animals up to a comparatively recent time even by scientific men, and by the lay mind any attempt to bind it down to the common-place rules of Evolution was regarded as an almost unpardonable affront to the Deity. Instinct is probably nowhere more in evidence to common observation than in the various activities of birds. The fact of migration, for instance, which is even now commonly attributed by many to a certain guidance of the Almighty's Hand, is found to be capable of an altogether different explanation. This instinct is found to be in part at least due to the gradual recession southwards, driven by the increasing northerly winds, of the multitudinous insects which birds require as food. Birds in fact make what is practically a conscious virtue of necessity. In other words if they did not follow the gradually receding tide of insects they would starve.

This popular view of Instinct deals with it exactly as it deals with "Reason" in man, as an ultimate principle beyond the pale of discussion.

Let it be clearly stated at once that neither Instinct nor Reason can thus stand alone, in a state of isolation from the rest of nature, but have to come into line with the view held by modern

Psychology that they are, like all other mental and physical activities, products of Evolution, serving a biological end, and in intimate and unalienable connection with them.

Instinct may be said indeed to be the cradle or nursing mother of Intelligence. It is as impossible to sharply define the territory of Instinct as that of Reflex Action. Somewhere it enters the stream of mental development in the sphere of Reflex Action and thereafter it colours that stream along its widening channel as far as we have been able to explore it in the highest forms of intellectual development.

It has been well said by someone that theories of Instinct are "as common as butterflies in summer" and this after all is but natural if we look at the wide scope for a variable interpretation of the same phenomena there is in the realm of Instinct.

Many of these theories may be said to merely darken counsel with words. We may at once dismiss the theory which holds that Instinct springs into being a perfect organisation of absolute and unerring infallibility. Instincts are rarely perfect from birth, and there are few if any which need no alteration and which undergo no modification in the lifetime of the individual. The instincts of suck-



ling, nest-building and flying in birds are by no means perfect at birth, undergoing variations according to circumstances, and, as we shall see later, the more modifiable they are the more adapted to serve the biological end of survival.

Probably at opposite poles of definition are Mr. Herbert Spencer's that Instinct is simply compound Reflex Action, and Mr. Marshall's, who holds that we must embrace under Instinct an ethical, artistic, and even religious emotion.

Others again class instinctive action with Intelligence, involving consciousness of end. Wundt defines Instinct in general as "movements following originally upon voluntary acts which have become wholly or partially mechanised in generic Evolution or individual life." Thus following closely upon Darwin's view that Instinct is inherited habit determined by Natural Selection.

Briefly, Wundt agrees with the view that Instincts are "the mechanised rudiments of manifestations of Intelligence," and further proceeds to divide Instincts into what may be called the ordinary congenital type according to the definition and into acquired or individual instincts. He holds, and to a large extent with justice, that nervous systems have a property of mechanising com-



plex - originally voluntary - movements, these appearing in the race in the course of countless generations as congenital instincts and in the individual as acquired instincts, instancing the mimetic impulse in the social life of the higher animals as a strong incentive to the growth of the latter. Certainly in many social customs this is so, but it is a question as to whether what is acquired ought to be regarded as instinct at all. Lastly he isolates the connate instincts which he calls those of sex and nutrition.

Hobhouse in his recent book would seem to define it as a response of inherited structure to stimulus, but will not allow that we must therefore identify it with Reflex Action.

In the care of Chickens by the hen, as he well points out, there are many reflexes involved as isolated acts, notably - danger clucks - spreading of wings to receive the chickens and so on. "Each particular act may be described," he says, "without obvious violence as reflex, but the whole is an adaptive combination of reflexes in which the combination is as important as each separate act." But beyond this he believes that there is some permanent state or tendency which we call maternal feeling or parental instinct; thus differing in his conclusion from

Spencer who would distinguish Instinct and Reflex Action solely by their relative complexity.

Mr. and Mrs Peckham, two very painstaking and accurate observers, in their monograph on the instincts and habits of the solitary wasp, have well defined instinct in the following terms:-

"All complex acts which are performed previous to experience and in a similar manner by all members of the same sex and race." (a)

This will be seen to exclude any idea of consciousness, which after all for the bare purpose of definition it would seem better to do, as most instinctive acts are performed for the first time at least without any possibility of conscious guidance, on the part of the individual.

Lloyd Morgan sums up these views in one, and defines instinctive behaviour as "comprising those complex groups of co-ordinated acts which are in their first occurrence independent of experience: which tend to the well being of individuals and the preservation of the race: which are due to co-operation of internal and external stimuli: which are similarly performed by all members of the same more or less restricted group of animals; but which are subject to variation and to subsequent modification under the guidance of experience." (b)

(a) G.W. & E.G. Peckham. "On the Instincts & Habits of the Solitary Wasp."

(b) Lloyd Morgan, "Animal Behaviour." p 71.

Now to deal with these extremely divergent views. Mr. Herbert Spencer's pronouncement that Instinct is merely compound Reflex Action would seem in the light of recent research to be inadequate. Both Mr. Hobhouse and Professor Lloyd Morgan seem to experience difficulty in getting away from this absolute view of the matter. And certainly many acts classed as instinctive can quite as reasonably be claimed for the Compound Reflex Theory. There is no objective evidence of what Hobhouse calls "a persistent inward condition" which co-ordinates and controls the many reflex acts involved in a compound reflex.

This would include under Reflex Action many of the more complicated acts of insects. M. Fabre mentions one which Hobhouse quotes, "A solitary wasp, *Iphex Flavipennis*, which provisions its nest with small grasshoppers, when it returns to the cell leaves the victim outside and goes down for a moment to see that all is right. During her absence M. Fabre moved the grasshopper a little. Out came the *Sphex*, soon found her victim, dragged it to the mouth of the cell and left it as before. Again and again M. Fabre moved the grasshopper but every time the *Sphex* did exactly the same thing until the observer was tired out.

In this case one gets that uniform

In this case one gets that uniform response to stimulus which is the inevitable accompaniment of Reflex Action. Opposite conclusions have been come to, however, by other observers in the same circumstances.

This view would parallel Instinct with a complicated Reflex act such as walking with the mind absolutely preoccupied. Certainly in proportion as they exhibit this fixed and unalterable response instinctive acts approach the more mechanical process of Reflex Action. The difficulty in this class of instinctive acts and the cause of much of the controversy appears to be that no line of demarcation between Reflex Action and Instinct has been drawn by Nature. The one insensibly glides into the other and their special characteristics becoming blended produce a reaction which, so to speak, is neither reflex nor instinct, but which can be viewed as either.

Instinct is foundationally pre-determined response to stimuli with a biological end in view, but Spencer's theory is not nearly comprehensive enough, for leaving out of account for the moment any question of intelligent guidance in compound Reflex Action, no matter how complex it be, there is at all stages of development an unvarying response; while

Instinct even in its lower forms shows some adaptability to circumstances, this being noted in the course of many generations, so slow is it to change. Reflex Action shows no such adaptability. But it is when we come to the large class of instincts where adaptation to circumstances occurs even in the life of the individual that the inadequacy of Spencers definition becomes apparent. The groundwork of the action may be in a sense mechanical, but there is something super-added, which differs in some kind in individual cases, and in individuals is adapted to the immediate matter in hand. Many instances might be quoted to support this from observations on spiders, caterpillars, and ants, and more especially, from their study of the solitary wasp, by the Peckhams. These careful observers state clearly the pros and cons of the matter. Their opinion is that instinct in these interesting little insects is present in a great variety of forms, from a dull unvarying response to a situation to a plasticity of adjustment which bears all the marks of intelligence.

The view that Instinct and Intelligence are practically interchangeable terms seems even more fallacious in its results than the compound reflex theory. This erroneous view is the more readily



understood if we remember that intelligent action - this being as we shall see later quite distinct from intellect - arises somewhere within the sphere of instinct. In the case of many instinctive actions there can be no doubt that they are purely instinctive only in their first performance, every subsequent performance being coloured and modified by the experience thus gained. Experience is the key-note of intelligence, and an instinctive act to begin with is not experiential.

Take Morgan's simple instance of the young chick; here, a few hours after birth, the little bird pecks at any small object within view. The pecking is a pure instinctive act, set in operation by an optical stimulus - to put the matter shortly - but the chick's initial efforts are frequently anything but accurate; as soon, however, as experience steps in complete precision in pecking is rapidly attained, and it is at this point, and here only, that intelligence begins to operate; before this there was no consciousness of end.

But there are many more complicated acts which must be called instinctive and yet which show some strange fore-knowledge and apparent purpose, chiefly among the lower invertebrates.

In support of this the striking instance of the caterpillar of the Emperor Moth may be mentioned.



In this case there is shown an astonishing amount of blind prevision and, according to some, of reflection and understanding, in the elaborate care which with an exit from its cocoon is provided; in all this the caterpillar had had no experience and could have learnt nothing from parents.

As Hobhouse puts it, "it is precisely the highly complex development of apparent purpose in certain relations, combined with entire absence of any corresponding manifestations of intelligence in other respects that forces us to recognise the purposiveness as only apparent." (a)

Inheritance, under Natural Selection, as we shall see, plays no unimportant part in these complicated instincts, and any definition of instinct must include this all compelling force.

Lowest in the scale we find instincts in which no variation from the path appointed by heredity takes place. Variations from this straight and almost unerring rule occur more and more as we progress upwards until, in the light of experience, which we saw was not inherited, we have an increasingly effective intelligent control, the instinctive act becoming indeed suffused with intelligence throughout.

Instinct in general is raised above reflex Action by the addition of what Hobhouse terms "the persistent condition" and what Lloyd Morgan calls, for want of a better name, "an organic prompting." This consists of an emotional element of some kind, experience is added, and with it the dawn of intelligent action appears.

### Intelligence.

For what we shall see afterwards is a biological end Intelligence and Instinct for some distance pursue a parallel course. Instinct provides the crude material in outline and Intelligence rounds, smooths and polishes it. The more rigid and unvarying an instinct is the less room is there for Intelligence to bring to play on it its power of adjustment. On the other hand, the more capable of variation the instinct is the more does Intelligence adjust the action to the immediate need of the situation. But it may be asked wherein lies the essential difference between Instinct and Intelligence proper? Briefly, as has been stated by Lloyd Morgan, Instinct is antecedent to experience, it is an animal's hereditary outfit; Intelligence is consequent on experience. Or, looking at the matter in a physiological light, in Instinct we have a complicated machinery ready for use, a perfect ner-

nervous co-ordination, Intelligence develops this along certain lines during the lifetime, checking nervous activity in some directions, stimulating it in others. Intelligence therefore is shown in a modification of what Lloyd Morgan calls "behaviour after experience". There can be no doubt also that in Intelligence the emotional factor plays an important part; pleasure and displeasure begin to be more emphatically features of the situation, and have a large share in determining action. We saw a crude emotional state was present in Instinct as such, but was comparatively in the background; in Intelligence, on the other hand, feeling-states play a prominent part in its development.

Now, what are more especially the criteria of Intelligence which mark it off from instinct? Complexity of adjustment it has been urged is one. But as we have seen complexity and precision are among the most wonderful attributes of instinctive action. Many instances of this among insects might be given, a notable one occurring in the habits of the solitary wasps, in the construction of their nests; their method of conveying the wounded insects and caterpillars to their nests, as related in Dr. Peckham's Monograph. But another and more distinguishing test must be stood, and we have it in the correlation between experience gained and

subsequent action. An experience under which will come sensations of pleasure or otherwise, motor-adjustments. This has an effect in modifying the response given to a similar stimulus. It is what Lloyd Morgan calls novelty of adjustment and individuality, the ability to perform acts in special adaptation to new circumstances, and "the individuality manifested in dealing with complex conditions or variable environment",-these seem to be distinctive features of Intelligence. (a)

In order to do this there must be some dim and elementary correlation. This correlation of experience may be said to be the first upward step in mental Evolution towards the correlation of ideas which is man's alone on the conceptual plane. But just as we talk of a man's ideas becoming broader so we have here a similar result on a lower perceptual plane. There is a broadening of reaction, according to circumstances, which leaves the beaten track of Instinct far behind.

