A PHILOSOPHICAL ANALYSIS OF THE CONCEPTS OF LEARNING, PERCEPTION, AND CONCEPTION AS THESE ARE TREATED IN CURRENT PSYCHOLOGICAL THEORY

DISSERTATION

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By

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The Setting of the Problem

Psychologists have been concerned of late with the problem of integrating the vast wealth of data arrived at in different areas of this rapidly growing science. Integration has been sought in more than one way. Personality, learning, motivation, perception and learning, learning and motivation, motivation and perception, personality and perception and/or learning and conditioning and so on, almost without limit, are examples which illustrate this effort. Some theorists, indeed, have been struggling with the idea of formulating a general psychological theory.

Why is this concern now, one may ask? The answer is not hard to seek. David Krech answers the question partially by asserting that "Other sciences have found that scientific inquiry frequently becomes more fruitful in almost direct proportion to the process of unification of principles."¹ This statement implies dissatisfaction with the host of unrelated, if not antagonistic, psychological principles now current in psychological studies. And this state of affairs does, in fact, hinder our understanding of

the object psychology sets itself to study—namely, man. Kretch

goes on to suggest that in physics, one of the most advanced of
the sciences, "Fields' of physics disappear and 'physics' begins to appear."²

The scientific method is a systematized way of relating
and interrelating different phenomena of nature and formulating
them in all-encompassing laws. If we have to draw upon a different
and independent "law" to explain each separate observation, we
are hardly better off than without such laws. This state of affairs
is critical in the case of psychology, where that unity we call
the human organism is the object of study. But the problem, by its
very nature, is most complicated. Man, when he sets himself to
study himself, is apt to dwell upon the host of names he assigns
to the different and varied experiences he has. And, for many
thinkers, when a name exists there is a tendency to believe that
a distinct entity must lie behind it; and, conversely, that where
no name exists there is nothingness. Thus, Plato, with all his
genius, could not escape this pitfall and to him the psychological
processes of man corresponded to his ultimate values: truth,
beauty, and goodness. He even went so far as to assign different
bodily centers for (1) cognition, the head; (2) affection, the
heart; and (3) conation, the abdomen.

²David Krech, Ibid., p. 68.
It is significant, and instructive, to note that regardless of what we claim to the contrary, we have and still are following his lead in this respect, as well as in many others. We speak of the thinking process and of motivational factors as essential ingredients of cognitive behavior and just because we do we are fain to speak of these ingredients, intellect and emotion, as interacting entities. We may even consider them to be independent entities. Were we to realize that we are dealing with abstractions or constructs that describe different facets of an ongoing experience, many of our difficulties would disappear. For whence comes the distinction between the intellectual and the emotional factors in any phase of the thinking process? No matter how we may look at the problem, we cannot help but see that the formulation of hypotheses, for instance, is but a sort of art production in the full implication of this term. As such, it is an aesthetic endeavor as much as an intellectual one; intellect and emotion are thus aspects of one act. Intellect and emotion or motivation are treated as separate entities only because our nomenclature treated them so historically. We speak of them as separate entities in part, at least, because we lack a name for the whole process. The distinction is not without its usefulness; it is simply when it is taken for granted that we tend to err.

If we turn to perception as a particular and specific psychological phenomenon, we run into a series of questions. What
is perception? Where do so-called directive factors intervene? What is the place of motivation in perception? Where do attitudes come into the picture? Where is the line that separates perception as psychophysical from autistic perception, so-called? What is the relation between perception and conception? Does behavior start with a percept or a concept? What role does thinking play in perception, if any? And where does perception stand with respect to the theory of experience? In other words, how are organic or physical, social and idiosyncratic factors related in the process of perception? Further questions could be raised but, again, the problem is whether or not we realize that we deal with abstractions or constructs which describe a dynamic process, whether or not we realize that the distinctions we make between these different constructs are merely arbitrary, whether we realize that we isolate variables, so far as the actual experience is concerned, which do not lend themselves to this process. The problem looks still more dramatic when we find that some psychologists specialize, or at least tend to emphasize, one aspect of behavior and treat it as if complete unto itself. Hence, we find learning theorists (mainly behaviorists) and perception theorists (mainly gestaltists) in conflict with each other; with different points of emphasis, different methodologies and different outlooks.
Statement of the Problem

A look at the status of psychological theory today will show that despite the genuine efforts made to bring different points of view closer; some obstinate obstacles stand in the way. We need not at this point reflect upon the remote past history of psychology to trace the sources of the present difficulties but the problem is complicated by an inheritance from the past. Suffice it here to notice that by the turn of the present century, and even into its first decades, psychology had established itself in terms of distinct schools, each with its enthusiastic followers and each with its own mode of thought.

Today, though the differences are not as sharp or as acute as they were earlier, some irreconcilable differences seem to exist. Behaviorism, for instance, is by and large concerned with learning. This is not surprising, since this is a proper concern of all psychology. The point is that it has little, if anything, to say about perception. If it refers to perception in passing, it does not conceive it as a concept which is necessary for explaining behavior. On the contrary, perception as a concept is explained, as is everything else, in terms of the principles derived from the field of learning. In contrast, gestalt theory focuses its attention upon perception and comes at learning through the principles it derives from this area.
Both theories, however, presumably deal with the same subject-matter. One may wonder, then whether the theories say essentially the same thing in different language. There may be some truth in this statement, but it neither diagnoses nor solves the problem. Learning does play, of course, a vital role in human activities, in human problems and concerns. It is a legitimate area of human inquiry, therefore. Yet the question has been asked whether, in their preoccupation with learning theories, American psychologists have not had the boot on the wrong foot, neglecting, in consequence, the relation between the two fields—perception and learning.

Perception is also equally important. Many branches of psychology find perception an invaluable tool for the explanation of behavior. In the preface of the Volume *Perception and Personality* (A Symposium), Bruner and Krech write: "Here we see experimental psychologists—traditional 'perceptionists'—social psychologists, students of personality, clinicians, all concerned with the determinants of perceptual operations."^3

The need for the reconsideration of psychological theories in an attempt to arrive at a broader envisionment of man in his environment is clear. The present writer, in confronting the problem, is merely undertaking what some psychologists have been asking for. The present study, is therefore, an echo of a need

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strongly expressed by psychologists, though the writer's approach will be philosophical. It is hoped that a philosophical examination of some of the present systems and approaches in psychology may throw new light on the problem of human behavior.

Assumptions Underlying the Study

1. The organism is the focal point in the study of behavior.

2. All sciences are of one piece. The method of science as developed in other natural and physical sciences should be utilized for the understanding of behavior.

3. "Transaction, is Fact such that no one of its constituents can be adequately specified as fact apart from the specification of other constituents of the full subject-matter." In other words, whatever variables are involved in the process of perception can not be fully dealt with or understood in isolation from other variables. The limitation of specifying or isolating a certain variable for the sake of clarifying or investigating the process should always be borne in mind.

