THE PSYCHOLOGY OF INSIGHT

by

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THE TREND OF INSIGHT.

A QUOTATION.

"The greatest invention of the nineteenth century was the invention of the method of invention. A new method entered into life. In order to understand our epoch, we can neglect all the details of change, such as railways, telegraphs, radios, spinning machines, synthetic dyes. We must concentrate on the method in itself; that is the real novelty, which has broken up the foundations of the old civilization. The prophecy of Francis Bacon has now been fulfilled; and man, who at times dreamt of himself as a littl little lower than the angels, has submitted to become the servant and minister of nature. It still remains to be seen whether the same actor can play both parts."

(Whitehead, A. N. Science and the Modern World. Macmillan, 1925. p. 136.)

Ligurent.

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THE PSYCHOLOGY OF INSIGHT

Chapter I

Introduction

1. Philosophical approach to the Problem of Insight.

This thesis is the study of a series of learning organisms which live, move, and have their being. Organisms are continually reaching out and looking about. Organisms grow in size and ability. This onward looking growth of organisms is interesting, not only because we who observe are likewise in the process of learning, but because the how and why of the process presents a problem which mere observation will not solve. The unsolved problem constantly presents a challenge to us to delve into it and emerge with our best effort at solution. Learning organisms do not react to everything at first. Learning is a dawn phenomena, a constant series of related adjustments, discoveries, manipulations, appropriations, distributions, radiations, and in the human being the great Philosophic goal of the finding of cold facts and warming them by reflection about them. Organisms may be graded as to the simplicity or complexity of their growth and learning.

In this learning process in the growing organism we find the appearance of two fundamental principles. Some things are like other things. Some things are unlike other things. Similarity and contrast are the two basic perceptive grasps of the organism upon environmental totality. Mathematical procedure in its primary simplicity is addition and subtraction. The lower organisms in their growth process take from their environment and add this to themselves. This process is simple,

unified living.

When organisms are equipped with the organ of sight, much of learning is a process called vision. Even in lower organisms we find various phototropic activities which could likewise be classed as adjustment to light or rudimentary vision. Vision depends upon light for its being as well as upon the possession of some organ to receive that light. Vision is a shorter cut to the goals of the organism. We look in a straight line. We see food. It looks pleasant. We try it. If it fits in our scheme of growing, we appropriate it. If it does not fit, we discard it. Life in the organism is a series of responses and choosings, with a total organization of (a) the organism; (b) the process of choosing; (c) the goal--the thing chosen, all three in the behavior pattern.

There is no such thing as utter inertness in the living organism. The blood follows its laws in carrying to their goals its food properties, each corpuscle is a living organism within an organism seeking a goal, likewise each cell. Each microcosmic organism is constantly equilibrating and filling its place in the over scheme of things. Restless, surging, equilibrium seeking, is a process always taking place both within and without the organism. We may term this process organismic, a organized relatedness in the ever readjusting pattern of the totality of things.

In this process which we call growth we find our present problem. For not only is there the biological growth of the organism, but there is another aspect of the organisms life which we may term the psychological aspect. The organism acts as well as reacts, strives and thrives

as well as falters and fails. It lives as well as exists. Action and interaction between the organism and environment are not mere mechanistic reactions to externally aroused forces, but a coalition of internally arising forces, and in the adjustment we find the learning process resulting in progress toward goals. These goals are patterns controlled by both internal and external adjustment demands. In the biological sense we call this process growth. In the psychological sense we term it the process of learning. Both terms are aspects of the same fundamental process.

When an organism comes into a new environment there is immediately thereby set up a need for readjustment, for the refitting of organism to environment. When this adjustment is advantageous to the growth and progress of the organism we say that the organism learns, acquires new knowledge, has a new grip on its environment, has mastered the newness in the situation pattern. This process is sometimes thought of as stepwise. However more truly it is a more or less constant and dynamic growth. Thus there is biological and also psychological growth or learning.

In this growth process the organism is not passive but active, cooperating in the ever changing progress of the dynamic pattern of living and learning. The relative process with regard to the biological goals of the organism we term maturation, a growth and differentation process conditioned by nourishment from within the organism, and by stimulation of the sensory receptors by patterns of environmental stimuli.

Humphrey (169) treats of the matter of the equilibration of forces in the organism. He says, "We have seen that the mechanical equilibrium

of an organism with its environment may be disturbed by either internal or external change of conditions, the conception of internal change which results in action directed towards the establishment of some end-state thus supplementing the straight stimulus-response psychology." Also in a foot note p. 504, "It will be realized that a biological system is provided with energy reserves, which, in the absence of this conservative processes, would be capable of causing reaction to be continued for a very long time. We have here, then, not a mere coming to the state of equilibrium with reference to the environment. . . . but the achievement of this end with bodily energy reserves still unexhausted and the mechanism for motion intact. To effect this, some kind of active, compensatory process is necessary, parallel with the systemic displacements of a chemical system obeying the Le Chatelier law." His conclusion is "as biological evolution progressed, organic complexes were able to respond more and more intimately to changes in the environment, until there was developed the power to make a dynamic adjustment to a highly complex four-dimensional manifold. This is the power to Learn."

Thus we see that any physical system, mechanical, chemical or electrical, may modify or be modified due to the interaction of internal and external forces. This modification, temporary or permanent, furnishes us with a parallel in the physical system comparable to insightful modification of the behavior pattern in the living organism. Gravity and heat modifications are examples in point. This is a physical relational process and makes for the resolving of the physical stresses of the organism. The controlling forces in each action of the organism are the

systematic totalities of the entire energy system in their dynamic and relational interplay in the growth of the organism.

2. The Term Insight.

The relational process with regard to the psychological goals of the organism, we term insight. Without maturation the organism remains stunted, dwarfed and dormant with no biological progress in the growth process. Without insight the organism fails to learn and lives upon a static level of existence.

Without going any further in our philosophical approach to the problem in hand, it is necessary to carefully define the term insight since it has been used in many different ways and in a number of differing senses. We must be on our guard lest we make insight a tool of a mechanistic system on the one hand, or else permit it to be used as a mystical term which is descriptive of an idea but indefinite in the sense of a measureable process.on the other. We must discard the use of the term insight as a general comprehension of a situation in a literary or conceptual sense. While this meaning of the term is usable if understood, yet it is not of use in a system which contemplates the exact measurement of the insightful behavior of the organism. Hartmann(142) mentions this view, also the use of the term to designate a personality trait. His third use of the term as configurational learning is in accord with our thesis, but needs clarification. Hartmann declares that both precision and uniformity have been lacking heretofore, which is true.

We shall throughout this discussion designate insight in the sense of Hartmann's third concept but with our own view and definition of insight more clearly defined. Concerning this definition of insight Hartmann says,

"Insight as configurational learning."

"This is now the commonest implication of the term and it is largely with its significance that we shall be concerned. One cannot be positive as to who first employed the word in connection with novel behavior, but that it is much older than Gestlat is evident from the following passage from Ruger's (435) study of puzzle solution: 'Of course there is no mechanical way for the production of insights, but the conscious attempt to get into a different attitude, to realize that there may be other possibilities and to search for them, may be affective as a stimulus.' Woodworth, who served as Ruger's main subject, had already used the term in his lectures of 1908 in contrasting human and animal modes of learning."

We wish to defer our further consideration of definition until a summary at the close of a historical consideration of the use of the term insight.

3. The Problem of Choice.

Before giving further historical usage of the term insight, we wish to note that choosing is and must be the point of departure for an experimental attack upon the problem of insight. It is in a choice situation that a problem appears, the choice to make a choice or not to do so. Whatever our theory of conation may be, we may cease to theorize and view the organism in an environmental dilemma with resulting action not upon two roads at once but in one of two or more. The cause and course of this activity presents a basic problem. We deal in this thesis primarily with the rise and course of the correct choice observed as a phenomenon of behavior, and only secondarily with any theory as to the basic causes of that rise, many of which still lie back of the observable behavior as definite, yet intangible forces. We can deal with the winds that blow though we may

not be able to discover their source in its entirety.

The wellknown and prevalent multiple choice methodology of men like Hamilton, Yerkes, Coburn, Burtt, Lumley and many others is splendid; but too complex for simple investigation such as we contemplate in this discussion and experimentation. We therefore have confined ourselves in our experimental procedure to choices in which there were but two possibilities, a correct and an incorrect choice. The possibilities of extending the present study to a multiple choice methodology remain for further investigation.

Wheeler (551) has conducted a noteworthy study of choosing in his "Study of Choosing" reviewed in "The Science of Psychology." "When two goals induce conflicting responses the resulting phenomenon is a choice. Wheeler once studied the process of choosing, from the standpoint of the introspectionist; his object was to ascertain what mental processes were involved in choosing. Certain psychologists believed and still believe that introspection abstracts from the process of choosing an elemental and unanlyzable experience which they call, by a circumlocution, a will-element. They give to this will-element such names as 'feeling of mental activity,' 'consciousness of action,' and 'consciousness of self-as-willing.' William James named it a 'fiat consciousness.' Wheeler showed, however, that these experiences might be singled out, but in any case were reducible to relatively simple sensory and imaginal processes. Accordingly, <u>will</u> as a mental process is not an element or faculty of mind; it is a configuration that can be broken down to processes of a different order. Wheeler discovered, also, that an essential feature of choosing is the making of a motor adjustment toward the alternative."

4. The Philosophy of Insight.

The Philosophy of Insight is that immense field of metaphysical implication which lies back of the problem of our research and also lies before us with alluring attractiveness. It would be impossible to enumerate and quote the many Philosophers who since Plato and Aristotle have treated of the presence or absence of abstract reasoning in animals, or of the problem of mediate and immediate knowledge, or of the relational properties of natural entities, or who like Kant have devised, a priori, various categories which direct our knowledge, or like Hegel have devised a Dialectic, a dynamic process of ideation which makes for simplicity, unity, and comprehensibility of the thinking process. The Philosophical implications of our study must remain for another research.

CHAPTER II

HISTORICAL REVIEW OF THE USE OF THE TERM INSIGHT

1. Important advocates and critics of insight.

(1) Köhler

Köhler (211), who has done more than any one else to bring the term insight into use in present day psychological discussions has called insight "the ability of an organism to obtain a goal by indirect means." At one place in his "The Mentality of Apes" (Ella Winter, Tr., p. 219) there is a note as follows, "The German word Einsicht is rendered by both 'intelligence' and 'insight' throughout this book. The lack of an adjective derived from the noun 'insight' apart from other considerations, makes this procedure necessary. (Tr. Note)". A passage which applies to our experimentation as well as giving Köhler's use of the word "insight" is found on page 266 of the same translation. "Of much greater importance is the fact that the experiments in which we tested these animals brought them into situations in which all essential conditions were actually visible, and the solution could be achieved immediately. This method of experimentation is as well adapted to the chief problem of insight as are any which can bring about the decision 'yes' or 'no;' in fact it may be the very best method possible at present, as it yields very many and very clear results." Again Köhler says, p. 267, "In the field of the experiments carried out here the insight of the chimpanzee shows itself to be principally determined by his optical apprehension of the situation; at times he even starts solving problems from a too visual point of view, and in many cases in which the chimpanzee stops acting with insight, it may have been simply that the structure of the situation was too much for his visual grasp

'relative' weakness situations. As experiments of this kind can be performed at the very tenderest age, and are certainly as scientifically valuable as the intelligence tests usually employed, it does not matter so much if they do not become immediately practicable for school and other uses. M. Wertheimer has been expressing this view for some years in his lectures; in this place, where the lack of human standards makes itself so much felt, I should like to emphasize particularly the importance and--if the anthropoids do not deceive us--the fruitfulness of further work in this direction.

Postscript.--When I finished this book, I received from Mr. R. M. Yerkes (of Harvard University) his work entitled The Mental Life of Monkeys and Apes: a Study in Ideational Behaviour (Behaviour Monographs, III, i, 1916). In this book some experiments of the type I have described are recorded. The anthropoid tested is an orang-utan, not a chimpanzee, but, as far as one can judge from the material given, the results agree with mine. Mr. Yerkes himself also thinks that insight must be attributed to the animal he tested."

"A total field would be experienced without insight if all its several states, wholes, attitudes etc. were simply given as a pattern in which none was felt directly to depend upon any other and none to determine any other." (212, p. 371-2)

(2) Yerkes

Yerkes (583) likewise makes use of the term "insight" in the following famous passages from "The Great Apes." "There are, as every intelligent observer of animals knows, various phases and modes of behavioral adaptation to internal and environmental conditions. We may not here undertake to present the subject adequately, but for our guidance in examination

of the phenomena of intelligence in the chimpanzee we shall offer a simple schema, the several sections of which designate distinguishable modes, which in actual life constitute a single, although possible irregular, course of adaptational development from the relatively simple and primitive to the obviously complex, recent, and elaborately conditioned."

Yerkes suggests five categories, each of which is characterized by one or more important varieties of adaptive process:

"(a) Repetitional modification of initial maturational response.

(b) Trial and error. This familiar expression is used to designate occurence of acts which are perceptually guided and directed toward some goal, but seemingly fail of definite and direct relation to the goal. Adaptive progress is achieved by the gradual disappearance of profitless acts and the persistence of those which yield satisfaction. Therefore, this mode of adaptation is described as lacking insight and in marked degree accidental in its outcome.

(c) Observational elimination of acts and attentional selection of certain among various possible responses. In this case there is evidence of attention to the objective and effort to attain it. The function of previous experience is much more obvious than in either (a) or (b). Yet such measure of appreciation of relations, or of other essential aspects of the situation as might suggest the term insight, is lacking. Obviously this category marks the transition from trial without insight to response with insight.

(d) Insight and direct adaptation. This is characterized by definite selection of acts which have adaptive value and either immediately or shortly yield success.

(e) Finally, in pre-adaptive response we discover what may appropriately be called foresight. In this instnace the organism gives evidence of anticipating certain events and of adjusting its behavior to them in advance.

All of these modes or phases of behavioral adjustment we may readily observe in our own lives."

"Constructive Imagination: Insight and Foresight (p. 520 f.)

Whereas in the previous section we have considered what may with entire appropriateness be described as reproductive imagination, we would now attent to evidences of constructive and creative imaginal processes. There are among our experiments none which were designed for the particular purpose of revealing insight or foresight. Instead, from our varied observations of the daily life and activities of our subject and from modes of response to scores of experiments, we have obtained the observational evidences which are now briefly to be described, characterized, and discussed. Our exposition, which will be primarily by quotation from reports, will necessarily be brief.

Insight is used throughout this report to designate varieties of experience which in us are accompaniments of sudden, effective, individually wrought adaptations to more or less distinctly new and problematic situations. For us as students of animal behavior its indications are aspects of the adaptive behavior itself, and in our work the essential thing is to observe and accurately to describe the facts, irrespective of any interest or bias we may have respecting methods of learning or types of experience in the organism under observation."

"In acts which by us are performed with insight or understanding or relations of means to ends, we are familiar with certain characteristics

which are important if not also differential. The following is a partial list of features of such behavior. It is presented here with the thought that the comparative study of behavior with insight, in different organisms, may reveal common characteristics.

(1) Survey, inspection, or persistent examination of problematic situation. (2) Hesitation, pause, attitude of concentrated attention. (3) Trial of more or less adequate mode of response. (4) In case initial mode of response proves inadequate, trial of some other mode of response, the transition from the one method to the other being sharp and often sudden. (5) Persistent or frequently recurrent attention to the objective or goal and motivation thereby. (6) Appearance of critical point at which the organism suddenly, directly, and definitely performs required adaptive act. (7) Ready repetition of adaptive response after once performed. (8) Notable ability to discover and attend to the essential aspect or relation in the problematic situation and to neglect, relatively, variations of non-essentials.

Some such list of characteristics or aspects of behavior with insight may ultimately serve as our criterion of such behavior, in the absence of definite and adequate knowledge of psycho-neurological events and their relations. It is unquestionably desirable that we continue to add to our list such observed features as regularly appear in human ideational behavior; and it is even more important that we make it our business to find out whether these characteristics are peculiar to ideational forms of response or appear also in other sorts of behavior. Without worrying unduly about objectivism or subjectivism, introspection, or other modes of observation, we may proceed with an unprejudiced study of the facts of behavior, profiting as much as may be from observation

of our own experience and its varieties of expression, and following carefully, critically, persistently, the course of adaptive process in our animal subjects by means and methods which, as above suggested, should be relatively independent of the observer's limitations.

I hold no brief for ideation, insight, understanding, or any other variety or assemblage of experiences in my subject Congo, but I consider it a part of my descriptive task to state in direct, simple, and intelligible manner, what happened in the experiments. The observations have confirmed my suspicion that the conventional formula for habit-formation is incomplete, and the process of 'trial and error' wholly inadequate as an account of anthropoid adaptations."

Yerkes and Learned (581) use the term insight as explanatory of behavior. "Thus with surprising suddenness appeared the perfect solution of the box stacking test. Subsequent opportunities to meet the situation adequately resulted merely in the perfecting of method. It is needless to describe the process. Chim had gained the necessary insight for the solution of the problem. That insight came not by suggestion from the experimenter, as in the case of Julius, the young orang-utan, but through observation, apparently supplemented by reflection.

The suddenness of Chim's success in the box stacking experiment suggests the orang-utan's solution of a multiple choice problem. The animal, after many days of effort which seemingly brought the solution no nearer, suddenly achieved success. Seemingly the problem was solved over-night. The only reasonable explanation of such sudden and radical change in behavior is insight. Köhler has described similar behavior in adolescent chimpanzees. It was, however, farthest from my expectation that Chim, scarcely beyond his infancy, would stack boxes without

suggestion or tuition."

"Once more it must be emphasized that these so-called tests of insight are merely formal examples of situations which supply opportunity for adaptation. The test situations which accidentally or unintentionally appeared during the several months of my study of the young chimpanzees are too numerous to enumerate, still less to describe.

(3) Garrett

Garrett (117) has treated the term "insight" in the comment upon Thorndike, Köhler and Koffka as follows:

"Thorndike's animal experiments."

"Another line of evidence cited by Thorndike as opposed to the thesis that animals think or reason is the fact that there is no sudden drops in the learning curves of his cats, dogs and monkeys. Sudden drops usually indicate that the learner has got the trick--seen the connections or relations--and henceforth might be expected to do it correctly whenever the situation presents itself. Instead of this sudden insight, what we usually find is a gradual sloughing-off of excess and useless movements with no clear evidence that the animal observed just how he got out or made use of this observation in future trials.

Thorndike's view that animals learn almost entirely by trial and error and have little insight into the problem at hand has recently been attacked by the German psychologist, Koffka (1924), who belongs to the school of Gestalt psychology. Köhler (1925), another member of the Gestalt school, in his studies of learning in the chimpanzee found many instances of quick learning which, he says, indicate that the ape suddenly grasped the relations involved in the problem.

According to Thorndike, such quick learning (which presumable involves insight) is to be expected only when the task is 'very simple, very obvious and very clearly defined;' whenever the problem is at all complex, the animal's behavior, he thinks, may be fairly described as 'stupid.' In Koffka's view on the contrary, the animal exhibits insight or intelligence whenever it is possible for it to grasp the problem; 'Stupid errors,' he says, 'occur when the task seems simple to us, but is almost surely not at all simple to the cat or chick.' Koffka argues further that Thorndike's puzzle boxes set before the animals tasks so difficult (for the animal) that trial-and-error learning was the only kind possible. Despite the difficulty involved in these tasks, Koffka points out instances in Thorndike's own data of sudden vertical drops in the learning curve which, he thinks, indicate insight into the problem.

Koffka's argument for intelligent learning in animals cannot be reproduced in brief space and should be read entire by the student. (The Growth of the Mind. 1924, pp. 163-174) It is an exceedingly keen and searching criticism of the mechanistic view which holds that animals always learn stupidly in a hit-or-miss fashion without any real comprehension of the situation or of the relations involved.

If it seems probable that Thorndike overemphasized the aimlessness of animal learning, partly, no doubt, as a result of his particular set-up, it is certainly just as probably that the insight shown by Köhler's apes is also the result of the kind of problem set. Köhler's chimpanzees were assigned very different tasks from those required of Thorndike's monkeys and cats, and for this reason the two sets of results are not directly comparable. For one thing, the chimpanzees were

given much freedom, while Thorndike's animals were nearly always confined. Examples of the kind of tasks set the chimpanzees are (1) securing a banana suspended from the ceiling of the cage by piling up boxes one on another, (2) reaching for and pulling into the cage a banana placed outside by ingeniously hooking together two sticks. Many other tasks involving ropes, sticks, and the piling up of boxes were set before the monkeys. In such situations sudden learning might very well take place, if the animals are intelligent to begin with (as Köhler's chimpanzees undoubtedly were) and if the task is not too different from the kind of thing which the animals habitually do. As Sandiford (1928) has pointed out, too, all of the learning is not shown in the fluctuations of the learning curve. A sudden drop in the curve may be preceded by a long trial-and-error process which is not represented, as when a man suddenly 'sees the point' after a long, tedious and bungling effort at solution. The chimpanzee who suddenly does a trick which he could not do before has not necessarily seen through it in a sudden burst of comprehension. Many tentative trials and errors not shown in the learning curve nor seen by the experimenter may precede the solution."

(4) Boring

In his "History of Experimental Psychology", Boring (33) has the following to say: "Thorndike's importance at the beginning of the new movement resulted not only from his initiation of the laboratory experiment upon mammals, but also from the challenging nature of his negative conclusions. The anthropomorphism of Romanes had been checked by Morgan and Loeb. Morgan, however, had only counseled parsimony without prescribing a positive method. Loeb had not disproved consciousness, but

had proposed to get along without it wherever possible. He did not touch the problem of the higher vertebrates. Common sense is seldom consistent. It could agree with Descartes that animals have no souls and yet ascribe human intelligence to a pet dog. Thus Thorndike's conclusions were shocking. They also brought out the criticism that the situations of the laboratory are artificial and not therefore tests of normal intelligence--a criticism that we can afford to ignore. However, they stimulated a great deal of research. In 1902 A. J. Kinnaman found some evidence for imitation in monkeys, and in 1907 L. F. Cole appeared to demonstrate imitation in raccoons. Nevertheless, the question as to whether the mental life of animals is a matter of mere mechanical, imageless association was mooted for two decades, with opinion inclined to favor the belief in mental hiatus between man and all other animal forms. Only recently has research on the anthropoid apes by Köhler and by Yerkes tended to swing the pendulum in the other direction, to indicate that the apes at least may learn suddenly by 'insight' and to eliminate the missing link in the mental series."

"For instance, Köhler, freed from conventions , was able to introduce the new term <u>insight</u> in the explanation of the intelligent behavior of the apes, a term that has since been adopted by many psychologists both within and without the school of Gestalt.

(5) Murphy

Murphy (279), another historical reviewer, treats of insight as revealed in the experiment of Ruger. He says, "Importance must be attached to the experiments of Ruger (1910), who offered partial confirmation of the trial-and-error theory of thinking, and made extensive use of the German and American studies of 'attitudes' mentioned

in the last chapter. He studied the process of solving mechanical puzzles, in which the subject had to disentangle and remove some part through a complex series of manual movements. In this process it was usually necessary for the subject to go through random movements or trial-and-error activity similar to that shown by Thorndike's cats. Ruger found in his twenty-five subjects much of this random exploratory behavior--in fact, such an extraordinary amount of it that a large proportion of the first solutions were genuinely accidental. Further, the subjects' reports showed that, in addition to such overt behavior, much trial-and-error activity was going on mentally. But he found that there was frequently a sudden and permanent drop in learning-curve, corresponding to a successful lead which the subject grasped clearly and continued to utilize. Such sudden drops were often due to his noticing the locus of a difficulty. In other cases the drops corresponded to much more complex instances of analysis of the nature of the problem. Ruger had, then, obtained experimental evidence, even in a very complex intellectual process, of a thorough-going similarity between reasoning and ordinary 'blind' learning, as found even in the behavior of very lowly animals.

Ruger was really more interested in those complex mental states where the process of 'analysis' occurred, that is, recognition of similarities and differences, observation of the relation between movements hitherto disconnected, and the like. The effectiveness of analysis was found to depend largely on the subject's attitude. The conception of attitudes, while specifically borrowed from Wurzberg experimentalists, was not, as with them, that of a new kind of structure, but that of a way of facing the situation. Among the attitudes discovered,

by far the most effective was the problem attitude, in which the subject forgot his self-consciousness and the desire to make a good showing, and became interested in the problem itself. The problem attitude was the one most favourable to the emergence of sudden and useful insights. Even here, however, Ruger's data showed that such insights were apt to come clearly in consequence of similarities between the new task and a previous task successfully mastered. In other words, they were transfers from situations which resembled the one in which the subject was now working. Sudden insight, far from overthrowing the trial-and-error conception, seemed at least in a large proportion of cases, to arise from the reappearance of a response-tendency which in a previous situation had given successful results. There were, to be sure, some cases in which it was very hard to see what in the past experience caused the particular flash of sudden insight to occur, and agnosticism and suspended judgment are still in order; but at least much of the mysteriousness of thought was dispelled."

"No less important for behaviourism has been the consistent exclusion of the concept of 'ideational' behavior and of the claim that animals and men are capable of sudden 'insight' into situations in terms other than those of previous learning and the operation of trial-and-error. An emphasis on the genetic method leads the behaviourist always to inquire regarding the organism's previous conditioning. Imitation itself is regarded not as the perception of the utility of duplicating an observed act, but as a type of behaviour which appears only as motor mechanisms have been practiced, ineffective acts having been rejected and effective ones gradually selected. As the sparrow gradually learns to approximate the song of the canaries with which he

he is caged, but can, after such learning, copy a trill with sudden and dramatic success, so all imitative conduct is based on the previous mastery of the necessary elements."