To prevent the confusion of terms which the use of a word like "correlation", so largely employed on the ideational level, might lead to, Professor Stout has an admirable phrase which he calls "acquisition of meaning;" and illustrates it with the classical story of the Chick and Cinnabar Moth. The  
Chick

(a)Lloyd Morgan, Animal Behaviour:pp 122,123.

having pecked at this nauseous creature (the instinctive) and the resulting sensation being unpleasant (sense-experience) on future occasions modifies his attentions to the Cinnabar Moth to such an extent as to dispense with the necessity of repeating the original experience, and controls the instinctive tendency to peck in that particular case or a similar one owing to some re-presentation, however dim, of the previous occurrence. Here obviously there is a correlation of events, in other words the Cinnabar Moth has acquired meaning.

Here then, broadly speaking, is the point where intelligence, including many manifestations to be afterwards mentioned, first leaves the realm of Instinct. Psychologically this state corresponds to the perceptual stage and out of it is largely built up the mental life of the higher animals, the mental life of young children and, in certain phases, the mental life of men. In it we can see the germs of comparative judgment, of generalization and indeed much of the conceptual life of man.

Where this capacity for learning by experience first makes its appearance in the animal world is almost impossible to tell. Certain it is that evidences of it appear so low down as the Cephalopoda



and even some Molluscs, but its range is not determined by a scientific classification of animals according to their position in the vertebrate or invertebrate world from a morphological point of view. Further than that we cannot go.

The perceptual stage of Professor Stout is the direct and immediate result of experience, but without a generalised conception of an ideal. There is intelligent control but not rational control of motor and other impulses.

As a definition of perception is of vital importance for what follows, and as in my opinion Stout's view of the perceptual process seems the most cogent and lucid with which I am acquainted, perhaps I may be allowed to give it in full:-

"Perception is essentially cognisant we cannot perceive without perceiving something . . . . . perceiving is a special mode of cognition, it is that special mode which immediately depends on the actual presence of an object to the senses . . . . . it is contrasted with that mode of cognition which takes place through ideal images. Such images are not dependent on the actual presence of an object to the senses. They are representations of absent objects which have already been perceived . . . . . thus existence of perception is a pre-condition of existence of ideal images. Direct cognisance of present objects must precede ideal representation of absent objects." (a)

(a) Prof:G.F.Stout - Manual of Psychology. p 251.

In other words, the stage of mental Evolution called Intelligence or in Psychological language, perception, is distinguished by the presence of concrete objects - their cognition - with resulting motor activities. It is capable of unity and continuity, when of a complex nature, thus differing from Reflex Action in which the responses are isolated and never continuous. There is adaptation to a varying environment, and with it learning by experience; unsuccessful modes of procedure are eliminated; successful ones survive, and finally there is some evidence of representation of images. These facts are of some importance in the criticism of some experimental methods to be afterwards described.

Although having no direct bearing upon the matter at present under discussion a bare reference to the Ideational stage is necessary.

Perception must be sharply distinguished from this. Free ideas would undoubtedly appear to exist in some of the higher animals; images of previous experience, of an isolated and detached character, would seem also to be present in animal consciousness. They are largely present in human consciousness also, in fact the mental life of children and of many of our fellow creatures would seem to be

largely based upon such and their concern in the immediate performance in hand. But the gulf between the conceptual and the ideational in man, which undoubtedly does exist, cannot be bridged by mere perceptual mentality, no matter how rich or how varied.

In conception the object is still concrete, but we deal with the attributes of objects, we analyse, compare, and generalize about them. Correlation is here more distinctive and far reaching than in perception, and we argue not only by means of deduction but of induction also.

In this paper we have nothing to do directly with conceptual thought, and I merely mention it to complete in the broadest and most general manner the definitions and special distinctions of the various mental processes to be discussed.

Conception, according to the line I have taken, is no new faculty, it arises in direct genetic descent from perception.

### 3. Biological Interpretation - Natural Selection - Inheritance.

From time to time in these remarks a reference to a biological end has been made, and the important bearing the mental life of animals has upon

upon this matter must be briefly referred to. The biological test of survival operates no less stringently in mental Evolution than in its physical counterpart; and the full significance of this appears to have escaped the notice of biologists until a recent date.

The stern examination of Natural Selection with adaptability to varying environment has to be passed both by mind and body; indeed we may venture to hazard that the capacity of the mental element in the matter settles the fate of the purely structural for weal or woe. The mammoths and huge sauroids of earlier days have been shown to be creatures of comparatively small brain, and for a time their huge bulk settled the issue in their favour; but their mental processes were not capable of intelligent adaptation and they had to succumb to weaker but more intelligent products of Evolution. So also we may note in the infancy of the human race brute strength alone survived, but by slow degrees Selection was operating upon mental development, refining and rendering more subtle until mere physical capacity had to give place to the more intelligent use of the possibly less vigorous organization. The most highly organised structure in the body, the brain, with its concomitant psychical



phenomena, has not yet come into its own, but is slowly, very slowly, advancing to that end.

The part played by consciousness in the biological end of racial survival is unknown to us in the lowest members of the animal world; all we can say is that their reactions to stimuli invariably seem to serve that end. It is only when we get to the more highly organised animals that the value of conscious intelligence becomes fully apparent. "It is a commonplace of evolutionary doctrine" says Morgan, "that other things being equal, those races will survive, in the constituent members of which intelligent behaviour enables them to deal most effectually with an environment of increasing complexity." (a)

When experience has been gained its prompt utilization to serve new situations is largely the determining element. As I before stated, the possession of organic structure of great size cannot alone determine fitness to survive racially, but rather, the use to which this is put by intelligent direction of the end to be attained.

The researches of Jennings would seem to have shown that the various psychical activities with which paramoecium has been endowed are carried out without any conscious choice or purpose, in other words, the animal reacts automatically; it assim-

(a) Lloyd Morgan. Animal Behaviour.



lates food, absorbs oxygen, and responds to stimuli, all of which, according to the effectiveness, contribute to its survival, but, as we have seen, without consciousness. There is no conscious end in view, but the end is somehow attained by the pruning hook of Natural Selection.

So too we say in the case of Reflex Action, which, as we noted in defining it, implied a differentiated nervous system; the organism is, as we say, so built that way, that its reactions to stimuli are in the main beneficial to it. In the course of thousands of years certain types of reaction might prevail which have proved to be more beneficial to the animal than others. Here the part played by the nervous system, such as it is, is one of great importance. Of course there can be little doubt that this method must be a terribly costly one in the case of individuals, but that is of no moment to the sifting hand of Biological Evolution.

In Instinctive types of action the same process can be followed if it be granted that structural alterations take place in the course of generations without any direct intervention on the part of the individual or of the race, these structural changes arising through heredity under the influence of Natural Selection, so too can the functions they are

adapted to perform, which have been modified by environment and the struggle for existence. There is thus a biological correlation between the adaptation of structure and of function all along the line. The flying fish to escape elimination has evolved a specialized type of fin which fulfils its object in short flights through the air, and so enables the animal to escape its natural enemies.

Under this heading too will fall the wondrous evolution of protective mimicry seen in a wider range of animal life. Instinct, as I have already shown, has a conscious aspect, and there can be little doubt that in proportion as its instinctive activities are influenced by consciousness in adaptation to varying environment the chances of survival are increased. Take a group of animals throw them into alien surroundings, in which their ordinary instinctive response does not serve, and refuse to grant them the saving grace of intelligent adaptation, the beneficial results of the acquirement of meaning, in other words the conscious aspect of things, and the chances are they will become extinct before long. Endow them with this mental factor on the other hand, which can be put into immediate action and temporise with the strange environment until congenital variations

have, after many generations, begun to take effect, and their chances of survival are correspondingly increased. This adjustment being arrived at by the few, the rest of the group would, if of a social order, necessarily benefit by imitation. As used in this sense, imitation does not mean reflective imitation, as will be pointed out later, but that which exists at the perceptual stage, that which Professor **Stout** calls **senseri-motor** imitation.

The part played by consciousness in sexual selection, that most vital branch of Biology, is also an undoubted fact. We need not here discuss whether the appeal to the female is through **any** aesthetic faculty or is simply sense-excitation, this is for the time immaterial. The point is that consciousness in some form determines the selection made by the female from among the many who pay her court.

As the question of inheritance directly bears upon the matter under **consideration** it will be well at this point to define my position on this debated territory. Let me state at once that I give my adherence to **Weismann's** theory, meaning by that the postulate of **Weismann** which asserts the perpetual continuity of germ-plasm and with it the non-transmissibility of acquired characters. With his second postulate the absolute stability of germ-

plasm, we have in this place nothing to do. The first alone bears upon the question of heredity.

Notwithstanding Romanes's brilliant "Examination of Weismannism", which undoubtedly points to one signal flaw in the theory, to be immediately referred to, it seems to me to have as an hypothesis a large amount of plausibility.

Briefly, Weismann asserts the non-transmissibility of acquired character, that Pan-genesis cannot be accepted, and that the continuity of germ-plasm satisfies every requirement. In this then the Lamarckian factor is absolutely discounted there is no compounding with it in the least degree, and yet, as Romanes points out, he waives again and again this absoluteness and submits the possibility of some slight and occasional transmission of acquired characteristics. As Romanes has remarked, there is a considerable difference between a germ-plasm which is largely continuous and one absolutely so. It does not immediately concern us here, however, whether Romanes has proved the invalidity of the absolute Weismann theory or not. As I have already mentioned, it will be well to accept it as a working hypothesis of heredity. According to this view then we have the problem of variations practically



settled in the germ-plasm, outwardly manifested however, in the mental and physical characteristics of the possessor. These bodily structures form the somatic elements, being sharply defined from the germinal cells which alone are reproduced; as Morgan remarks "the former take no direct share in reproduction, they are off the line of continuous descent. They die without issue." But we saw that Reflex Action, Instinct and Intelligence were largely bound up in the perfect co-ordination of the nervous system, which is a part of this somatic element, which dies without issue; these are not therefore in a sense inherited, but the germ-plasm handed on to another generation is capable of re-producing a similar body and nervous organisation.

The immediate struggle for survival falls upon the body alone, from this the germ-plasm is exempt. And so we are once more brought face to face with the fact that it is in the capacity of the body for intelligent adjustment to varying surroundings which decides whether the germ-plasm in the particular case is to be preserved or not. The body is the product of a given germinal substance and according to the practical efficiency and use of the bodily organs does Natural Selection pronounce its fiat as to the fate of the given germ-plasm for survival



or non-survival. Use of organs is a co-operative factor with heredity on this basis, as affecting the somatic elements. It is through use that favourable modifications of acquired characters take place, and it thus directly helps in securing the continuance of the germ-plasm.

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#### 4. Psychological Interpretation - The Principle of Conation.

It is on the importance of the Psychological aspect of the behaviour of animals in the light of Evolution that I would more particularly wish to dwell. I have endeavoured to point out that from a Physiological point of view and from a purely Biological aspect all the activities of animals which I have defined rest upon the fundamental basis of Evolution by Natural Selection. It is upon the value of the Psychological factor as helping to determine the same Biological end that I wish to insist in this paper. As I have already stated, it has been too much neglected in estimating and determining the status of the various species of animals in the scheme of Evolution. Under this heading I shall also discuss the principle of Conation which Professor Stout has elaborated with

so much care, and endeavour to indicate its great importance in the realm of Instinct and in that of Intelligence. The principles of Conation indeed would seem to be an unvarying and inseparable accompaniment of the psychical side of Animal activity.