4. Factors and variables involved in any psychological process are essentially social abstractions or constructs which aim at describing, interpreting, clarifying and manipulating psychological phenomenon.

Scope, Implications, and Limitations of the Study

This study is essentially theoretical. It will undertake to survey, criticize, and re-interpret some basic aspects of

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4 J. Dewey and A. Bentley, Knowing And The Known, p. 122.
psychological theories and of philosophical studies. By its very nature, the problem does not permit the author to tackle more than a small segment of the available literature.

The writer, being aware of the varying philosophical backgrounds of the different psychological approaches to the problem of human behavior, can not but admit his own limitations in philosophical outlook. Moreover, in assuming that the philosophical point of view is basic in dealing with and understanding psychological phenomena, no claim to complete objectivity is implied. This, from the point of view of the writer is impracticable. Thus, in dealing with the theories of perception, the transactional approach as advanced by John Dewey and Arthur F. Bentley, with which the writer agrees in general, will occupy a central position in the study.

A General Outline of the Study

I. In the first chapter some relevant aspects of the history of psychology will be discussed from a philosophical point of view.

II. In the second chapter, a representative sample of the theories which are associated with the "Field Concept" and which

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5 The writer believes that it is only because of a philosophical point of view that such a problem has arisen. The present study aims to clarify some aspects of psychological theory in terms of a philosophical point of view and, at the same time, to reinterpret some aspects of philosophy in terms of psychological findings and understandings.

6 See Knowing and the Known, The Beacon Press, Boston, 1949.
are sometimes called 'Cognitive Theories' will be examined. The
theories to be examined are:

1. Gestalt theory.
2. Hebb's theory.
3. Brunswik's theory.
4. Snygg and Comb's theory.

III. In the third chapter a representative sample of the
theories which belong to the 'Association Family' will be presented
in an expository style to serve as a frame of reference for the
discussions that follow.

IV. The fourth chapter will be devoted to a critical
examination of some differences and conflicting points of view
between some cognitive theories and behavioristic theories, in an
attempt to point out the inadequacies in each.

V. The fifth chapter will be devoted to a philosophical
examination of the methods of inquiry in some natural and physical
sciences from a historical perspective. The aim of this chapter
is to suggest a more comprehensive frame of reference for the
understanding of human behavior.

VI. In this chapter the 'Trans-actional' approach for the
study of human behavior will be examined with special reference
to Ames' work to show its implications and significance for the
science of psychology.

VII. Some critical aspects of the transactional approach in
psychology will be treated in this chapter.
CHAPTER I

THE EVOLUTION OF THE SCIENCE OF PSYCHOLOGY

Psychology as a natural science is relatively new. As a part of philosophy, however, it is as old as philosophical thought. This fact should not prove surprising, since every philosophical system necessarily embraces a conception of man in harmony with and complimentary to the system itself. Thus psychology as part of philosophy goes back to Plato and Aristotle and, until recently, it remained subservient and secondary to whatever philosophical trend happened to be in vogue at any given period of time.

This state of affairs might be well illustrated by Descartes' dualistic philosophy in which he attempted to reconcile the two independent entities, mind and matter. To Descartes the ultimate criterion of existence was man's awareness of thought. The criterion of truth, therefore, lay in subjective clarity and distinctness. Descartes, in making the distinction between mind or soul on the one hand, and matter or body on the other, was forced to deal with each of the two categories independently. Under the impact of the physical and biological sciences which had already distinguished themselves as legitimate disciplines, chiefly under the leadership of Galileo and Harvey, in their respective fields, Descartes adopted the new physics and applied it to human and animal behavior.
For Descartes, man alone possessed soul and consequently man alone possessed the faculty of thinking or reasoning. Animal behavior was simple enough; with no soul to intervene, physics provided appropriate means to explain it. Animal behavior consisted purely of physical motion.

Man, with his soul, caused Descartes a great deal of trouble. The problem, simply stated, was how to reconcile the two irreconcilable entities: the physical, the spatial and the tangible, on the one hand, with the nonphysical, the non-spatial and the intangible, on the other. Descartes sought to settle the problem by locating the "mind" in the brain. The pineal gland, which stood as a unique structure defying the over-all symmetry of the brain, was assigned the task of bringing peace and harmony to human behavior. It was said to be the center of interaction between body and mind.

Thus, although Descartes was by no means the first to formulate dualistic philosophy in terms of soul and matter, he was nevertheless the first to advance a concrete formulation of dualism in which he brought into focus the inherent problems of dualistic approaches to human thought and psychological inquiries. In this sense, Descartes' system may provide us with an intelligible conceptual framework for examining and appraising different psychological systems, new and old.

Descartes' solution to the psychological problem was short lived, yet the struggle between the mind and body for supremacy
in human thought continued, with the advances in the physical and biological sciences having their share in directing subsequent psychological theory. Thus, in the history of psychology we encounter a dualistic conception of body and mind, one which places mind in a superior position to body and, consequently, defines human behavior essentially in terms of mental activities. But the effects of physical and bodily conditions on the working of the mind are often too evident to be ignored. The influence of drugs on mental activities is a case in point. The answer to this problem may be encountered in the philosophical thought which advanced a parallelistic approach to mind and body, trying thereby to avoid the whole problem of interaction. But the problem was too complex to be solved by avoiding it. Monistic approaches, choosing one or the other horn of the dualistic dilemma—that is, either mind or body—seemed more promising. One approach chose the mental horn and thus reduced everything to mentality. A second approach, mechanistic in character, rejected the concept of mind or soul in toto, together with the concepts consciousness and conscious behavior, and defined behavior in purely physiological terms.

Religion has had its influence on such philosophical thinking. What interests us at this point is the concern the theologians showed concerning a priori knowledge or innate ideas which were necessary for the belief in the Diety around the Seventeenth
Carbary, especially in the face of the Baconian empiricism. Locke, although a good Christian who was anxious to argue on behalf of the reasonableness of Christianity, did not accept apriorism. His was an experiential philosophy, one which held that all our knowledge comes through our senses from experience. At birth, he believed the mind to be blank—a "tabula rasa"—upon which sense impressions are ingraved, thus leading to memory, with memory leading to ideas. Locke argued that "there is nothing in the mind except what was first in the senses." But Locke's position cut both ways within the framework of dualism. There were those who argued that "since only material things can affect our senses, we know nothing but matter, and must accept a materialistic philosophy." The status of mind was endangered by this conclusion. If mind is made up solely of sense impressions, matter must be the material out of which mind is made.

Bishop Berkeley rose to the occasion and argued that Locke's analysis did not prove that mind is matter but, on the contrary, that matter does not exist except as a form of mind. We cannot know matter, since our knowledge is derived merely from sensations. Our knowledge of anything is our sensations of it and is gained by an active force, or entity, which receives and acts upon these

1 Quoted from Will Durant, The Story of Philosophy, p. 256.

2 Durant, Ibid., p. 256.
sensations. Thus, at the hands of Berkeley, the status of mind as the knower, was thus saved and rather exalted at the expense of matter. Says Berkeley,

"Besides all that endless variety of ideas or objects of knowledge, there is likewise something which knows or perceives them, and exercises diverse operations—as willing, imagining, remembering—about them. This perceiving, active being is what I call mind, spirit, soul or myself. By which words I do not denote anyone of my ideas, but a thing entirely distinct from them, wherein they exist or, which is the same thing, whereby they are perceived—for the existence of an idea consists of being perceived."