"The Gestalt school has, however, proceeded far beyond these premises. It has attempted to show that learning is no more trial-and-error process, but conforms to definite Gestalten; that 'imitation' and 'insight' are forms of perceptual activity which grasp situations in other terms than those imposed by the blind elimination of false starts. Judgment and reasoning, again, have their Gestalten. Thought can never really be 'analysed,' though its patterns can be grasped.

It appeared clear from Thorndike's curves that sudden insight into the nature of the task was rare or indeed entirely absent. There was no sudden and permanent drop in the curve indicating that the cat had 'solved' the problem. The cat started with random movements, which were gradually eliminated as practice went on; the time taken to strike the latch necessarily decreased. Thorndike saw (as Spenser and Bain) the importance of such 'random' movements in leading to the discovery of the 'right' movement; for this kind of behavior the term 'trial-and-error' was soon in general use. Even in the monkey, learning was of this general type; Thorndike found no clear cases even of the process of 'imitation'."

(6) Weld (545 a)

Weld (p.196) mentions various types of behavior of animals in novel situations. "The purpose of one type (1) is to determine whether in is possible for an animal to inhibit an instinctive tendency." "Another type (2) is called the 'puzzle-box method'." "A third type of the experiment is (3) the labyrinth or maze method." "Still another type

(4) may be called the 'insight method' or intelligence test (Intelligenz prüfung). This experiment was early employed by Lubbock with ants, and by Hobhouse with monkeys, but it was first systematically used by Köhler in his work with chickens and chimpanzees. The experiment consists in placing in the animal's environment, a natural obstacle such as it might meet under ordinary living conditions. The object is to devise a problem that the animal may be expected to 'understand', to create a situation which the animal must grasp if it is to be surmounted. Köhler, for example, placed food on the ground at a point where the ape could not reach it from its cage. Sticks which the animal already knows how to use, are in the cage. The test now is: will the ape employ the stick to rake in the food? Again, food was suspended from the top of the cage beyond the ape's unaided reach; but boxes were provided which the ape might use to climb upon and thus reach the food. In experiments of this kind the problems set may range in difficulty but they must, of course, be adapted to the powers of the individual."

(7) Bentley

Bentley (14) in "The Field of Psychology" says of thinking, "In the first place, thinking brings us new knowledge, i.e., knowledge of a new order, significant relations and hidden resemblances--in a word, knowledge which is INSIGHT." (p. 380)

He mentions insight, foresight, which together lead to valuation, and finally training so that in simple tasks the solution of one problem helps in the solution of another.

(8) Lindworsky

Lindworsky (246) in his "Experimental Psychology" makes an interesting though brief comment upon insight, p. 393. "The production of

a purely subjectively conditioned image is, therefore, something different from suggestion. The former is possible in principle even in an animal; the latter is not. Suggestion always assumes an insight: first because it conveys to the subject a material relation; secondly, because it leads to conviction which is not wholly without foundation." We might voice Lindworsky's view in the following terms, insight is a discerned relationship together with an appropriate mode of action or behavior.

(9) Helson

Helson (146) on insight in "Psychology of Gestalt" says: "It is probable that in voluntary activities, as distinct from non-voluntary, phenomenal fields undergo transformation, so that insight or understanding governs the part-activities in the light of the total pattern or situation." (p. 45)

"Even as able and careful a thinker as Bühler (I omit here the speculations of Jaensch, Lindworsky and others) is really forced to speculate more about the mental processes and memory capacity of the ape than Köhler does in his doctrine of 'insight.' Bühler hopes, by means of traditional associationistic-sensationalistic assumptions, to show that the ape possesses no structure-function reactions. Let us see what Bühler offers in place of Köhler's description: the ape is able 'to feel itself towards the end-situation of attaining its goal, which is not difficult to explain theoretically as a memorial after-effect of successful pursuits of a goal in the past.' Moreover the animal is able to 'note' material relations in the problems he is called upon to solve, just as he notes sensory contents (see Koffka 205-230 for acute criticism). Both Koffka and Köhler have re-

peatedly emphasized the fact that to note relations and to perceive a configuration are two entirely separate affairs, involving different phenomenal fields and structure-functions, probably in the case of the relation perceiving attitudes, very much more complicated perceptual patterns." (p. 47)

"Insight depends upon the ability to break up existing configurational structures and to make fruitful transpositions from one configuration to another." (p. 55)

"Insight demands analysis as well as synthesis. There are different kinds of analyses and part-activities which cannot be discussed here." (p. 211)

"Creative insight depends as much upon breaking up configurations as in their preservation." (p. 212)

Helson (147) in his article on Insight in the White Rat has the following to say: "The experiments described in this article were designed to test the learning theories of Thorndike and Watson and at the same time to discover if the white rat, like the ape, shows any evidence of what Köhler has called 'insight.' Specifically, we shall try to answer the following questions: (1) can the rat learn to respond to a visual structure; (2) is the rat's response conditioned by or to the element connected with the food or other goal, or does the rat carry away something general from a specific learning problem and what is it; does the rat show 'insight' or is its learning merely a matter of conditioning part-responses by chance, pleasure or what not, to form a total response which is adequate to the situation: By 'visual structure' we mean any pattern of stimuli which can be observed by anybody and can be named in such a way as to be communicable to others.

'Insight' may be defined in a number of ways and may be tested through a number of criteria, such as ability to respond to a part in the light of the whole, modification of activities to meet the exigencies of a situation in a manner we may call sensible, or the transposition of the general properties from one situation to another; but in no case do we mean by insight any mental process, a peculiar vitalistic entelechy or anything not objectively observable." (p. 380)

Also his concluding statement follows: "Wertheimer and Köhler have laid the foundations for a physiological theory designed to account for configurational responses and insight without the assumption of sensations, images, or even activities previously utilized. Stated briefly, we assume that physiological processes must be regarded as total, structured events whose properties are determined by the field properties of the stimulus-pattern. Reflex is not added to reflex through frequent repetition, but rather the specific form of an environing situation determines the form of the response and thus the part-activities. Instead then of saying that a memory image of the wires and food actuated the rat to modify its behavior in a sensible manner (a possible explanation but hardly verifiable since we cannot control memory images) we prefer to say that the food at the end of the path modifies the character of the approach, investing it with an entirely different significance so that given a structure in which each part influences every other, the presence of one part elicits a response appropriate to the whole. The initial, transitional and final (or consummatory) responses form part of a single, dynamic act adequate in parte et in toto to the problem confronting the animal. While we realize that such a description does not constitute a complete explanation, it does raise a host of interesting

problems that may prove fruitful in future animal experimentaion. Subsidiary hypotheses like our principle of least energy follow from a configurational view of the stimulus-situation and the resulting responses and suggest definite experimental problems in settings which may give us more information about the nature of intelligence, the mechanisms of learning, and the limits of ability.

Conclusions

From the conditions and results of our experiments we feel justified in concluding that:

(1) The rat can and does react to a purely visual structure;

(2) Transfer of training takes place in accordance with structure-function principles and not in accordance with the theories of identical elements, recency, frequency and vividness;

(3) When the conditions of chance obtain, no learning takes place;

(4) Insight, as we have defined it, appears in the behavior of the white rat and cannot be explained away by any theory which begins with the assumption of unit activities meaningless in themselves and joined together without significance;

(5) A proper approach to the problems of animal psychology can be made by means of useful hypotheses which do not do violence to the facts and yet are suggestive of further work and capable of observation, verification and measurement." (p. 394-96)

(10) Washburn

Miss Washburn of Vassar in "The Animal Mind" treats of the subject of insight as follows: "The German psychologist Köhler is one of the leaders of the 'configurationist' school, which insists that in all conscious experience the important thing is the total situation. In

accordance with this view, instead of saying that first one stimulus and then another one is reacted to, we should say that reaction is made first to the total situation with one part of it emphasized, and then to the total situation with another part emphasized: it is thus the pattern that has changed. From this point of view Köhler has been interested in the solution of problems by animals, especially their solution not by accident but by what he calls insight. The external marks of difference between a solution by accident and one by insight are (a) that the achievement by insight forms one single continuous occurrence, while 'a successful chance solution consists of an agglomeration of separate movements'; and (b) that the moment when a solution by insight occurs in the animal's mind is often marked 'by a kind of jerk,' a sudden pause followed by a complete change of behavior. Thus, to amplify (a), if several successive acts are necessary to attain food, by accidental solution Köhler would mean that each act is independently learned by a chance success, and connected with the next act by mere external association. As we shall presently see, it may well be doubted if such a type of learning occurs in any animal: even where the requisite movements are accidentally discovered, they are from the beginning unified by the presence of the drive or motive to solution. Many cases of learning by insight are described by Köhler, especially in the chimpanzees he observed at Teneriffe. They comprise instances where a roundabout path suddenly taken by an animal which can reach its objective in no other way; where objects such as sticks or blankets are used to draw in the otherwise unattainable banana, or boxes piled one on another to reach it; where obstacles in the path to the objective are suddenly removed by the

animal, and where tools are constructed, the parts of a jointed rod being fitted together. Similar behavior in anthropoid apes is described by Yerkes.

It seems plausible to describe the change which occurs in an animal's conscious state when such a flash of insight, such a sudden solution of his problem, takes place, as an alteration in its total pattern: certain objects which were formerly in the background now stand out against the background. The ape's consciousness at one moment is dominated by the unattainable banana; at the next moment the stick lying on the ground assumes prominence along with the banana. But it seems equally true that insight requires in many cases the memory idea, and in many others at least that incipient revival of movements which we have regarded as the basis of a memory idea. Take a very simple case of insight: a dog tries to get the food on the other side of the bars, and then suddenly turns through 180 degrees and runs around a corner, reaching the food by an indirect path. He would not act in this way unless he suddenly remembered, either that a roundabout path existed in this particular case, or at least that on former occasions roundabout paths had led to goals. His first discovery of this fact would of course have been accidental. The infant ape may very likely have learned by accident that objects can be reached by poking sticks at them: his sudden insight in the present situation would involve recalling such experiences, not necessarily of course in complete detail as memory images. Lindworsky and Bühler suggest that the association of fruit and branches must be frequent in the natural life of arboreal animals, and Buytendijk explains the failure of his monkey to draw in food by means of a stick, through the fact that monkeys are light enough to run out to

the end of branches and get food, while apes have to haul the branches in. Köhler objects to Bühler's memory-idea theory, pointing out that a wild ape would get food by pulling in branches or breaking them off, whereas his apes used the stick to draw in the food. This objection will hold against the supposition that recall of momory ideas is the sole and sufficient explanation of 'insight': we are here merely pointing out that such recall, more or less (often less) definite and detailed, is involved in insight. Köhler himself mentions several cases where obvious use is made of a memory idea; as for example when the chimpanzee Sultan, after vainly trying to get a tool that would reach a suspended bit of food, 'quite abruptly and without visible external cause' ceased his efforts, 'remained for a moment motionless, sprang to the ground,' ran around a corner and returned with a box which he had previously seen in the position where he now sought it, and upon which he now proceeded to climb for the food. In most of the cases of insight, however, the solution occurs not by introducing an object absent at the outset, but by the emergence into the 'focus of attention' of an object already present but disregarded. Our theory would suggest that this emergence happens because the sight of the relevant objects sets off slight recurrences of the movements by which in past experience they have been reacted to; that is, slight anticipatory movements such as would, if the objects were not present, revive memory ideas of them." (p. 308-310)

(11) Ruger

Concerning Ruger's (435) "The Psychology of Efficiency," it was the starting point for many of the ideas which we have tried to work out in this study and still remains a classic. We have already given a review of Ruger's study of the process of solving mechanical puzzles. We cannot

understand why Boring should make no mention of Ruger. Any review of the course of experimental psychology will be incomplete without mention of this crucial work. Ruger used thirty seven varieties of puzzles and twenty seven subjects. It is not our purpose to criticize his work. It stands for itself. However the puzzle material chosen made it difficult to analyze step by step the progress of solution and there was difficulty in narrowing down the path choices. We believe our methodology is much superior.

(12) Koffka

Koffka's (206) comments concerning the use of the term insight are numerous and cogent. He refers to the term no fewer than thirty-seven times. His references are so many and scattered throughout seventy-seven pages of his "Growth of the Mind" that we shall briefly summarize here and refer the reader to the text. Koffka devotes five pages to a consideration of Ruger's experiment and concludes: "It has been shown that improvement in efficiency goes hand in hand with an increased insight into the nature of the task. We use this word insight without theoretical presuppositions in the common sense in which everyone takes it. If one knows that he is to remove a ring in a certain puzzle, and that in order to do so he must first move this piece and then that, turn the puzzle over and do something else, his procedure will be said to possess a greater degree of insight then the procedure of another person who simply goes ahead without any plan at all."

Koffka attributes chance discovery to the nature of Ruger's puzzles. He treats of the fitting of the problem to the status of the subject, and says concerning Köhler's apes, "The criterion of insight is found in the animals capacity to select the indirect way unaided." (p. 181)

On page 182, he notes "In the case of a child one can often notice the very moment when the right solution first dawns upon him by the way in which his face lights up." On page 195, Koffka uses the phrase, "We have described this experiment in full because it furnishes some insight into the stage which intervenes between perplexity and a complete solution." Koffka treats of Bühler's (46) criticism of insight when he says, "According to Bühler one must differentiate a true discovery from a discovery by chance, which only indicates the blind activity of an associative mechanism without insight." We note here the implication of Bühler's bias. Koffka disposes of Bühler's criticism by saying (p. 210), "It seems to me that Bühler has confused the issue by approaching it with a fixed definition of insight which presupposes a judgment involving experiences of certainty and assurance."

Koffka's criticism might be summed up in his statement, "I must confess I can find no logical fallacy in Köhler's procedure. What we have to determine is whether an observed behaviour shows insight or not; but the criterion by which this decision is reached must not itself include the concept of insight."

(13) Alpert

Alpert's (7) most excellent study of the behavior of the pre-school child is vital to this study. Alpert used forty-four children ranging in age from 19 to 49 months. Also a comparison was made of results with those of Köhler whose method was followed. The conclusions 3-7 apply to insight.

"31 No matter what the type of response, it culminates in a solution only if the subject has gained insight into the problem-situation. This, again, is equally true of both types of subjects.

4. Though chance may aid the arousal of insight by throwing the elements of a situation into a suggestive constellation, no solution was found to directly caused by chance.

5. It is also highly probable that insight is not always complete and stable before the solution, that is, that there are varying degrees of insight accompanying a solution; but no solution was found wholly unaccompanied by insight. There is no direct evidence that the first part of this conclusion applies to apes.

6. Transfer and retention seem to be indices not only of the presence of insight but also of the degree to which it is present. This needs to be further tested by an investigation specifically designed for the purpose.

7. The arousal of insight and its consummation in a practical solution are favored by emotional, temperamental, and mental factors--those which in effect constitute the total personality. This is true in a far lesser degree of apes, probably because of their lower level of development." Ref. also (552, p. 114-145)

(14) Hunter

Hunter (177) reverting to the habit concept rejects insight. He claims (p. 577), "It is impossible to do more than philosophize when dealing with such definitions of insight (Köhler's and Yerkes'). The only practical and scientific problem is this: Are there types of behavior or characteristics of behavior so different from those present in the formation and use of habit in general that we are justified in speaking of insightful behavior?

Insight is described by Köhler as a form of response which appears suddenly and runs its course smoothly from the beginning until the

attainment of the goal, under conditions where all of the essential aspects of the problem can be viewed at one time by the subject. We have already rejected this last characteristic because it seeks to confine the alleged phenomenon to visually controlled behavior. The 'smooth, continuous' aspect of behavior is characteristic of all well-established habits, including the maze habit, and so cannot serve to mark off one habit from another. (Köhler did not know the past history of his apes, and so could not know to what extent the 'solutions' were merely reinstated habits.) This leaves us with the possibility that behavior which appears suddenly is insight. We shall discuss this after noting the characteristics proposed by Yerkes.

Hunter then proceeds to dispose of all need for insight in Yerkes' report by claiming the impossibility of "straight-forward experimental attack upon the determining conditions of behavior from which alone an adequate solution can be derived. All learning is essentially of a kind, the modification of behavior as a result of repeated stimulation under specified conditions. Some learning periods may be shorter than others, or may result in a higher degree of efficiency than others, or may involve verbal guidance, but there is no adequate reason for believing in two kinds of learning."

Until Hunter concedes that an organism is capable of executing a brand new type of behavior in the discovery of new goals and procedure thereto, not from habitual but from insightful patterns of action, we must agree to disagree and let the matter remain there. Our experimental attack, we believe to be a "straight-forward experimental attack" which was his point of criticism in the methods of Köhler and Yerkes.

(15) Hartmann

Hartmann's (143) concept and criteria of insight is at least timely as well as apropos to our study. His criticism that "current investigations and analyses of insight suffer from lack of clear-cut conceptions and definite criteria for recognizing the experience" is in line with our own conclusions. Hartmann declares that "The term insight appears to have had greater descriptive potency than the tradition burdened phrase 'ideational behavior', since Yerkes and his pupils have all but abandoned the latter designation for the former."

Hartmann then gives the lists of criteria as given by Yerkes. His own list follows:

"As a whole, I believe the following criteria are pertinent to definition of insight:

1. Experience. A problem situation in which the crucial experience must be acquired with the solution probably provides most favorable controls for investigating evidences of insight.

2. Versatility.

General inspection.

Abrupt changes.

Sudden initiation. In addition to abrupt changes in exploratory behavior, there are moments or periods when the behavior appears inspired. This is commonly indicated by marked change in facial expression, particularly the lips and sometimes by a squeal or sharp cry.

Correction of errors.

3. Consistent orientation.

4. Anticipatory responses.

5. Representative behavior.

Subordination of the final step until a preceding stage is reached.

Abandonment of readiest means that is blocked and pursuance of a roundabout course that is open.

6. Sudden change in the time curve.

Drop occasioned and followed by methodical and consistent performance.

Rise occasioned by exploratory interruptions of consistent procedures.

7. Selection of goals.

8. Fluent solutions."

He concludes with a list of questions showing the need of a more definite methology and terminology in the use of insight. His statement, "We are now in the curious position where objectively more is known about insight in animals than in man. To be sure the implication is that the characteristics hold for both, but that is an assumption which must first be demonstrated. Our greatest present need is knowledge about the operation of insight in the human, the absence of which constitutes an effective check to progress in the animal field."

We would remark, hence the need for experimentation such as ours upon insightful behavior.

(16) Tolman

Tolman (502, p. 447) gives as a definition in his glossary of insight learning, the phrase "inventive ideation." He calls "insight"(p.197 f) a certain other much-mooted concept. He states that Köhler calls insight an "experienced determination" between two or more items in one and the

same phenomenal field. Tolman thinks insight is only indirectly related to what he calls the concept of means-end-capacity. Attributing to Köhler the implication that apes have insight insofar as they can actually and successfully solve problems involving differentiations and round-about-nesses (502, p. 199), he concludes that insight in this sense is no more than the capacity behind certain types of action which makes them successful. The use of the term capacity here is the doubtful quantity in the criticism. With regard to the common use of the term insight in contrast to the trial and error, blind, method of learning, Tolman thinks that Thorndike himself would be uncertain as to whether human beings were possessed of any true insight as measured by an abrupt drop in the learning curve. The difficulty is that the term has not been clearly defined. Tolman finally sets off insight learning from trial and error only by virtue of (a) its "conscious or ideational" character and by virtue of (b) its "new or inventive character. In his chapter on inventive ideation, Tolman treats of the creative side of ideation and concludes: "Take two organisms who are by hypothesis alike as far as their ultimate abilities for understanding go, and yet one of them will hit upon the new expectations and correlated readinesses much sooner then the other. For the one has more 'creative-ability' than the other." Tolman here refers to the behavior which we designate as insightful. His hyphenations and new verbiage in attempting to classify the subjects treated would predispose him to be wary of the term insight. Much splendid material has been gleaned from the pages of his recent book, "Purposive Behavior in Animals and Men."

Hartmann's (142) summary and criticism of Tolman's new point is

well stated, "A slightly different version is discernible in Tolman's account. Unlike Yerkes, he does not distinguish between insight and foresight, and as may be suspected from his purposive approach, tends to find a reference to ends as the common characteristic of trial and error learning and insightful learning."

(17) Lashley

Lashley (276) makes an apt criticism of the frailty of the trial and error theory in his article on nervous mechanisms in learning in "Foundations of Experimental Psychology," Chap. 14 on page 560. He says, "Most of the recent attempts to develop a theory of learning have started from the problem of random activity and the selection of successful acts. The statement of the problem is usually some variant of the following: a stimulus (hunger, maze, or what not) initiates a series of activities which may be called a-b-c-d-e-f-g-h, and which follow each other in a natural order. Acts b, d, f, and h contribute to success in the problem. With practice, the others are dropped out, leaving the series b-d-f-h as a direct solution. No question of the association of b with d and so on is raised; it is taken for granted when c is omitted.

This we believe to be a wholly misleading statement of the problem box. The acts do not form an internally conditioned series from which the dropping of some will leave the remainder in association. On the contrary it is a chance sequence determined by the environmental stimuli which the animal encounters, an odor here, a contact there, calling out specific unrelated activities. The linking of the successful acts is not explained by the dropping of the unsuccessful.

The acts making up the final series are not those which originally

intervened between the unsuccessful movements. Entering the true path from a section of the cu-de-sac in the maze is the same act as entering the section from the preceding part of the true path only when the act is defined in terms of its end result; the movements involved are never the same.

The first evidence of learning is a focalization of activity to which the elimination of errors seems purely subsidiary. In the maze the animal pushes forward in the direction of the food compartment; in the problem box his responses to the latch become prolonged. The effectiveness of certain stimuli is heightened, responsiveness to other stimuli drops out in consequence. The problem of learning by trial and error is thus not one of the mechanism of dropping of useless movements, but of the fixation of the effective behavior. The behavior shows a responsiveness to relationships and a unity which is difficult to express in terms of simple associations and for which none of the suggested principles of selection is a satisfactory explanation."

Lashley presents the neurological and biological side of the learning process which is complementary to the insightful process.

(18) Wheeler

Wheeler's (551) references to insight in his recent text "The Science of Psychology" follow: "We may define learning tentatively as that behavior in terms of which the individual extends his insight into a given situation and increases the complexity of his actions with respect to a certain goal. Recall that by insight we mean organized response at the level of conscious behavior." (p. 240)

"If children fail to learn meaningless material readily by the

whole method, or if the feebleminded do not learn readily by the whole method, it can hardly be concluded that some modification of the part method is better for learning in general. Rather, when the task is properly articulated with the insight of the learner the whole method is better." (p. 250)

"It is a commonplace fact that learning involves a growth of insight, for the learner is able to execute more complicated performances as he repeats the task; he perceives a more complex and definite goal. How does the individual gain his insight? Here we encounter a difficult problem which as yet we have solved only superficially by referring it to the extent of evolutionary development of the organism and to the degree to which it has matured in its life history. What purported to be an adequate answer to this question is found in the theory that we learn by experience. Nearly everyone accepts this statement as fact; it is common sense! But is is not so adequate as it seems on first thought." (p. 261)

"The expression, learning by 'trial and error,' is easy to misinterpret. The learner's random efforts in any learning process are random only with respect to an incomprehensible goal imposed upon him. Only by chance will they bring him into sensible relationship with the goal. If this happens, however, to assert that he learned by experience implies that he made a discovery, that is, exhibited a flash of insight. The fact that the insight followed upon a chance performance means that the chance performance is no more a cause of learning than is any other external stimulus. The performance contributed in forming the configuration, but as a chance stimulus, not as an experience. Moreover, the chance or 'trial and error' aspect of the situation is irrelevant;

the determining feature of the situation is a particular juxtaposition of objects that reduces the problem to the level of the learner's insight. Finally, one stage in the learning process is related to the next through the medium of maturation. Indeed, without the factor of maturation, the change from one stage to the next would be unintelligible, because old experiences or old movements will in no way account for the new features of later experiences and subsequent co-ordinations.

The 'criteria' of insight. Throughout the text the term insight has been used to describe organized or configurational activity at the level of conscious behavior. Insight implies a qualitative difference between conscious behavior and simpler varieities of configurational activities like those studied in physics, just as water is qualitatively different from either hydrogen or oxygen. But insight is a descriptive, not an explanatory term, except as one organized response functions as a condition of another.

The criteria of insight that appeared from time to time throughout the book may be summarized as follows in the order of their generality, with the most general presented first:

(1) The perception of a goal in its relation to a total stimulus-pattern and self propagation toward it.

(2) Changing the character of the goal when stimulus-patterns are repeated (modifiability of behavior).

(3) Consistently responding to novel aspects of situations correctly the first time. The use of a new tool in arriving at a goal; the use of new words and phrases correctly in novel situations; invention.

(4) Responding to the constant but abstract features of changing stimulus-patterns; learning the relatively brightest light of a changing

combination; 'transfer' effects.

(5) Sudden formation of configurational responses. Rapid rises or falls in the learning curve, depending upon the fashion in which the curve is plotted; sudden solving of problems when responses were previously controlled by a chance distribution of conditioning factors; sudden elimination of long routes to the goal; sudden abandoning of wasteful procedures.

(6) Periods of initial delay prior to the execution of a new performance, that is, hesitating while studying a novel situation. This is presumably a sympton that the configuration is forming.