It will be well to give Dr. Stout's own definition of the Conative attitude in this connection:

"Such words" he goes on to say, "as interest, craving, longing, yearning, endeavour, desire, purpose, wish and will, all mark this characteristic of the process of consciousness. All of them imply an inherent tendency of conscious states to pass beyond themselves and become something different, an inherent tendency which continues to operate unless interrupted by interfering conditions, until a certain end state is reached which is called the satisfaction or fulfilment of realisation of these emotions." (a)

With this end stage then Conation ceases. In this Conative process emotional states and feelings play an important part, more especially within the scope of intelligent actions, although it is undoubtedly present in instinctive action also. Indeed so low down as we can reasonably infer consciousness of any sort to exist this Conative attitude is a distinguishable feature. The Biological end of animal activities is survival; the Psycho-

(a)

Prof:G.F.Stout. Manual of Psychology p.64.

logical end, and inherent in it the end of Conation, is individual satisfaction or pleasure. By the end of Conation here I do not mean its actual termination but its goal of attainment. As Dr. Stout remarks an important distinction is to be drawn here. The idea of winning a race is representative of the end of Conation in one sense; the race having been won is representative of it in the other sense; that is, Conation as a process is ended in satisfaction. This is of course on the Ideational plane, but it serves as an example.

This state of endeavour to an end is in all cases, whether the end be recognised as such or not, one to avoid obstruction and secure success; in other words, individual satisfaction. That is, putting it in psychological language, to avoid the affective state of displeasure and ensure that of pleasure.

Professor Stout, in his Analysis of the subject, does not seem to go below the level of conscious endeavour; i.e. the plane of Instinct with super-added Intelligent adaptation. Certainly the roots of the process on the Intelligent plane would appear to arise in the affective states of the animal, and as below the level of Instinct, so far as our knowledge goes, there exist no such affective states, it would seem that as a demonstrable force in animal life we must not seek for it

in more lowly organisms. And yet, may we not say that a property of at least similar aim is present in the dim sentience - if such there be - even of the Protozoan, and in the reflex life of many of the lower invertebrates; where, given an obstruction, there is the continuance of a state of irritability, or what Dr. Stout would call in physiological language, a disturbance of nervous equilibrium, which goes on till the obstruction is removed. Naturally, the active side of the Conative attitude, the endeavour after a pleasurable end, with its corresponding satisfaction, is not so easy to prove, much less to demonstrate. But in essence, I take it, the irritability of protoplasm is the bedrock of Dr. Stout's Conative process.

To its action and importance on the perceptual plane of Instinct and Intelligence I have already referred; there remains to mention the corresponding effect on the Ideational plane. In the perceptual stage we saw that Conation was a conscious and felt tendency or endeavour, chiefly in the motor sphere, and that satisfaction was reached when the end was obtained, but that there was no realization of the end as such. There we had to deal with impulses which were isolated, and determined by a material and immediate objective. On the Ideational level this is not so. Here the Conative tendency

is under control and is considered in relation to the "total system of tendencies." There may very easily be two or more Conative impulses, but deliberation is brought to bear on them and a decision is come to in relation to the Ideal. We set before ourselves an ideal of conduct and sometimes consciously, though more frequently unconsciously, strive after its attainment. It is in fact a new aspect of an old matter, and simply brings us face to face once more with another of the facets of the many sided Natural Selection; it is indeed part of this great process. It would seem that in no other way can we explain what is without doubt a constant feature in all animal life.

This Conative stream of Energy, always making for Evolution, is in marvellous consonance with what we know of, or reason as being, the objective of Natural Selection. Those animals endowed with a strong force of Conative energy escape the dread fiat of elimination; those again in whom it is feebly developed, if there be no countervailing advantage, paying the penalty. The getting of pleasure then and the avoidance of pain may be termed the psychological contribution to racial survival. If we consider one or two of the activities of animals we can see in what wonderful agreement this all pervading tendency is



with biological ends.

In his work on "The Play of Animals" Professor Groos very ably deals with this important phase of Animal life, and has conclusively shown the biological import of the seemingly purposeless and random physical activities of play. The felt end or motive in the animal's mind, to put it thus, is one of satisfaction of the pleasurable end; not as one fitting it more effectively for the struggle of life, adapting it to meet new and every varying contingencies, the animal does not study that, but here is shown that marvellous consonance of the biological end before referred to and the individual satisfaction of the moment. We may not be prepared to admit some of the animal activities referred to by Professor Groos as coming under the scope of "play", but the underlying principle in all cases is the same; that when the animal, is, so speak to speak, not actively engaged in the struggle for existence, Natural Selection under Evolution cunningly interweaves this instinct of play into her own great pattern and uses it thus indirectly to secure the biological end of racial survival.

It is in youth that the stream of Conative Energy flows most strongly, and it is then that the tendency to play is most in evidence - experimentation - practice - curiosity - the instinctive im-

pulse to mock fighting (which is not the only play activity of animals, as Prof. Wundt seems to infer) - the periodic fits of half flying which are so common among the young domestic fowls - the sham hunting of the kitten by the domestic cat - these and many others are evidences of this tendency. But it is not only in youth that practice is gained for the serious struggle of life; in adult life in the intervals of the struggle the same conditions prevail. The animal is as it were playfully testing its harness of battle, strengthening any weak points, and perfecting itself in the type of situation with which it is likely to be confronted in serious life. And this is not to be wondered at, for it is vital to its very existence and a situation inadequately dealt with in the real struggle may mean the forfeit of its life.

In the courtship of birds, although, strictly speaking, there is no play-time, we may note a similar state of affairs. We know for instance that some birds begin to practise the love-song quite early in the autumn in preparation for the coming spring. This, I believe, is in brief, an outline of the theory Prof. Groos advances in his very philosophical work.

But, as Prof. Lloyd Morgan points out, we are too apt to lay stress upon the bodily skill dis-

are too apt to lay stress on the bodily skill displayed, the wonderful co-ordination of movement shown in this form of animal and human activity, and to lose sight of the fundamental psychological element. He says:-

" . . . . . Rightly considered the behaviour itself is simply the outcome of a conscious situation, duly elaborated and knit together through the association and coalescence of its constituent data . . . . . it is a means to the unification of consciousness by bringing into relation scattered and at first quasi-independent sensory and emotional elements.

Success is only attained through the concentration of attention and effort on that which is the centre of interest and also the focus of endeavour." (a)

We can thus see the co-ordination of end of the psychological of animals with that of Evolution, and the important share they fulfil in the achievement of this end; this being especially illustrated by the instinctive activities of animals in the sphere of play.

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V. The Plea for Comparison - Divergent Interpret-

Having thus hypothetically established the claim of the purely psychological side of animal activity in Biological Evolution, there remains to consider the arguments for and against the contin-

(a) Lloyd Morgan. Animal Behaviour p 319.

uity of this mental factor through ascending stages of development to its present consummation in human consciousness, when conceptual thought first comes on the scene.

Incidentally I have referred to some of the activities of the more intelligent animals bearing some noted resemblance to those of men under certain circumstances. The remainder of this paper will be devoted to the proofs for the continuity in Evolution of the mental processes of man and those of animals, and a critical account of some recent methods of investigation.

While the doctrine of purely morphological evolution finds ready adherents and few opponents at the present time, wonder being frequently expressed even by the lay mind that so simple and obvious a thing could ever have been doubted, its analogue in the realm of mind has received but scant recognition.

After the long reign of materialism, Romanes may be said to have been among the first in this country to lay claim for the animal mind a place which challenged comparison with that of man. He founded what may be called the Intelligent School of Animal Psychology, as opposed to the doctrines of Wundt who would explain all the mental activities of animals in terms of Association.

Admirable as are some of Romanes' investigations in certain fields of animal life; it has been noted, and justly I think, that in his eagerness to do justice to the mentality of animals, he was carried too far, and appears to have interpreted in the light of logical reflection many of the activities of animals which could quite well, and with no discredit to the animals concerned, be explained on the lower level of Instinct or Intelligence. Unfortunately for the value of Professor Romanes' observations as records in his "Animal Intelligence" and "Mental Evolution in Animals" they are for the most part derived from unscientific sources, and he appears to have accepted them, coloured as many of them undoubtedly are by the exuberant imagination of his interested correspondents. As Wundt observes, the facts may be wholly true; the interpretation of the philosopher, innocently woven in with his account of them, puts them from first to last in a totally wrong light. A typical instance may be mentioned which Wundt refers to, it is a story of ant life.

"At one formicary half a dozen or more young queens were out at the same time. They would climb up a large pebble . . . face the wind, and assume a rampant posture." Several having ascended the stone at one time, there ensued a little playful passage at arms as to position. They nipped each



other gently with their mandibles and chased one another from favourite spots. They, however, never nipped the workers. These latter evidently kept a watch upon the sportive princesses, occasionally saluted them with their antennae in the usual way or touched them on the abdomen, but apparently allows them full liberty of action." As Wundt remarks, there is certainly full licence of imagination here. Such is in part the inevitable result of the use of words and phrases which imply analytical thought to describe mental processes which involve no analysis.

In the work referred to Professor Romanes would not seem to have adopted the critical attitude necessary in dealing with a mass of material the observation of which shows anything but exact psychological methods. Faulty and inexact observation and an utter absence of experimental control were the characteristics of much that was done by this school in the sphere of comparative Psychology.

We cannot too often remind ourselves of Lloyd Morgan's principle that in no case is an animal activity to be interpreted as the outcome of the exercise of the higher psychological faculty if it can be fairly interpreted as the outcome of

exercise of one which stands lower in the psychological scale." "

But Romanes is not the only offender in this respect. His instances are confined for the most part to a section of the Zoological world where one would reasonably expect the high level of mental development so far as it goes.

To mention one other, let us go to the opposite end of the scale, and we find M. Binet discovering in the daily life of paramoecium many problems as complex as can be presented by our own mentality. This author actually satisfies himself of the existence of such mental attributes as senses, choice, memory, and intelligence, to say nothing of his social scheme of life in these organisms! I shall deal with this in a succeeding paragraph.

Professor Wundt, who deals with animal mentality as a subsidiary problem arising out of the consideration of human psychology, deals in no uncertain manner with the assumptions of the "Intelligence" School.

He would seek to explain in terms of simple Association all the objective mental phenomena of animals. In his view the criterion of Association

(a) Prof:Binet. The Psychic Life of Micro-organisms.

is that it does not extend beyond particular and isolated ideas, however many they may be. He grants that the wonderful association mechanism which an animal develops is, even in some of the invertebrates, of a most complicated character but that it remains an association process all the same. In the case of the higher animals he finds it more difficult of application but nevertheless endeavours to explain all their mental activities in these terms.

Association of one sense impression with another thus covers the whole field of Reflex Action, Instinct, and Intelligence, and is in close correlation with physiological nerve processes. Wundt would in all probability allow that individual sets of association are acquired, and that there is some inherited facility in the nervous system for the establishment of this linkage of sense impression with sense impression, to go no further. There is no necessary and fixed co-ordination of certain nerve cells and nerve fibres, as we may suppose, in the case of Instinct, but rather that such is the nature of nerve matter that connecting links of individual acquirement are readily formed. In our own mental life we are made aware of the same process from day to day, and the readiness with

which certain actions are, so to speak, stamped in, as familiar to all. Professor Wundt also points out the constant inter-action between Association and Intellection in human life, and adds that by practice anything can be reduced to Association.

"Trains of thought" he says, "which at first involved considerable intellectual labour are completed with increasing certainty and mechanical facility the oftener they are repeated."

Upon this process then Professor Wundt holds that all the mental life of animals may be said to hang. The effects of Association do not go beyond the connection of particular ideas whether directly excited by sense impressions or only re-produced by them. Intellectual activity presupposes a demonstrable formation of concept, judgment and inference, or an activity of the constructive imagination". With all the restriction he imposes upon the study of Zoological psychology, Professor Wundt quite readily admits that animals give evidence in nearly all aspects of their mental life that it is the immediate precursor of our own.

Wundt, like the late Professor Romanes, views the matter of animal psychology from the standpoint of empirical human psychology. Romanes, however, had made many observations, although as before point-

ed out they seem to lack scientific restraint. It does not appear that Professor Wundt has specially observed the objective ~~marks~~ of the mental factor in animals. In neither case were the conclusions arrived at as the result of systematic experiment, and this renders the evidence, except on the most general grounds, of an untrustworthy nature.