The arguments that Berkeley utilized to destroy matter were likewise utilized by Hume to destroy mind. Hume's argument was essentially this: "The mind is not a substance, an organ that has ideas, it is only an abstract name for the series of ideas; the perceptions, memories and feelings are the mind; there is no observable 'soul' behind the process of thought." Hume seemed to have destroyed or completed the destruction of matter as well. He attempted to destroy science by destroying the concept of law. According to him we do not perceive laws or causes but only events and sequences and infer causation and necessity. Only mathematical formulae are inherently and unchangeably true; and this only because they are tautological. Thus science, according to Hume, must limit

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3 Bishop George Berkeley, Principles of Human Knowledge, Sec. 2.

4 Quoted in Will Durant, The Story of Philosophy, Ibid., p. 258.
itself to direct experiment since man cannot trust unverified
deductions from laws, and to mathematics since it is the only un-
changeable truth that we know of. Thus to Hume nothing is of
value except direct experiment and mathematics.

When we run through libraries, persuaded of
these principles, writes Hume, what havoc must we
make! If we take in our hands any volume of school
metaphysics, for instance, let us ask, 'Does it contain
any abstract reasoning concerning quantity or number?
'No.' Does it contain any experimental reasoning
concerning matter of fact and existence? 'No.'
Commit it then to the flames, for it can contain
nothing but sophistry and illusion.

Here we find the epitome of skepticism and, at the bottom, the
eternal mind-matter controversy. The dilemma is beautifully
illustrated by the wit who said, "No matter, never mind." and added,
"No mind, never matter."

It needed a Rousseau to challenge the reasonableness of reason
to escape from empiricism and to resort to feeling and instinct to
save theism and morality. Rousseau may be considered the father
of instinct psychology in its most modern forms. His impact may be
felt at least indirectly, in the psychologic of trend, Jung, Adler
and McDougal. The latter writer may illustrate the utmost specificity
with respect to the taxonomy of instincts. McDougals classified
instincts in fourteen and later seventeen entities to account for
all modes of behavior. In comparison with McDougal, Freud was
vague with respect to the taxonomy of instincts. The fact of

5 See G. W. Allport, Becoming, Basic Considerations for a
Psychology of Personality, pp. 15-16.
the matter, however, is that Rousseau's reasoning finds an echo in these different instinctive psychologies.

Kant attempted to restore to experience what belonged to it, leaving to "pure reason" that which belonged to it. By pure reason Kant meant knowledge that does not come through our senses, apriori knowledge that is independent of all sense experience and which belongs to us by virtue of the structure of our minds. Says Kant, "My question is, what we can hope to achieve with reason, when all the material and assistance of experience are taken away." What is left of knowledge after all experience is taken away would perforce be apriori knowledge, or transcendental knowledge. "I call knowledge transcendental which is occupied not so much with objects, as with our apriori concepts of objects." Mathematics offered Kant the finest example of our advancement independent of all our experience. He said, "How far can we advance independently of all experience, in apriori knowledge, is shown by the brilliant example of mathematics."

Mathematics represent absolute and necessary truths and they come not from experience, for experiences give us nothing but separate sensations and events. Kant's problem was then to show

how the raw material of sensations is worked up into the finished product of thought. This process takes place on two levels. First, sensations are developed to percepts as the forms of perceptions (i.e., space and time) are applied to them; and, second, percepts are developed to concepts by applying to them the forms of conceptions (i.e., categories of thought).

It is of prime importance at this point to note the difference in the line of thought between the British empiricism represented by Locke and Hume and the German idealism represented by Kant. The difference lies mainly in this question: How do sensations group themselves into perceptions and then into conceptions and ideas; is this process automatic? British empiricists said "Yes," but Kant said "No." For Kant, the forms of perceptions and the forms of conceptions, which do not depend on experience, do the trick.

The foregoing exposition of British empiricism versus German idealism as represented by Kant may be shown to bear upon the conflicts obtaining now between behaviorism and field theory. If we couple the laws of association as formulated by Aristotle, way back, with Locke and Hume's empiricism and then swing to the material horn of the dualistic dilemma, we will have in front of us a crude form of modern behaviorism. As a contrast we will have to elaborate on Kant's forms of perception and conception in terms
of the law of Pragnanz and its sub-laws; similarity, continuity, closure, etc. as formulated by Wertheimer and we will end with a psychology pretty much like Gestalt.

The dualistic frame of reference seems thus far to assert itself sometimes positively and sometimes negatively. In other words, the nature of human behavior derives its chief significance from the conception of mind and its relation with body. Guthrie, a learning psychologist, who subscribes to a behavioristic theory, recognizes the significance of the conception of mind in psychology but reduces it to learning as physical motion. Guthrie says, "The ability to learn, that is, to respond differently to the situation, is what distinguishes those living creatures which common sense endows with minds. This is the practical descriptive use of the term mind." 

The dilemma revealed by the foregoing exposition of the relation between philosophy and psychology will bear watching as we deal with present-day psychology. The problem is not as simple as it may now seem to some to be (Guthrie's statement above, for instance). With the advancement of the physical and biological science, concepts and methods from these fields were borrowed by psychologists and adapted to suit their newly developing science. It was felt that

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9 For a detailed account of this problem see Boyd H. Bode, How We Learn, especially preface and first chapter.

10 E. R. Guthrie, The Psychology of Learning, p. 3.
the controversies of the dualists could be left with the philosophers, who, argue though they might, could no longer be expected to throw light upon the study of behavior.

The extent to which scientific method and scientific concepts as developed in the physical and biological fields have been utilized in psychology varies from one psychological approach to the other. We find, for instance, that Titchener, without concerning himself with the problem of whether psychology is a branch of biology or not, adopted the classification of the field of biology, into morphology, physiology and ontology and classified psychology accordingly. He regarded the study of morphology in the biological sciences, by necessity, to precede and not to follow physiology. The latter concerned itself with the study of the functions of the living organism and its organs. In psychology, by the same token, morphology—the analytical study of the mind—should precede the study of function, else the science of psychology would regress to metaphysics. Says Titchener ".... The morphological study of the mind serves, as no other method of study can, to enforce and sustain the thesis that psychology is a science, and not a province of metaphysics."\(^{11}\) He went further to assert that only after analytical psychology had advanced far enough would its results ultimately "serve as a basis of function."\(^{12}\)


\(^{12}\) E. B. Titchener, Loc. cit.
For Titchener, in other words, it was mandatory that the elements of consciousness should first be identified and studied, in the same manner plant organs and tissues are identified and studied in morphology, as a prerequisite for the study of their functions. Titchener defended his position, therefore, on the assumption that scientific development in biology should serve as an example for psychology. He thus held the belief that the problems of psychology should, to start with, be studied, "as static rather than dynamic, structural rather than functional." 13