Observational behavior. The more important problems in connection with observational behavior in general were concerned with its conditions, which are commonly known as conditions of attention. Among them are mental set and movement or change in the stimulus-pattern. With respect to the latter a law was formulated that the stimulus-situation demanding new insight controls the organism's behavior above all else at the time. Then, the problem of fluctuations of attention was considered in the light of Guilford's experiment which showed that the fluctuations are determined by chance variations in the controlling conditions. The range of attention was treated from the standpoint of the configurational hypothesis, using the tachistoscope experiment as an illustration. The more important problems in connection with specialized forms of observation dealt with the conditions of space perception, localization and apparent movement in the different sense departments." (p. 518-20)

Dr. Wheeler more than any other present day psychologist has grasped the need and significance of the term insight. Up until the present the term has been largely descriptive. Our study makes the attempt to bring

insightful behavior under laboratory control both for animals and human beings in an organismic series.

(19) Perkins and Wheeler

Perkins and Wheeler (303) in their article on Configurational Learning in the Goldfish have the following to say: "The experiment here reported was undertaken for the purpose of studying, under controlled conditions, the learning process in animals fairly well down in the evolutionary scale; and to determine to what extent these animals exhibit 'insightful' activity.

The term insight is used in general in the sense in which Köhler originally used it, and as Helson has also employed it. By it is meant (a) transpostion of the general properities from one situation to another, (b) response to a complex, total situation the details of which have been altered without changing their relationships in the total structure, (c) response to parts in the light of a whole, (d) configurational or 'structured' response, (e) reacting to a complex situation in a way that might be called adequate or 'sensible.' Insight seems to describe specific responses in the learning process far better than terms which have to do with alleged learning by chance, or the mechanical selection of responses by means of repetition, recency, satisfyingness and the like. Indeed, it seems clear that our entire conception of animal as well as human learning is undergoing a radical change from a view largely atomistic and mechanistic to one that is organismic and non-mechanistic."(p.1)

Their conclusions numbers 5 and 6 are as follows:

"5. We have described learning in the goldfish in terms of insight and maturation rather than in terms of 'trial and error.' The usual criteria of insight are found in the behavior of the goldfish.

"6. We have interpreted learning in the goldfish in terms of the general law of least action." (p. 50)

(20) Cuts forth

Dr. Margery Cutsforth in a study soon to be published has investigated the insightful behavior of chickens and finds insight both in discrimination with transposition of lights, and in various choice situations involving light intensities.

(21) Ogden

Ogden (293 a) declares that the term insight is one the common meaning of which is understood by all. He quotes the small dictionary definition "Sight into: thorough knowledge or skill: power of acute observation," and asks "But can psychology use such a term, with such meanings, in what it chooses to call a scientific context?"

Quoting Köhler (212, p. 371) who states, "When I used this term in my treatment of intelligent behavior in apes, I ran the risk of an unfortunate interpretation. Since that behavior comprised extraordinarily conspicuous accomplishments which we did not expect to find in animals, insight would be readily misinterpreted as some special and supernatural faculty producing admirable and otherwise inexplicable results. As I used and intended the term, nothing of the sort should be implied in it." Ogden thinks that various schools of psychology will doubt the simplicity of Köhler's explanation. Ogden goes on later to argue for the term insight by saying, "We do not know precisely when the ape begins to exercise insight in gaining what he wants. Neither do we know when we ourselves began to be intelligent. But we do know the difference between vague groping, with or without chance-success, and the phenomenon: 'Eureka, I have found it!'" There must be a

difference in these two kinds of behavior. "Insight" names one of them. While it does not explain it to name it, it does state a problem which my behaviorist, who confines himself to situation and response as quite separate terms, cannot even state.

Again Ogden takes up the Hartmann (142) discussion and says, "Insight, however, is a term for noting an intelligent behavior in which the 'why' is registered by an appropriate discrimination of desire, means, and end: that is to say, appropriate in the only way in which any thing is 'realistically' or 'objectively' appropriate. For the use of the term 'insight' does not imply an idealistic philosophy, though it can be made consonant with such a view. Neither does it imply a purposive philosophy by its descriptive employment of such terms as means and ends. But it does imply that behavior is intrinsically meaningful, and that its data are neither the positive existential experiences which Titchener postulated, nor the independently existent parts of a machine.

It was my original intention to discuss a recent article by Mr. George W. Hartmann on The Concept and Criteria of Insight. I have refrained from doing so in the body of my paper because Mr. Hartmann's concept and criteria seem to fall outside the context of my discussion. At the risk of an anticlimax, I shall make my comment on Mr. Hartmann's views in the form of an appendix.

Although Mr. Hartmann signs his article from the source and origin of Gestalt-Theory, the University of Berlin, I doubt if his statement of the case for and against insight would meet with the approval of the Berlin Gestalt-psychologists.

Mr. Hartmann's approach to the subject is that of definition and terminology. His 'primary task,' he tells us, 'is to attempt, by means

of a comparative and historical analysis, a reduction of the term to the level of a 'clear and simple idea.''

In the course of his article the author charges me with mixing badly the technical and colloquial uses of the term insight in my book: 'Psychology and Education.' I make no defense, because he is right. However, his insistence that insight can, or should, be used as a 'clear and simple idea' strikes me as being questionable. Insight, as I have tried to show in the earlier part of this paper, states a problem rather than a solution. But the very statement of the problem rules out certain kinds of solution which Mr. Hartmann wishes us to test experimentally.

Mr. Hartmann's paper ends with ten 'preliminary questions' which, he says, 'must be settled before we can attain a satisfactory theory of insight.'

I venture to quote and make reply to his questions without recourse to the 'extensive program of research' which, he adds, 'will be necessary before even the simplest of these problems can be answered.'

Question 1: 'Are specific insights the outcomes of prior trial-and error?' Answer: In the context of Gestalt-theory there is no trial-and-error.

Question 2: 'Does all learning require some insight, even of a rudimentary sort?' Answer: You must first define what you mean by learning.

Question 3: 'What is the best single criterion (or group of criteria) of insight?' Answer: The observation that the behavior in question discriminates means and ends. I 'feel' my own discriminations, and I infer those of others.

Question 4: 'Is insight necessarily accompanied by ideas? If so,

what is their character?' Answer: In the context of Gestalt-theory ideas have no special place as a class of entities which can be said to accompany insight.

Question 5: 'Is insight an active production of the organism, or does it arise spontaneously?' Answer: Both. The dilemma is not rigorous.

Question 6: 'Is the moment of insight emotionally-toned? What is the nature of this coloring? Answer: These questions imply introspective data which are irrelevant to a bare statement of insight as a special kind of behavior. The organism is undeniably 'moved' when it indicates insight; it may also be 'moved' without insight.

Question 7: 'Can insight be identified with association by similarity?' Answer: Not in the context of Gestalt-theory.

Question 8: 'Is insight a species of the genus intelligence, or vice versa?' Answer: It is a species of intelligent behavior.

Question 9: 'How is insight related to inference and induction?' Answer: As types of behavior inference and induction are species of insight.

Question 10: 'What is the connection between closure and insight?' Answer: All insight implies closure, but not all closure is effected with insight."

"There is plenty of experimental research to be done before we can know all that insight implies, and whether or not we can give it the strict definition Mr. Hartmann desires, but I confess that my insight does not tell me how these ten questions can be translated into fruitful experiments."

(22) Platt and Baker

In our experimentation with students and adults we frequently received replies using the word "Hunch" as a name for the ideational stream which was seeking equilibrium in the solution of the problem. This idea of the "Hunch" has been taken from the realm of the mystical and colloquial and made a term of investigation in that fine study by Dr. Washington Platt and Professor Ross A. Baker, entitled "The Relation of the Scientific 'Hunch' to Research" (325) a report analyzing the replies from scientists in many lines of research. While this research is in no sense experimental, yet it clearly shows that a "dawn-phenomena" or "solution-emergence" is experienced by students and scientists everywhere. It is this commonly experienced phenomena which we are attempting to bring into experimental control in our present research and to devise a method of investigating it which will be a satisfactory scientific methodology. The following exerpts will show the great value of the study of Drs. Platt and Baker.

In their study they define the "Hunch" as follows:

"The Hunch Defined"

"It is realized of course that the hunch, illumination, or revelation shades imperceptibly into conclusions arrived at by more conscious reasoning. A clearer understanding will be obtained from the examples quoted than from a definition, but we nevertheless attempt a definition as follows: A scientific hunch is a unifying or clarifying idea which springs into consciousness suddenly as a solution to a problem in which we are intensely interested. In typical cases, it follows a long study but comes into consciousness at a time when we are not consciously working on the problem. A hunch springs from a wide knowledge of facts but is essentially a leap of the imagination, in that it goes beyond a mere necessary conclusion which any reasonable man must draw from the data at hand. It is a process

of creative thought.

Dallenbach, in a private communication, has given a more concise definition as follows: A hunch or an intuition is a judgment the bases or premises of which are unknown or not clear to the individual having the hunch. . . . .

The first page of the questionnaire folder contained examples of hunches taken from the writings of Helmholtz and Kropotkin and from the report of the Syracuse symposium already quoted.

A total of 232 replies was received. Among those who replied are some of the best-known contemporary American scientists in academic, industrial, and government work."

The questions asked were as follows:

"Question 1. Have you ever received assistance from the scientific revelation or hunch in the solution of an important problem? Frequently .....Occasionally.....Never.....

33% report 'Frequently'; 50% 'Occasionally'; and only 17%, 'Never.'

Question 2. If so, please describe one or more typical instances as fully as possible.

Of many interesting instances which were cited, the following may be regarded as typical:"

"In trying to develop a method for the treatment of a potash mineral a considerable amount of time had been spent in laboratory and library. No chemical method tried had been economically feasible. After about four weeks on this problem, I had occasion to take a very early train (3.50 A.M.) to another city. While riding, a thought of a totally different process from those I or my associates had been considering came to me. I made a rough outline of the basic ideas and the

development work on the process has since proved it to be both technically and economically possible. (J. F. T. Berliner)"

"Question 3. Please describe conditions under which these revelations or hunches usually appear, giving: (a) time of day, (b) your occupation at the moment, (c) mental and (d) physical condition such as complete relaxation, fatigue, etc., (e) time which had elapsed since your attack of the problem, and (f) any other details which seem of interest.

In the replies to this question and the next two, lie the suggestions of greatest practical usefulness."

"Among occupations mentioned during which hunches often appear are: shaving or dressing, driving automobile, gardening, fishing, golfing, riding in train, playing solitaire. Several say their best ideas come to them while walking between their home and the laboratory morning or evening. Several mentioned walking in the country. A considerable number state that hunches have come when listening to music and a few refer to the related condition of listening to a sermon."

"I must say that my hunches come as the result of deliberate purposeful thinking about the problem, drawing consciously or unconsciously upon a broad knowledge of other closely allied fields. Any condition favorable to such thinking yields results but owing to the nature of my work which involves a great deal of administration, such periods can only come at night after the day's work is done. Any employer of my services who wanted creative thinking oftener THAN ONCE A DAY, SHOULD RELIEVE ME OF MY ADMINISTRATIVE WORK, otherwise I might describe myself as a hard worker during the day on the mechanics of the job and a creative thinker at night on my own time. (------)"

"Question 4. Do you find any particular conditions definitely unfavorable for the appearance of such revelations? If so, please describe.

In the answers to this question, we find a remarkable unanimity of opinion."

(1) "worry;" (2) "intense interest in something else such as football and baseball games, bridge, etc.;" (3) "too constant work on the problem, working under pressure, anxiety over the success of the research;" (4) "too long periods of confined work, going stale;" (5) "having to get to work on time;" (6) "interruptions of all kinds;" (7) "feeling that one may be interrupted at any time."

"Question 5. Do you ever purposely invite such revelations by creating favorable conditions in any of the ways given below? If so, please describe. . . . .

(a) By temporarily abandoning the problem and taking up other work? If so, what type of work?

(b) By a period of idleness and complete relaxation not spent in attacking any other problem?

(c) By going over the problem just before retiring for the night?

(d) By special physical exercise or occupation?

(e) By the use of coffee, tobacco, or alcohol?

(f) Any other special means? (Kindly describe.)

Many replies to this question were not entirely clear. However, 53% indicated that they purposely use some means to create conditions favorable for scientific hunches. Taking as 100% the number of those who purposely create favorable conditions, the expedients used are as follows:

By temporarily abandoning the problem and taking up other work, 60%.

By a period of idleness and complete relaxation not spent in attacking any other problem, 45%.

By going over the problem just before retiring for the night, 47%.

By physical exercise or occupation, 15%.

By the use of coffee $4\frac{1}{2}$%, tobacco 14%, alcohol $3\frac{1}{2}$%.

It is now generally admitted by health authorities that alcohol often hinders and only under the rarest conditions furthers real constructive thought. Several who reported that tobacco aids their thinking, state that they 'do not recommend this method.'

Question 6. How definitely and completely does the revelation usually present the answer to you (i.e., in full detail or only as a central idea)?

The overwhelming majority reported that the hunch came as the central idea only. Several stated that when once the central idea had presented itself to them, their minds then with great rapidity filled in the details. A small but notable minority reported that a hunch presented the plan to their minds complete in all its details.

Question 7. Have you ever had a revelation that turned out wrong? If so, what is the proportion between correct and incorrect?

Only 7% reported that their hunches always turned out correct. The remainder gave figures for the percentage of correct hunches varying from 90 to 10%. We have here of course a chance for a wide difference in interpretation of the meaning of the word 'hunch.' It may have been interpreted by some to mean any wandering idea that comes into one's head."

"Question 8. What is your explanation of the working of your own mind in the production of a revelation or hunch?

(a) Is the working completely conscious?

(b) Is it subconscious, i.e., on the margin of consciousness?

(c) Is it completely unconscious except for the moment of the appearance of the revelation?

(d) Is the revelation as it appears merely a logical organization of information already acquired, or does it contribute anything essentially new?

The figures are: conscious, 19%; margin of consciousness, 28%; unconscious, 13%. Answer not given or not clear, 40%.

In these replies certain types of mind stand forth rather clearly defined. Those who report that their ideas come to them consciously usually seem to be of the 'accumulator' type, and their answers to all the questions display this trend of thought. Many of them found the idea of the 'hunch' to be very distasteful. The replies from other scientists indicate that they are typical 'guessers.'"

"The reactions of psychologists toward the problem of the hunch are also of interest.

A letter was sent out by the present authors to a number of American psychologists asking:

1. What explanation do you favor for the appearance of the scientific hunch?

2. What are the conditions which are most favorable for the appearance of the hunch?

3. Do you believe a definite attempt should be made to create these conditions?"

A typical reply: "Your recent letter about the psychological interpretation of the scientific hunch interests me very much. It is one of the most important, as well as one of the most neglected, questions that has been raised for some time. (L. L. Thurstone)"

"The effort to solve a problem mentally is a constant series of trials and errors. The mind in searching for a solution considers in rapid succession a long series of conceivable answers, each of which is almost instantly rejected on account of some obvious objection. Finally in this process of trial and rejection we more or less accidentally stumble upon an answer to which the objection is not so obvious. The smooth course of trial and rejection is brought to a halt. Our attention is arrested. Further consideration only confirms the plausibility. The closely allied mental condition when working a puzzle is described by Ruger.

Bentley says:

It appears that the transcendent accomplishments of genius are due in large measure to condensations and ellipses on a large scale which reduce the elaborative procedures to their lowest terms. Intuition frequently means only defective observation of the rapid process of thinking."

The conditions for successful incubation are given as follows:

"First, we must have a great interest in the problem and a desire for its solution."

"Second, and closely allied, there should be an absence of other problems which would tend to crowd out the first."

"Third, the mind must have available a large store of pertinent information."

"Fourth, the material should be stored in the mind in a systematic

fashion and it should be well digested so as to be useful."

"Fifth, there must be a sense of well-being and a sense of freedom from interruptions. Woodworth says:

We see in this experimentally studied case some of the conditions that favor invention. Good physical condition, freshness, mastery of the subject, striving for some result and "hopefulness." Now what is this last? Confidence, enterprise, willingness to take a chance, eagerness for action and readiness to break away from routine? Some of this independent manipulating spirit was probably there."

"Closely related to the foregoing factors is the ability to recognize and grasp valuable new ideas as they flash before our consciousness. It will be remembered that Wallas follows Helmholtz in dividing research into investigation, incubation, illumination, and verification."

Their conclusion is: "Obviously the minds of different people work quite differently. In this paper we have given concrete illustrations from scientific literature and from specific answers of contemporary scientists showing how the minds of these investigators worked. We have pointed out some definite conditions which have proved to be favorable for creative mental achievement, and other conditions which are usually considered unfavorable. We have discussed some of the probable explanations.

From these facts and opinions--many of them conflicting--each must determine for himself what conditions are most favorable for his own creative mental achievement."

2. Additional experimental and historical sources for our experiment.

The present study uses human subjects, but the problem involved finds its sources in both the human and animal experimentation of the past forty years.

In 1911, Hamilton (139) devised a choice apparatus for studying ideational behavior. He found striking differences in the modes of activity of various mammals. His method of experimentation was ingenious and Yerkes (577) took it as the basis of his multiple choice apparatus for testing the mentally defective. We quote from Yerkes' article, "Now it happens this relational method of studying ideational behavior has several points of merit for those comparative psychologists who seek to apply precise methods of studying behavior to the materials of the psychiatrist. These merits, it must be admitted, are not accidental, but instead result from the requirements which I had in mind in devising problems, apparatus and procedure. The most important of them may be described thus; 1. A series of problems ranging in difficulty from the very simple and easy to the extremely difficult may be selected, standardized and presented, either in part or in entirety, to any given subject. 2. Each of these problems is completely soluble by a subject with excellent ideational capacity, although not necessarily by a given subject. 3. The attempts of the subject to solve a problem are readily recordable as forms of reaction for the most part as definite choices of objects in a group. The experimenter may, however, make time measurements and keep, if he so desires, detailed records of behavior between choices. 4. Introspective data supplementary to those recorded obtained, it is important to request of the subject, if linguistic reaction is possible, a definition

of the right object or a description of the method of selecting it.

5. Graphic representations of the process of solution, ideational or otherwise, are possible. Such, for example, are curves of learning constructed on the basis of right and wrong choices, coefficients or indices of ideational capacity may also be used. Likewise formula descriptive of the mode or modes of reaction, reactive tendencies or methods of choice become available."

Yerkes (577) took Hamilton's suggestion as the basis of his multiple choice apparatus for testing the mentally defective. He says p. 379, "Experience indicates that the relational test has considerable value in mental examining as well as varied value as a method of research." His multiple choice method was used in studying animal behavior by Coburn and Yerkes (72), (73), in the study of the crow and pig, and by Burtt(48) in the study of the white rat. Brown and Whittell (45) used it in the study of human adults, and Yerkes (577) perfected his method in his study of the mentally defective and deranged as compared with normal individuals.

As early as 1902 Kinnamen (197) had discovered the ability of monkeys to perceive relative brightnesses, and Yerkes (575) found that they possessed a type of ideational behavior. More recent developments have disclosed certain abstractive ability in apes, as Révész (334) discovered but it remained for Köhler (211) to do his monumental work with apes in which he found insightful activity in the perception of relationships and objects-in-relation to goal activity.

Turning to human subjects in the matter of puzzle solving we note the important investigation of Lindley (242) and Book(29).

Wyatt (571) in his analysis of Ruger's experiment says, "The moment or act of insight can only sometimes be described as a sudden flash; it is often a succession of glimmering apprehensions and is found in all degrees, from elusive and indefinite dimness to a clear and convincing definiteness."

The sources of experimentation in mental testing are so voluminous and numerous that it is impossible for us to tabulate the many psychologists who have contributed to our knowledge of the behavior of animal and human organisms under test contitions. Rather than attempt such a list we refer the reader to the authors and titles to be found in the comprehensive bibliography at the close of this study.

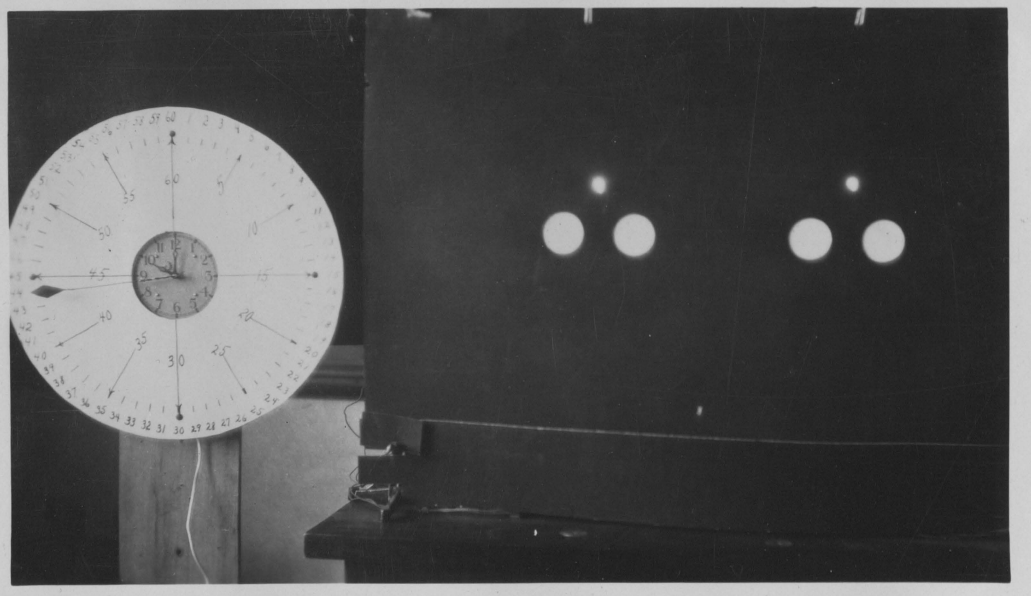


Fig. 2.

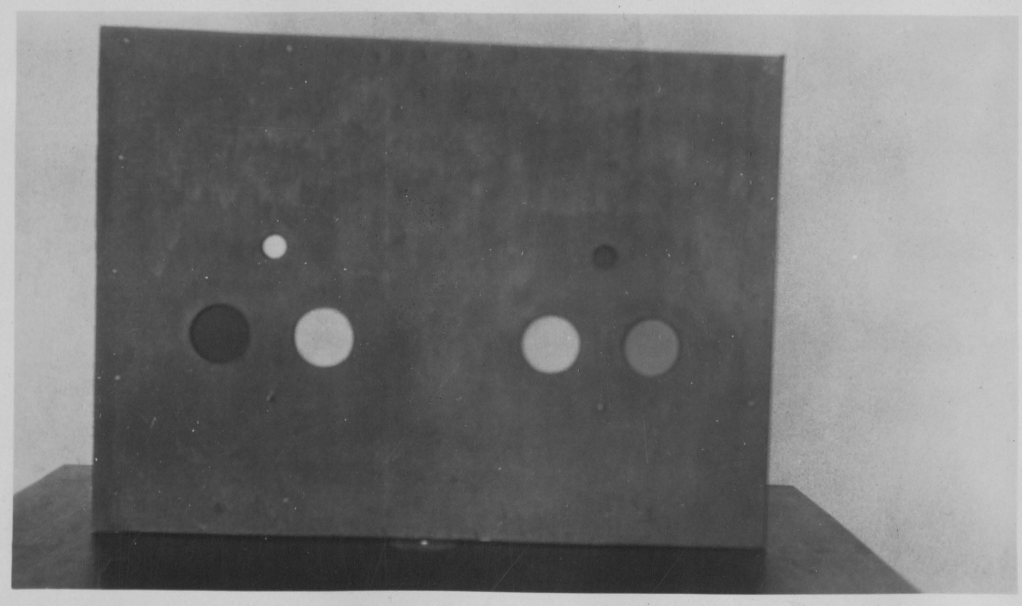


Fig. 3.

CHAPTER III

DEFINITION OF INSIGHT AND INTRODUCTION TO THE PROBLEM

1. Definition and criteria of insight.

A brief statement of some of the more prominent and promising definitions of insight is as follows:

Köhler - Insight is the ability of an organism to obtain a goal by indirect means.

Yerkes - Insights are varieties of experience which in us are accompaniments of sudden, effective, individually wrought adaptations to more or less distinctly new and problematic situations.

Lindworsky - Insight is a discerned relationship together with an appropriate mode of action or behavior.

Hartmann - Insight is the adequate configurational response of an organism.

Wheeler - Insight is organized or configurational activity at the level of conscious behavior.

We would at once note that all these definitions are aiming at the same thing. There is after all a remarkable unanimity in the central core of definition. With the psychologists who insist that the concept of insight is unnecessary and who remain with their inadequate concepts which do not explain, we must differ. Habit will no longer suffice as an explanation. The conditioned response will not answer all our C - R problems. In the more highly organized organisms there is a something in their behavior which may be called what you please, we choose to call it insight as the term which most

adequately fits the concept. Furthermore we are not satisfied to allow the term insight to be called merely a descriptive term. With experimental methodology worked out where we may definitely analyse each step in the process of an organism's progress from utter ignorance of a problem to complete solution of the problem, the term insight becomes of explanatory importance.

While none of the following phrases express exactly the meaning of insight, yet they are interesting attempts to throw light upon the meaning of insight.

We may call insight the correct choice of advantageous paths to a goal, or the adeptness of an organism in reaching its goals, or the goal-apprehension-action of an organism, or the total pattern recognition of an organism together with suitable behavior, or the microcosmic activity of an organism, or the direct adaptation of behavior to the achievement of goals. Again we might speak of the ease and rapidity and directness of an organism's problem solution or attempt to solve all stresses tending toward the quilibrium of goal attainment. It might be called the progress of an organism from deficiency to efficiency by the most adequate route. Finally it is the ingenuity of an organism in solving problems, the conscious cleverness of the organism in conquering new relational, problematic situations. Insight is the "aha" or "I see" of the conscious organisms learning process.