Wundt rightly points out the erroneous conclusions Romanes appears to have been led to in many of the instances he quotes, in granting the power of inference to animals when the more simple law of association could explain them. But can we say that Association explains everything in animal mentality? Does not Wundt himself, in granting not only contiguity-association but similarity-association, admit a certain perception of relations, and thus the possibility of a certain attribute of mind which has been called a "practical judgment"?

In association pure and simple the connecting links are unalterably fixed as related to a series of acts and will continue to operate after a considerable lapse of time. Now Wundt, in support of his theory, relates an experience with a poodle dog of his, which it seems to me violates the very rule in support of which he quotes it.

Briefly, the poodle was in the habit of crossing a river with his master in a boat. once he was





left behind, and was compelled, much against his inclination, to swim across. Some days later the same accident happened, but, apparently objecting to swim across again, he ran up and down the bank whining, until seeing a strange boat pushing off for the opposite shore he sprang in to it and arrived dry-footed and happy. To explain this by pure association is obviously straining the meaning of the term to fit the occasion in quite an unjustifiable manner. The keynote of ordinary association in this case would be, not the getting across, but the getting into the boat with his master. The animal really seems to have left association behind, selected the essential part, getting across - with the end in view of rejoining his master; thus giving every evidence, as we shall see later, that the animal had some idea of fitting the means to the end. But if it be granted that association will explain most of the activities of animals already mentioned, it seems practically useless in accounting for some of the social instincts of the higher mammalia. Without necessarily implying the sympathy of an ideal conception, mutual aid rendered by one animal to another when wounded surely goes beyond the limits of mere association. Sympathy is shown, not because the animal regards sympathy as a virtue, but because it purposes to relieve.

In Brehm's 'Thierleben' many instances of this kind are given. The animal does not analyse its intention in the matter but it certainly directs its action to the practical end of affording relief. Nay more, the very foundations of human self control may be noted in some animals, notably in dogs, in cases such as Hobhouse relates of dogs impelled to bite under the painful dressing of a wound checking the impulse and converting it into a caress. This control of impulse is therefore not an absolute prerogative of human mentality, although in the case of the animal it does not arise from knowledge of an idea of right and wrong; nevertheless, it cannot be said to harmonise with the notion of a simple associative process.

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VI. Importance of Observation and Experiment under Controlled Conditions. - A Summary of Results.

A SUMMARY OF RESULTS.

It is only within recent years that the importance of placing psychology on the footing of an experimental Science has been thoroughly appreciated. In Zoological Psychology this is doubly needful, as in the absence of language objective evidences of mind are all that we have to go by.

Then these have to be re-translated into terms of subjective experience. Observation alone in so wide and varied a field as the psychical activities of animals afford is almost bound to lead to fallacious results, and it is only when backed up by experiment under properly controlled conditions and capable of exact repetition that a reasonable approach to accuracy can be expected. But experiment without due checking of results is equally bad, and the conclusions arrived at must be corroborated by wider observations in the same field. Then the conditions of experiment must as far as possible approximate to the natural habits of the animals, as an unnatural strain in the surroundings appears to discompose the animal with resulting abnormality of reaction. Then account must be taken of individual difference, of the level of intelligence, even in animals of the same species. This has been noted by the Peckhams in their study of the habits of wasps, and is a factor difficult to discount except by dealing with a great mass of material and so striking an average. Then non-acquaintance with the training and previous life history of the animal will introduce another discrepancy which is almost impossible to overcome unless the animal has been observed from its birth onwards. This has been done more particularly by

Small in his study of the young white rat; in the higher animals it is naturally much more difficult.

Valuable work has been done in several sections of the wide field open to investigation in Comparative Psychology, and although at the present time the objective and experimental study of mind in animals from the standpoint of Evolution is only in its infancy, the work already done by Thorndyke, Small, Lloyd Morgan, Wesley Mills, Hobhouse and others has opened up a territory of transcendent interest, in which may lie the solution of much that is at present apparently inexplicable to the Evolutionist concerning the whence of human mentality and the whither of the mentality of brutes.

The key to the mysteries of Evolution is, I maintain, hidden away in the secret recesses of mental development. Nervous tissues, we saw, were, from their earliest differentiation, of paramount importance in the modification of structure, whether it be in the mere reflex of the lowest invertebrates, or in the highly organized cerebro-spinal system of mammalia. But it is not nervous tissue in the strict physiological sense of the word that brings this about. It is its alter ego or correlative, the psychological element; whether this be

the quasi sentience of the invertebrates, the intelligence of the higher animals, or the Ideational life of man. That this mental factor, whatever it be, operates even before consciousness comes into the field I have already shown. When, in what way, and at what point consciousness first enters the arena we cannot tell, and all efforts to elucidate this can only end in a confession of failure.

Let me notice first Mr. Jennings's researches on the behaviour of paramoecium, which is perhaps one of the most typical of its class, the infusorians. Anatomically, paramoecium is readily described; it consists of a single cell, rather almond shaped, and about an eighth of a millimetre long; the entire surface of the animal is covered by waving hair-like cilia, which keep it in a state of constant activity. At its lower part there is a kind of intussusception or funnel, in which the cilia wave inwards; this serves as mouth, generative, and excretory apparatus.

Now, as I mentioned earlier in this paper, various interpretations, some of them quite intellectual in character, have been deduced from the activities of this little creature. The animal feeds upon masses of bacteria almost entirely, but how do they choose their food? "If paramoecia,



says Jennings, "are placed upon an ordinary slide, such as is used for examining objects with the microscope, together with a small bit of bacterial zooglea, and the whole covered with a cover glass, it will soon be found that all the paramoecia, which were at first scattered throughout the preparation, have gathered closely about the mass of zooglea and are feeding upon it. It will be seen that many paramoecia, which cannot on account of the crowd get near enough to the mass to touch it, are pushing closer and shoving their more fortunate brethren, all apparently trying to get as near the delicacy as possible." . . . Here we have a related problem. Similarly, he goes on to say that if we mount them without bacteria, another phenomena singularly like the behaviour of human beings occurs, i.e. the scattered paramoecium soon collect into bodies or assemblages. "It appears" says Jennings, "as if they did not enjoy being alone, and had passed the word along to gather and hold a mass-meeting in some part of the preparation." There are other indications too of the beginnings of social conditions in these interesting little creatures.

Further, the paramoecium seems to have preferences in taste. Any solution with a faintly acid

reaction being favoured by them, and anything alkaline in reaction being apparently shunned. They seem too to exercise choice of temperature. Can the complex psychology apparently thus forced upon us be explained in any other terms? Dr. Jennings proved that it can, and has shown, by a study of the structure of the animal, that the direction of the strokes of the cilia in the oral groove alone determines the ingress of food, that this is quite automatic and that no choice is exercised. There is no selection, pieces of blotting paper, sponge, cloth, and other fibrous bodies, all find their way into the gullet, so long as they are capable of passing along it. The animals collect too round these various materials just as they do in the case of their natural food, the bacterial zooglea. It is a mere organic response, arising from contact with any substance, and consists in a cessation of action of the general cilia of the body, those of the oral groove alone working.

Dr. Jennings disposes of the alleged social customs, memory, preference in taste, and other attributes of the higher mentality in one or two interesting experiments. In general the result arrived at was that a faintly acid reaction attracts the paramoecium, that carbon dioxide in particular exercised an attractive influence.

Now paramoecium itself excretes CO<sub>2</sub>, and the amount excreted was shown by chemical reaction to be appreciable. A drop of water in which paramoecium were mounted was coloured by rosol - a substance decolourized by CO<sub>2</sub>, and producing no ill effect on paramoecium. The result was instructive. Where the groups were collected the reddish tinge fades and disappears, and as the groups begin to break up the colourless area expands also. The paramoecia swim back and fore in the colourless area, which increases coincidentally with their movements. Then too, the finding of any given object and the subsequent grouping round it was found to be entirely due to the random movements of the animal - the excretion of CO<sub>2</sub>. at the same time taking effect. The attraction to certain re-agents and conditions and the repulsion from certain others is accounted for in a manner by no means exemplifying choice, as appears on the surface.

How then does a drop of attractive solution affect the animal? "Exact observation" says Mr. Jennings, "of the method by which the paramoecium enters such a drop shows that this question (of choice) is based upon a false assumption. The animals do not turn towards the drop . . . . the paramoecia may be seen in their random course to

almost graze the edge of the drop without their motion being changed in the slightest degree. They keep straight on past the drop and swim to another part of the slide . . . some of the paramoecia, in their random swimming, come directly against the edge of the drop, these do not react, but keep on undisturbed across it. But when they come to the opposite margin, where they would if unchecked pass out again into the surrounding medium, they re-act negatively - jerking back and turning again into the drop. Such an animal then swims across the drop in a new direction till it again comes to the margin, when it reacts negatively as before." Thus it is clearly seen that the animals are not, in an intelligent sense of the word, attracted by the fluid of which the drop is composed, they enter it solely by chance.

In the case of a drop of repellant solution, there is a reversal of the cilia, and swimming straight backwards, the animal at the same time revolving on its long axis in a direction opposite to that in which it was previously revolving. It then turns through an angle and moves forward again, frequently with the result of again and again striking the repellant drop. There seems to be no localization of the stimulus, what occurs is merely a result of stimulation, and that this is



the case has been shown by immersing the animal in a solution, which, as a whole, acts as a source of stimulus. Here there is no obstacle to be avoided, and therefore no especial reason for swimming backwards. The first thing paramoecium does in every case is to reverse the cilia and swim backwards, and this is so of all classes of stimuli. Dr. Jennings sums up his results as follows:-

"A strict parity is to be observed between the reactions of paramoecium and those of an isolated frog's muscle. Paramoecium responds to any stimulus by a definite, well-characterised reaction . . . Reaction in such a manner as to show a relation to the position of the stimulating agent has been rightly regarded as the first and lowest step in perception . . . This lowest step is quite lacking in paramoecium . . . . An animal that learns nothing, that exercises no choice in any respect, that is attracted by nothing and repelled by nothing, that reacts entirely without reference to the position of external objects, that has but one reaction for the most varied stimuli, can hardly be said to have made the first step in the Evolution of mind, and we are not compelled to assume consciousness or intelligence in any form to explain its activities." (a)

The nature of the activities of many other unicellular organisms may be demonstrated to be of essentially the same unvarying type as this.

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(a) H.S.Jennings. "The Psychology of a Protozoan"  
(American Journal of Psychology)  
1899.



It is a wide step from the Infusoria to the Hymenoptera, but it is in this class that the second of the series of phenomena I have already detailed is most emphatically and characteristically displayed. What the present Lord Avebury has done for the more reasonable view of the instinctive activities of ants in particular, the Peckhams have accomplished in their observations of the instincts and habits of the solitary wasp. Their's has indeed been a notable contribution to the better interpretation of the word Instinct.

Dr. Peckham's observations have proved among other things that stinging, the taking of a particular kind of food, the method of carrying prey, and of taking the prey **into its nest, are all instincts** of a well defined character; each species having its own invariable method of stinging, its own hereditary preference in regard to food, and so on.

In the case of stinging, the careful and intelligent observations of the Peckhams have shown that there is none of the "precise anatomical and physiological knowledge" of delivering the sting only in the nerve centres, that Romanes and others seem to have noted. The nerve centres are not stung with a certain uniformity of this sort, and in some cases it has been shown that paralysis and death follow even when the victim has been stung far from a nerve

centre. According to the Peckhams, the primary purpose of stinging is to prevent resistance and so prevent escape, as in the matter of food, each species has some modification of its own in the manner of stinging.

The carrying of prey to the nest is relatively uniform in method, but in getting the prey into the nest the wasps show in individual cases a considerable originality of method in attaining their end, and deal with the emergency presented by the difference in size of the victims in the most practical manner. In one of the instances given by them and quoted by Hobhouse "the wasp was holding its victim (a spider) by the under side of the body, the venter being towards the hole, and the legs being spread out stopped its entrance. A moment's tugging convinced her that this would not do, and she then turned the spider over, holding it by the back, whereupon the legs at once folded themselves across the under side of the thorax, and the spider was drawn out of sight.