Functional psychology, however, adopted the concept "function" directly from biology and maintained, contrary to structuralism, that structure and function cannot be studied in isolation, one from the other. "This involves the identification of functional psychology with the effort to discern and portray the typical operations of consciousness under actual life conditions, as over against the attempt to analyze and describe its elementary and complex contents." 11

The theory of evolution brought into focus a mass of problems which left their strong impact upon psychology as well as upon other biological and physical sciences. Herbert Spencer was perhaps the first thinker to write a psychology based directly on the

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biological theory of evolution. It is interesting to note that Spencer's early writings on psychology were a vigorous defense of materialism and determinism. That was how he understood the theory of evolution. He presented different biological and psychological theories based on the theory of evolution. The origin of nerves was traced back to intercellular connective tissue; the origin of instincts to the compounding of reflexes and transmission of acquired character; and the origin of consciousness and thought to the clash between the conflicting impulses. Mind, in other words, had its origin in the evolution of matter. In The Principles of Psychology (1873) we find him reverting somewhat to a mentalistic philosophy and hence to a mentalistic interpretation of psychology.

Can the oscillation of a molecule be represented in consciousness side by side with a nervous shock, and the two be recognized as one? No effort enables us to assimilate them. That a unit of feeling has nothing in common with a unit of motion, becomes more than ever manifest when we bring the two into juxtaposition. And the immediate verdict of consciousness thus given, might be analytically justified.... for it might be shown that the conception of an oscillating molecule is built out of many units of feeling.... Were we compelled to choose between the alternatives of translating mental phenomena into physical phenomena or of translating physical phenomena into mental phenomena, the latter alternative would seem the more acceptable of the two.

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15 Spencer's earlier psychology (1855) coincided with Darwin's famous papers which were read before the Linnaean Society in 1858. His Development Hypothesis (1853), however, antedated the above-mentioned papers.

16 H. Spencer, Principles of Psychology, pp. 496-497.
In this quotation we find Spencer interpreting our knowledge of matter in terms, "... of units of mind—sensations and memories and ideas." This is almost the languages of Locke, Berkeley and Hume, but not quite. For him "... although the objects of experience may very well be transfigured by perception; and be quite other than they seem, they have an existence which does not all depend upon perceiving them." He further believed in the evolution of mind from reflex to tropism to instinct through memory and imagination to intellect and reason. From all this it seems clear enough that Spencer, despite his materialistic start, was caught finally on the two horns of the dualistic dilemma.

It is significant that a theory of effect based on random movement which, if culminated by a satisfying state of affairs, may lead, through nervous energy discharges, to the fixation of the right connections, appeared in Spencer's psychology. The similarity between Spencer's formulation and contemporary laws of effect and reinforcement is really striking. At bottom there is a hedonistic philosophy which has dominated human thought about behavior in one way or another since ancient Greek thought.

Plato saw in the pleasure-pain principle an important factor in the motivation of human action, especially with respect to the

17 Will Durant, The Story of Philosophy, p. 374.
18 Loc. cit.
working class. Aristotle considered the pleasure-pain principle to be the basis of will. Hobbs' self-interest principle as the basis of social life revolved around the pleasure-pain principle. And finally, under the influence of the theory of evolution, hedonism took definite shape. The pleasure-pain principles provided the basis for selection and the principle of association provided the mechanism of fixation.

The pleasure-pain principle, however, involves a mentalistic connotation. Thorndike's psychology, which was based explicitly on success and failure in its earlier formulation, suffered from this mentalistic connotation and was criticized accordingly. Thorndike's later formulations consequently attempted to avoid such an implication by emphasizing physiological interpretations. Whether or not he succeeded in his effort is of no great moment at present. Thorndike's problem with the law of effect, illustrates the point. Says Postman, "In its approach to motivation, modern learning theory has deep roots in the philosophy of hedonism, and the development of the psychology of learning has been characterized by a stubborn defense of hedonistic principles on the one hand and a struggle for the emancipation from hedonism on the other." 19

It is of some significance at this point to observe that the departure of different behavioristic learning theories from Thorndike's

centers to a great extent on a reformulation of, or the complete rejection of, the law of effect. Watson rejected the law of effect on the basis that there is nothing in it that could not be accounted for by the principles of recency and frequency. Guthrie followed Watson's lead. Hull, Mowrer and Skinner, however, retained the law of effect in their respective systems in some form or another. This point will be discussed in some detail later on. All this is not to say that other psychological theories have done away with the hedonistic principles. The real problem is how a hedonistic principle is applied. Gestalt and field psychological theories deal with hedonism in the form of equilibria and disequilibria and by the law of pragnanz. The principle of closure is evidently a hedonistic principle; and the good Gestalt is by definition a hedonistic concept. But the difference between behavioristic learning theories and field or cognitive theories becomes apparent when we face the issue "reinforcement versus cognition."²⁰ Is reinforcement necessary for learning? Skinner, Hull and Mowrer say "Yes." Lewin and Tolman say "No." The latter say that reinforcement is necessary for performance but not for learning. The former insist that such a principle is essential for both learning and performance. The issue that centers around latent learning will be discussed in detail later on.

²⁰ By "reinforcement" here is meant primary need reduction.
Gordon Allport stands in between. Though he maintains that some form of the principle of reinforcement is applicable to animals and young children, he asserts that such a principle cannot in its simple form account for adult behavior. He insists that such a concept as the ego concept or a system of interests, which is autonomous in its function, should be substituted for the reinforcement principle for the explanation of adult behavior. A legitimate question at this point arises. Does Allport, by making the distinction between animal and child behavior, on the one hand, and adult human behavior, on the other, still follow the theory of evolution? The answer would seem to be that he does. He makes a significant distinction between phylogenetic development and ontogenetic development, however, and puts the emphasis on the latter in dealing with adult behavior. Cantril and Sherrif follow a similar approach to that of Allport and they include the ego concept in their psychologies.

Thus we find that although the theory of evolution is accepted by almost all present-day psychologists, its implication and significance vary from one psychology to the other. The problems brought about as a direct result of the promulgation of the theory of evolution are many and far-reaching. Perhaps first and foremost is the realization that after all man does not stand in complete isolation from the rest of the animal kingdom. The problem of heredity versus environment gained momentum around the turn of the
century. But this new understanding meant different things to different psychologists. On the one hand, we find those who took their point of departure from the top of the evolutionary ladder and attributed to lower animals such mental qualities as were attributed to man alone. A host of articles and studies reported the intelligence of lower animals. On the other hand, there were those who took their point of departure from the bottom end of the evolutionary scale. Man's status was gradually reduced. Under the influences of the invention of the steam engine and the following advent of the machine age, man became likened unto a machine. Skinner, in his attempt to defend the proposition that man is a machine, and that apparently spontaneous motion was and is the factor that is responsible for the illusion that living creatures are different from machines, reports that, "When Wordsworth and Coleridge once passed a steam engine, Wordsworth observed that it was scarcely possible to divest oneself of the impression that it had life and volition. 'Yes' said Coleridge, 'it is a giant with one idea.'"21 Skinner, then goes on to say, "Since that time two things have happened: Machines have become more lifelike and living organisms have been found to be more like machines."22

The study of animal behavior consequently loomed large in the field of psychology by the turn of the century. The difference


22 Ibid., p. 46.
between man and lower animals came to be regarded merely as a matter of degree of complexity of the organism's bodily structure. The battle of man's intelligence and intelligent behavior versus habit, that is, mechanical habit formation, was fought in the field of animal behavior. The case of behaviorism versus Gestalt psychology is too familiar to be recorded at this point.