Insight, a long needed concept, is better, more definite, more apt as an explanatory term of the thing variously spoken of as inventive ideation, habit formation, and what not. Insight has taken the field and fits the need and is here to stay. Clarification and abundant experimentation now remain as the program in the investigation

of insightful behavior.

The various criteria of insight will be sifted, revised, and codified, as time goes on. It seems to be too soon to give an adequate and complete list. The following concepts must enter into the criteria of insightful behavior in an organism.

(1) Organismic behavior. It must be the action of an organism.

(2) Relational behavior. There must be the perception of relations.

(3) Goal-tending behavior. The organism must be making definite progress.

(4) Learning behavior. The organism must be meeting and conquering the newness in the situation.

(5) Choosing behavior. The selection of the better behavior pattern from two or more possibilities.

As secondary criteria may be mentioned,

(1) Directness. Obstacle passing in the most direct way possible according to the law of least action.

(2) Deliberation. Appropriate pauses in the path toward solution.

(3) Versatility. Ability to revise plans which prove false. Goal-revision.

(4) Transfer-ability. Improvement due to advantageous modification of the behavior pattern.

(5) Anticipation. Recognition of the tendencies in a situation.

(6) Ingenuity. Skill in adequately coping with any emergency.

(7) Selectivity of essentials. Choice of the better of tools or paths to the goal.

Final definition of insight.

Insight may then be defined as the adequacy of an organism's conscious choosing in a new situation.

Another good definition is as follows:

Horace B. English (100) in "A Student's Dictionary of Psychological Terms" defined insight as "more or less sudden realization of the meaning, significance, or use of an object or situation which is not based on previous experience in a like situation. The resulting reaction has therefore real novelty. But although the influence of specific experience is thus excluded, it is not implied that an explanation may not be found in the life history of the animal."

2. Statement of the problem of a methodology for adequate investigation of the emergence of insightful behavior in an organism.

One phenomena of organismic life which has not be sufficiently investigated is the matter of choosing in a maze-like situation when visual cues of correctness or incorrectness are given immediately following the choice. It is not sufficient to investigate behavior when mere place awareness (as this side or that side in each choice-point or path-dilemma) is the way in which the animal solves the maze. Visual patterns which indicate correctness of the proper path, signs of the correct path, must be investigated as to their character and potency. In the following chapter we shall describe a carefully planned series of experiments designed to investigate the rise, growth and solution of a maze like problem situation in which insight emerges and solution is arrived at in each stage as well as in the total problem. With but four discs or spots of light of varying intensity against a black background a series of relational problem patterns are presented to both animals, and human beings of various ages. Each stage is a choice followed by an immediate indication as to the correctness of that choice. With persons correctness is indicated by the flashing

of a little light, and with animals it is the finding of food. The test is based not upon response to disparate items but upon configural responses to varied similar situations or patterns. The course of these choices is plotted automatically, and the steps up to insight, presented in a manner capable of analysis.

In attempting a systematic survey of the organism series starting from the lower forms through guinea pig and ending with the human high I. Q. in the matter of insight, it is at once apparent that it will be difficult to discover any given set stimulus pattern or series of patterns which will suffice. Some comparable series of patterns must be found which will serve in the lower organisms as well as in the higher and serve as problems for both.

We chose light intensities, the problem lying in the matter of <u>relations</u>. The useableness of such a stimulus pattern we have amply demonstrated in organisms which respond to a visual pattern. Thus insight is brought within the scope of laboratory experimentation and a method of graphic presentation of data devised for the measurement of purposeful and insightful behavior in the organism.

Chapter IV

Insight In The Human Organism

I. Description of the apparatus.

1. The pattern variator (Type A) (Fig.2)

Three years ago an apparatus was constructed which we have called the pattern variator. By its use a pattern of four circular areas of light, whose intensities may be varied from no light and very dim up to very bright, may be presented against a black background. The front of the apparatus to be viewed by the subject consists of a black screen with four circular apertures arranged horizontally in two pairs. The apertures are round, two and one half inches in diameter, arranged horizontally, the members of the pairs being 1 7/8 inches apart and the pairs 8 inches from inner edge of circle to inner edge of circle. In the apertures are milk glass plates. Above and between the members of each pair is a little signal light. The subjects taking the test see a group of white spots arranged in two pairs and on a level with their eyes, against a black field. When the test is given to a single subject two keys similar to telegraph keys are mounted upon a table in a position convenient to the subjects hands. These keys are connected to the approiate signal lights.

Behind the milk glass plates in the apparatus proper are two tubes of asbestos 9 inches long and 3 inches in diameter. To remove shadow from the milk glass plates another thin frosted glass plate is mounted in the tube adjacent to the aubert diaphragms which control the light intensities. The aubert diaphragms are a contrivance of the author so arranged that sliding controls with scaled metric readings make accurate and rapid settings possible and provide a gradation of light intensity

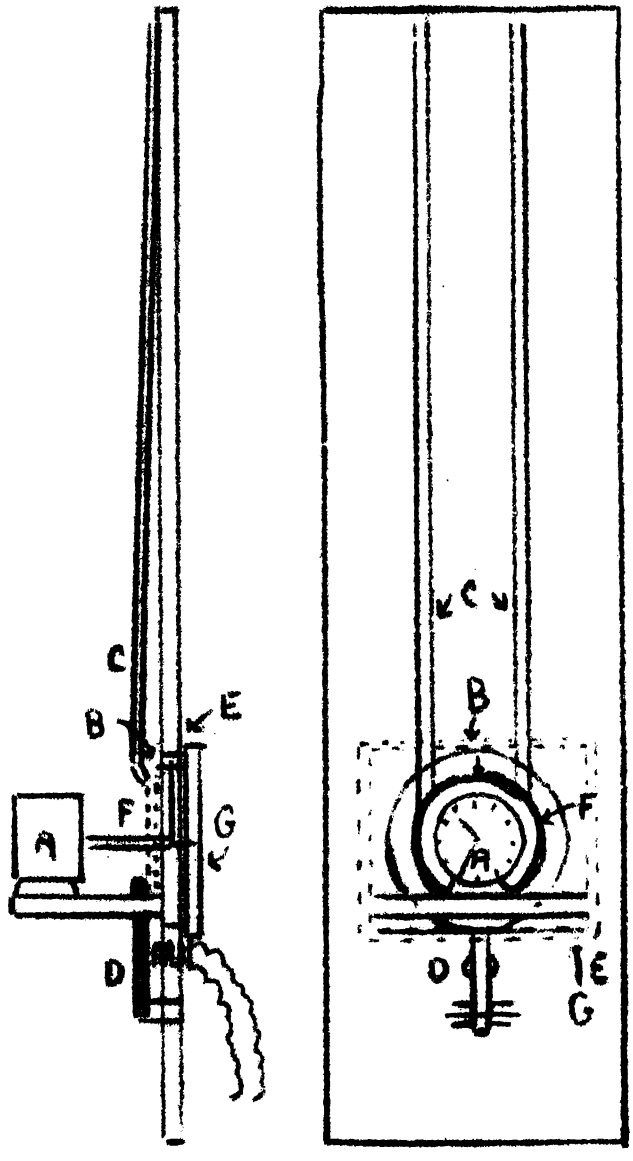
from no light to very bright. The light sources are four 150 watt daylight bulbs mounted and carefully centered. These masdas are matched in quality of light. The apparatus has ventilators above each light.

2. The wiring of the apparatus.

The wiring of the apparatus is so constructed that a main switch, three pole, double throw, will both light the main intensity lights when thrown to either side, and will also make the electrical connection on the appropriate side so that when the subject presses the correct key the signal light will light on that side. If the other key is pressed the signal bulb on that side does not light. Behind and mounted before the experimentor is a signal board with four signal lights, two at each end. When the response is correct both little lights light up on the appropriate end of the signal board and inform the experimenter that a correct response has been made. If an incorrect response is made only one of the pair of experimenter's signal lights will light on the appropriate side. These lights operate from a pair of dry cells.

3. The automatic timer. (Fig. 4)

Timing is done in the individual experiment by means of an automatic timer (Fig. 4) which registers the exact time of the exposure of the pattern. When the choice is made the pattern lights are automatically turned off. The timer is a new device making use of an alarm clock in the following manner. The clock is mounted upon a shelf before a board in which is a circular opening seven inches in diameter and covered with a tightly stretched thin cloth. The center shaft which turns with the hands is fitted with an extension shaft which carries at its end a 3 $\frac{1}{2}$ inch hand upon which a slider is mounted carrying a steel needle which rotates with the hand, its point being within a millimeter of the cloth.



A - CLOCK
B - NEEDLE
C - PENDULUM
D - MAGNET
E - RECORD SHEET
F - KICKER RING
G - FELT PAD

FIG. 4

This slider is drawn toward the center by a little thread which winds up on a center pin mounted in the center of the cloth and held in the center of the rotating shaft. This causes the needle to make a spiral about the seven inch circle. Behind this steel slider is a kicker made of wood and rubber faced, a circular hoop on the end of a pendulum. Below is a magnet arranged to strike the kicker hoop against the needle slider no matter where it may be in its path around the circle. In back of the board is a pad of felt with a sheet of thin paper pressed against the cloth covering the opening. Whenever the lights are switched on in the pattern variator the magnet arm strikes the needle through the cloth and the paper. When the subject presses a key the needle makes two impressions in the paper or rather a double stroke in the same hole making a rather larger hole. This process results in a record on the paper consisting of a circular path made up of tiny perforations through the paper. When the paper sheet is placed against the cloth a tiny central hole is punched in the exact center of the circle. To calebrate the time, the sheet of perforations is taken from the timer and placed upon a chart which has a central needle and a thread running from it to the curcumference of a large circle three feet in diameter and calibrated in fifths of a second. The exact time of each choice can be taken and listed opposite the record of that choice. This device was constructed at slight expense and furnishes a record of the time of choosing of the subjects, accurate to the fifth of a second.

4. The pattern variator (Type B). (Fig. 3)

The type of pattern variator using light intensities we called Type A. We devised another pattern variator, which we called Type B, which uses a series of grays instead of the light intensities. Behind the pattern screen

consisting of a black background in which are four apertures arranged in two pairs, are four wheels running at right angles to the screen and behind the apertures and carrying a series of grays in gradation from black to white in nine steps and matched carefully with the Munsel grays. These equal steps correspond with our list of light intensities which are high bright, bright, low bright, medium, high dim, dim, low dim. In the case of the grays, black and white were added to this list making nine values in all including black and white. The variator using grays makes any pattern of grays possible. When the carriage upon which the four wheels are mounted is pulled back the apertures are closed by shutters. Then the carriage is pushed forward the pattern is presented. Timing is taken by a contact when the carriage touches the rear of the screen. The experimenter pulls back the screen when the choice has been made. With the Type A pattern variator, the list of presentations was prepared and listed in a rotating device which presented each setting in order with the correct side and the variety of problems indicated. This device was used with the pattern variator (Type B) also, but the intensity settings for Type A were changed to read in terms of the series of grays.

5. The telegraphic recorder. (Figs. 5& 6)

A recorder of a new type was devised by the author which automatically draws the performance curve during the experiment. It consists of a table upon which a stylus writes upon a stylographic record sheet. This stylus is actuated by an arm which in turn rides in the 90 degree angle made by the crossing of two straight edges which ride upon tracks. Rachet mechanisms actuated by magnets cause either the one or the other of these straight edges to advance a step, causing the stylus to make a mark on the paper. The field of plotting is a departure from the old vertical-

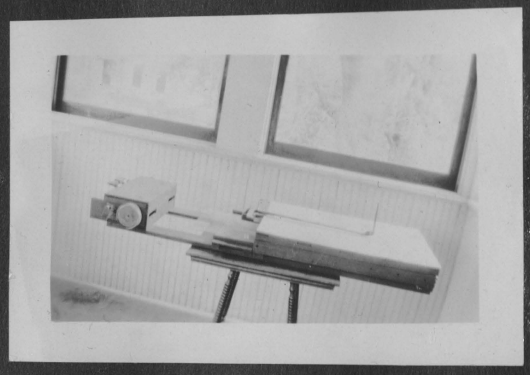


Fig. 5.

Fig. 6.

horizontal plotting of the learning curve. It consists of a central horizontal random line with fields above and below it within angles of 45 degrees from the horizontal line. A correct choice causes the appropriate straight edge to advance, causing the stylus to rise one step at a 45 degree angle. An incorrect choice causes the other straight edge to advance, causing the stylus to fall one step at an angle of 45 degrees. The resultant series of steps reveal the progress of the subject throughout the experiment. These patterns of progress in both human and animal experimentation give splendid data revealing the plan of the subject at the various stages of solution.

II. Experimental procedure.

1. Individual test procedure.

The main experimental group consisted of 100 students in the Winchester Rural High School. In the individual experiments the following procedure was followed. A room either dark or semi-dark was used. In the case of the Type B variator, a light room was necessary. The subject was shown the two keys after he was seated at the table. The lights were all four turned on full and the two signal light circuits arranged so that pressing either key would give a light on the appropriate side. The subject's hands were placed upon the keys and pressed down to demonstrate that they would light the little signal lights. No verbal instructions were given. To the invariable question, "What am I to do?" the answer was "Do what you think best or appropriate as the experiment proceeds." Using a previously constructed table (No. 1) of 60 settings, the first problem pattern was set and switched on. When the subject pressed one key the signal light indicated correctness or incorrectness of the choice and the lights went off. Another pattern

TABLE I

Table of Intensity Settings

1.	3	1	1	7	31.	5	7	1	4
2.	7	1	3	7	32.	7	6	6	1
3.	7	5	4	1	33.	2	7	2	3
4.	6	7	1	6	34.	2	5	6	4
5.	7	3	3	2	35.	7	3	2	3
6.	5	2	4	6	36.	5	7	2	7
7.	3	7	3	2	37.	7	5	3	3
8.	7	5	7	2	38.	3	5	6	1
9.	5	7	3	3	39.	6	4	1	4
10.	5	3	1	6	40.	5	2	6	6
11.	5	6	5	1	41.	1	4	7	6
12.	2	5	6	6	42.	7	2	3	1
13.	4	1	6	7	43.	7	5	7	2
14.	2	7	1	3	44.	6	2	5	7
15.	7	5	4	1	45.	2	7	5	2
16.	5	2	4	6	46.	7	1	4	1
17.	7	5	7	2	47.	7	6	6	1
18.	5	6	5	1	48.	3	1	1	7
19.	2	5	6	6	49.	7	1	3	7
20.	5	6	6	1	50.	6	7	1	6
21.	3	2	3	7	51.	5	1	5	7
22.	7	2	7	5	52.	6	3	1	6
23.	3	3	4	7	53.	5	7	3	4
24.	1	6	3	5	54.	2	6	6	6
25.	5	1	5	6	55.	1	7	1	4
26.	6	6	2	5	56.	5	6	5	1
27.	6	7	4	1	57.	5	7	1	4
28.	1	3	2	7	58.	4	1	6	7
29.	1	3	7	1	59.	7	1	5	5
30.	1	7	7	3	60.	4	1	6	7

was set and switched on. The time of each choice was automatically recorded on the timer and the correctness or incorrectness of the choice was recorded on the teleographic record which was watched by the experimenter.

The experimenter had a page for qualitative data and comments of the subject before him. He recorded any interesting comment and also notes as to the behavior of the subject during the experiment. At the close of the 20th presentation, questions were asked as follows:
1. What did you first see beforeyou as you began this experiment? Describe accurately. 2. What did you expect to see happen? 3. What did happen? 4. What do you think is the purpose of this experiment? 5. Are new ideas coming to you? 6. What is your plan in pressing the keys? 7. When does the little light light?

Many of the subjects themselves asked questions which were more valuable as data then the prepared list. "What do you want me to do?" and "Am I getting it right?" were most frequent questions, showing a sensing of the problem character of the experiment by the subject.
2. The group test procedure.

As soon as we discovered that the group procedure was approximately as accurate as the individual method, we devised the following method. The pattern variator was used, either type A or B. A special timer was devised which consisted of a large dial graduated in seconds and set facing the group and illuminated by a special soft glow lamp or by the use of a semi-dark room. The lights were switched on full and the subjects seated at tables with pencils and blank pages before them. They were asked to write at the top of the page their name, age, grade in school, date and the time of the experiment. Then they were instructed

to draw a line across the page below the heading and to subdivide the page into two columns. They were then asked to describe what they saw. They were instructed to give four answers each time the lights came on; (1) the number of the presentation (numbering as they went along), (2) to write which side they chose as correct (sides were labelled A & B), (3) to write the time at which they made the choice, and then to hold up their pencils high. An assistant to the experimentor remained in the rear of the room and tabulated the time when the lights were flashed on. When all pencils were up, he said, "All ready." The experimenter then indicated the correct side by himself pressing the correct signal light from the rear of the apparatus. The presentation lights were switched off and the subjects told to write (4) a plus if their choice was correct, a minus if their choice was incorrect. The next presentation pattern was then switched on. This procedure proved as accurate as the individual testing and with certain modifications will be used in large groups hereafter. The spirit of competition, although never mentioned, always entered into group testing and was indicated by the questions asked later, "How did I do?" "Who answered best?"

III. Presentation of results.

1. Quantitative data (Statistical)

In tables (Nos. II&III) we present the results of our research in testing 101 high school pupils; 34 seniors, 19 juniors, 19 sophomores, 29 freshmen. In the grade school group, we tested pupils, all grades represented by two or more pupils.

A few pre-school tests were planned but only six subjects were procurable and the results difficult to get in the case of infants due to fatigue and distraction. However enough was done to indicate the

TABLE II

No.	Age	Sex	Class	Av. Grade	IQ	Total G.D.	+	-	Av. Time G.D.
101	14	M	Fr.	B	118	139	81	56	3.37
102	16	F	So.	B	105	135	65	70	7.34
103	15	F	So.	A	113	21	13	8	3.61
104	17	F	Jr.	B	109	90	74	16	5.56
105	15	M	So.	C	106	76	55	21	2.95
106	18	F	Sr.	C	88	120	84	36	4.60
107	14	F	Fr.	D	107	255	197	58	4.03
108	16	M	Fr.	C	91	190	125	65	5.25
109	17	F	Jr.	C	91	50	38	12	5.32
110	18	M	Sr.	C	94	97	54	43	4.69
112	17	F	Sr.	B	96	110	60	50	5.05
113	16	M	So.	D	77	140	73	67	4.73
114	17	F	Jr.	C	92	75	43	32	5.34
115	14	M	Fr.	C	94	143	106	37	4.72
116	15	F	So.	D	96	68	53	15	4.05
117	17	F	Jr.	B	121	75	38	37	3.37
118	19	M	Sr.	D	88	100	64	36	6.06
120	14	F	Fr.	C	109	90	70	20	6.59
122	17	F	Sr.	B	86	80	39	41	5.04
123	15	M	Fr.	B	100	100	41	59	4.84
125	17	M	Sr.	B	121	54	30	24	5.03
127	18	M	Jr.	C	91	150	100	50	4.41
128	16	M	Fr.	D	95	75	41	34	6.20
129	16	F	Sr.	A	121	50	22	28	6.55
130	20	M	Jr.	C	73	135	76	59	5.71
132	16	M	So.	C	104	54	49	5	5.63
133	17	F	Sr.	B	86	100	67	33	6.32
134	17	M	Sr.	B	97	52	37	15	5.25
135	15	M	Fr.	C	89	85	51	34	6.36
136	14	F	Fr.	D	80	137	80	57	7.66
137	16	F	Jr.	A	107	45	22	23	6.00
138	14	M	Fr.	D	87	127	69	58	6.67
139	18	F	Sr.	C	75	128	74	54	6.52
140	17	M	Sr.	C	91	60	35	25	4.90
141	18	F	Sr.	B	94	50	33	17	4.76
142	17	M	Sr.	B	100	81	51	30	5.18
148	15	M	Fr.	B	91	82	47	35	7.38

TABLE II Cont'd

No.	Age	Sex	Class	Av. Grade	IQ	Total G.D.	+	-	Av. Time G.D.
150	16	M	Jr.	B	119	40	23	17	3.35
151	14	F	Fr.	C	108	108	57	51	5.57
152	18	M	Sr.	C	93	145	102	43	3.97
153	14	F	Fr.	C	104	95	56	39	5.89
155	16	M	Fr.	D	82	130	66	54	4.47
156	19	F	Sr.	C	80	80	54	26	6.52
159	14	F	Fr.	B	99	118	68	50	4.78
160	19	F	Sr.	B	98	80	49	31	6.06
161	16	M	Fr.	C	102	80	43	37	6.75
162	16	M	So.	D	87	60	39	21	5.44
163	14	M	Fr.	B	99	58	36	22	4.05
166	14	M	Fr.	C	108	50	21	29	6.06
167	15	M	Fr.	B	112	50	25	25	5.94
168	14	M	Fr.	B	115	51	30	21	7.33
169	16	F	Jr.	B	93	88	38	50	4.60
171	18	M	Jr.	C	94	50	39	11	6.00
172	14	F	Fr.	B	115	42	22	20	4.20
173	17	M	Sr.	A	117	30	16	14	4.49
175	15	F	Fr.	C	112	137	108	29	4.35
176	15	F	So.	B	91	135	99	76	4.81
177	16	M	So.	B	115	70	45	25	4.13
178	16	M	So.	B	115	28	22	6	4.22
181	14	F	Fr.	B	110	65	53	12	4.93
182	18	F	Sr.	C	91	70	42	28	7.21
183	16	F	So.	C	84	90	61	29	6.46
186	17	M	Jr.	C	74	120	90	30	4.76
187	16	F	Fr.	C	93	71	54	17	4.45
188	16	F	Sr.	C	97	99	57	42	7.93
189	16	M	Sr.	C	121	18	16	2	4.66
190	17	M	Sr.	B	112	40	29	11	4.97
191	17	F	Jr.	C	110	60	40	20	3.93
192	14	M	Fr.	D	104	40	23	17	7.55
193	15	M	So.	C	108	161	89	72	5.97
194	15	M	Fr.	C	102	65	43	22	5.99
195	14	F	Fr.	C	96	106	62	44	9.37
197	16	F	So.	B	113	85	43	42	7.09
198	16	M	Jr.	D	96	100	66	34	6.53
199	14	F	Fr.	C	102	50	35	15	9.66

TABLE III

No.	Age	Sex	Class	Av. Grade	IQ	Total G.D.	+	-	Av. Time G.D.	Total L.S.	+	-	Av. Time L.S.
111	17	M	Sr.	C	99	132	88	44	5.34	58	49	9	3.85
119	16	F	So.	C	92	90	53	37	5.73	20	9	11	5.65
121	15	F	So.	D	89	110	51	49	4.52	30	13	17	4.05
124	16	F	So.	B	121	51	34	17	4.84	20	12	8	4.25
126	14	F	Fr.	A	124	16	13	3	4.46	58	43	15	4.03
131	16	F	So.	A	100	52	35	17	3.21	20	13	7	1.89
143	19	M	Sr.	C	80	63	39	24	6.12	58	39	19	4.01
144	17	F.	Jr.	C	87	50	34	16	3.96	29	27	2	3.29
145	16	F	Fr.	C	98	66	41	25	2.66	78	60	18	2.65
146	16	F	So.	C	94	64	38	26	6.40	16	11	5	3.31
147	17	F	Fr.	D	78	137	106	31	4.23	58	51	7	3.15
149	17	F	Jr.	A	121	19	14	5	6.00	58	36	22	3.50
154	15	F	Fr.	C	102	49	15	34	4.00	58	51	7	2.50
157	18	F	Sr.	B	100	63	44	19	5.19	58	40	13	2.98
158	18	F	Sr.	B	91	46	26	20	5.81	58	43	15	2.12
164	17	F	Sr.	A	114	39	31	8	5.23	58	42	16	4.49
165	18	F	Sr.	C	95	60	36	24	3.88	20	11	9	2.00
170	14	M	Fr.	A	131	10	8	2	5.88	58	39	19	3.75
174	14	M	Fr.	A	129	39	30	9	4.87	58	41	17	4.53
179	16	M	Jr.	B	127	23	15	8	3.62	26	10	16	3.40
180	15	F	So.	B	106	65	53	12	4.74	20	14	6	3.75
184	16	F	So.	B	108	99	85	14	4.42	58	50	8	2.74
185	14	F	Fr.	B	109	80	70	10	4.30	58	52	6	2.74
196	14	M	Fr.	C	994	94	38	56	3.90	22	13	9	1.95
200	16	F	So.	C	92	80	53	27	6.69	52	39	11	1.92
201	14	M	Fr.	C	101	81	56	25	4.56	31	23	8	3.61

possibility of successful testing of the child of six months and upward. Below this age a new technique would have to be devised as to reward or incentive. The reaching reaction of children for identical objects, one loose and one fastened, served as a method with small children. Also a pair of reward boxes with lids was tried, the one adjacent to the correct side containing a reward. This is similar to Klüver's (201) pulling-in technique with monkeys only a visual pattern is presented adjacent of the choice boxes.

The college undergraduate group was made up of 33 individuals all of whom were tested individually. There were 15 college graduates tested, also 6 persons engaged in post graduate study in the department of psychology. A grand total of 185 individuals were tested.