Still more remarkable was the following instance of a wasp which actually seemed to compare the relative size of its hole and the spider before trying to pull the latter in. Mr. Peckham relates it thus: . . . . "presently she went to look at her nest, and seemed to be struck with the thought that

had already occurred to us - that it was decidedly too small to hold the spider. Back she went for another survey of her bulky victim, measured it with her eye without touching it, drew her conclusions, and at once returned to the nest to make it larger . . . . this seemed a remarkably intelligent use of the comparative faculty."

But if these cases of extraordinary adaptation of means to end occur, showing great plasticity of instinct, a plasticity which cannot be described as other than intelligent, the same observers relate many actions which, in the light of intelligence, seem strangely irrational. It seems as if these little creatures, so amazing in their adjustment to circumstances in some cases, yet in others are positively the victims of a blind and seemingly senseless instinct. It would appear also that any disturbance of the plan of action, predestined and pre-formed by instinct, quite threw the animals out of their reckoning.

In a more recent paper by the same observers these facts are borne out more fully by a number of typical instances presenting the same general features of interest. (a)

Starting from the assumption that Genetic Psychology has more to hope for in the study of the

(a) Peckham, Additional observations on the Instincts & habits of the solitary wasp."

development period of young animals of all species than from the adult stage, Mr. Willard Small has made some painstaking investigations on the psychic development of the white rat. (a) (Mr. Small has published a later and fuller account of his experiments in *The Journal of Psychology* in 1900, which I have not been able to refer to.)

Mr. Small kept a close and accurate diary of the life of a number of young rats, from the day of birth until the 28th day, and he gives his observations in detail.

A notable fact would seem to be that there are very few, if any, congenitally perfect instincts in rats. Indeed, were it not for maternal solicitude the young would be at a considerable disadvantage in this way. One of the first psychological activities noted was a desire for warmth, which is undoubtedly the occasion of the characteristically social habit of "huddling" in rats.

Sucking, Mr. Small found, was not congenitally perfect; the young finding the mother's teats largely by accident, even the sense of smell, which so early develops in rats, playing no part in the discovery. This rapidly improved by practice.

(a) Small. Notes on the psychic development of the young white rat. (*American Journal of Psychology*) 1899.

Small, as was to be expected, was noted at a very early stage, within three or four hours of birth. At first the reaction to pleasant and unpleasant odours, such as violet and cheese, are exactly similar; after a day or two some discrimination is shown. Indeed on the 4th day the reaction to asafoetida was rapid, and showed marked dislike. On the other hand, in four cases out of five, there seemed to be pleasurable response to the cheese odour.

Mr. Small notes three distinct stages in the rat's sense of smell; (1) Extreme sensitiveness when all olfactory stimulations are displeasurable. (2) An indifferent stage. (3) Discrimination of those odours associated with food and those not so associated. He has also elucidated an important point, that the association of certain smells with foodstuffs is not necessarily experiential, but that in the case of cheese and milk especially there seems to be a sort of instinctive selective faculty.

Dealing with the instinctive activities of rats, Mr. Small lays stress upon the fact that there are practically no perfect instincts at birth, and dwells also upon the conditioning of instinct by the development of the neural muscular system.

He gives as a tentative definition of Instinct "an organic impulse, affecting through the neural



muscular system, definite purposive motor ends." Perfect instinctive activity is this plus definiteness of movement gained by the exercise of the function. This is, in all essential respects, a part at least of the definition of Instinct I accepted at the beginning of this paper.

Mr. Small seems to see in the "huddling" of rats - already referred to as being one of their most characteristic instincts when young, as indeed it is throughout life, one of the rudiments of the social system; and this is worth remarking from the point of view of our present study.

In the matter of play, Mr. Small is not disposed to follow Professor Groos unhesitatingly, and goes so far as to suggest that many of the play activities (of rats in particular, I take it to mean) may be merely survivals or rudiments of old activities now functionless and purposeless, but persisting more especially in young life, and as not being preparatory for the serious business of life and the exercise of those organs which make more especially for survival.

In regard to affective states, Mr. Small repeats what has been often noted before, that an animal has no instinctive Fear sense. This is certainly a striking fact when applied to rats.

He points out, however, that with the functioning of the ear and eye of the young rat, the sense of fear appears in some form, quite apart apparently from any experience.

A matter especially worthy of notice is the mutual service of rat for rat by licking and picking vermin; this being perhaps a dim foreshadowing of the altruistic principle in human character.

That very prominent trait of rat character - Curiosity - is, it seems to me, rightly attributed as serving a biological end of safety, quite as much as the ends of nutrition. Mr. Small, in conclusion, points out the extremely rapid growth of a helpless organism into one able to adapt itself to surrounding conditions. A life full of motor and emotional instincts gradually evolved and perfected, possessing the inception of a social existence, and the claims of mutual assistance and forbearance.

I must pass now, omitting, for the sake of brevity, many grades of animal life and intelligence, to the conclusions arrived at from the study of the mental processes of the higher mammalia, including the primates.

This stage more especially corresponds with the third of the great classes of mental activity

I have already detailed, namely Intelligence. This field is perhaps the one which has been most fully investigated, but with conclusions as divergent as the poles. Mr. Thorndike, Professor Lloyd Morgan, Prof. Wesley Mills, and latterly Mr. Hobhouse, have all stated their views on this matter, as the results of experimental work. Perhaps a reference may be allowed to the experiments of one or two of those mentioned, and first those of Mr. Thorndike. (a)

The views of this observer in the experimental field of psychology, correspond with those of Prof. Wundt in the theoretical; i.e. he would reduce all the mental activities of animals to Association.

The experiments consisted chiefly in placing cats, dogs, and chickens, when hungry, in various types of boxes and enclosures, from which they could escape and obtain food, by the manipulation of some simple piece of mechanism, well within their physical powers, but otherwise novel to their experience - such as pulling a cord, depressing a lever etc. The animal was put in the enclosure, food was left outside, and his actions observed.

"Besides noting his general behaviour, special

(a) Thorndike. Animal Intelligence. 1898

notice was taken of how he succeeded in performing the necessary act, in case he did succeed; and a record was kept of the time that he was in the box before performing the successful pull or clawing or bite." . . . . . If on the other hand, after a certain time the animal was not successful he was taken out, but not fed; and if after a sufficient number of trials he still failed to get out, the case was recorded as one of failure. Mr. Thorndyke especially remarks the state of hunger in which the animals were kept.

Besides other advantages, Mr. Thorndyke claims for his method that no personal factor is introduced, save in observation and interpretation - surely an important enough qualification of its merits.

The apparatus in general, for the cats, consisted of a box 20 inches long, 19 inches broad, and 12 high, and a number of ingenious attachments, within the limits mentioned, were used in several cases for opening the door. At first there were vigorous and random efforts to escape by clawing and biting at everything. In the course of these movements, sooner or later, an accidental success brought about the desired result of escape, and gradually, by repetition of the act, there was a

stamping in of the successful impulse and an elimination of the unsuccessful; so that at last, by what Lloyd Morgan calls "The Trial and Error Method", a perfect association came to be established between a sense impression of the interior of the box and that particular impulse with resulting freedom and food.

Similar experiments were made with dogs in larger boxes, but do not appear to have given such satisfactory results. In discussing the question of reason or inference in the animals, in their efforts to escape, Dr. Thorndike lays great stress on the nature of the time-curve or record, which to him seems to point conclusively to the absence of inference in the minds of the various animals experimented upon. He points out that when one success had been attained, if we premised inference, the animal ought not to fail again when confronted with the same situation soon afterwards. There ought to be, he considers, if reasoning be present, a sudden descent of the time-curve, marking the instantaneous and well defined action of a rational decision. But this is not so; the gradual slope of the time curve thus shows the absence of reason. In none of the experiments was there any sign of abstraction or comparative judgment.



### Imitation.

The importance of this psychological process and its results for biological ends has been recognised by all comparative psychologists. But, according to Mr. Thorndike, the specific kind of Imitation has not been sufficiently differentiated.

In his view of animal imitation he rules out of court the imitative sounds of birds, also the imitative action of young birds in following the example of the parent bird, in which case he considers instinct and experience between them satisfy all requirements without resorting to imitation for an explanation.

Dr. Thorndike's experiments led him to the conclusion that in animals below the primates there is no such thing as imitation by "transferred association," in other words there is no reflective imitation. Indeed he seems to find small room for the imitative faculty in the higher mammalia as an aid to their intelligent acquisition of experience. In this connection experiments were made with chicks, cats, and dogs.

Referring more particularly to the experiments with cats, Dr. Thorndike's plan was as follows:-

The experiments were so arranged that Cat No.2 was able to see Cat No.1 perform the action necessary to

to enable it to escape from a box and get food. This action was repeated a number of times, the observer noting the number of times that Cat No.2 had his eyes clearly fixed upon Cat No.1, who was apparently an expert at getting out of the box. Cat No.2 was then put into the box, and the time which he took to escape, after thus having the advantage of seeing the other animal do so was duly noted. Dr. Thorndike's conclusions would show that the conduct of Cat No.2 in his efforts to escape was in no way influenced by what he had seen. There were several other experiments of the same nature, all bearing out this conclusion. In other words, the animal was unable to form an association leading to an act from having seen another perform this act in the same situation.

"Till the primates," says Dr. Thorndike, "we get practically nothing but instinct and individual acquirement through impulsive trial and error. Among the primates we also get acquisition by imitation." And Dr. Thorndike concludes that no animal can form an association leading to an act unless there is included in the association an impulse of its own which leads to the act. What Dr. Thorndike intends to convey by the use of the word "impulse" is the direct feeling of innervation which accompanies the actual performance of the action.

The same unsatisfactory results were obtained by him in putting the animal through the action. There was no learning of the process any quicker, in other words, instruction had no effect, and never succeeded in getting the animal to change its own method for his. This also showing, according to his theory, that the animal's own innervation was needed to establish the association and so facilitate the action.

Dr. Thorndike then goes on to elaborate his view of the stage of mentality implied in the associative processes of animals, as borne out by his experiments. "The groundwork of animal association", he concludes, "is not association of ideas, but association of idea, or sense-impression, with impulse." While not admitting the presence of memory of events in time and space in animals, that is, ~~aa~~ memory judgment, he gives it as his opinion that animals do have re-presentations of some sort, and consequently ideas, but that such are confined to narrow and rigorous lines.

From some further experiments, Dr. Thorndike comes to the conclusion that animals do not form similarity associations, which, he states, involve conception and generalisation.

The experiments were on the familiar lines already described, that is, the means of escape from

the box was by pulling a loop, this loop being, in two or three instances, totally different in size and appearance. The experiments, according to Dr. Thorndyke, indicated that the animal had no generic notion of the thing "loop", in other words, that the cat in the box did not discriminate between the loops to be pulled and react to the essential. The reaction, he asserts, was due to "a vague, ill-defined sense impression", utterly different from the accurately defined sensations of human discrimination. "In general" he says, "the unit of their consciousness, apart from impulse and emotion, is a whole association series. Such soil cannot grow general ideas, for the ideas, so long as they never show themselves, except for a particular practical business, will not be thought about or realised in their nature or connections."

He further states that it is only a small share of human association that can in any way be compared with animal association; that even leaving reason out of account, there are tremendous differences between man and the higher animals. The associations of man are naturally far more complex, delicate, and numerous, and the animal's method of attaining these qualities is one which man uses only in a limited part of the field.

Finally, he states that he does not believe animals have ideas of another's feelings of pain or pleasure. That such must always be an abstraction, something thought about, - not a mere sense presentation - and, as such, is outside the range of animal consciousness.