Russian physiologists, chiefly Pavlov and Betcherev, added their contribution to the picture. Conditioning was hailed by early behaviorists as the key to all problems of behavior. The most complex behavior was explained as a matter of building up segments of conditioned responses. And, although the early formulation is no more held in its simple form, conditioning remained the cornerstone on which the behaviorist theory in its modern formulation was built. At the heart there is the deviation from the strict identification of behavior with known physiological facts. Hypothetical constructs and intervening variables, such as habit for instance, were postulated where the physiological correlates could not be identified. The study of behavior was not regarded as a different discipline in any essential manner from physiology; although the known physiological facts were found to be too meager to account for the science of behavior. It is instructive to note at this point that most of the so-called intervening variables have their hypothetical roots in the peripheral nervous system.
Concepts from the science of physics were equally instrumental in shaping the growing science of psychology. Some concepts were explicitly adopted and applied directly to psychology. The field concept, as it is utilized by Gestaltists and other field theorists, is a case in point. Along with the field concept, other allied concepts, such as force and energy, are also incorporated in such psychological theories. Newtonian mechanics are at least tacitly utilized by psychologists in terms of actions (stimuli), reactions (responses) and interaction between outside or inside stimuli and outside or inside reactions or responses.

Mathematics, considered in physical and to a lesser degree in biological sciences the tool for precision and prediction, led the psychologist to believe that quantification was equally important in his science. He felt that any science would be appraised by its advancement in the direction of quantification. This position seems to follow from the dictum 'anything that exists, exists in some amount.' Skinner undoubtedly holds some such belief. In commenting on Pavlov's conditioning experiments Skinner said, "Only a quantitative description will make sure that there is no additional mental process in which the dog associates the tone with the idea of food." Hull similarly leans heavily towards such a belief and his mathematico-deductive approach is consequently a highly quantitative

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23 Skinner, Science and Human Behavior, pp. 53-54.
Without, at this point, discussing this position it may be in order to note here again that different psychological approaches have adopted different mathematical concepts to fit their respective systems. Lewin, for instance, utilized vector and topological concepts to fit his field theory. Hull utilized the mathematico deductive system in parallel with Euclidean geometry for his system. Skinner, who compares his system with physical chemistry, follows a more or less similar approach to that used in physical chemistry to estimate behavioral constants, such as reflex, reserve, extinction, rate, etc. Egon Brunswik found the statistical approach, along a line comparable to Maxwell's law of probability, most suited for explaining behavior. Brunswik in this respect is in harmony with all experimental psychologists, though his reasoning is rather unique. Says Brunswik,

In the natural environment of living being, cues, means or pathways to a goal are usually neither absolutely reliable nor absolutely wrong. In most cases there is, objectively speaking, no perfect certainty that this or that will, or will not, lead to a certain end but, only a higher or lesser degree of probability.24

And so the story goes. Medicine, especially through psychiatry has had its role in the picture. But psychiatry, which made its start in treating the insane, followed two distinct lines of approaches: the somatic and the psychic. The two approaches,

chiefly at the hands of Freud, have led to the development of psychoanalysis with its wide ramifications. Thus, by the turn of the century, we find some psychological approaches have distinguished themselves as distinct schools. By and large, every one of these schools has arisen as a revolt against some other school. Titchener in referring to structural psychology, for instance, said, "We must remember that experimental psychology arose by way of reaction against the faculty psychology of the last century." And Angell, speaking about the province of functional psychology in contrast with structural psychology, said, "It (referring to functional psychology) gains its vitality primarily perhaps as a revolt against the exclusive excellence of another starting point for the study of the mind...." Gestalt psychology, as is well known, made its revolt against the elementalistic approach of other psychological systems, maintaining that 'wholes' disclose properties and influences that are more than the sum of their parts." The revolt of early behaviorism against the study of consciousness or mental states is very well known. Watson, in his early writings asserted: "The time seems to have come when psychology must discard


all reference to consciousness; when it need no longer delude itself
into thinking that it is making mental states the object of observa-
tion." 28

The foregoing citations suffice to illustrate the point that
most new psychological movements have made their start as a revolt
against pre-existing schools of psychology.

As this century entered its first years the following schools
of psychology were known:

"FUNCTIONAL PSYCHOLOGY: Very old; wide in scope; not
sharply defined; named in
America in 1898.

STRUCTURAL PSYCHOLOGY: German in origin; 1879 out-
standing date; named and
sharpened in America in 1898.

ASSOCIATIONISM: An old British school, taking
stimulus-response form in
America in 1898, in Russia in
1913.

PSYCHOANALYSIS: Originated in Austria about
1900.

PERSONALISTIC AND ORGANISMIC PSYCHOLOGIES:
Originating in both Germany
and America about 1900.

PURPOSIVISM OR HORMIC PSYCHOLOGY: Originating in Britain in
1908.

BEHAVIORISM: Originating in America in 1912.

GESTALT PSYCHOLOGY: Originating in Germany in 1912. 29


29 Woodworth, Contemporary Schools of Psychology, Revised Ed., p. 1.
As for present day psychology, the time seems to have passed when schools of psychology stand in extreme isolation from each other. In fact we no more have schools of psychology as such, but rather different points of view and different areas of inquiry. With respect to perception versus learning theories, the concern of the present study, it is impossible to make a clear-cut distinction between categories within the contemporary points of view of psychology. Hilgard, in his *Theories of Learning*, categorizes contemporary theories as belonging to one or the other of two families—association theories and field theories. He notes, however, that "The distinctions between the families are not always sharp, and there are agreements and disagreements which cut across lines."30

Hilgard recognizes five main differences between the two categories of psychological families. These are: (1) environmentalism versus nativism; (2) the nature of wholes and of parts; (3) reaction and cognition; (4) mechanism versus dynamic equilibrium; and (5) historical versus contemporary causation. To this list we may add continuity versus discontinuity and blind trial and error versus insightful learning. Such a division, of course, is arbitrary; other forms of categorizations, which would call for some rearrangements in the above order, are possible. One possible alternative would be behaviorism versus Gestalt or field theory.

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On this basis we would not be able to locate either Tolman's or Brunswik's theory.