2. Quantitative data (Graphic)

Types of curves differ greatly. There are the quick solvers with curves that rise gradually, or descend and rise, or follow the random line and suddenly break into insightful behavior. There are the slower solvers who may be random, abrupt or gradual abrupt. And there are the slow random solvers who after a long period of fruitless guessing come to a solving behavior pattern. Some rise gradually from the first. Some run along the random line and in the end solve abruptly. Each type of curve tells its story as to the behavior of the subject. Each type of curve when analyzed tells what plans were being tried without the subjects needing to tell those plans. We give (Figs. 7-11) curves of the most striking representatives of the various classes. Alpert (7) under the discussion of Types of Solution gives three types into which the solutions readily fall. The list is as follows:

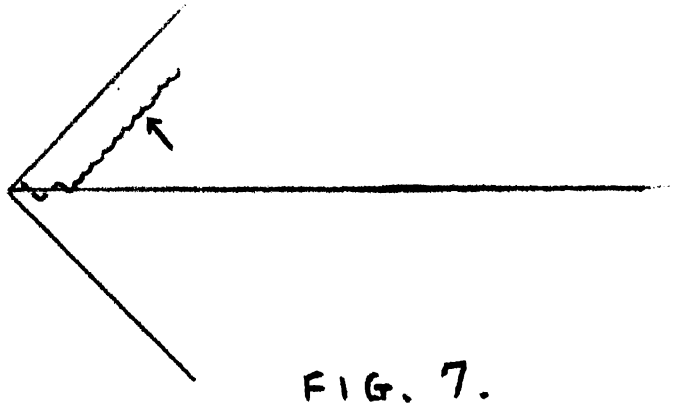


FIG. 7.

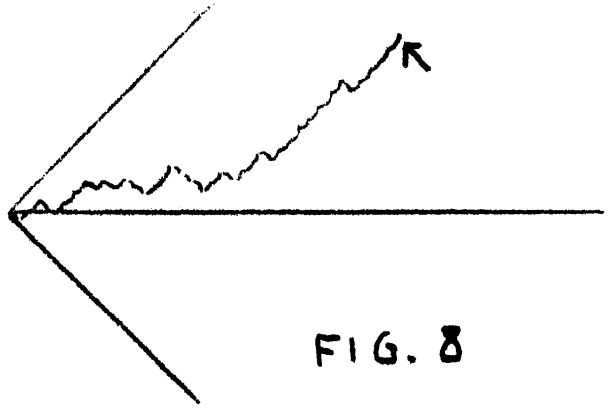


FIG. 8

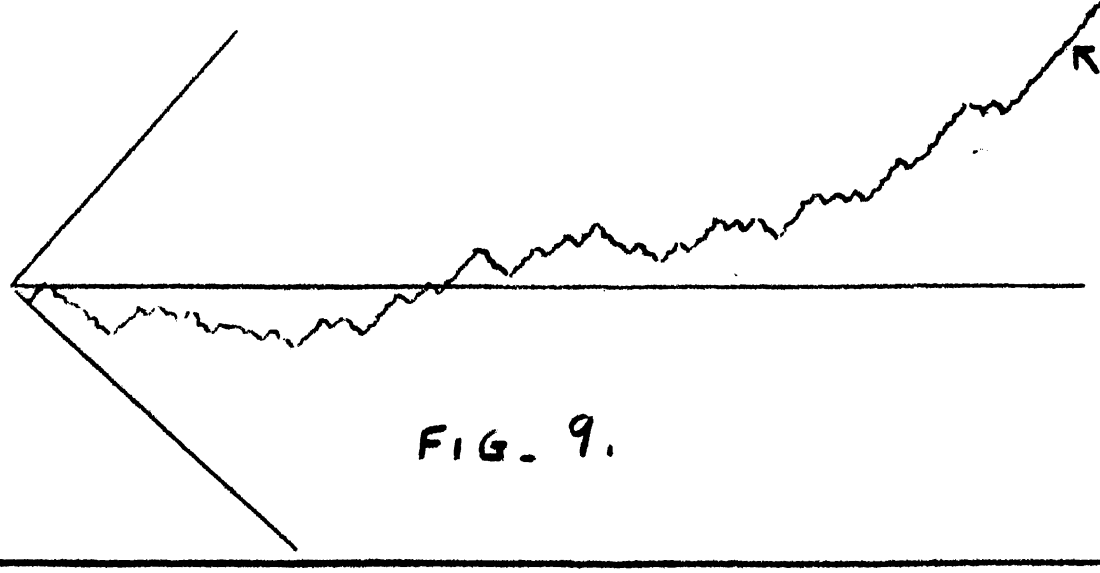


FIG. 9.

"1. Solution with immediate insight.

2. Solution with gradual insight.

A. Partial B. Complete

3. Solution with sudden insight.

A. Matured during exposure

B. Matured between exposures."

Our classification was as follows:

1. Class A. Brief solution.

(1) Abrupt type

(2) Gradual type

2. Class B. Average solution

(1) Abrupt type

(2) Gradual type

3. Class C. Slow solution

(1) Abrupt type

(2) Gradual type

4. Special Class D.

(1) Memoriter type

(2) Erratic, non concentrative or distracted type

(3) Non cooperative type

Various combinations of these types are discernible by analysis.

We now present a few sample curves out of the 185 solving curves which we have obtained from our subjects.

Figure 7, #170, is the performance curve of the highest I. Q. student in the high school and one who received a gold medal for first place in the state. He is a boy who is most ingenious and of the thinking type. His remarkable solution of the Greater Difference problem in ten

presentations remains the phenomenon of our series of testings. His I. Q. was likewise considerably above the others in school. In Figure 8 is given the rapid-gradual solution of student #190 who solved rapidly yet without the abrupt break in the curve. Figure 9 is an average solution with the point of solution following a long series of attempts at other solutions and finally the correct one. Figure 10 shows another type of curve with a gradual rise and finally the correct solution. Figure 11 is the curve of a four year old boy, pre-school, showing his first 80 choices. His curve shows a selection of brightest light and then dimmest light and finally dimmest side. His solution came later at the end of 162 choices.

3. Qualitative data and discussion.

The introspective data taken from the various subjects is too voluminous to be included in this study. Many exceedingly interesting things have developed. For instance all subjects were asked to state whether their ideas came to them gradually or quickly. The very odd thing which resulted was that many who thought their ideas came quickly were of the gradual type of solvers. Another very interesting fact was that memory was of little use in this test and the memoriter type of student fared badly if a memoriter method was tried. One very good student who is able to memorize long passages quite rapidly turned out to be a slow solver. He tried to memorize the series of presentations hoping to recognize similar situations. Finally his memoriter methods revealed by his introspective reports, failed and as he said he "blew up." He then began to think and soon solved the problem. Had we not checked his introspective material against his performance curve, we would have been in a quandary in analyzing his curve.

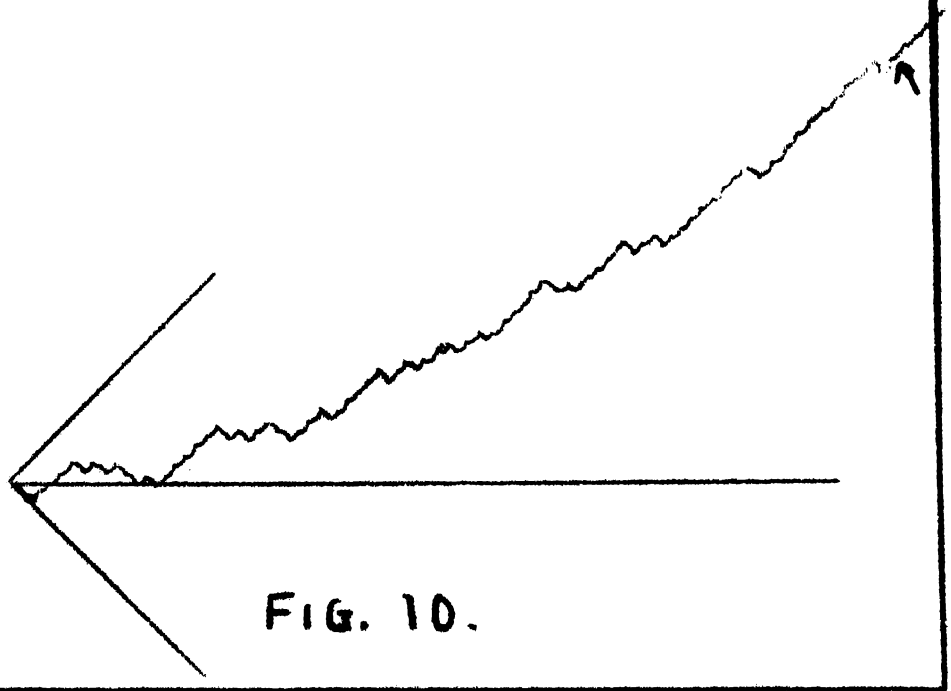


FIG. 10.

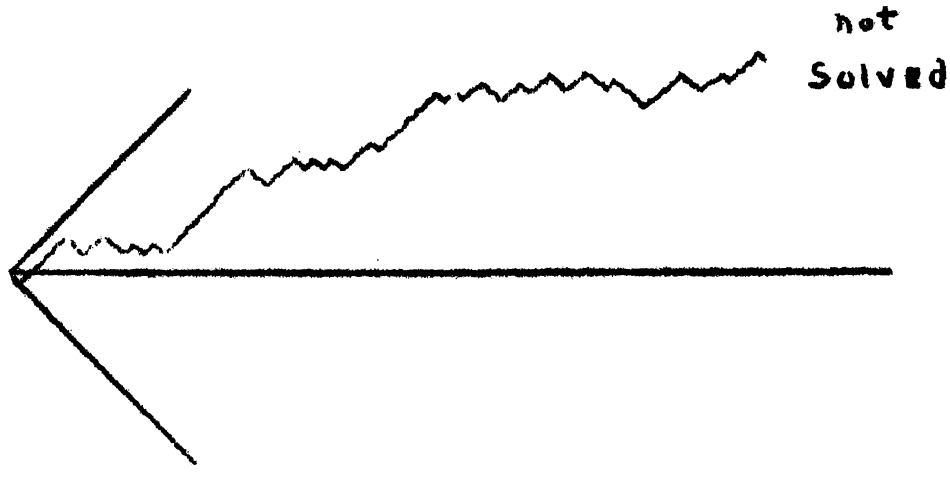


FIG. 11. 4 YEAR OLD CHILD
(Solved later at Choice #162.)

Another interesting fact is that the groups can solve a little more rapidly on the average than the single individual taking the test. Whether the "feel" of a competitive situation or test condition caused this or not, we cannot say, but the atmosphere was competitive in the group tests although we were careful not to mention competition.

A great many rough edges remain to be smoothed off in future insight testing. We found one group averaging one to two seconds slower than a similar group and upon investigation discovered that they were writing down their choices before looking at the timing dial. They had been instructed to look at the pattern and take their time in the same glance. One group followed instructions, and the other failed to do so.

Another thing that governs the testing is the time of day. Late afternoon tests slowed up the group, while morning tests averaged both faster and better solutions. Tired pupils coming after school gave results that were below average.

One most interesting case was that of a resident dentist who desired to take the test and did so in a group of five, the others were college graduates. After a number of presentations he spoke out, "Well, it's either similarity or contrast, I'll try contrast, and he immediately solved." We mildly reproached him for "speaking out in meeting" as he afterward expressed it. But he replied that he had just "boiled over" when the idea struck him. Later he took waht we called a transfer problem, that is, we started him on the first solution and then switched without notice. When his correct solutions "went bloole" as he said, he tried a number of new ones, thought the experimenter was "fudging on him," and that the machine had gone wrong. He fussed around considerably, and returned to his original plan twice although it was proved

wrong. Afterward he said in commenting on his slowness in solving the transfer problem, "We older folks get set in our ways and it's hard to change." The older psychologists would have termed this habit formation. However, his curve showed a definite series of plans to solve, tired one after another with a reversion to the original "right" one to make sure that it was wrong. All the younger pupils showed a greater flexibility in changing from one solution to another when the experimenter made a transfer without notice. A multitude of possibilities in testing grow out of th se facts which later experimentation will have to try out and it will be necessary to sift out the more advantageous methods.

4. Curve analysis.

Every curve taken together with the introspective material and the answers to questionnaries of which we gave various kinds, is capable of most interesting analysis. We used a celuloid sheet upon which was drawn standard curves as follows. When the Greater Difference was correct the sixty presentations would give a straight line upward at the angle if all choices were correct. A corresponding downward line represented a series of Lesser Difference choices. Against this we plotted the results if various other plans should be tried, viz. greater summation, lesser summation, brighter member, dimmer member, and we used these standard curves in analyzing the performance curves of the subjects. Hence we could tell with approximate accuracy what plan the subject was following and the degree of consistency which was shown and how quickly the subject abandoned a false clue. While this was interesting methodology and revealed many most interesting facts, yet it was later when we applied this method to the analysis of animal curves that the amazing possibilities of curve analysis showed up. This we will briefly describe at the close of the next chapter.

All in all the methodology which we are using will apply to the testing of insight in human beings from the infant who can sit up and reach for things, to the genius. It holds countless possibilities in the comparative testing of various races where language difficulties have been a great barrier. Also it will prove fruitful in establishing norms for abnormal cases. We can see the possibilities of using this test to discover the persons best fitted to do creative and inventive work in various lines of business. The person who can adjust in a new situation is thus easily separated from the memoriter type that depends upon a stock of past knowledge and is unable to think in a new situation.

Other similar fields occur to us in which this methodology is splendidly applicable. We might mention our contemplated adaptation of this method of testing to the determination of an aesthetic insight where choices were made of comparable figures etc. Such tests are now in existence and with the addition of the performance curve methodology an index of aesthetic judgment could be devised. We would likewise be so presumptuous as to hope that a plan of determining moral insight upon the "right-wrong" choice method could be worked out. This would give the "true-false" or "correct-incorrect" choices in determining simple insight in the organism, "beautiful-ugly" choices in determining the aesthetic insight and "right-wrong" choices in determining the moral insight of an individual. The author has partially devised a technique for attacking these problems which only the years to come with an abundance of arduous labor and careful experimentation will suffice to validate.

We have only one further suggestion in connection with the whole matter of testing the series of organisms in a comparative manner and that is that a graduated scheme of increasing complexity of the test pattern series will have to be fitted to the increasing complexity of the organism's level of behavior. This will take much careful work. But the field of adventure in the land of insight will remain a most alluring goal for the years to come.

Fig. 13

Chapter V.

Insight in the animal series from guinea pig to monkey

I. Introductory statements.

If insight is to be made an explanatory term, not only must a technique be devised for testing the insightful behavior of human beings from infant to adult genius, but a method of attack upon the goal tending behavior of the animal series must be devised. In our methodology we have tried to avoid the many pitfalls into which experimentation tends to fall when dealing with animals. First of all observation alone will not suffice. While this is an interesting way of getting data, yet it is too indefinite to be accurate. We have centered our efforts upon the devising and constructing of an automatic animal insight maze which promises to reveal some most valuable facts concerning learning and insight in the animal series.

II. Description of apparatus.

The automatic animal insight maze.

1. Choice compartment.

Figure (13) shows the choice compartment of the maze. This is constructed of wood with a screen wire lid and a double screen floor. The upper deck is for guinea pigs, rats and small animals and is on a level with the pattern variator and choice pedals. The size of this compartment is 24 inches wide by 4 feet 6 inches long. Through the center and above the floor level runs a gas pipe in which a shaft turns. The height of this compartment is 24 inches, divided into two decks.

2. The pattern variator.

Two circular wheels or discs (fiber board, see Fig. 14 of the monkey, Su, sitting on chair and the variator disc below) were made

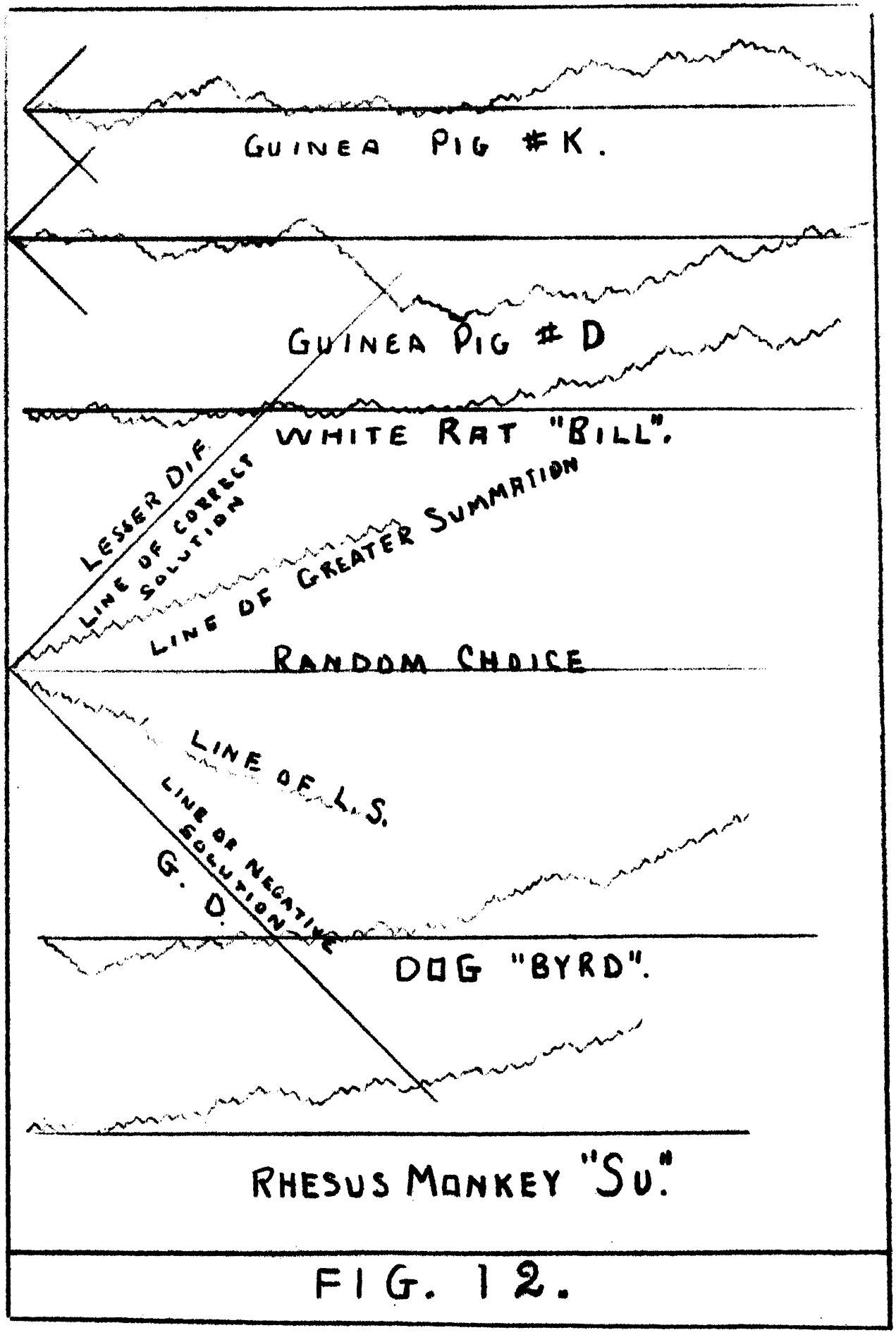

GUINEA PIG #K.
GUINEA PIG #D
WHITE RAT "BILL".
LESSER DIF.
LINE OF CORRECT SOLUTION
LINE OF GREATER SUMMATION
RANDOM CHOICE
LINE OF L.S.
LINE OF NEGATIVE SOLUTION
G. D.
DOG "BYRD".
RHESUS MONKEY "SU."

FIG. 12.

Fig 15

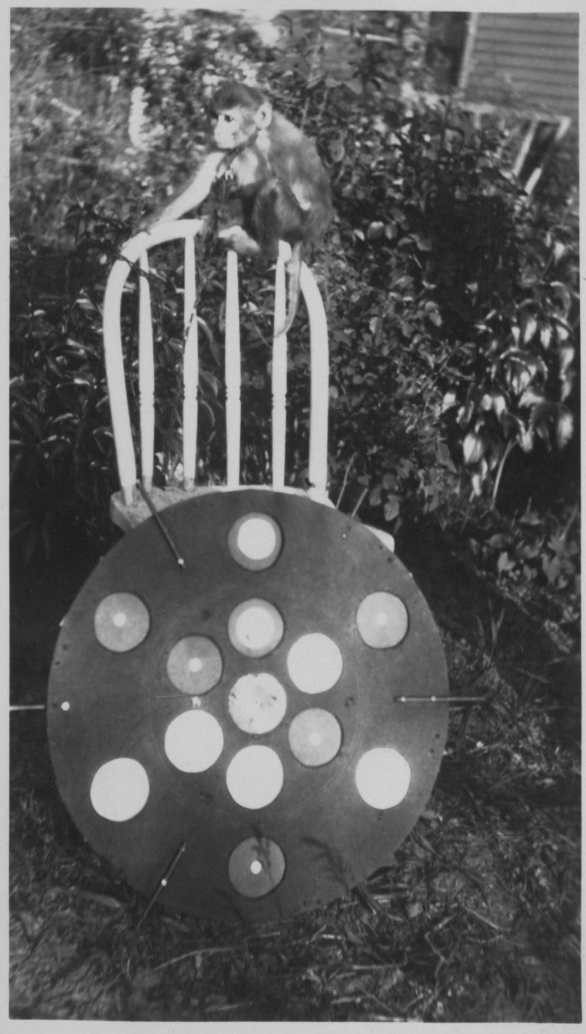


Fig 17

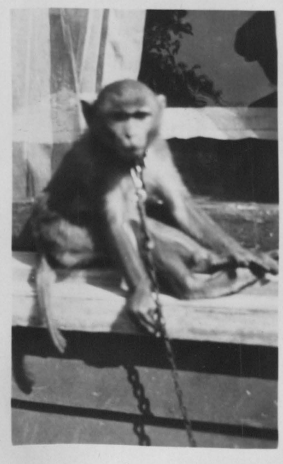


Fig. 14

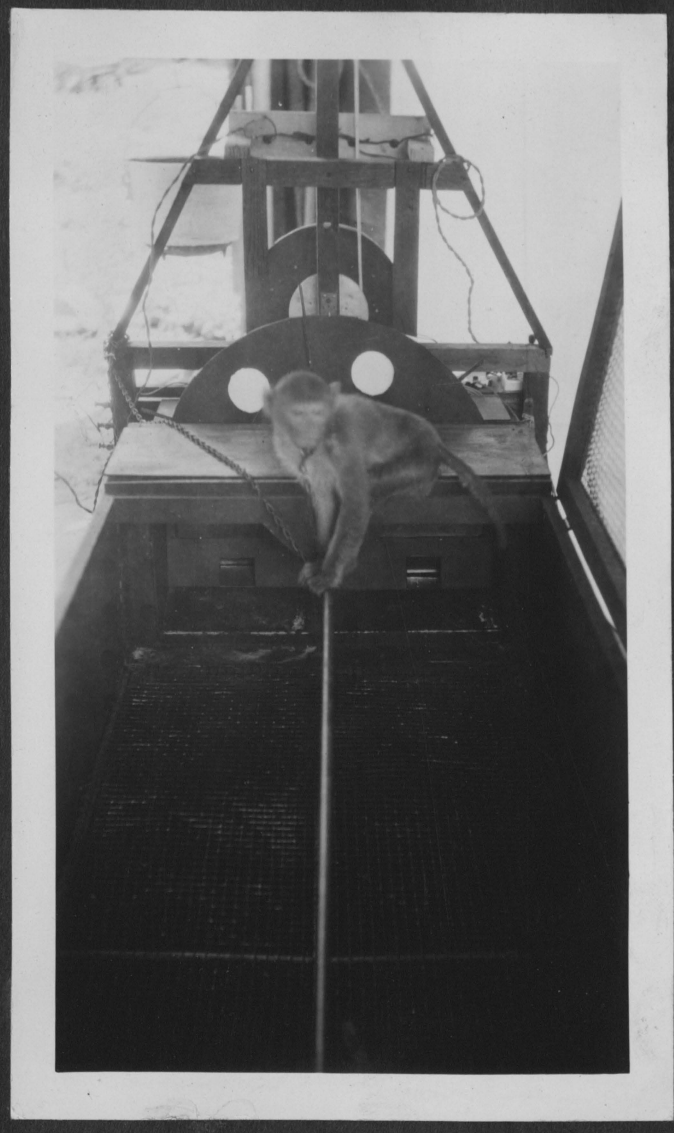


Fig. 19

Fig. 20

Fig. 21

Fig. 22

Fig. 23

Fig. 24

Fig. 25

which rotate upon a center shaft and present alternately at one end or the other a visual pattern consisting of two pairs of intensities.

3. The power unit.

The power unit consists of an iron kettle filled with sand, measured to just a little more than balance the load which it must drive. A window cord runs through pulleys to the driving drum of the apparatus. This drum is 4 inches in circumference and is bolted to a larger drum which drives the small cylindrical wheel on the main shaft by means of a motor fan belt. This cylinder is ratcheted to its shaft so that the weight may be wound up without disturbing the apparatus.

4. The step regulator.

The key to the proper stepping of the pattern variator discs is a wheel on the main shaft with 12 projecting spokes which rest one after another against a magnet arm extension. This extension is double with a set back, so that when the magnet draws the arm, the spoke of the wheel slips up against the other arm extension. When the magnet releases the arm, a spring draws it back and the spoke is released. The next spoke now comes up against the magnet arm. Twelve presentations, six on each variator disc, are made by means of this step regulator.

5. The choice pedals and food compartments (Figs. 26 & 27)

The magnet is actuated by any one of the four pedals situated two at each end of the choice compartment. These pedals are separated by a glass partition. In front of each pedal is a panel having a window of glass through which the paif or light discs may be seen. Below this window is an opening with a lid over a food carrier. When the four

lights, one behind each disc in the pattern, are lit the food compartments are both open. When a choice is made the small step of the variators releases the lid of the incorrect side, closing the food compartment and preventing the animal from eating in the incorrect side. The lid on the correct side remains open. As soon as the animal has eaten the small amount of food presented on the food carrier and leaves the pedal the magnet releases the spoke on the step regulator and the lights go off on that end and light at the other. Both food lids are now shut and pressing the pedal makes no record on the dark end. The animal soon learns to go to the light end for food.