In a more recent monograph on the mental life of the monkeys, (a) Dr. Thorndike continues his investigation of the matter. Experiments were carried out on similar but rather more advanced lines, and dealt with the behaviour of the animals in learning to get into boxes containing food, the door of which could be opened by some simple mechanism, in learning to obtain food by other simple acts, and discriminating between two signals. The rapidity with which the various tricks were learnt was most pronounced in comparison with that displayed by the cats and dogs. There was frequently "a sudden acquisition by a rapid and often instantaneous abandonment of unsuccessful movements and a selection of the appropriate one, which rivals in suddenness the selection made by human beings in similar performances." So marked was this, that even Mr. Thorndike admits a natural tendency to attribute to monkeys a totally different mental function from that of cats and dogs, namely, the possession of free ideas, instead of vague sense impressions.



And while denying the national consciousness to monkeys in any form from his results, he suggests that reason is but a secondary result of the general function of having free ideas in great numbers, and allows that monkeys do seem to possess the first beginnings of such free floating ideas.

The tests for learning from tuition and imitation, the distinguishing tests for discrimination, seem to be inconclusive, although he states that there was no very marked advance in these particulars upon cats and dogs. It was in the animal's own method of learning that the great difference was emphasized.

Dr. Thorndike's conclusions briefly are - that the monkeys do represent progress in mental development towards man in their focalized vision; their more complete co-ordination of movement, and their general physical and mental activity. Whereas, their method of learning was the same, there was a notably quicker formation of association, a greater number, and those of greater complexity and greater permanence. He adds:-

"Let us not wonder that the only demonstrable intellectual advance of monkeys over the mammals in general is the change from a few narrowly confined practical associations to a multitude of all sorts, for that may turn out to be at the bottom the only demonstrable advance of man, an advance, which in connection with

a brain acting with increased delicacy and irritability, brings in its train the functions which mark off human mentality from that of all other animals."

The position of Prof. Lloyd Morgan on the debated question of the nature and status of animal mentality, as defined by him in "Animal Behaviour", seems to be in essential agreement with that adopted by Dr. Thorndike. "The method of animal intelligence" he says, "is the method of varied trial and error, with the utilization of chance success." The establishment, in fact of associations which lead to success - success in this case meaning satisfaction; he holds that there is no evidence of the problem being considered in all its relations with a view to ascertaining the essential nature of the difficulty, that there is, in other words, no reflection such as exists in the ideal scheme of reason.

Prof. Morgan quotes some experiments with dogs which appear to bear out his view of the matter to the fullest extent.

Dr. Stout, in his recent Manual of Psychology, would also seem from independent observation to have arrived at precisely the same conclusions as Dr. Thorndike. "The vast interval" he says, "which separates human achievements, so far as they depend upon human intelligence, from animal achieve-

ments, so far as they depend upon animal intelligence, is connected with the distinction between conceptional and ideational processes. Animal activities are either purely perceptual or, in so far as they involve ideas, these ideas only serve to prompt and guide an action in its actual execution . . . . on the other hand, man constructs in his head, by means of trains of ideas, schemes of action before he begins to carry them out."

With Mr. Thorndike he agrees that success is only attained in the case of animals after a great deal of tentative groping, and when attained, that it by no means follows that the same action will invariably result in success on future occasions. It may do so by vary gradual elimination of unsuccessful methods. He points out that if the first success was in any way due to inference, all subsequent trials should take a minimum time.

Even though he insists that fatuitous success explains much or all of the intelligent actions of animals, Dr. Stout admits that in human life there are many occasions on which an exactly analogous form of intelligence is in constant operation. This is undoubtedly the case. Take for instance in the game of Cricket, a bowler who has attained a certain pitch and "break" which has proved most successful from his point of view; he has attained

success by the tentative groping Dr. Stout refers to. The method of trial and error has given him a certain dexterity through practice, but he would be quite unable to teach his method by the aid of comparison. This much then is admitted by the opponents of intelligence in animals in the wider sense, that the parallel, though limited, in human life, is absolute so far as it goes.

Widely different are the conclusions arrived at by a recent investigator in the same field, Mr. L. T. Hobhouse, which, before offering any criticism, I must briefly refer to. (a)

The experiments were begun with domestic animals, but afterwards embraced a variety of animals from the Manchester Zoological collection, including ~~a~~ monkeys and elephants. The method was similar in its general features to those already mentioned; the endeavour being to find out whether an animal could learn by perception of results. In this case the animal had to obtain food by opening a box by some means, or food was placed out of reach, yet which could be obtained by pulling a string. The animal was first allowed to discover the method of obtaining food for itself. If, after a little

(a) Hobhouse. "Mind in Evolution." 1901.

while, it showed no signs of hitting on the right method, it was shown, and allowed to get the food. A new trial was then begun. As the special object of these experiments was to decide if possible that the animal learnt by perception of results, Mr. Hobhouse emphasizes the necessity of getting the animal's Attention, and this was no easy matter. To secure it, he called to his aid the method of suggestion, that is, merely pointing at the task to be undertaken, and also that of encouragement.

Mr. Hobhouse did not insist on the importance of the time factor in these experiments, and, as it seems to me, with good reason, for, as we shall see, it certainly introduces a possible fallacy into the results.

The possibility of accident bringing about a successful issue was also carefully guarded against.

One experiment consisted of putting a piece of meat on a card, to which a string was tied, and then placing it on a shelf beyond the reach of the animal, with the string dangling down.

For a considerable number of trials, a cat belonging to the observer took no notice of the string, did not in the least seem to appreciate



the result that would follow from pulling it; attention, indeed, was conspicuous by its absence. On one occasion, however, when by accident he had pulled the string down with his tail, he watched its re-adjustment, and thereupon pawed it down immediately, and thereafter seldom failed. The trick was substantially and apparently suddenly learnt after a certain event.

The dog, who was present when the kitten was being taught, saw Mr. Hobhouse pull down the string once, and next time took it between his teeth and pulled it down, after several unsatisfactory attempts, on his eighth trial he did it successfully, and never afterwards forgot. As Hobhouse points out, the first success was of quite a definite character, apparently deliberated in intent and entirely distinct from the irregular pawing and scrabbling which resorted to for several trials. This, indeed, is strongly suggestive of learning by perception of results.

Another experiment, which seemed to indicate acquirement of discrimination, was the opening of the door of a cage or box, first by pulling a lever fixed to the door and which ran out beyond the side of the cage, secondly by a loose bolt, which could be drawn out when, in a certain position of the cage, the door would open. The dog had been

in the habit of taking the end of the lever in his mouth and pulling it, with unsuccessful results of course. Hennow treated the pull bolt in the same manner and the door naturally fell open, but discrimination was slowly acquired; in the end, however, the dog was able to learn that one sort of projection had to be pulled out and the other pulled at right angles to the box.

The cat learnt this rapidly, and soon came to pull out the bolt quite scientifically. In the case of an elephant larger and stronger boxes were used, and the animal learnt the trick after four trials. At first she succeeded in pushing out the bolt and so opening the box by a random effort, but after being shown twice she had several successes, and after an interval of several days, pulled out the bolt on the first trial.

A box that had to be opened by a push-back bolt presented many difficulties to the animals; for the most part they tried to pull it out like the other bolt, and even a chimpanzee, though repeatedly shown, failed to do it correctly. Eventually, the box was left in a monkey's cage, and after two days was found open for the first time. Later Mr. Hobhouse saw the method of opening it: at the second trial he witnessed one of the monkeys attack the bolt, which was now placed with the catch down;

the animal took hold of the handle, raised it out of the catch by an up and down movement, and, continuing this, gradually worked it back. It was noticed that he kept up this up and down movement when there was no further need for it; the monkeys learnt the trick thoroughly. It was far different with the dog, who never seemed to quite grasp the difference between working the bolt back part of the way and the whole way. And when, after a few trials, he had an accidental success, it produced no effect on his after efforts.

In another case of a box closed with an ordinary window latch which could be lifted with the animal's nose, and the box opened by pulling at the catch with his paw, - this latter movement being, however, apt to close the catch again - the dog found out the process in one trial. He actually seemed to show some appreciation of correlation by selecting the catch for attack first, and then pulling the box open.

Various other experiments were made, but those with tumblers - the upsetting of the tumbler to get at the contents - do not seem so conclusive, nor were those with stoppered jars. Indeed, Mr. Hobhouse owns to the accidental success which seemed to be the only result in these cases.

In the opening of the drawers of a cabinet some interesting results were obtained, and in one or two cases showed appreciation of what had to be done. But in the discrimination of a drawer in which food was placed the failure was most marked in all cases. This the observer attributes largely to inattention.

Mr. Hobhouse considers, moreover, that the Imitation of action by the various animals rises above a sensory-motor imitation in the narrower sense.

This requires that "the animal should be influenced by the perception at the time when it perceives it." (Of course there were some results which would seem to suggest sensory-motor imitation). The experiments in general, however, showed that the performance was repeated when it was all over, and the result was attained.

To prove as far as possible the direct influence of the end to be attained upon the act, some further discrimination experiments were instituted. (Mind in Evolution, p.191.) et seq.)

These go to show that whatever force of habit and whatever feebleness and uncertainty of attention, the animals were, on the whole, aware of what they were about, and able at need to correct their errors by results. H. H.

Mr. Hobhouse gives as a reason for imputing perceptual learning to these animals, that there was in

in nearly all the experiments which succeeded a marked change of attitude at a certain point. Before this point the efforts were mostly random and directed at getting the food by the animal's natural impulsive methods. About the eighth or ninth trial it began to be quite clear that the animal was abandoning these and adopting the methods of the observer. Sometimes, indeed, the transition was quite abrupt and striking.

There were indications also, not of learning a certain movement only, but of doing it to bring about a certain external change in things. That the animal learned, not merely to respond automatically in a fixed manner, but its response was of the nature of an endeavour to effect a certain change, and so obtain food. "If this view is correct" says Hobhouse, "we have here, in an elementary form, the equivalent in action of the practical judgment or idea." While allowing this, however, Hobhouse carefully draws the line at attributing analysis to animals. "None of them showed the least understanding of the how or why of their actions, as distinct from the crude fact that to do such and such a thing produced the result they required." As already stated, the factor of accidental success in these experiments was reduced to a minimum, and any such random success



was followed by many more failures than the apparent learning by perception.

An interesting fact was elucidated in the course of these experiments, namely, that the process of learning seemed to involve great effort on the part of the animal, and that after a comparatively few trials it appeared to be exhausted. There did not seem to be any essential difference between the various animals in the rate of acquirement.

Mr. Hobhouse continued his experiments at the Manchester Zoological Gardens with monkeys, more especially with a little Rhesus monkey, whose ideas certainly seemed to show more of what Mr. Hobhouse calls "articulateness." By an articulate idea he means "one in which comparatively distinct elements are held in a comparatively distinct relation."

The monkey's ceaseless experimentation soon enabled it to apply one object to another, use different objects to obtain the same result, such as a rug or stick to get hold of a banana just out of reach. The animal had originally reached the food by squeezing his rug through the bars of the cage and using it as a means of swishing it in. The observer then used a walking stick and several other articles for the same purpose, which were then in turn placed in suitable positions within reach of the animal, and these were promptly taken advantage of for the same

end; this certainly suggesting imitation of a reflective order.

Instances of "original application" were common, and success was attained with marvellous rapidity in some cases in overcoming obstacles to a desired end. Adjustments were made, involving alterations of relations of one thing to another, to meet the purpose in hand. A stick which had been used in a vain attempt to reach a banana, having been thrown away in a fit of impatience, was afterwards pulled in by means of a second stick which had been given to the animal.

Practical judgment, Mr. Hobhouse regards as something not identical with Association of Ideas, but as intermediate between habituation on the one side and general reasoning on the other.

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## VII. Criticism and Discussion of Results.

It has been a matter of extreme difficulty, in detailing some of the experiments mentioned, to select simply such as are needed to point out and indicate the point aimed at by the observers in question, and as a result the notes made are, I fear, very imperfect. I have stated as nearly as possible, the conclusions arrived at, in my

judgment, by the various experiments mentioned, but greater detail would have been desirable to do them full justice.