The main differences between the two families, association theory and field theory, follow.

1. ENVIRONMENTALISM VERSUS NATIVISM: Both families lean partly towards nativism and partly towards environmentalism. The difference is a matter of emphasis. Even Watson, who is considered an extreme environmentalist, recognized two innate reactions—that of fear and that of anger. But yet none of the contemporary association theories go so far as Watson did in leaning upon environmentalism. Suffice it here to refer to Hull's third postulate which asserts that the responses activated by a given need are not merely random but are essentially those which are most likely to terminate that need. When we shift to the field family we find that although most positions within it emphasize form perception as independent of past experiences, such concepts as the phenomenal field, life space or memory trace, undoubtedly recognize the importance of past experience.

2. THE NATURE OF WHOLES AND OF PARTS: This issue has been one of the hottest issues between the two families. In its simplest form it can be stated thus: Is the "whole" a mere summation of its parts or is it more than that? Association theories prefer the former alternative, while field theories prefer the latter. On each side of the fence, however, we find some recognition
of the significance of form or organization of behavior. Thorndike's relatively new concepts which he postulated in his *Human Learning* are akin to Gestalt thinking. These concepts are (a) belonging, (b) identifiability, (c) availability, (d) trial, and (e) system. The postulation of these concepts by Thorndike led Brown and Feder to conclude that Thorndike's learning theory could be explained by Gestalt psychology and that Thorndike, so far as the above were concerned, was talking Gestalt. Hull's neural interaction postulate is a wholist concept and in it Hull sees the two families—field and associationism coming closer together. Gestaltists and field theorists do not completely neglect the significance of parts and their influence on the whole. The difference between the two families, no matter how serious it is, is a matter of emphasis.

3. **REACTION AND COGNITION:** The difference between the two families, with respect to this issue, has to do with the history of behaviorism. Associationism in its history was concerned with the association of ideas. In its modern version as behaviorism, it attempted to free itself from any introspectionistic or mentalistic tinge and, hence, followed the rejection of cognition. Discrimination or reaction is a better term for behaviorists than cognition because it refers to observable behavior and learning. Cognitive psychologists at the same time reject any mentalistic connotation in their use of the term "cognition." The extent to which they have succeeded will be left to later consideration. All this is
not to say, however, that the difference between the two families is merely a matter of terminology. But the issue cannot be exhausted in this brief review. It will be considered in a separate section of this study.

1. MECHANISM VERSUS DYNAMIC EQUILIBRIUM: The difference between the two families with respect to this issue is a matter of preference of the physical model after which psychologists build their systems. The field theorists are influenced by the field concept in physics and hence include in their systems such concepts as field forces, dynamic equilibrium and the like. The association family, however, in their insistence upon observable behavior, prefer machine models which work in accordance with Newton's mechanics, that is, in terms of action and reaction as discrete happenings. But between these two extremes we find a number of theories which do not fall strictly within one of these two alternatives but rather lean more towards one than the other.

5. HISTORICAL VERSUS CONTEMPORARY CAUSATION: This is also a matter of emphasis. Field theorists, without completely denying the influence of past experience, believe that it is more profitable to inquire into the immediate dynamic experience and its structure. They believe that the historical approach is complicated and the historical details of any event are rarely completely available for investigation, while the immediate situation contains all the factors that are relevant. Association theorist, however, in
their emphasis upon reaction and the sequence of interaction in a mechanistic fashion, naturally emphasize past experience and, hence, the historical approach.

6. CONTINUITY VERSUS DISCONTINUITY OF LEARNING: Behavioristic theories, insofar as they emphasize reinforcement as 'primary need reduction,' consider learning—the acquisition of habit—as a monotonous function of reinforcement and, hence, make the continuity of learning a central consideration. Field theorists, however, in their emphasis upon equilibrium and restructuralization of the field, consider learning to take place essentially in one try and, hence, accept the notion of discontinuity. This position is clear and has caused a long controversy, especially between Tolman and his followers on the one hand, and Hull and his followers on the other, in connection with so-called latent learning. Field theorists assume that learning can take place cognitively without doing or performance; in Tolman's words a rat in a maze learns what-leads-to-what even though he might not eat the food as he learns its position. Reinforcement psychologists, however, insist on learning by doing; the doing leads to reinforcement, whether primary or secondary. This issue is of serious philosophical importance and will, therefore, be discussed later on in connection with latent learning.

We must not, at this point, fail to observe that Guthrie, although an avowed behaviorist, does not stand in the association
camp so far as this issue is concerned. Guthrie believes that learning is completed in one try. He does not belong in the continuity group, therefore. His reasons differ from those of the cognition theorists, as will be seen later.

7. TRIAL AND ERROR VERSUS INSIGHTFUL LEARNING: This issue follows from the difference between the two families on the issue of environmentalism versus nativism. Behaviorists believe that random movements in a motivated situation lead to habit formation, as the organism by chance makes the correct response. Such an understanding influences the structure of the experimental designs in behavioristic studies. These largely depend on maze experiments and rote learning. Field theories, however, emphasize cognition or insightful behavior and their experimental designs usually emphasize meaningful relationships.

This effort to present a broad but brief outline of the history of contemporary movements in psychological theories was made to provide the ground against which the main interest of this study, an examination of cognitive aspects of behavior, may be pursued. Both families of psychological theories, associationist and field, will be examined. The next chapter will examine the field theory family, emphasizing its cognitive aspects.
CHAPTER II

FIELD THEORIES

Introduction

In the literature of field theories such terms as percept, sense organization, insight, wholeness, figure, ground, expectancy, purpose or purposive behavior and the like frequently occur. For this reason they are sometimes called the cognitive theories. In order to understand the main points of difference between theories which belong to this family and those which belong to the association-ist, or more precisely, the behaviorist group, we will have to note some points of emphasis of the field family as they attack behaviorism. Some psychologists believe that the differences between the S-R and cognitive theories is one of emphasis. They assume that while S-R theories focus on observables or inferred or hypothetical S-R connections, the cognitive theories focus on reported or inferred perceptual organizations as mediators between stimulus patterns and behavior. The difference, however, though a result of difference of emphasis, certainly goes deeper than that. Cognitive theorists see in the molar-molecular issue, the crux of the difference between the two groups.
The Molar-Molecular Issue

Gestalt psychology, as was pointed out in the first chapter, arose as a revolt against elementarism or atomism in the study of behavior, mainly, as it related to perception. Perception from their point of view could not be described in terms of a mosaic of sensations held together by means of associations. Their criticism of introspectionist psychology was directed mainly against its atomistic nature. So also has been their criticism of behaviorism and all sorts of associationism. To them the whole is more than the sum of its parts and analysis of behavior phenomena, therefore, in terms of their ultimate parts is artificial and misleading. From their analysis of the molecular approach, the concept of the whole and the molar approach may be understood. The molecular approach, according to the field theorists, rests on the following biases.¹

The atomistic reductive bias: The attempt to explain a complex interrelated whole in terms of its constituent elements with the underlying assumption that something small is more fundamental than something large.