6. The teleographic recorder.

A recorder similar to the one used for human subjects has been devised which automatically plots the choices of the animal on a sheet of stylographic paper. Also the timer records the time of each choice throughout the experiment.

7. The choice selector.

The key to the selection of choices is a choice selector (Fig. 28) with contacts which automatically send the correct impulse to the proper magnet of the teleograph, correct or incorrect as the case may be. This selector is carefully adjusted to the series of presentation patterns so that when the animal chooses correctly or incorrectly the proper record is made.

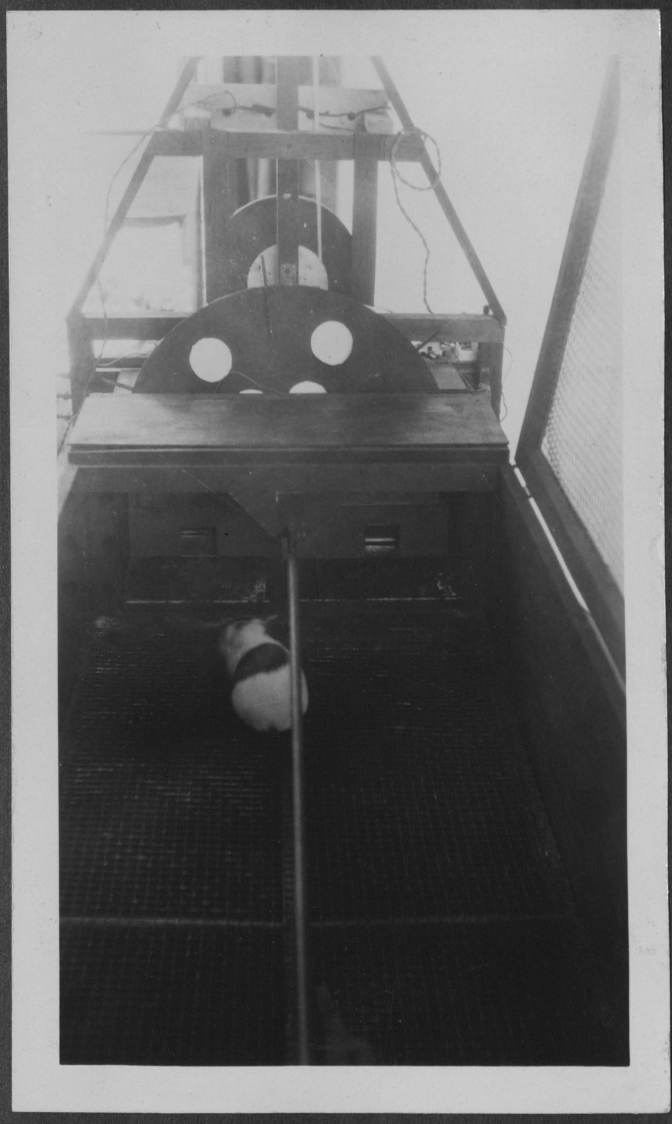


Fig. 26

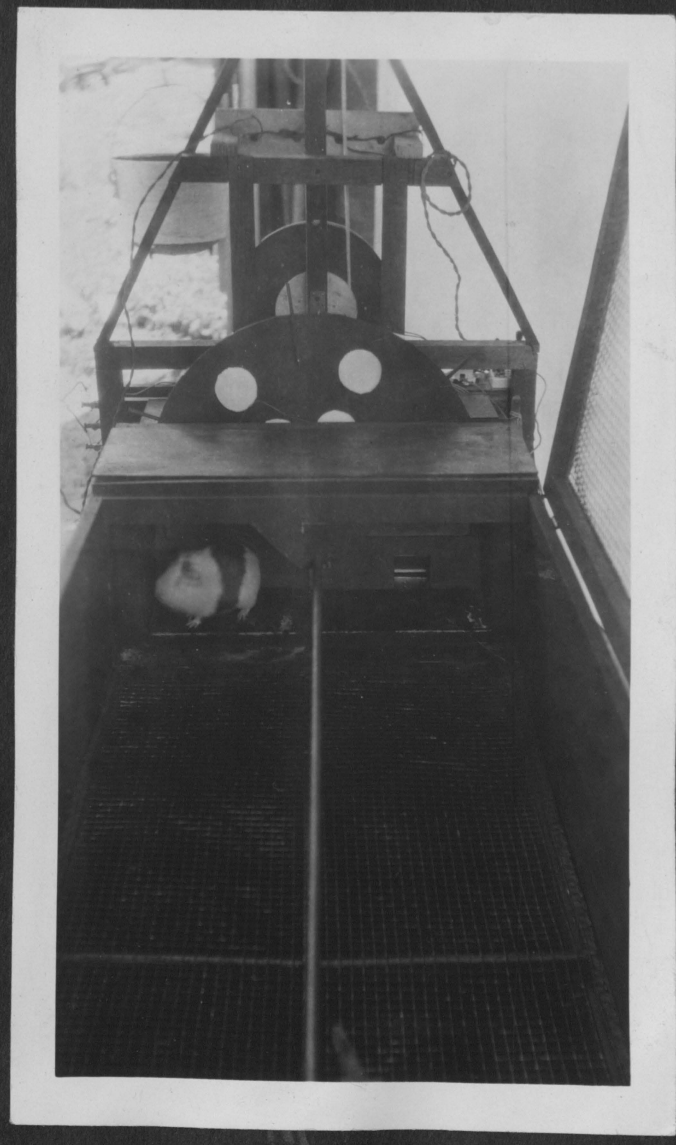


Fig. 27

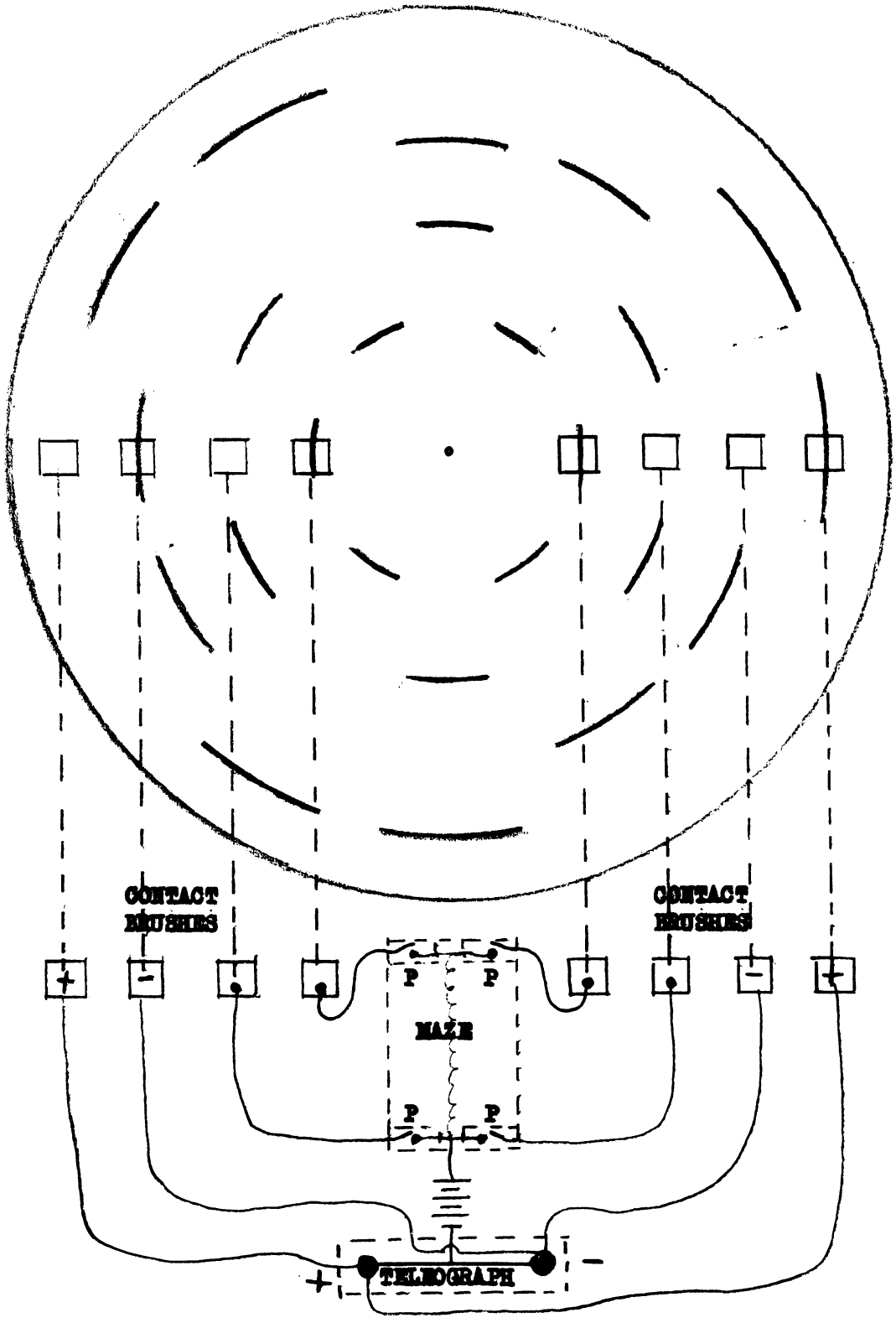


FIGURE 28. SELECTOR DISC AND WIRING (AUTOMATIC ANIMAL MAZE)

G. Results.

The results of the animal experimentation are hard to evaluate without more data. We set the maze with G.D. (Greater Difference) as the correct solution and got random results for a while and then a tendency toward the brighter side. When the correct solution was set for Lesser Difference we got the curves which we show herewith in Figure # 12. All animals continually tended to go to the brightest side. Difficulties in completing the mechanical operation of certain parts of the maze made further experimentation impossible. We believe with the construction of a Selector Disc for Greater Summation we would get a curve with fewer errors. We are not optimistic enough to think an animal will perfectly solve a relational problem without any mistakes, but if the great proportion of choices are correct we will have to say that the performance is not a random procedure.

In Figures 14 - 19 are shown the Monkey "Su". She is a Rhesus, and 11 months old. When we got her she was untamed and we spent a number of days with leather gloves frustrating her attempts to bite. She has become quite tractible now. She has three calls among many which we always recognize. When we ask her if she likes things, such as food, etc, she gives a little chirp of assent. When we bother her and she desires to be left alone she has a warning gutteral "ahgh". When she is lonely she calls with a sort of "bob white" call. We tried her with the Klüver technique and choice boxes with strings attached, she worked well but was worried because of onlookers whom we will eliminate hereafter. She gives promise over a period of time of demonstrating a discernment of relational patterns. That remains to be seen.

The Dog Byrd has been in our home for a year and a half. He is the son of a German Shepherd (Police) and a Scotch Collie. He was very glad to cooperate in choosing from boxes placed adjacent to the stimulus pattern. He preferred the brightest side and gave a greater number of correct than

incorrect choices. We plan to construct a runway with a larger Pattern Variator at each end , in other words an enlarged automatic maze, and we hope to get some most interesting facts from her behavior. Her present curve is quite similar to that of the Monkey "Su".

Finally, in the limited time which has been at our disposal, we have tried to originate apparatus and formulate a technique and carry on a research with 185 individuals on varying schedules with a multitude of interruptions. Nevertheless we believe we have "hit upon" a methodology which will open up a large field of research.

In the comparative field we have scarcely made a beginning. Our back yard is virtually living with guinea pigs from which we have selected a few that seemed to be brighter than the others. They learn readily and stand up to eat their food from hand and show far more adaptability than their reputation had led us to believe. We believe they can see patterns, especially the black eyed-ones, and will give interesting results.

We could wish that our Animal Insight Maze had been developed sooner. But the dead line for the delivery of this Study is here and we must draw our experimentation to a close so far as the present study is concerned.

Many of our own ideas seem tooccur as "strokes from the blue", but upon reflection there are always antecedents,sometimes analyzable and frequently not so. Would that we might live in a maze with a tabulator of our choices running constantly and that we might sit down sometime with the record and analyze and reflect. Perhaps that is just where we do live, psycho-biological organisms striving by insight to achieve the solution of what it is all about. And perhaps in the long future we shall find and having found shall be satisfied in that a preponderance of our choices have proven correct and our supreme choice a glorious reality.

No.	IQ Rank	Test Rank	Av. Grade	No.	IQ Rank	Test Rank	Av. Grade	No.	IQ Rank	Test Rank	Av. Grade
101	7	52	B	135	32	33	C	169	29	34	B
102	18	50	B	136	33	51	D	170	1	1	A
103	11	5	A	137	16	12	A	171	28	15	C
104	14	35	B	138	34	46	D	172	9	11	B
105	17	29	C	139	41	47	C	173	8	8	A
106	33	45	C	140	31	20	C	174	2	9	A
107	16	59	B	141	28	15	B	175	12	51	C
108	31	58	C	142	22	31	B	176	31	50	B
109	31	15	C	143	38	21	C	177	9	26	B
110	28	38	C	144	34	15	C	178	9	7	B
111	23	49	C	145	24	24	C	179	3	6	B
112	26	43	B	146	28	22	C	180	17	35	B
113	40	53	D	147	39	51	D	181	13	23	B
114	30	28	C	148	31	32	B	182	31	26	C
115	28	54	D	149	5	4	A	183	36	35	C
116	26	25	D	150	6	10	B	184	15	35	B
117	5	28	B	151	15	42	C	185	14	30	B
118	33	40	D	152	29	55	C	186	42	30	B
119	30	35	C	153	19	37	C	187	29	27	B
120	14	26	C	154	20	14	C	188	25	39	C
121	32	43	D	155	37	48	D	189	5	3	C
122	35	30	B	156	38	30	C	190	12	10	B
123	9	40	B	157	22	21	B	191	13	20	C
124	5	16	B	158	31	46	B	192	19	10	D
125	5	18	B	159	23	44	B	193	15	57	C
126	4	2	A	160	24	30	B	194	20	23	C
127	31	28	C	161	20	30	C	195	26	41	C
128	27	56	D	162	34	20	D	196	28	36	C
129	5	15	A	163	23	30	B	197	11	33	B
130	43	50	C	164	10	9	A	198	26	40	D
131	22	17	A	165	27	20	C	199	20	15	C
132	19	19	C	166	15	15	C	200	30	30	C
133	35	40	B	167	12	15	C	201	21	31	C
134	25	17	B	168	9	16	B				

This is a table showing the comparative ranking of 100 high school students showing their I. Q. rank, insight test rank (Insight Index) and average grade. There is a striking comparison between the I. Q. and the insight test.

CHAPTER VI

Summary and Conclusions.

1. The term insight has been established as an explanatory term and an adequate definition formulated.

2. Explicit criteria of insight are presented.

3. Insightful behavior is measurable by the use of the pattern variator insight test methodology.

4. Insightful behavior may be either gradual or abrupt.

5. There is a striking correspondence between the Insight Index rank and the I. Q. rank in a high school group of 101 pupils.

6. The language barrier can now be overcome in the testing of the adequacy of a conscious organism's behavior in a new situation.

7. The insight test furnishes a methodology for the direct comparison of the learning behavior of visually responsive animals and human beings.

8. Transfer, invariable pre-solution pause and similar response to transposed patterns are found in insightful behavior.

9. A greater proportion of correct than incorrect choices in animal learning has been demonstrated. Greater in the case of the dog and monkey, less in the cases of the rat and guinea pig. We present these results as indicative but not conclusive without further experimentation.

10. A vast field of experimentation in the measurement of insight is now open for further research.

1. Abel, Jl J. Education of the superior student. Jour. Chem. Educ., Feb., 1930, 7, 283-293.

2. Adams, D. K. Experimental studies of adaptive behavior in cats. Comp. Psychol. Monog., 1929, 6, No. 27.

3. Adler, A. The practice and theory of individual psychology. New York: Harcourt, Brace and Company, 1924.

4. Allen, J. The associative processes of the guinea-pig. Jour. Comp. Neur. and Psych., 1904, Vol. 14, 293.

5. Allport, F. H. Social psychology. New York: Houghton Mifflin Company, 1924.

6. Alonzo, A. S. The influence of manual guidance upon maze learning. Jour. Comp. Psychol., 1926, 6, 143-158.

7. Alpert, A. The solving of problem situations by pre-school children. New York: From Columbia University Contributions to Educ., 1928.

8. Andrews, E. C. Science and history: a short contribution to philosophy. Science, 1930, 72, 205.

9. Arps, G. D. Work with knowledge of results versus work without knowledge of results. Psy. Mon., 1920, Vol. 28.

10. Baldwin, B. T. Child psychology. Psy. Bull., 1928, Vol. 25, 629-697.

11. Bancroft, W. D. Rice Institute Pamphlet, 1928, 15, 167-286.

12. Batson, W. H. Acquisition of skill. Psychol. Monog., 1916, 31, No. 3.

13. Benger, E. D. The organization of industrial research. Ind. Eng. Chem., 1930, 22, 572.

14. Bentley, I. M. The field of psychology. New York City: D. Appleton & Co., 1924.

15. Beritoff, J. Ueber die individuell erworbene Tatigkeit den Berversystem bei Tauben. Pflug. Arc. f. d. ges. Physiol., 1926, 213, 370-406.

16. Bierens de Haan, J. A. Experiments on vision in monkeys. I. The colour sense of the pig-tailed Macaque. Jour. Comp. Psych., 1925, Vol. 5, 417.

17. _____. Uber das Suchen nach verstecktem Futter bei Affen und Halbaffen, 1930, II, 630-655.

18. Bierens de Haan, J. A. Die Baukunst eines niederen Affen (Cebus hypoleucus Humb.). Tijdschrift der ned. Kierkinde Vereiniging, 1930, 2, 23-27.

19. _____. Werkzeuggebrauch und Werkzeugherstellung bei einem niederen Affen (Cebus hypoleucus Humb.). Zsch. f. vergl. Physiol., 1931, 13, 639-695.

20. Bingham, H. C. Size and form perception in gallus domesticus. Jour. Animal Behav., 1913, Vol. 3, 65-113.

21. _____. Chimpanzee translocation by means of boxes. Comp. Psychol. Monog., 1929, 5, No. 25.

22. _____. Selective transportation by chimpanzee. Comp. Psychol. Monog., 1929, 5, No. 4.

23. Bingham, W. V., and Davis, W. T. Intelligence test scores and business success. Jour. Appl. Psy., 1924, Vol. 8, 1-22.

24. Billings, M. F. An experimental study for the purpose of comparing the ability for solving problems in the different fields of endeavor. thesis, University of Michigan, 1930.

25. Bird, C. The effect of maturation upon the pecking instinct of chicks. Ped. Sem., 1926, 33, 212-234.

26. Bode, B. H. Consciousness and psychology, creative intelligence, essays in the pragmatic attitude, by John Dewey and others. New York: Henry Holt and Company, 1917.

27. _____. Conflicting psychologies of learning. Chap. 10, Boston: D. C. Heath & Co., 1929.

28. Book, W. F. The intelligence of high school seniors. Macmillan, 1922.

29. _____. Psychology of skill. New York: Gregg, 1925.

30. _____. How to succeed in college. Baltimore: Warwick and York, 1927.

31. Book, W. F., and Norvell, L. The will to learn. Ped. Sem., 1922, Vol. 29, 305-362.

32. Boring, E. G. Psychology for eclectics. Psychologies of 1930. Worcester, Mass., Clark Univ. Press, 1930, 115-127.

33. _____, History of experimental psychology, New York, 1929.

34. Borovski, W. An attempt at building a theory of conditioned reflexes on spinal reflexes. Jour. Gen. Psychol., 1929, 2, 3-11.

35. Borovski, W. Experimentell Untersuchungeu uber den Lernprozess Nr 4 (Uber Labilitat der Gewohnheiten) Zsch. f. vergl. Physiol, 1930, 11, 549-564.

36. Bouman, L., & Grunbaum, A. A. Experimentelle-psychologische Untersuchungen zur Aphasie Und Paraphasie. Zsch. f. d. ges. Neur. u. Psychiat., 1925, 96, 481-538.

37. Brainerd, P. B. The mentality of a child compared with that of apes. Jour. Genet. Psychol., 1930, 37, 268-293.

38. Bray, C. W. Transfer of learning. Jour. Exp. Psy., 1928, Vol. 11, 443-467.

39. Breed, F. S. Reactions of chicks to optical stimuli. Jour. Animal Behav., 1912, Vol. 2, 280-295.

40. Brodie, Sir. Benj. Psychological inquiries. London: Longmans, Brown, Green & Longman, 1856, 3rd edition, Vol. 1, 20 et seq.

41. Bronner, Healy, Lowe, Shimberg. A manual of individual mental tests and testing. Boston: Little, Brown, and Company, 1927.

42. Brown, R. W. Essentials of mental measurement. 1911, 79-80.

43. _____. A comparison of the 'whole,''part' and 'combination' methods of learning piano music. J. Exp. Psy., 1928, Vol. 11, 235-247.

44. _____, and Thompson, G. H. Essentials of mental measurement. 3rd ed. Cambridge: Uni. Press, 1925.

45. Brown, Warner and Whittell, Florence Yerkes' multiple choice method with human adults. Jour. Comp. Psychol., 1923, Vol. 3, 305-318.

46. Buhler, K. Die geistige entwicklung des kindes. 3rd ed. Jena, Hustav Fischer, 1922.

47. Burt, Cyril Mental and scholastic tests. London, 1921, 180-184.

48. Burtt, Harold E. A study of the behavior of the white rat by the multiple choice method. Jour. Animal Behavior, 1916, Vol. 6, 232-246.

49. Bryan, W. L., & Harter, N. Studies in the physiology and psychology of the telegraphic language. Psychol. Rev., 1897, 4, 27-53; 1899, 5, 345-357.

50. Cannon, W. B. Bodily changes in pain, hunger, fear, and rage. 2d. ed. New York: D. Appleton and Company, 1929.

51. Carlson, A. J. The control of hunger in health and disease. Chicago: Univ. Chicago Press, 1916.

52. Carmichael, L. A further study of the development of behavior in vertebrates experimentally removed from the influence of external stimulation. Psychol. Rev., 1927, 34, 34-47.

53. Carmichael, R. D. The logic of discovery. Chicago: Open Court Pub. Co., 1930.

54. Carothers, F. E. The psychological examination of college students. Archives of Psychology, 1921, No. 46, 21 ff.

55. Carpenter, W. B. Principles of mental physiology. New York City: D. Appleton & Co., 1877.

56. Carr, H. A. Principles of selection in animal learning. Psy. Rev., 1914, Vol. 21, 157-165.

57. _____. Psychology, a study of mental activity. New York City: Longmans, Green & Co., 1925.

58. Carr, H. and Watson, J. B. Orientation in the white rat. Jour. Comp. Neur. and Psychol., 1908, 18, 27-44.

59. Cason, H. The conditioned reflex or conditioned response as a common activity of living organisms. Psychol. Bull., 1922, 22, 445-472.

60. _____. Criticizms of the laws of exercise and effect. Psychol. Rev., 1924, Vol. 31, 397-418.

61. _____. The physical basis of the conditioned response. Amer. Jour. Psychol., 1925, 36, 371-393.

62. Casteel, D. B. The discriminative ability of the painted turtle. Jour. Animal Behav., 1911, Vol. 1, 1-28.

63. Chapman, J. C. and Feder, R. B. The effect of external incentives on improvement. Jour. Educ. Psy., 1917, Vol. 8, 469-474.

64. Chartoris, J. Field Marshall Earl Haig. New York City: Charles Scribner's Sons, 1929.

65. Chassell, L. M. Tests for originality. Jour. Ed. Psychol., 1916, 317-328.

66. Chidsekel, M. Strictly private. Boston: The Stratford Co., 1928.

67. Child, C. M. The origin and development of the nervous system. Chicago, 1921

68. _____. Behavior origins from a physiologic point of view. Archives of Neur. & Psy., 1926, Vol. 15, 173-184.

69. Churchill, E. P. The learning of a maze by goldfish. Jour. Anim. Behav., 1916, Vol. 6, 247-255.

70. Clark, Hull The joint yield from teams of tests. Jour. of Educ. Psychol., 1923, 14, 396-406.

71. Clements, F. E. The effect of time on distance discrimination in the albine rat. Jour. Comp. Psychol., 1928, 8, 317-324.

72. Coburn, Charles A. and Yerkes, Robert M., A study of the behavior of the crow by the multiple choice method. Jour. Animal Behavior, 1915, Vol. 5, 185-225.

73. _____ and _____. A study of the behavior of the pig, Sus Scrofa, by the multiple choice method. Jour. Animal Behavior, 1915, Vol. 5, 185-225.

74. Coghill, G. E. Anatomy and the problem of behavior. New York: Macmillan, 1929.

75. Colvin, C. C. The learning process. New York: Macmillan, 1913.

76. Coover, J. E. Formal discipline from the stand point of experimental psychology. Psychol. Monog., 1916, 20, No. 3.

77. Culler, E. Nature of the learning curve. (abstract) Psy. Bull., 1928, Vol. 25, No. 3, 143.

78. Dashiell, J. F. Direction orientation in maze running by the white rat. Comp. Psychol. Monog., 1930, 7, No. 32.

79. _____. Spatial orientation in maze-learning as a species of animal gestaltung. Proc. ninth Internat. Cong. Psychol., Princeton Psychol. Rev. Co., 1930, 139-140.

80. Davis, H. G. The racoon: a study in animal intelligence. Amer. Jour. Psychol., 1907, 18, 447-490.

81. Davisson, C. J. Wave properties of electrons. Science, 1930, 71, 651.

82. Detwiler, S. R. Experiments on the reversal of the spinal cord in Amblystoma embryos at the level of the anterior limb. Jour. Exper. Zool., 1923, 38, 293-321.