From what, on the whole, may be termed satisfactory results, I think we may conclude that the foundation of Comparative Psychology, as an experimental science, has been established. Although the experiments, as a whole, undoubtedly show the tremendous obstacles to be overcome in the investigation of comparative mental processes, yet, in spite of the fact that there are many obvious and perhaps inevitable weaknesses in the methods used, the prospect of further good work seems assured.

The experiments of Mr. Thorndike, valuable though they are, seem to me to be unfortunate in the conditions under which they were carried out, and his conclusions thereby seem vitiated. He appears also to have weakened his case by the lack of that essential of Inductive method - the wider observation which accompanies experiment; and there is an air of assertive dogmatism about his conclusions which, for a study still in its infancy, seem singularly unfortunate.

But the weakness most palpable in all of his experiments - and it has been even mentioned by Prof. Morgan, who in general agrees with him - is the fatal unnaturalness of the conditions under

which the experiments were carried out. To pen cats in the limited space he allowed them, and then expect them to react normally, or in other words to do themselves justice, seems to have been a serious error of judgment. The conditions were too precise. They were too restricted altogether. And to add to their other miseries, the wretched animals were put through their operations in a state of utter hunger, upon the necessity of which Dr. Thorndike insists. To get results, quite as satisfactory at least, Mr. Hobhouse was content to experiment with his animals shortly before a meal.

Dr. Thorndike dwells upon the abnormal studies of psychology of some of his fellow scientists, but surely he could not expect a normal reaction of any sort in circumstances of semi-starvation! The reason apparently was to induce the animals to make greater efforts to obtain the food, and so the more readily escape from their prison house. But here again a fallacy creeps in; as it is well known that hunger, while being an irresistible stimulus to some animals, is reacted to almost negatively by others. Then Mr. Thorndike relies with almost absolute confidence upon the time-slope or curve, as pointed out by Mr. Hobhouse, too exclusively. There might be many reasons for delay,

such as failure of persistence, alteration in mood, or accidental failure to do the necessary actions as accurately as usual. Then the time curve certainly in some instances appears to have a more sudden drop than could altogether be accounted for by the tedious process of trial and error. Indeed, some of the examples given approximate very closely to what Mr. Hobhouse would call learning by perception of results, that is, perfection was attained after a very few trials, and then often quite suddenly.

In dealing with the important psychological factor of imitation, while admitting that among the primates we get acquisition by imitation, Dr. Thorndike refused to grant that animals of any lower order "have associations of the sort which may be acquired from other animals by imitation."

To arrive at the conclusion, Dr. Thorndike seems to me to have laboured his theory a good deal. There can be no doubt that reflective imitation is absent from all animal life below the primates, but man himself comparatively rarely moves on the lines of this higher form of imitation, and instinctive imitation of his neighbours is the commoner order of his life; so also is another form of imitation - the doing of an act from having seen it done and noting the result, both



of these forms of imitation are present in many of the higher mammalia.

Mr. Hobhouse, while not too dogmatic about the matter, appears to have come to a conclusion almost the opposite of Mr. Thorndike's, namely, that the influence of this perceptual form of imitation is very considerable in animal life. Even Dr. Stout, while agreeing in the main with Dr. Thorndike's results, admits that the essential features of imitation are present and operative at the perceptual level. Dr. Stout dwells especially on the importance of Attention in this form of imitation, and it seems to me that this factor has been too often relegated to a secondary position in these experiments.

Why Dr. Thorndike excludes instinctive imitation is difficult to understand. There is a certain tendency to a definite act; its performance in another is noted; this becomes a focus of interest and attention, and so the imitative impulse comes into operation. It may be frequently noted that chickens will actually stand in water without making any effort to drink, until the mother hen, by doing so, sets the impulse in operation. In all young life this form of instinctive imitation is constantly in evidence, and is of the utmost importance in the lives of the more social animals.

Of course Mr. Thorndike is right in saying that the chick can do without the mother's example, but it has been noted that there certainly is delay in the acquirement of the act of drinking water and picking up grain without the maternal tuition.

Then observation has shown again and again that animals deliberately, as it appears, teach their young certain physical activities which will be of after benefit, and that the young follow the mother's action; in the case of deer this has been frequently noted.

The animals of Mr. Thorndike's experiments would certainly required to have been possessed of reflective imitation to do the actions required of them. If they had no previous knowledge of the means of escape, granting even attention, the mere witnessing of the performance of the necessary action by another animal would necessitate a certain grasp of the nature of the problem, so to speak, in order to follow suit; and this of course is beyond the type of imitation I am contending for, and certainly beyond that which Dr. Thorndike is prepared to concede to the animal mind.

It is a most difficult question, but one on which hang large issues. It is to be feared, however, as Mr. Hobhouse says, that the influence of imitation cannot be finally established until com-

parative experiments on a large scale have been conducted on this point.

### Memory.

Dr. Thorndike asserts that what serves as memory in animals is really only permanence of association. When, after an interval, an animal is set to do something and does it, it is not because the animal feels the task the same as it was set some weeks before and that such and such requires to be done to free itself, but simply because on being confronted with the same situation it feels the same impulse as it had done before. But if Dr. Thorndike grants ideas to animals at all, and he does appear to do so rather grudgingly, the very existence of memory of some sort is implied in them. It is playing with words to say that permanence of association and memory are two distinct processes. The one is intimately and indissolubly bound up in the other. The association may fade from memory and become incapable of recall, but for the reinstatement of any occurrence some kind of memory - using the word in its wider meaning - is essential.

There is ample evidence that animals can reinstate past experiences, particularly such animals as elephants and dogs. Dr. Wesley Mills mentions

alcase of a greyhound who had a proclivity for chasing cats, which, encouraged by success, became strongly marked. On one occasion, when walking in a certain direction, the animal chased a cat so closely that the latter sprang up a tree for safety. A good many weeks after, Dr. Mills was approaching the same spot with his dog, but from an opposite direction; when he noted every mark of attention on the part of the animal as the scene of the chase was reached, and, to his astonishment, the dog stopped, looked, and generally behaved in a very suggestive manner opposite the very tree the cat had sought refuge in.

Of course memory in animals varies. I have not been recognised by my own collie after an absence of only a few months' duration. But some of the evidences of memory in dogs would almost seem to imply time localization, so accurate is their apparent knowledge of events. Still, however, acting on the canon laid down by Prof. Lloyd Morgan, there is no need to explain these instances as a perception of time relation on the part of the animal. An exact parallel can be furnished in the case of children, in whom, as is well known, localization in time is of a most hazy sort. So too in human memory of a desultory order, permanence of association is practically the whole factor in the case.

Of whatever sort the memory of animals may be, from what we know of their intelligence otherwise, it is likely to be of the immediately practical order, with no consideration of the event, when reinstated, in relation to other events. Human memory, as Mr. Hobhouse points out, is not an absolute thing. Memories of past events or of things learned are in all degrees of completeness.

Dr. Thorndike argues that if the animals he experimented with were possessed of memory they ought, if placed in a box after some interval, to remember exactly that by doing so and so they were able to escape from the box. But instances might be quoted in which precisely the same rule applies to human memory in certain circumstances.

Mr. Hobhouse does not elaborate any theory on animal memory, and indeed, for investigation, the whole subject is fraught with the greatest difficulty.

In discussing the social consciousness of animals, in particular their feeling for one another, Dr. Thorndike asks "Do animals when they see others feeding, feel that the others are feeling pleasure? and vice versa." And the answer that he gives is that they do not. In this conclusion he appears, quite unnecessarily, to make his standard of comparison an ideal one.



It is quite possible for an animal to know or become aware of the fact that another is feeling pain, and to show evidences of sympathy and to purpose relief, without realising the nature of the suffering or being conscious that to afford sympathy is a virtue; that is in obedience to a universal and abstract end. This is, of course, impossible in animals. Dr. Thorndike's argument would appear to be one of two extremes, either that the animals are possessed of the abstract idea of sympathy, which they are not, or that they are incapable of any. But need this be so? Is it indeed so in a great number of the actions of our fellow men? Is the relief of distress and suffering in humanity always in obedience to an ideal end? I think not. The sympathetic act merely purposes to give immediate relief, and though perhaps less explicit in animals, is precisely the same in kind. It is done for a particular instance, and not as following general principles of action. A wise statesman or king who, in obedience to a certain standard of moral law, which he conceives to be right, ameliorates the distress of a number of his people, is really an example of one of the moral virtues which Mr. Thorndike finds lacking in animals.

Although on similar lines, Mr. Hobhouse's experiments are much more illuminating. The animals were less cramped, and the observations made under conditions as natural as possible; the habits of the various animals being as little as possible interfered with. The nature of these experiments I have already referred to in some detail.

The phraseology Mr. Hobhouse makes use of is of so free a character as to make his views difficult of comparison, on certain points, with other investigators. In his use of the word "Inference" for instance, he goes far beyond its restricted meaning in human ratiocination as the result of the alternate use of inductive and deductive reasoning. He gives it a much wider class meaning. To him it expresses "a certain generic unity of function, exercised with a very different degree of articulateness", applying both to human and brute mentality. If this can be done without the risk of fallacy in the result, it will simplify greatly one of the problems of Comparative Psychology.

Mr. Hobhouse makes out a good case in support of his view of the matter, and would seem to establish, in theory at least, an ample justification.

He confronts the associationists with the following instance of the behaviour of a dog; the story

is contributed to "Animal Intelligence" by Mr. Stone. . . . . "One of them, the larger, had a bone, and when he had left it, the smaller dog went to take it; the larger one growled, and the other retired into a corner. Shortly afterwards the larger dog went out, but the other did not appear to notice this, and at any rate, did not move. A few minutes later the larger dog was heard to bark out of doors; the little dog then, without a moment's hesitation, went straight to the bone and took it." This course of action is readily explained by Prof. Lloyd Morgan, and would be no doubt by Prof. Wundt, both of whom deny any possibility of animals thinking the ergo in any form whatsoever, on the lines of pure association.

But, taking Hobhouse's broader view of Inference, is it necessary, because the animal admittedly ~~cannot~~ cannot reason the matter out in general terms, that the almost mechanical aid of association has to be sought to explain the position. May there not be, as Hobhouse suggests, a middle state of mental development, functioning as Inference, in circumstances such as the above, and really the forerunner of Inference on the higher plane?

If we grant this much, then, there need be no hesitation in allowing the presence in animal con-

consciousness of ideas resulting from concrete experience of objects, that is, re-presentation of objects in some kind. This much, as we have already seen, the Associationists allow. It is in the reproduction of ideas, in relation to a present perception, that the divergent views of the two schools become so strikingly apparent.

In Association the present perception calls up some past idea, this idea arising in a sort of mechanical sequence from the one immediately in focus. The two are held in no relation to one another, and the sequence need not even be grasped by the consciousness.

In the case of those who would grant a form of Judgment to animals at this stage, both of the factors, the recalled idea and the present perception, are present in some definite relation to one another, and this, moreover - no matter how indistinctly - is apprehended by consciousness.

Hobhouse calls this stage a "practical judgment" within the perceptual sphere, and quite a different matter from a logical judgment, which, as the apprehension of a relation expressed in words, is outside the scope of animal mentality in all its bearings.

Taking this view, what Hobhouse refers to as Inference in animals, may well be termed practical

Inference, so as to draw a wide distinction between it and the same process on the higher plane which I have already referred to.

The knowledge of relations, in the form of Judgment, which would seem to be present in some of the higher animals, may indeed be but dimly apprehended by the animal's own consciousness, but, however vague it may be, it lifts animal mentality from the plane of Association. And there are innumerable actions on the part of some of the higher animals, of which such a mental attribute would undoubtedly seem to be the the only possible explanation, and in which it is only by twisting and straining our interpretation of them, that we can apply to them the master key of the Associationists. The point of view I have taken does not, it seems to me, do any violence to the canon of interpretation of Lloyd Morgan, which I accepted at the outset of my argument, and I see no reason, at the present stage of the discussion, for withdrawing my acceptance of it.