The genetic bias: The belief that a phenomenon which is genetically early is more fundamental than that which comes later.

Peripheralism: The assumption that complex modes of behavior can ultimately be explained in terms of relatively simple nervous connections.

The reinforcement bias: The assumption that learning occurs only as a result of the reduction of specific primary or derived drives.

From a molar point of view, however, behavior is dealt with in terms of interaction between the organism and its environment. The organism is considered as a unity or whole and not as a summation of specific sensory and molecular segments which are insulated each from the other. Molar behavior, from Tolman's point of view, for instance, requires mutual interconnections between all parts of the organism. To identify a single behavior act it is required to reckon with a specific 'goal-object'. This goal object requires the selection of means to reach the object 'means-object'. This implies the selection of the shortest routes in the direction of the goal-object. Trial-and-error can be defined from this point of view as the persistence of the organism to reach the goal. The organism benefits from such tries in that it can select and retain the more efficient means to that end. In this view, trial-and-error is not blind, neither is it mere fumbling.

Cognition in Tolman's terms is defined as
The initial orientation towards a goal-object in terms of distance, direction and valence character and as the selection of means-object or path in terms of its suitability for reaching the goal. Cognition is further definable as the behavior change upon attaining the goal and is the variation of behavior if the goal does not prove to have the initially perceived valence. 

Purpose, by the same token, is objectively defined by Tolman as the "invariant terminal" with reference to which reactions may continuously differ. Tolman's definition of these terms are operational, where cognition is identified with change in behavior and purpose is merely an invariant terminal. Such definitions of cognitive terms fall short of Hullfish's assertion that cognitive behavior may be viewed as "trial and error become conscious of itself and thus escaping from the demand of the pressing situation for immediate action." Alternatives are examined, not merely acted upon one at a time. Thus, delayed reaction is a characteristic of cognitive behavior.

Tolman's position shows, however, a marked difference from the orthodox behaviorist approach in that it reckons with an end in view. In other words, behavior does not converge to the terminal point by mere accident which is the position of behaviorism. Tolman, being a motor behaviorist does not deal with abstractions as Goldstein does. Goldstein believes that a cognitive theory must provide room for the representation of behavior in more

\(^2\) Martin Scheerer, Ibid., p. 94.
broad abstract terms not directly dependent upon concrete action goals; that is through concepts.

The Proximal Distal Issue

In philosophical terms the issue (the behavioristic) trial-and-error versus cognition falls within the realm of the ends-means category. From a psychological standpoint it is a proximal-distal issue. Spence points out that total concrete events are never repeated exactly, but only certain features of them. Thus he concludes that even the holist has to abstract and fractionate in order to arrive at uniformities or laws. Now this argument cuts both ways. Hullfish in his monograph inspects Thorndike's psychology and shows how the concept "dogness" is formed upon one experience with a dog. The concept "dog", for the little child, might include other furred animals such as rabbits. With further experience with dogs, however, and with other animals he builds-up the concept dog not by adding to or subtracting from the original concept but by broadening his envisionment of 'dog'. To this extent, it is true that total concrete events are never repeated exactly. The fact remains, however, that in each and every

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4 H. G. Hullfish, Aspects of Thorndike's Psychology in Their Relation to Educational Theory and Practice.
situation the total object is presented to the perceiver and whatever features are accentuated, reinterpreted or omitted are being so dealt with in the context of a host of interrelated features and characteristics. It is the remaking of the original stimulus in the new situation that accounts for the modification of the concept. The dog can be described in terms of so many characteristics that it is almost impossible to give a complete empirical definition for "dogness" which would fully describe or define all members of the genus canis familiaris. What feature or features can we isolate and pick out as representative of the concept "dogness"? Is it the texture of the fur, its color or pattern or is it the dog's size, its movements, length, or shape or movement of its tail, or its four limbs or claws, or is it its general attitude of friendliness or aggressiveness.

We could continue with countless other characteristics, each of which might be taken as a proximal stimulus determining the perception of the object. But actually they are all distally perceived. We agree with Scheerer, therefore, who says, "that not all proximal regularities are representative of the underlying organizational determinants."\(^5\) Kohler's critique of traditional introspective analysis, as Scheerer has pointed out, bears on this point. Kohler has noted that introspective analysis can destroy

the functional dependency of perceptual parts (for example, as in the use of the reduction screen), with the result that a certain brightness or form is considered the "true" regularity of the retinal image as a proximal event. In contrast to this isolating procedure the holists attempt to determine the genuine parts of wholes versus "fictitious" elements. Now this criterion does not preclude the functional roles played by parts of the organized whole or the function of proximal events. In fact, the writer agrees with Bartlett who maintains that "there is no perceptual situation in which some detail does not stand out and influence what is perceived more than the rest." But this is also a distal not a proximal determinant. It is a fact that in our perceptual and cognitive behavior in general we deal with objects, not with local stimuli. The starting point for the study of behavior should, therefore, be with objects as distally represented. Dewey, in another connection, asserted that he was able to pursue his philosophical inquiry because he assumed that there were 'objects' of knowledge. The S-R theorists naturally face this same problem and attempt to account for it in terms of specific elementary or proximal stimulus-response determinants or S-R sequence in behavior. But did they succeed? Heider shows how Skinner does in effect speak

6 See W. Kohler, Gestalt Psychology, p. 92.

about distal determination when he refers to proximal stimulus response determinants. Skinner finds that, in the case of the experiment in which the rat presses a lever, the number of distinguishable acts on the part of the rat that will give the required movement of the lever to be indefinite and large. Thus, instead of the intended proximal events Skinner speaks about "a class which is sufficiently well defined by the phrase "pressing a lever."

The phrase clearly signifies not a proximal stimulus response but a distal determinant which is to press the lever. By the same token, Hill's habit family hierarchy, which provides a purely physical basis for the theory of knowledge, does in effect involve distal determinants of behavior. Hull tries to account for the fact that habits can vary in situations in which there is more than one action sequence that will lead to the attainment of a particular goal or sub-goal. His account rests on an assumed family hierarchy based on past learning of many different action sequences, for example, of different paths in different mazes. What makes the different action sequences belong to one family and be interchangeable, therefore, according to Hull, is the fact that they possess a common element, namely the same goal reaction as a "fractional anticipatory goal reaction." Heider justifiably points out that from the position of the locomoting organism,
e.g., a rat in a maze, each detour within the repertoire of the family hierarchy follows proximally different S-R action sequences. Proximally viewed, therefore, the end place of each detour in that repertoire cannot be identical with the end place in the current maze. The identical element is thus distally determined, although the theory is based on proximal S-R sequences.

Gestalt Theory

The issue 'proximal-distal' representation of objects in the environment was originally introduced by the Gestaltists. We need to consider some basic tenets upon which the Gestalt theory rests. One of these is the tenet of distal representation. This, in contrast to the proximal conception of the behaviorists, creates a critical issue, the distal-proximal issue.