83. _____. Coordinated movements in supernumerary transplanted limbs. Jour. Comp. Neur., 1923, 38, 461-490.

84. Dewey, J. How we think. Boston: Heath, 1910.

85. Dewey, Moore, et al. Creative intelligence. 1917, 8.

86. Dimnet, E. The art of thinking. New York City: Simon & Schuster, 1929.

87. Dodge, Raymond Autobiog, in psychology. History of Psychol. in Autob., 105.

86. Doll, E. A. The growth of intelligence. Psy. Mon., 1921, Vol. 29, No. 131, 21-130.

87. Dougherty, M. L. What changes the I. Q.? Elem. Sch. Jour., 1929, Vol. 29, 114-122.

90. Downey, J. E. Creative imagination. New York City: Harcourt, Brace & Co., 1929.

91. Dudeney, H. E. Modern puzzles and how to solve them. New York: Frederick A. Stokes Co., 1926.

92. Duncker, K. A qualitative (experimental and theoretical) study of productive thinking (solving of comprehensible problems). Jour. Genet. Psychol., 1926, 33, 642-708.

93. _____. Constructive thinking. Ped. Sem., Dec., 1926.

94. Ebbecke, U. Die kortikalen Erregungen. Leipzig, 1919.

95. Ebbinghaus, H. Uber das Gedachtnis. Ruger, orig. 1885. Eng. tr., New York, Teachers College, Columbia Univ., 1913.

96. Edwards, A. S. The fundamental principles of learning and study. 2d ed. Baltimore: Warwick and York, 1926.

97. Elliott, M. H. The effect of change of reward on the maze performance of rats. Univ. Calif. Publ. Psychol., 1928, 4, 19-30.

98. _____. The effect of change of "drive" on maze performance. Univ. Calif. Publ. Psychol., 1929, 4, 185-188.

99. Ellis, W. D. Gestalt psychology and meaning. Berkeley: Sather Gate Book Shop, 1930.

100. English, H.B. A Student's Dictionary of Psychological Terms. The Antioch Press.

101. Ewert, P. H. Bilateral transfer in mirror-drawing. Ped. Sem., 1926, (1929. 3, 235-249.

102. _____. A study of the effect of inverted retinal stimulation upon spatially co-ordinated behavior. Genet. Psychol. Monog., 1930, 7, Nos. 3 & 4.

103. Fehr, H. Enquete de l'enseignment mathematique. Gauthier-Villars, Paris, 1912.

104. Fields, P. E. Form discrimination in the white rat. Jour. Comp. Psychol., 1928, 8, 143-158.

105. _____. The white rat's use of visual stimuli in the discrimination of geometric figures. Jour. Comp. Psychol., 1929, 9, 107-122.

106. _____. Contributions to visual figure discrimination in the white rat. Part I Jour. Comp. Psychol., 1931, 11, 327-348.

107. Fields, P. E. Contributions to visual figure discrimination in the white rat. Part II, Jour. Comp. Psychol., 1931, 11, 349-366.

108. Fracker, G. C. On the transference of training in memory. Psychol. Monog., 1908, 9, No. 2.

109. Frank, L. K. Suggestion for a theory of learning. Psychol. Rev., 1923, 30, 145-148.

110. _____. The problem of learning. Psychol. Rev., 1926, Vol. 33, 329-351.

111. Franz, S. I. Variation in the distribution of the motor centers. Psychol. Monog., 1915, 19, 80-162.

112. Freeman, F. N. Mental tests: their history principle and application. Boston: Houghton, Mifflin, 1926.

113. _____. Scientific and philosophical methods in education. Science, 1931, 73, 54.

114. Fritz, M. F. A note on the use of tools by the white rat. Jour. Genet. Psychol., 1930, 37, 330-331.

115. Gayton, A. H. The discrimination of relative and absolute stimuli by albine rats. Jour. Comp. Psychol., 1927, Vol. 7, 93-107.

116. Galton, F. Hereditary genius: an inquiry into its laws and consequences, 1869.

117. Garrett, H. E. Statistics in psychology and education. New York: Longmans, Green, 1926.

118. _____. Great experiments in psychology. New York: New Century Co., 1930, 255-262.

119. Gelb, A. & Goldstein, K. Psychologische analysen hirnpathologischer falle. Leipzig, 1920.

120. Gellermann, L. W. The double alternation problem: I. the behavior of monkeys in a double alternation temporal maze. Jour. Genet. Psychol., 1931, 39, 50-72.

121. Gengerelli, J. A. Studies in abstraction with the white rat. Jour. Genet. Psychol., 1930, 38, 171-202.

122. _____. Preliminary experiments on the causal factors in animal learning. Jour. Comp. Psychol., 1928, 8, 435-458.

123. Gesell, A. The mental growth of the pre-school child. Macmillan, 1925.

124. Gesell, T. R. and Lord, E. E. A psychological comparison of nursery school children from homes of low and high economic status. Ped. Sem., 1927, Vol. 34, 339-356.

125. Gibson, J. J. The reproduction of visually perceived forms. Jour. Exper. Psychol., 1929, 12, 1-39.

126. Gibson, W. R. B. The principle of least action as a psychological principle. Mind, N. S., 1900, 9, 469-495.

127. Gilbert, G. K. Amer. Jour. Sci., 1886, 8, 81, 286.

128. Gilhousen, H. C. The use of vision and of the antennae in the learning of crayfish. Univ. Calif. Publ. Physiol., 1929, 7, 73-89.

129. _____. An analysis of errors in serial motor action. Univ. Calif., Ph. D. Thesis, 1930.

130. _____. An investigation of insight in rats. Science, 1931, 73, 711-712.

131. Goddard, H. H. Psychology of the normal and subnormal. New York: Dodd, Mead, 1919.

132. Goldstein, K. Das wesen der amnetischen aphasie. Schweiz. Arch. f. Neur. u. Psychiat., 1924, 15, 163-175.

133. Gotz, W. Vergleichende untersuchungen zur psychologie des optischen wahrnehmungsvorgange. I. Experimentelle untersuchungen zum problem der sehgrossenkonstanz bein haushuhn. Zsch. f. Psychol., 1926, Vol. 99, 247-260.

134. Graber, Vitus Grundlinien zur erforschung des helligkeits und farbensinnes der tiere. 1886. Cf. Washburn and Bentley, Jour. Comp. Neurol. and Psychol., 1906, Vol. 16, 113-125.

135. Gregory, Sir Richard Discovery, or the spirit and service of science. New York: Macmillan Co., 1923.

136. Guilford, J. P. The role of form in learning. Jour. Exp. Psy., 1927, Vol. 10, 415-423.

137. Guthrie, E. R. Conditioning as a principle of learning. Psychol. Rev., 1930, 37, 412-428.

138. Hamil, R. Sequence of twins versus distances as essential pattern elements in the maze problem. Jour. Comp. Psychol., 1931, 11, 367-382.

139. Hamilton, G. V. A study of trial and error reactions in mammals. Jour. of Animal Behav., 1911, Vol. 1, 33-66.

140. Hamilton, G. V. A study of perseverance reactions in primates and rodents. Behav. Monog., 1916, 3, No. 13.

141. Hankin, E. H. Common sense and its cultivation. New York: Dutton & Co., 1926.

142. Hartmann, G. W. The concept and criteria of insight. Psychol. Rev., 1931, 38, 242-253.

143. Hazlitt, H. Thinking as a science. New York: E. P. Dutton & Co., 1916.

144. Head, H. Aphasia and kindred disorders of speech. New York, 1926.

145. Helmholtz, H. von Vorträge u. reden, 5th Aufl., Braunschweig, F. Viewog u. Sohn, 1903.

146. Helson, Harry The psychology of gestalt. 1926, Off print from the Amer. Jour. Psychol., Vol. 36, 1925, 342-370, 494-526; Vol. 37, 1926, 25-62, 189-223.

147. _____. Insight in the white rat. Jour. Exper. Psy., 1927, Vol. 10, 378-396.

148. Herrick, C. J. Brains of rats and men. Chicago, 1926.

149. Hertz, M. Beobachtung an gefangeugen rabenvogeln. Psychol. Forsch., 1926, 8, 336-397.

150. _____. Wahrnemungspsychologische untersuchungen am eichelhaher, I & II. Zsch. f. vergl. Physiol., 1928, 7, 144-194; 617-656.

151. Higginson, G. D. Visual perception in the white rat. Jour. Exper. Psychol., 1926, Vol. 9, 337-347.

152. Hilgard, E. R. Conditioned eyelid reactions to a light stimulus based on the reflex wink to sound. Psychol. Monog., 1931, 41, No. 184.

153. Hineline, G. M. W. Color vision in the mudminnow. Jour. Exper. Zool., 1927, Vol. 47, 85-94.

154. Hobhouse, L. T. Mind in evolution. 1915, 70 ff.

155. Holmes, G. & Lister, W. T. Disturbances of vision from cerebral lesions with special reference to the macula. Brain, 1915, 39, 34-73.

156. Holmes, O. W. Mechanism in thought and morals. Boston: J. R. Osgood & Co., 1871.

157. Holmes, S. J. The evolution of animal intelligence. New York: Henry Holt and Company, 1911.

158. Holmes, S. J. Studies in animal behavior. Boston: Richard G. Badger, the Gorham Press, 1916.

159. Holsopple, J. Q. and Vanouse, I. A note on the beta hypothesis of learning. School & Soc., 1929, 29, 15-16.

160. Holt, E. B. The freudian wish. New York: Henry Holt and Company, 1915.

161. _____. Animal drive and the learning process. New York: Henry Holt and Company, 1931.

162. Holzinger, Karl J. Note on the use of spearman's prophecy formula for reliability. Jour. Educ. Psychol., 1923, Vol. 14, 5, 301-305.

163. Honzik, C. H. Delayed reaction in rats. Univ. Calif. Publ. Psychol., 1913, 4, 307-318.

164. Howell, W. H. Text-book of physiology. Philadelphia: W. B. Saunders Company, 8th ed., 1922.

165. Hull, C. L. A functional interpretation of the conditioned reflex. Psychol. Rev., 1929, 36, 498-511.

166. _____. Simple trial-and-error learning: a study in psychological theory. Psychol. Rev., 1930, 37, 241-256.

167. _____. Knowledge and purpose as habit mechanisms. Psychol. Rev., 1930, 37, 511-525.

168. Hullfish, H. G. Aspects of Thorndike's psychology in their relation to educational theory and practice. Columbus: Ohio State Univ. Contr. in Princ. of Educ., 1926, No. 1.

169. Humphrey, George Learning and the living system. Psy. Rev., 1930, 37, No. 6.

170. Hunter, W. S. Delayed reaction in animals and children. Behav. Monog., 1913, 2, No. 6.

171. _____. Kinaesthetic sensory processes in the white rat. Psychol. Bull., 1918, 15, 36-37.

172. _____. The temporal maze and kinaesthetic sensory processes in the white rat. Psychobiol., 1920, 2, 1-17.

173. _____. The behavior of raccoons in a double alternation temporal maze. Jour. Genet. Psychol., 1928, 35, 374-388.

174. _____. Human behavior. Chicago, 1928, 355.

175. _____. Sensory control of the maze habit in the white rat. Jour. Genet. Psychol., 1929, 36, 505-537.

176. Hunter, W. S. Experimental studies of learning. Foundations of experimental psychology. Worcester: Clark Univ. Press., 1929, 564-627.

177. _____. Experimental studies of learning. Chapter 15, in The foundations of experimental psychology. Clark University Press. 1929.

178. _____. The delayed reaction tested by the direct method: a correction. Psychol. Bull., 1929, 26, 546-548.

179. Hurlock, E. B. The effect of incentives upon the constancy of the I. Q. Ped. Sec., 1925, Vol. 32, 422-434.

180. Hutchinson, E. D. Technique of creative thought, unpublished Report to National Research Council.

181. Hsiao, H. H. An experimental study of the rat's "insight" within a spatial complex. Univ. Calif. Publ. Psychol., 1929, 4, 57-70.

182. James, Wm. Talks to teachers on psychology--the gospel of relaxation. New York: Henry Holt & Co., 1915.

183. Jastrow, Joseph The subconscious. Boston: Houghton Mifflin Co., 1906.

184. Jennings, H. S. Modifiability in behavior. I. Behavior of sea anemones. Jour. Exper. Zool., 1905, 2, 447-472.

185. _____. The behavior of lower organisms. New York, 1906, 366.

186. _____. Behavior of the starfish astereas forreri de loriol. Univ. Calif. Publ. Zool., 1907, 4, 53-185.

187. Johnson, H. M. Visual pattern discrimination in the vertebrates. Jour. Animal Behav., 1914, Vol. 4, 319-339; 340-361. 1916, Vol. 6, 169-188.

188. _____. Some fallacies underlying the use of psychological tests. Psy. Rev., 1928, Vol. 35, 328-337.

189. _____. A simpler principle of explanation of imaginative and ideational behavior and of learning. Jour. Comp. Psychol., 1927, 7, 187-235.

190. Jones, D. Caradog A first course in statistics, 1921, 233.

191. Kantor, J. R. The evolution of psychological textbooks since 1912. Psychol. Bull., 1922, 19, 429-442.

192. _____. Principles of psychology. New York: Alfred A. Knopf, 1924, Vol. 1.

193. Kappers, C. U. A. Further contributions on neurobiotaxis. IX. An attempt to compare the phenomena of neurobiotaxis with other phenomena of taxis and tropism. Jour. Comp. Neur., 1917, 27, 261-298.

194. Kelley, T. L. Statistical method, 1923, p. 190.

195. _____. Interpretation of educational measurements. Yonkers: World Book Co., 1926.

196. Kincaid, M. A study of individual differences in learning. Psychol. Rev., 1925, 32. 34-53.

197. Kinnaman, A. J. Mental life of two Macacus Rhesus monkeys in captivity. Amer. Jour. Psychol., 1902, Vol. 13, 98-148, 175-218.

198. Kjerstad, C. L. The form of the learning curves for memory. Psychol. Monog., 1919, 26, No. 5.

199. Kluver, H. An experimental study of the eidetic type. Genet. Psychol. Monog., 1926, 1, 71-230.

200. _____. The equivalence of stimuli in monkeys. Pro. Ninth Internat. Cong. Psychol. (Princeton, Psychol. Rev. Co., 1930) 263-264.

201. _____. The equivalence of stimuli in the behavior of monkeys. Jour. Genet. Psychol., 1931, 39, 3-27.

202. Koch, H. C., The influence of mechanical guidance upon maze learning. Psychol. Monog., 1923, 32, No. 147.

203 Koffka, K. Perception: An introduction to the Gestalt-Theorie. Psych. Bull. (1922) 19, 531-585.

204. _____. Mental development. Ped Sem., 1925, Vol. 32, 659-673.

205. _____. On the structure of the unconscious in The Unconscious, A Symposium. New York: Knopf, 1928, 43-68.

206. _____. The growth of the mind. 2d. ed. rev. New York: Harcourt, Brace and Company, 1928.

207. Koffka & Köhler, articles in Psychologies of 1925.

208. Köhler, W. Die Methoden der psychologischen Forschung an Affen. Handbuch der biologischen Arbeitsmethoden. Berlin. 1921.

209. _____. Intelligenzprufugen an Anthropoiden, Berlin, 1921.

210. _____. Über eine neue Methode zur psychologichen Untersuchung von Menschenaffen. Psychol. Forsch., 1922, 2, 380-397.

211. _____. The mentality of apes. New York: Harcourt, Brace and Co., 1925.

212. _____. Gestalt Psychology. New York: Horace Liveright, 1929.

213. Kreezer, G. & Dallenbach, K. M., Learning the relation of opposition. Amer. Jour. Psychol., 1929, 41, 432-441.

214. Kroh, O. Weitere Beitrage zur Psychologie des Haushuhns. Zsch. f. Psychol., 1927, Vol. 103, 203-227. (See Psychol. Abst. Jan. 1928).

215. Kroh, O., and Scholl, R. Vergleichende Untersuchungen zur Psychologie der optischen Wahrnehmungsvorgange II. Über die teilinhaltliche Beachtung von Form und Farbe beim Harshuhn. Zsch. f. Psychol., 1926, Vol. 100, 260-273.

216. Kuo, Z. Y. The Nature of unsuccessful acts and their order of elimination in animal learning. Jour Comp. Psy., Vol. 2, 1922, 1-27.

217. _____. The fundamental error of the concept of purpose and the trial and error fallacy. Psy. Rev., 1928, Vol. 35, 414-433. See also 524-530; 532.

218. Laguna, Grace A. de. Sensation and perception. Jour. Philos., Psychol. Sci. Meth., 1916, 13; 533-547; 617-630.

219. _____. Speech, its function and development (New Haven, Yale Univ. Press, 1927).

220. Lang, J. M. and Olmsted, J. M. D. Conditioned reflexes and pathways in the spinal cord. Amer. Jour. Physiol., 1923, 65, 603-611.

221. Langfeld, H. S. Consciousness and motor response. Psychol. Rev., 1927, 34, 1-9.

222. _____. A response interpretation of consciousness. Psychol. Rev., 1931, 38, 87-108.

223. Lapicque, L. Lepoids du cerveau et l'intelligence. J. de psychol. 1922, 19, 5-23.

224. Lashley, K. S. The aquisition of skill in archery. Washington: Carnegie Inst. 1915.

225. _____. A causal factor in the relation of the distribution of practice to the rate of learning. Jour. Anim. Behav., 1917, 7, 139-142.

226. _____. A simple maze; with data on the relation of the distribution of practice to the rate of learning. Psychobiol., 1918, 1, 353-367.

227. _____. Brain mechanisms and intelligence. Chicago: Chicago Univ. Press, 1929.

228. _____. Learning: I. Nervous mechanisms in learning. The foundations of experimental psychology. Worcester, Mass., Clark Univ. Press, 1929, 524-563.

229. _____. The mechanism of vision: II. The influence of cerebral lesions upon the threshold of discrimination for brightness in the rat. Jour. Genet. Psychol., 1930, 37, 461-480.

230. _____. The mechanism of vision: III. The comparative visual acuity of pigmented and albino rats. Jour. Genet. Psychol., 1930, 37, 481-484.

231. _____. The mechanism of vision: I. A method for rapid analysis of pattern vision in the rat. Jour. Genet. Psychol., 1930, 37, 453-460.

232. Lashley, K. S., & Ball, J. Spinal conduction and kinaesthetic sensitivity in maze habit. Jour. Comp. Psychol., 1929, 9, 70-106.

233. Lashley, K. S., & Hubbert, H. B. Retroactive association and the eli ination of errors in the maze. Jour. Anim. Behav., 1917, 7, 130-138.

234. Leuba, J. H., Psychology of Religious Mysticism. New York: Harcourt, Brace and Co., 1925.

235. Lewin, K., Vorsatz, Wille und Bedurfnis. Psychol. Forsch., 1926, 7, 330-385.

236. _____. Untersuchungen zur Handlungs-und Affektpsychologie. I. Vorbemerkungen uber die seelischen Krafte and Energien und uber die Struktur des Seelischen. Psychol. Forsch., 1926, 7, 294-329.

237. Lewin, K. Untersuchungen zur Handlungs-und Affektpsychologie. III. Über das Behalten von erledigten und unerledigten Handlungen. Von Bluma Zeigarnik, Psychol. Forsch., 1927, 9, 1-85.

238. _____. Die Auswirkung von Umweltkraften. Proc. Ninth Internat. Cong. Psychol. (Princeton, Psychol. Rev. Co., 1930) 286-288.

239. _____. Environmental forces in child behavior and development, A Handbook of Child Psychology. Worcester, Mass.: Clark Univ. Press, 1931), 94-127.

240. Libby, Walter, An introduction to the history of science. Boston: Houghton Mifflin Co., 1917.

241. Lindemann, E. L. Untersuchungen uber primitive Intelligenzleistungen hochgradig Schwachsinniger und ihr Verhaltnis zu den Keistungen von Anthropoiden. Zsch. f. d. ges. Neur. und Psychiat., 1926, 104, 529-570.

242. Lindley, E. H. A study of puzzles. Amer. Jour. Psychol. Vol. VIII, 431 ff.

243. Lindley, S. B. The maze-learning ability of anosmic and blind anosmic rats. Jour. Genet. Psychol., 1930, 37, 245-267.

244. Lindworsky, J. Das Schlussfolgerndo Denken. 1916.

245. _____. Der Wille, 3rd ed., 1923.

246. _____. Experimental Psychology. The Macmillan Co., 1931, (Tr. by H. R. De Silva, 1930).

247. Lipmann, O. Uber Begrill und Erforschung der 'naturlichen' Intelligenz. Zsch. f. angew. Psychol., 1918, 13, 192-201.

248. Lipmann, O., and Bogen, H. Naive Physik., Theoretische und experimentelle Untersuchungen uber die Fahigkeit zu Intelligentem Handeln. Leipzig, Barth, 1923.

249. Liu, S. Y. The relation of age to the learning ability of the white rat. Jour. Comp. Psychol., 1928, 8, 75-86.

250. Loeb, J. Comparative physiology of the brain and comparative psychology. New York: 1902.

251. Loews, J. L. Road to Xanadu; A study in the ways of the imagination. Boston: Houghton Mifflin Co., 1927.

252. Lubbock, J. Ants, Bees and Wasps. (1881) 1906.

253. Ludgate, K. E. The effect of manual guidance upon maze learning. Psychol. Monog., 1923, 33, No. 148.

254. Luh, C. W. The conditions of retention. Psychol. Monog., 1922, 31, No. 3.

255. Lumley, F. H. An investigation of the responses made in learning and multiple choice maze. Psychol. Monog., Vol. 42, No. 2, Ohio State, 1931.

256. Lyon, D. C. The relation of quickness of learning to retentiveness. Arch of Psy., 1916, Vol. 34, 1-60.

257. Macfarlane, D. A. The role of kinesthesis in maze learning. Univ. Calif. Publ. Psychol., 1930, 4, 277-305.

258. Maier, N. R. F. Delayed reaction and memory in rats. Jour. Genet. Psychol., 1929, 36, 538-550.

259. Matthaei, R. Von den theorien uber eine allgemein-physiologische Grundlage des Grundlage des Gedachtnisses. Zsch. f. allg. Physiol., 1921, 19, 1-46.

260. May, M. A. Predicting Academic Success. Jour. Educ. Psychol., 1923, Vol. XIV, 7, pp. 439-440.

261. Mead, G. H. A behavioristic account of the significant symbol. Jour. Philos., 1922, 19, 157-163.

262. Meumann, E. sycholoby of learning. (Tr. Baird), New York: Appleton, 1913.

263. Miles, W. R. The narrow-path elevated maze for studying rats. Proc. Soc. Exper. Biol. & Med., 1927, 24, 454-456.

264. _____. On the history of research with rats and mazes--a collection of notes. Jour. Genet. Psychol., 1930, 3, 324-337.

265. _____. The comparative learning of rats on elevated and alley mazes of the same pattern. Jour. Comp. Psychol., 1930, 10, 237-261.

266. Monakow, C. Z. Die Lokalization im Grosshirn. Wiesbaden, 1914.

267. Morgan, C. L. Animal behavior. London: Arnold, 1900.

268. Muenzinger, K. F. Plasticity and mechanization of the problem box habit in guinea pigs. Jour. Comp. Psychol., 1928, 8, 45-69.

269. Muenzinger, K. F., Koerner, L. and Irey, E. Variability of an habitual movement in guinea pigs. Jour. Comp. Psychol., 1929, 9, 425-536.

270. Muller, G. E. And Schumann, F. Experimentelle Beitrage zur Untersuchung des Gedachtnisses. Zsch. F. Psychol., 1894, 6, 81-190; 257-339.

271. Munn, N. D. Concerning visual form discrimination in the white rat. Jour. Genet. Psychol., 1929, 36, 291-300.

272. _____. Visual pattern discrimination in the white rat. Jour. Comp. Psychol., 1930, 10, 145-166.

273. Munsterberg, H. On the witness stand. New York: Clark, Boardman, 1923.

274. Murchison, Carl Criminal intelligence. Clark Univ. Press, 1926.

275. _____. Psychologies of 1925. Clark Univ. Press, 1927.

276. _____. The foundations of experimental psychology. Clark Univ. Press, 1929.

277. _____. Visual form discrimination in the rat. Jour. Genet. Psychol., Worcester, Clark University, XXII, 1925.

279. Murphy, Gardner An historical introduction to modern psychology. 1929.

280. McCall, W. M. How to experiment in education, 1923, p. 95 ff.

281. Mc Dougall, K. D. and McDougall, W., Insight and foresight in various animals- monkey, raccoon, rat and wasp. Jour. Comp. Psychol., 1931, II, 237-274.

282. McDougall, W. Psychology, the study of behavior. New York: Henry Holt and Co., 1912.

283. _____. Outlines of psychology. New York: Charles Scribner's Sons, 1923.

284. _____. Purposive or mechanical psychology. Psychol. Rev., 1923, 30, 273-288.

285. McDougall, W. Men or robots? I & II Psychologies of 1925, Worcester, Mass: Clark Univ. Press, 1926, 273-305.

286. _____. Modern materialism and emergent evolution. New York: Van Nostrand Co., Inc., 1929.

287. _____. The hormic psychology, Psychologies of 1930. Worcester, Mass: Clark Univ. Press, 1930, 3-36.

288. McDougall, W. and McDougall, K. D. Notes on instinct and intelligence in rats and cats. Jour. Comp. Psychol., 1927, 7, 145-175.