Mr. Hobhouse rightly lays great stress on the factor of Attention in his experiments, and this is also regarded as of vital importance in perceptual learning, by Prof. Stout, who insists upon the fact of its forming an integral part of the



principle of Conation, already referred to. Perceptual activity, he considers, is marked throughout by this expectant and anticipatory attitude.

That Attention is an important element in nearly all the instinctive activities of animals, must be obvious to the most casual observer. Nay, it is upon occasion vital even to the animal's very existence. The value of this factor in the performances of animals, does not seem to have been sufficiently appreciated by Mr. Thorndike, who seems to have been too easily satisfied that the mere perception of an action ought to be sufficient to ensure its speedy learning by the animal, if the capacity for learning was upon a higher plane than the method of trial and error.

Mr. Hobhouse, to secure attention, actually called to his aid suggestion and encouragement - the latter certainly a valuable reinforcement of the animal's own efforts. He found too, in direct contradiction to Mr. Thorndike's results, that accident need play but a small part in the rapidity of perceptual acquisition; indeed, that in the instances in which accident had inadvertently crept in, were noteworthy in being less satisfactory in results than those in which it had been entirely eliminated.

Mr. Hobhouse gives as one of his reasons for imputing perceptual learning to animals, that after a certain number, generally not more than eight, random efforts to obtain the desired result, there was a certain crucial point in nearly every case at which a change in the attitude of the animal took place. The old methods were abandoned and those of the experimenter employed. The fact which he adduces, that what was acquired was rarely lost after an interval, is not in itself evidence of importance in support of his theory, as it would apply equally to the "stamping in" of successful methods in learning by trial and error.

Further, there was every indication that what an animal learnt was not mere to respond in a particular way to a particular object, but to affect a certain change in that object. There was of course an entire absence of analysis as to the why and how of these actions.

A few experiments on discrimination do not appear to have been in any way conclusive, and this point needs a great deal of careful investigation.

The experiments with monkeys were particularly fortunate in being on a field most suited to their peculiar habits. Amongst other evidences of their general mental advance upon the other animals ex-

perimented upon, may be mentioned the imitative faculty, which here, for the first time, seems to reach the Reflective level, and leave the merely instinctive form of imitation behind. Intelligence in monkeys, in respect of ideas, is certainly more clearly defined and articulate than in any others of the mammalia. That they may have the beginning of free floating ideas, even Mr. Thorndike allows, and it is the possession of a large stock of free ideas, that he considers marks that of human mentality from that of animals.

The evidence, in these experiments, of ascertain knowledge of relations, on the part of the monkeys, and in one or two cases of a sort of analogical generalization, I have already referred to. But Mr. Hobhouse's results, all through the series of experiments, are most instructive as well as entertaining, and his inductive conclusions most judiciously weighed.

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#### VIII. CONCLUSION.

In the earlier part of this paper, I endeavoured to emphasize the importance of the Psychological element in the life of man and animals

as a factor in Evolution; to show that the Biologist has too consistently ignored the part it plays in the wide scheme of Natural Selection, and to prove that it is the dominant element in the situation, morphological fitness to survive being really a result of the fitness of the mental make-up of the animal.

This Psychological factor then, is really the keynote of the situation, and as Natural Selection sweeps the gamut of Zoological life, it is by the instrumentality of this factor, that it operates in the test for survival.

Those animals which most quickly, and to the greatest advantage, profit by experience, which are able to adapt themselves most readily to a changing environment, stand the test, those which are not so able, are eliminated.

This psychological factor, we saw, expressed itself in what Dr. Stout calls the Conative attitude, and which is to be noted, in some form or another, in nearly the whole range of animal life; that in proportion as Conation is sustained and well directed, is the biological end secured.

I endeavoured to trace this tendency, or "striving towards" right back to the stage of Reflex Action, venturing to suggest that its basal element

might really be the well known irritability of protoplasm, even so low down as the nerveless unicellular organisms. It is on the level of animal mentality, however, where affective states first begin to be in evidence, that the effects of this process are first shown, and that its consonance with biological ends becomes so apparent.

The endeavour to avoid obstruction; to attain satisfaction, in the individual, is, we saw, coincident with the broader aims of Evolution in racial fitness for survival. And we noted, how, in one form or another, it might be applied to all the instinctive activities of animals, particularly those sub-serving reproduction and play.

In the wide field of the perceptual stage of animal life which has to <sup>do</sup> with immediate and practical issues, the operation of this principle of Psychological activity is naturally more in objective evidence than in any other. But, in the ascending scale of mentality, reaching to the sublimest level of the Ideational life of man, this same mental factor is of paramount importance. Here the striving is no longer after the satisfaction of an immediate need or desire; "the process of generalization brings with it generalized Conative tendencies," and the personal gratification of the



moment becomes sub-servient to the general aim of a moral standard to be realised, whether that standard be the gradual realization of a moral ideal for oneself, or part of a general scheme of human perfection. In either case the difference between the end of perceptual Conation and Ideational Conation, is that the former, either in man or in animals, is the satisfaction of an immediate and practical need, irrespective of any standard or ideal, the latter is the endeavour after an end, in which the immediate impulse is subordinated to the ideal objective. The two processes are different only in degree. In the mentality of animals, we have to deal merely with the detached chords of the same great symphony, which, in that of man, become unified into one majestic harmony.

The conscious endeavour of man towards a higher Evolution, may not be, and indeed probably is not, in consonance with the Evolution of Natural Selection: the ideal of one man may be in conflict with that of another, both of them perhaps with the highest aims in view. Beyond this we cannot go, since, surmise as we may, we are permitted no further knowledge of what is the ultimate goal of the great scheme of Evolution.

Keeping in view, therefore, this unifying principle of Conation, we may note that each of the great classes of mental phenomena, referred to at the beginning of this paper, is likewise continuous, and essentially similar, throughout the whole range of Psychology, from the lowest possessor of a differentiated nervous system to the complex organisation of man.

Reflex action may thus be traced from the lower invertebrates to man, but with a decreasing relative importance as the scale ascends and higher nerve centres are evolved, until, in man, it plays quite an insignificant part as a psychological factor, and is subordinated to the control of the higher nerve centres, and the well being of the whole body.

Instinct, we saw, must have arisen from a more highly organized nervous system than Reflex Action, one resulting in co-ordination of impulses, and having under its jurisdiction a number of reflex acts, and that in addition to this, there had begun to appear a certain emotional element. We noted that from a psychological standpoint it could equally be assigned a place in the scheme of Evolution, not a territory with well defined borders, but, nevertheless, a province in which

it rules supreme; where, as a psychical force, it is at its maximum; a region in which it merges into Reflex Action below, and one in which it is gradually supplanted by intelligence above. This latter is a notable enough fact, as it is a well known thing that in man and the higher mammalia, where the young are very largely deprived of the nursing aid of instinct, there is longer and more constant need of the maternal solicitude of an intelligent order to take its place.

The guidance of Instinct in man, although in view of the possibilities of his mental life far less important than in animals, has more sway in his everyday existence than is at first sight apparent. Instinctive imitation of those about him sums up nearly two thirds of the average man's mental life.

The traditional is the most prominent form of imitation in animal life; that is, the animal does things because its ancestors for generations have done so, and because it sees other animals do so. But the influence of similar traditional behaviour, particularly among country people, is as inexorable as fate itself, and in no wise differs from the animal form of imitation.

Instinct, in the pure sense, we saw was incapable of any modification, in individual cases, to suit

changing circumstances. We also noted that there was present in it an element of consciousness, ineffective, however, and inoperative for guidance and control.

Somewhere, in the course of mental Evolution, Intelligence on the perceptual level reaches down into the vast domain of Instinct, quickens into active life this dormant force, and puts it in the place of authority. Henceforth the realm of Instinct is one with constantly narrowing borders, and, in so far as Intelligent control increases, actions once entirely instinctive, become, in a corresponding ratio, less and less so.

It is on this level, when fully attained, - the perceptual level - involving concrete ideas of things; what, as showing a certain appreciation of relations, we agreed to call "practical judgment"; and, lastly, a certain kind of practical Inference, that we saw most of the higher mammalia moved and had their psychical being.

It is on this level too, that the method of learning called by Lloyd Morgan "Trial and Error" is to be found; but, as I pointed out, we have reason to believe that when fully attained, it involves learning by perception of results.

The evidence goes to prove that this tedious process of learning by trial and error has had its analogue in human mentality, as shown in the amazingly slow progress made by man in the long interval which elapsed between the stone and iron ages.

Then the life of many savage races of mankind may be said to be lived wholly on the perceptual level, the practical needs and pleasures of the moment alone being considered. The savage, in most cases, indeed, is a creature of impulse only; self control and deliberation, two great marks of the Ideational plane, being practically absent.

So too, children, before language has assumed its descriptive element, pass through a phase which is in all essentials similar to what is the permanent state of consciousness of one of the higher social mammalia, such as the dog. At this stage the spoken judgment has not come into being; language, to call it such, being merely the expression of emotions by isolated ejaculations or monosyllables. It is when sentences are formed, judgments uttered, and language used for explanatory purposes that the impassable, and, as human intellect on this plane advances, ever widening gulf between human and brute mentality is established.

It is outside the scope of this paper to enquire whether language of this sort is the cause



of this great barrier, or is itself merely the result of a certain stage of mental development.

One thing is certain, that it is an invaluable and indeed necessary aid, when once formed, to the upward progress of the mental factor in man.

What language does for human mentality, and how it does it, it is not my purpose to try to show here.

Putting aside then this higher form of language or predicated speech, with all its mighty possibilities, what I wish to prove is that, using language in the wider sense of any form of inter-communication, there exists a strict parity between the calls and cries of animals of social habits, which are purely instinctive in origin, and the emotional expression of the early wants of childhood. The various sounds uttered by the animal are quite as intentional and meaning as the monosyllables of the child. The dog which stands on its hind legs at the word "beg" is practically equal in mental development - to say nothing of its other advantages - to that stage of child life at which, before an undesired object is given, the monosyllable "Ta" must be uttered. The word has no meaning for the child apart from what is to follow, and the one is no more language, strictly

so called, than the other. Both cases hang upon the establishment of Association.

Having endeavoured to show the evolutionary continuity of human language with that of animals, we may note that in nearly all the psychical activities of human life, we can similarly find a connecting link between them and their representatives in animal mentality.

We have seen that imitation in animals is of precisely the same sort we find in human experience, until we reach the stage where the imitation is one of an Ideal.

The linkage between the psychical factor of sympathy in animal life and its equivalent in human emotion, I also pointed out, was a very close one. They both have their roots in the needs of a social order of life.

Then, the appreciation of the beautiful is, as experienced by the average human mind, merely a sensuous one; it is a pleasurable emotion and nothing more. There is no analysis or comparison involved. The choice of a mate by a bird - in so far as choice is exercised - can be accounted for by the superior sense-excitance caused by the plumage or strut or song, of a particular male; Is it going too far to say that the choice of the

human female, on a certain level, is based essentially on the same conditions?

Other comparisons might be made, but those I have given appear to be sufficient evidence in support of the view I have taken

I have endeavoured to show that Comparative Psychology is a practical study for the Biologist, and, that given controlled conditions of investigation, as has been pointed out, the results so far, if inadequate, are by no means unsatisfactory. They seem to prove that any observation must be made, not under restricted or artificial conditions, but, as far as possible, with the animals natural environment. They would emphasize also the necessity for observing the animal from birth upwards - although this is by no means an easy task in the case of the higher mammalia - and noting every detail of psychical development. Then the use of a large number of animals of one class, so as to establish an average mentality, and so avoid the abnormal as far as possible, is a point to be insisted on.

The results so far given, however, are rather suggestive than convincing, and much work in this field of Biology still remains to be done.

I have discussed these experiments thus briefly in outline, mainly because they seem to strengthen

the arguments I have brought forward in support of the Evolutional continuity of Mind, from its earliest beginnings in the lowest forms of animal life to its full efflorescence as seen in the mentality of man.

And lastly, I have tried above all to urge that this Psychological factor is, under Natural Selection, of paramount importance, and that it is indeed one of the very foundations upon which the mighty edifice of Evolution rests.

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