289. Nellman H. and Trendelenburg, W. Ein Beitrag zur Intelligenzprufungen neiderer Affen. Zsch. f. vergl. Physiol., 1926, 4, 142-201.

290. Neumann, G. Experimentelle Beitrage zur Lehre von der Okonomie und Technik des Lernens. Zsch. f. exper. Pad., 1907, 4, 63-101.

291. Nyswander, D. B. Recency, frequency and pattern factors in learning. Ph. D. Thesis University of California, 1926.

292. Ogden, R. M. Learning as improvement. Amer. Jour. Psy., 1927, Vol. 39, 235-258.

292a. _____. "Insight". Amer. Jour. Psy., Apr. 1932, Vol. XLIV, No. 2. p.350-356.

293. _____. Psychology and education. New York: Harcourt, Brace and Co., 1929.

294. Otis, A. S. Statistical method in educational measurement, 1925, 334-336.

295. Parker, G. H. Hearing and allied senses in fishes. Bull. U. S. Bureau Fish., 1903, Vol. 22, 45-64.

296. Paterson, D. G. The Johns Hopkins circular maze studies. Psychol. Bull., 1917, 14, 294-297.

297. Pavlov, I. P. The Work of the digestive glands. 2d. Eng. ed. London: Charles Griffin and Co., 1910.

298. _____. Conditioned reflexes. An investigation of the physiological activity of the cerebral cortex. London: Oxford Univ. Press, Humphrey Milford, 1927.

299. _____. Lectures on conditioned reflexes; twenty-five years of objective study of the higher nervous actitity (behavior) of animals. New York: International Publishers, 1928.

300. Pear, T. H. Skill in work and play. New York: Dutton, 1924.

301. Pechstein, L. A. Whole vs. part methods in motor learning. Psychol. Monog., 1917, 33, No. 99, p. 80.

302. Pentschew, C. Untersuchungen zur Okonomie und Technik des Lernens. Arch. f. d. ges. Psychol., 1903, I, 417-526.

303. Perkins, T. F. and Wheeler, R. H., Configurational learning in the goldfish. Comp. Psychology Monog. Vol. 7, No. 1, 1930.

304. Perrin, F.A.C. and Klein, D. B. Psychology, its methods and principles. New York: Henry Holt and Co., 1926.

305. Perry, R. B. Purpose as a systematic unity. Monist., 1917, 352-375.

306. _____. Purpose as tendency and adaptation. Philos. Rev., 1917, 26, 477-495.

307. _____. Docility and purposiveness. Psychol. Rev., 1918, 25, 1-21.

308. _____. A behavioristic view of purpose. Jour. Philos., 1921, 18, 85-105.

309. _____. The independent variability of purpose and belief. Jour. Philos., 1921, 18, 169-180.

310. _____. The cognitive interest and its refinements. Jour. Philos., 1921, 18, 365-375.

311. _____. The appeal to reason. Philos. Rev., 1921, 30, 131-169.

312.q _____. General theory of value. New York: Longmans, Green and Co., 1926.

313. Peterson J. The effect of attitude on immediate and delayed reproduction. A class experiment. Jour. of Educ. Psy., 1916, Vol. 7, 523-532.

314. _____. Completeness of response as an explanation principle in learning. Psy. Rev., 1916, Vol. 23, 153-163.

315. _____. Frequency and recency factors in maze learning by white rats. Jour. Anim. Behav., 1917, 7, 338-364.

316. _____. Experiments in ball-tossing; the significance of learning curves. Jour. Exp. Psy., 1917, Vol. 2, 178-224.

317. Peterson, J. The backward elimination of errors in mental maze learning. Jour. Exper. Psychol., 1920, 3, 257-280.

318. _____. Learning when recency and frequency factors are negative. Jour. Exper. Psychol. Vol. 5, 1922, 270-300.

319. _____. Early conceptions and tests of intelligence. Yonkers: World Book Co., 1926.

320. _____. Forced adjustments vs. association in constructive learning and thinking. Amer. Jour. Psy., 1927, Vol. 39, 264-282.

321. _____. Learning when frequency and recency factors are negative and right responses are painful. Psychol. Bull., 1931, 28, 207-208.

322. Pieron, H. Thought and the brain. London, 1926.

323. Pintner, R. Intelligence testing. New York: Henry Holt and Co., 1923.

324. Platt, W. Organization of industrial research. Ind. Eng. Chem., 21, 655, 1929.

325. Platt, W. and Baker, R. A. The relation of the scientific hunch to research. Jour. of Chem. Educ., 8, 1931, 1969.

326. Pöffenberger, A. T. The influence of improvement in one mental process upon other related processes. Jour. Educ. Psychol., 1915, 6, 459-474.

327. _____. Applied Psychology: its principles and methods. New York: D. Appleton and Co., 1927.

328. Poincaré, H. Science et méthode. Paris, 1920.

329. Poppelreuter, W. Ueberden Versuch einer Revision der psychophysiologischen Lehre von der elementared Assoziation und Reproduction. Monatssch. f. Psychology u. phychiat. u. Neur., 1915, 37, 278-323.

330. _____. Die psychischen Schadigungen durch Kopfschuss. Leipzig, 1917.

331. Pyle, W. H. Standards of mental efficiency. Jour. Educ. Psychol., 1913, 4, 61-70.

332. _____. The psychology of learning. (Rev. ed.). Baltimore: Warwick and York, 1928.

333. Révész, G. Experiments on animal space perception. Brit. Jour. of Psychol., (Gen. Sect.) Vol. 14, Pt. 4, 1924, 286-414.

334. _____. Experimental study in abstraction in monkeys. Jour. Comp. Psychol., 1925, Vol. 5, 295-341.

335. Ribot, Th. A. Essay on creative imagination. (Tr. by A. H. N. Bacon) Chicago: Open Court Publishing Co., 1906.

336. Richter, C. P. Behavioristic study of the activity of the rat. Comp. Psychol. Monog., 1922, 1, No. 2.

337. _____. Animal behavior and internal drives. Quart. Rev. Biol. 1927, 2, 307-343.

338. Rignano, Eugenio, Psychology of reasoning. (Tr. by W. A. Hall) New York: Harcourt, Brace & Co., 1923.

339. Ritter, W. E. The Unity of the organism. Boston. 1919.

340. Roback, A. A. Behaviorism and psychology. Cambridge, Mass., Sci. Art. 1923.

431. Roberts, W. H. The effect of delayed feeding of white rats in a problem cage. Jour. Genet. Psychol., 1930, 37, 55-68.

432. Robinson, E. W. and Wever, E. G. Visual distance perception in the rat. Univ. Calif. Publ. Psychol., 1930, 4, 233-239.

433. Rosenow, Curt. The analysis of mental functions. Psychol. Monog., 1917, Vol. XXIV, 5, p. 20.

434. Rossman, J. The psychology of the inventor. Washington: The Inventor's Publishing Co., 1931.

435. Ruger, H. A. Psychology of efficiency. New York: Science Press, 1910.
435a. _____. Archives of Psychology. No. 15, June 1910, p. 1-88.

436. Rugg, H. O. Statistical methods applied to education. Boston: Houghton, Mifflin Co., 1917.

437. Sawdon, E. W. Should children learn poems in wholes or in parts? Forum Educ., Vol. 3, 1927, 182-197.

438. Schaller, A. Sinnesphysiologische und psychologische Untersuchungen an Wasserkäfern und Fischen. Zsch. f. verg. Physiol., 1926, Vol. 4, 370-464.

139. Shepard, J. F. and Breed, F. S. Maturation and use in the development of an instinct. Jour. of Anim. Behav., 1913, Vol. 3, 274-285.

140. Simmons, R. Relative effectiveness of certain incentives in animal learning. Comp. Psy. Monog., 1924, Vol. 2.

141. Singer, E. A. Mind as behavior and studies in emperical idealism. Columbus, Ohio: R. G. Adams Co., 1924.

142. _____. On the conscious mind. Jour. Philos., 1929, 26, 561-575.

143. Smith, S. and Guthrie, E. R. General psychology in terms of behavior. New York: D. Appleton and Co., 1921.

144. Snoddy, G. S. An experimental analysis of a case of trial and error learning the human subject. Psychol. Monog., 1920, Vol. 20, No. 124.

145. Spearman, C. The nature of 'Intelligence' and the principles of cognition. London: The Macmillan Co., 1st. ed., 1923; 2d ed., 1927.

146. _____. The new psychology of 'shape'. Brit. Jour. Psychol., 1925, 15, 211-225.

147. _____. The abilities of man --their nature and measurement. New York, The Macmillan Co., 1927.

148. Starch, D. A. A demonstration of the trial and error method of learning. Psychol. Bull., 1910, 7, 20-23.

149. _____. Periods of work in learning. Jour. Educ. Psychol., 1912, Vol. 3, 209-213.

150. _____. Educational Psychology. New York: The Macmillan Co., 1927.

151. Stern, W. Uber Psychologie der Individuellen Differenzen. Leipzig, Barth, 1900.

152. Stevenson, R. L. Memories and portraits, talks and talkers. New York: Scribners, 1926.

153. Stoddard, G. D. The problem of individual differences in learning. Psychol. Rev., 1928, 25, 479-485.

154. Stone, C. P. The congenital sexual behavior of the young male albino rat. Jour. Comp. Psychol., 1922, 2, 95-153.

455. Stone, C. P. The age factor in animal learning: I. Rats in the problem box and the maze. Genet. Psychol. Monog., 1929, 5, 1-130.

456. Stratton, G. M. Some preliminary experiments on vision without inversion of the retinal image. Psychol. Rev., 1896, 3, 611-617.

457. _____. Upright vision and the retinal image. Psychol. Rev., 1897, 4, 182-187.

458. _____. Vision without inversion of the retinal image. Psychol. Rev., 1897, 4, 341-360; 463-481.

459. Sullivan, E. B. Attitude in relation to learning. Psychol. Monog., 1927, 36, No. 169.

460. Swift, E. J. Studies in the psychology and physiology of learning. Amer. Jour. Psychol., 1903, 14, 201-251.

461. _____. Beginning a language. (Garman Memorial Volume). New York: 1906, 297-313.

462. _____. The learning process; a criticism and a theory. Psy. Rev., 1929, Vol. 36, 27-43.

463. Symonds, P. M. Laws of learning. Vol. XVIII, No. 6, Sept. 1927.

464. Takei, K. On visual discrimination and its learning with chickens. Jap. Jour. Psychol., 1927, Vol. 2, 32-87.

465. Teegarden, F. M. Change of environment and the IQ. Jour. Appl. Psy. 1927, Vol. 11, 289-296.

466. Terman, L. M. The measurement of intelligence. Boston: Houghton, Mifflin Co., 1916.

467. _____. Genetic Studies of Genius. (2 Vols.) Stanford Univ. Press, 1925 and 1926.

468. _____. The influence of nature and nurture upon intelligence scores. Jour. Educ. Psy., 1928, Fol. 19, 362-373.

469. Thomas, E. Lord Kelvin's 'Mortal Spring'. Science 74, 1931, 173.

470. Thorndike, E. L. Mental life of monkeys. Psychol. Rev. Monog., 1901, 3, No. 5.

471. Thorndike, E. L. Animal intelligence. New York: The Macmillan Co., 1911.

472. _____. The psychology of learning. New York: 1913, p. 542.

473. _____. Work, fatigue, and individual differences. New York: 1914, p. 408.

474. _____. Educational psychology. (3 Vol.) 1913, Columbia Univ. Press. (Briefer Course, 1915).

475. _____. The measurement of intelligence. New York, 1926. p. 616.

476. _____. The law of effect. Amer. Jour. Psychol., 1927, 39, 212-222.

477. _____. The influence of primacy. Jour. Exper. Psychol., 1927, 10, 18-29.

478. _____. The refractory period in associative processes. Psychol. Rev., 1927, 34, 234-236.

479. _____. A fundamental theorem in modifiability. Proc. Nat. Acad. Sci., 1927, Vol. 13, 15-18.

480. _____. Adult learning. New York: 1928, p. 335.

481. _____. Fundamental factors in learning. Proc. Ninth Internat. Cong. Psychol. (Princeton, Psychol. Rev. Co., 1930), 429.

482. _____. The strengthening and weakening of mental connections by their after-effects. Proc. Ninth Internat. Cong. Psychol. (Princeton, Psychol. Rev. Co., 1930), 430.

483. _____. Human learning. New York: The Century. Co., 1931.

484. Thorndike, E. L., and Woodworth, R. S. The influence of improvement in one mental function upon the efficiency of other functions. Psychol. Rev., 1901, 8, 247-261; 384-395; 553-564.

485. Thorsen, A. M. The relation of tongue movements to internal speech. Jour. Exper. Psychol., 1925, 8, 1-32.

486. Thurstone, L. L. A method of scaling psychological and educational tests. Jour. Educ. Psychol., 1925, 16, 433-451.

487. _____. The nature of intelligence. New York: Harcourt, Brace and Co., 1927.

488. Thurstone, L. L. The unit of measurement in educational scales. Jour. Educ. Psychol., 1927, 18, 505-524.

489. _____. The absolute zero in intelligence measurement. Psychol. Rev., 1928, 35, 175-197.

490. Thwing, C. F. Edward W. Morley, Chemist, Investigator, Teacher. Science 73, 1931, 276.

491. Tinklepaugh, O. L. An experimental study of representative factors in monkeys. Jour. Comp. Psychol., 1928, 8, 197-236.

492. Titchener, E. B. A textbook of psychology. New York: The Macmillan Co., 1911.

493. Tolman E. C. Instinct and purpose. Psychol. Rev., 1920, 27, 217-233.

494. _____. A new formula for behaviorism. Psychol. Rev., 1922, 29, 44-53.

495. _____. Behaviorism and purpose. Jour. Philos., 1925, 22, 35-41.

496. _____. Purpose and cognition, The determiners of animal learning. Psy. Rev., 1925, Vol. 32, 285-298.

497. _____. A behavioristic theory of ideas. Psychol. Rev., 1926, 33, 352-369.

498. _____. A behaviorists definition of consciousness. Psychol. Rev., 1927, 34, 433-439.

499. _____. Habit formation and higher mental processes in animals. Psychol. Bull., 1927, 24, 1-35; 1928, 25, 24-53.

500. _____. Purposive behavior. Psychol. Rev., 1928, 35, 524-530.

501. _____. Maze performance a function of motivation and of reward as well as of knowledge of maze paths. Jour. Genet. Psychol., 1930, 4, 338-343.

502. _____. Purposive behavior in animals and men. New York: The Century Co., 1932.

503. Tolman, E. C. and Honzik, C. H. Degrees of hunger, reward and non reward, and maze learning in rats. Univ. Calif. Publ. Psychol., 1930, 4, 241-256.

504. Tolman, E. C. and Honzik, C. H. Introduction and removal of reward and maze performance in rats. Univ. Calif. Publ. Psychol., 1930, 4, 257-275.

505. _____. "Insight" in rats. Univ. Calif. Publ. Psychol., 1930, 4, 215-232.

506. Travis, L. E. and Hunter, T. A. The relation between 'intelligence' and reflex conduction rate. Jour. Exper. Psychol., 1928, II, 342-354.

507. Tredgold, A. F. Mental deficiency. (4th ed.) New York: Wood, 1922.

508. Tryon, R. C. The genetics of learning ability in rats. Univ. Calif. Publ. Psychol., 1929, 4, 71-89.

509. Tsai, L. S. Gradual vs. abrupt withdrawal of guidance in maze learning. Jour. Comp. Psychol., 1930, 10, 352-332.

510. Tucker, A. Light of nature pursued. printed by T. Jones and sold by T. Payne, London, 1768, 1st. ed., pt. 1, Vol. 1, 9-11.

511. Turner, C. H. Behavior of the common roach(periplaneta orientalis L.) on an open maze. Biol. Bull., 1913, 25, 348-365.

512. Twenty-seventh yearbook of the National Society for the Study of Education. Bloomington Ill., Pub. Sch. Pub. Co., 1928.

513. Tyndall, John Faraday as a discoverer. London: Longman, Green and Co., 1868.

514. Upton, M. The auditory sensitivity of guinea pigs. Amer Jour. Psychol., 1929, 41, 412-421.

515. Valentine, R. The effects of punishment for errors on the maze learning of rats. Jour. Comp. Psychol., 1930, 10, 35-54.

516. Varendonck, J. Psychology of day dreams. London: G. Allen And Union, 1921.

517. Vincent, S. B. The white rat and the maze problem. I. The introduction of visual control. Jour. Anim. Behav., 1915, 5, 1-24.

518. Wada, T. An experimental study of hunger in its relation to activity. Arch. Psychol., 1922, No. 57.

519. Wakeham, G. Query on "A revision of the fundamental law of habit formation." Science, 1928, 68, 135-136.

520. _____. A quantitative experiment on Dr. K. Dunlap's "Revision of the fundamental law of habit formation." Jour. Comp. Psychol., 1930, 10, 235-236.

521. Wallace, Wm. The logic of Hegel. Oxford Clarendon Press, 1892.

522. Wallas, G. The art of thought. New York: Harcourt, Brace and Co., 1926.

523. Walton, A. C. The influence of diverting stimuli during delayed reaction in dogs. Jour. Anim. Behav., 1915, 5, 259-291.

524. Wang, G. H. The relation between "spontaneous" activity and oestrous cycle in the white rat. Comp. Psychol. Monog., 1923, 2, No. 6.

525. Wang, T. L. The influence of tuition in the acquisition of skill. Psychol. Monog., 1925, 33, No. 154.

526. Warden, C. H. and Warner, L. H. The development of a standardized animal maze. Arch. Psychol., 1927, 15, No. 92.

527. Warden, C. H. and Aylesworth, M. The relative effects of reward and punishment in the formation of a visual discrimination habit in the white rat. Jour. Comp. Psychol., 1927, 7, 117-127.

528. Warden, C. J. and Rowley, J. B. The discrimination of absolute vs. relative brightness in the ring dove, turtur risorius. Jour. Comp. Psychol., 1929, Vol. 9, 317-338.

529. Warren, H. C. History of association psychology. New York: Scribners, 1921.

530. Washburn, M. F. Movement and mental imagery. Boston: Houghton Mifflin Co., 19 5.

531. Washburn, M. F. The animal mind. New York: Macmillan Co., 1930.

532. Washburn, M. F. and Abbott, E. Experiments on the brightness value of red for the light adapted eye of the rabbit. Jour. Anim. Behav., 1912, Vol. 2, 145-180.

533. Waters, R. H. The influence of large amounts of manual guidance upon human maze learning. Jour. Genet. Psychol., 1930, 5, 213-228.

534. Watson, J. B. Kinaesthetic and organic sensations: their role in the reactions of the white rat in the maze. Psychol. Monog., 1907, 8, No. 2.

535. _____. Psychology as a behaviorist views it. Psychol. Rev., 1913, 20, 158-177.

536. _____. Image and affection in behavior. Jour. Philos. Psychol. Sci. Meth., 1913, 10, 421-428.

537. _____. Behavior, an introduction to comparative psychology. New York: Henry Holt and Co., 1914.

538. _____. Is thinking merely the action of language mechanisms? Brit. Jour. Psychol., 1920, II, 87-104.

539. _____. Psychology from the standpoint of a behaviorist. Philadelphia: Lippincott, Rev. ed. 1929.

540. _____. Behaviorism. New York: W. W. Norton and Co., Rev. ed. 1930.

541. Watt, H. J. Economy and training of memory. London: Longmans, 1909.

542. Webb, L. W. Transfer of training and retroaction. Psychol. Monog., 1917, Vol. 24, No. 104.

543. Weiss, A. P. The relation between physiological psychology and behavior psychology. Jour. Philos., Psychol. Sci. Meth., 1919, 16, 625-634.

544. _____. A theoretical basis of human behavior. Columbus, Ohio: R. G. Adams Co., 1925.

545. Weiss, A. P. The relation between central and peripheral coordination. Jour. Comp. Neur., 1926, 40, 241-252.

545a. Weld, H. P. Psychology as Science. New York; Henry Holt & Co., 1928.

546. Wertheimer, M. Ueber Schlussprozesse in produktiven Denken. Berlin, 1920.

547. _____. Untersuchungen zur Lehre von der Gestalt. II. Psychol. Forsch., 1923, 4, 301-350.

548. Westaway, F. W. Science and Theology. London; Blackie & Son, Ltd., 1920.

549. Wever, E. G. The upper limit of hearing in the cat. Jour. Comp. Psychol., 1930, 10, 221-234.

550. Wheeler, R. H. Report of testing program. University of Kansas, 1921-1927.

551. _____. The science of psychology. New York; Crowell, 1929.

552. _____. Readings in psychology. New York; Crowell, 1930.

553. Whewell, Wm. Philosophy of discovery. London; J. W. Parker & Son, 1860.

554. Whipple, G. M. Manual of mental and physical tests. Baltimore; Warwick and York, 1924.

555. Whitehead, A. N. Science and the modern world. New York; The Macmillan Co., 1925.

556. Whitely, P. The dependence of learning and recall upon prior mental and physical conditions. Jour. Exper. Psychol., 1924, 7, 420-428.

557. _____. The dependence of learning and recall upon prior intellectual activities. Jour. Exper. Psychol., 1927, Vol. 10, 489-508.

558. Williams, D. C. A metaphysical interpretation of behaviorism. Harvard Ph.D. thesis, 1928.

559. Williams, K. A. The conditioned reflex and the sign function in learning. Psychol. Rev., 1929, 36, 481-497.

560. _____. The reward value of a conditioned stimulus. Univ. Calif. Publ. Psychol., 1929, 4, 31, 55.

561. Wilson, W. R. Principles of selection in trial and error learning. Psy. Rev., 1924, Vol. 31, 150-160.

562. Wiltbank, R. J. Transfer of training in white rats upon various series of mazes. Behav. Monog., 1914, 4, No. 1.

563. Winsor, A. L. Inhibition and learning. Psy. Rev., 1929, 36, 389-401.

564. Wolf, E. Die Aktivitat der Japonischen Tanzmans und ihre rhythmische Verteilung. Zsch. f. vergl. Psysiol., 1930, 11, 321-344.

565. Woodworth, R. S. Racial differences in mental traits. Science, N. S., XXXI, 1910.

566. _____. Combining the results of several tests: A study in statistical method. Psychol. Rev., 1912, XIX, p.113.

567. _____. A contribution to the question of "quick learning, quick forgetting". Psychol. Bull., 1914, 11, 58-59.

568. _____. Dynamic psychology. New York: Columbia Univ. Press, 1918.

569. _____. Psychology. New York: Henry Holt and Co., rev. ed. 1929.

570. Wulf, F. Uber die Veranderung Von Vorstellungen (Gedachtnis und Gestalt): Nr. VI. der Beitrage zur Psychologie der Gestalt, herausgegeben von K. Koffka. Psychol. Forsch., 1922, 1, 333-373.

571. Wyatt, H. G. Intelligence in man and ape. Psychol. Rev., 1926, 33, 375.

572. Wylie, H. H. An experimental study of transfer of response in the white rat. Behav. Monog., 1919, 3, No. 5.

572. Yardley, H. O. The American black chamber. Indianapolis, The Bobbs-Merrill Co., 1931.

573. Yerkes, R. M. The dancing mouse. New York: The Macmillan Co., 1907.

574. Yerkes, R. M. The intelligence of earthworms. Jour. Anim. Behav., 1912, 2, 332-352.

575. _____. The mental life of monkeys and apes. A study of ideational behavior. Behav. Monog., 1916, 3, No. 12.

576. _____. Methods of exhibiting reactive tendencies characteristic of ontogenetic and phylogenetic stages. Jour. Anim. Behav., 1917, 7, 11-23.

577. _____. A new method of studying the ideational behavior of mentally defective and deranged as compared with normal individuals. Jour. Comp. Psychol., 1921, Vol. 1, 369-394.

578. _____. Almost human. New York: The Century Co., 1925.

579. _____. The mind of a gorilla: II. Mental development. Genet. Psychol. Monog., 1927, 2, No. 6.

580. Yerkes, R. M. and Coburn, C. A. A study of the behavior of the crow, Corvus Americanus Aud., by the multiple choice method. Jour. Anim. Behav., 1915, 5, 75-114.

581. Yerkes, R. M. and Learned. Chimpanzee intelligence and its vocal expressions. Baltimore: Williams & Wilkins Co., 1925.

582. Yerkes, R. M. and Yerkes, D. N. Concerning memory in the chimpanzee. Jour. Comp. Psychol., 1928, 8, 237-272.

583. _____. The great apes. New Haven: Yale Univ. Press, 1929.

584. Yoshioka, J. G. A preliminary study in discrimination of maze patterns by the rat. Univ. Calif. Publ. Psychol., 1928, 4, 1-18.

585. _____. A further study in discrimination of maze patterns by the rat. Univ. Calif. Publ. Psychol., 1929, 4, 135-353.

586. _____. A study of orientation in a maze. Psychol. Bull., 1929, 26, 591-592.

587. _____. What is maze learning for the rat? Jour. Genet. Psychol., 1929, 36, 51-58.

588. _____. Frequency factor in habit formation. Jour. Comp. Psychol., 1930, II, 37-49.

589. Yoshioka, J. G. Size preference of wild rats. Jour. Genet. Psychol., 1930, 37, 159-162.

590. _____. Size preference of albino rats. Jour. Genet. Psychol., 1930, 37, 427-430.

591. _____. Direction as a factor in maze solution in rats. Jour. Genet. Psychol., 1930, 38, 307-318.

592. Young, K. The history of mental testing. Ped. Sem. 1924, 1-48.

593. Yule, G. U. An introduction to the theory of statistics, London: Charles Griffin, 5th. ed. 1919, p. 258.

594. Zinsser, Hans. The next twenty years. Science74, 1931, 397.