Gestaltists distinguish between distal and proximal stimuli. To illustrate the point, Koffka says,

When I see a table, this table does not affect any senses at all; they are affected by processes which have their origin in the sun or an artificial source of light, and which are only modified by the table before they excite the rods and cones in our retinae. Therefore these processes, the light waves, and not the geographical objects, are the direct causes of our perceptions...

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8 K. Koffka, Principles of Gestalt Psychology, p. 80.
This illustration helps to show the distinction between the two kinds of stimuli.

We see now that this word (stimuli) has two different meanings which must be clearly distinguished from each other; on the one hand the table in the geographical environment can be called a stimulus for our perception of a table, on the other hand the excitations to which the light rays coming from the table give rise are called the stimuli for our perception.

Koffka calls the first distant stimulus, and the second proximal stimuli. To answer the question, why do things look as they do, Koffka goes on to refute the proposition that "changes in the proximal stimulation unaccompanied by changes of the distant stimulus-objects should produce corresponding changes in the looks of the behavioral object." To support his views, he cites instances of the constancy of size, shape and brightness. He concludes, therefore, that, "The constancy of real things is to a great extent preserved in the constancy of the phenomenal things despite variation in their proximal stimuli." Furthermore, although he accepts the proposition that "any change in the distant object which produces no effect in the proximal stimulation should leave the looks of the behavioral object unchanged," he rejects conversion of this statement. He refers to reversible figures and puzzle pictures

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9 Ibid., p. 80.

10 Ibid., p. 83.
to bear witness to the fact that changes may occur in the looks of things without corresponding changes in the proximal stimuli. He further concludes that the looks of things do not depend only on the proximal stimulation but also "upon sets of other conditions which must lie within the real organism." Here lies the cornerstone on which gestalt theory is based.

Past Experience

The gestaltists reject past experience as forming part of those conditions which lie within the real organism and affect the perceptual process "or the looks of things." The constancy phenomenon, in other words, does not depend upon past experience. It is a given. They reject the proposition that interpretation based on past experience is an explanation of the constancy phenomenon. Koffka cites many experiments to support this point of view. His case may be briefly summed up by stating that size constancy has been shown to exist with young animals as, for instance, the three months old chicks which could not be expected to be able to utilize their past experiences for interpreting their perceptions. Human infants have

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11 Ibid., p. 84.

12 Reference to this point will be made in Chapter Six of this study.
also shown a remarkable constancy in responding to size. Moreover, human adults have shown constancy of size even when experimental changes in the object of perception were not consciously observable; a fact which eliminates "interpretation" as a cause for constancy, since awareness of the conditions which lead to the variation of the retinal image is essential for an interpretation hypothesis. If size constancy depended on interpretation, gestaltists argue, the constancy of size should be exhibited regardless of distance provided there is awareness of conditions and their meanings. Sometimes even with the presence of conscious meaning of observable objects, size constancy ceases to work; that is, when the distance between the subject and the object of perception exceeds a certain limit as, for example, when an observer on the top of a skyscraper looks down to the streets and perceives pedestrians and cars as pedestrians and cars, although their sizes are perceived to be much smaller than they are in reality. Koffka concludes, therefore, "that constancy of size follows as a natural and original result."

By the same token, brightness-constancy has been proved to exist in infants, chimpanzees and chickens.

The distinctive features of the gestalt theory may be summarized in the following:

1. A distinction is made between the physical objects (i.e. distal stimuli and the proximal stimuli—light rays, air particles, etc.) which impinge on our local receptors and are therefore the direct cause of perception.
2. The proximal stimuli belong to the medium which is interposed between the object (distal stimuli) and the sense organ.

3. Percepts, or phenomenal objects result from a process within the organism which may be called representation of the distal objects. It is accounted for by the principle of isomorphism.

4. Perception is direct i.e., interpretation in terms of past experience is ruled out as a determinant of the phenomenal object in perception.

The Dynamics of Perception

In order to understand the dynamics of perception from the gestalt point of view, it may help to summarize the sequence of events in the process. First, there is the distal stimulus (the physical object); then are the proximal stimuli which impinge on local receptors; sensory organization next occurs; and, finally, there is response to the product of organization. "The product of organization is the phenomenal unit formation which represents the distal object."\(^{13}\) The concept of organization is introduced in order to distinguish between the phenomenal object which is considered to be the result of organization and local or proximal stimuli. Koffka says, "If we speak of pictures or images as stimuli we mistake the result of organization, a mistake that is

being committed again and again."

This formulation helps the Gestaltists to do away with the elementarist's approach by deriving the characteristics of behavioral objects from the properties of local stimulation; that is, by assuming a one to one relationship between the behavioral objects and the local stimuli. Along this line, Kohler says, "The waves of light, ....do not as such contain the slightest indication of the fact that some are reflected by parts of one physical object and others by objects in its environment ....Thus in the reflected light no trace is left of the units which actually exist in the physical world."15 He goes on to say that "so far as retinal stimulation is concerned, there is no organization, no segregation of specific units or groups."16 Organization must, therefore, occur on another level. This conclusion introduces us to Kohler's theory of Isomorphism to account for the organizational character of percepts.

Isomorphism

Kohler defines isomorphism as the, "Thesis that our experiences and the processes which underlie these experiences have the same

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16 Ibid., pp. 161-162.
structure." In other words, Isomorphism assumes a formal correspondence between brain-field patterns and phenomenal patterns. The phenomenal patterns, in the last analysis, are derived from brain-field patterns. Kohler says, "whatever the process may be by which organization is believed to be introduced in the field of vision, it cannot be imported without existing beforehand in the region in which it is said to have its origin." The dynamic self-distribution of nervous excitations in the brain processes is merely triggered off by the local stimuli.

**The Law of Pragnanz**

The law of pragnanz is introduced in gestalt theory to account for the assumed correspondence between the phenomenal and the physical objects. In other words, the law of pragnanz and its sub-laws describe the organization of local stimuli in such a way as to correspond to the outside object. Kohler says in this regard, "Although the local stimuli are mutually independent, they exhibit formulations such as those of proximity and similarity."18


By this means, the Gestalt psychologists are able to explain the reason why "sensory organization tends to produce results which agree with the actual make-up of the given physical-situation."\(^{19}\) The explanation is simply that "the stimuli copy corresponding formal relations among the surface elements of the physical objects. The formal relations in the physical objects are preserved as corresponding relations among the stimuli and since organization depends upon the latter, it must also depend upon the former."\(^{20}\) In Koffka's words, "The behavioral object is a dynamic map of the distant stimulus object when and in as much as the proximal stimulus distribution possesses such geometrical characteristics as will produce a psychophysical organization similar to the one of the distant stimulus object."\(^{21}\)

From the foregoing discussion we find that the cognitive significance of the Gestalt psychology is merely an outcome of a geometrical correspondence between a postulated brain field and the real world. The cognitive significance of the Gestalt principles, "may be summed up," says Scheerer, "in the proposition that phenomenal organization is a cohesive structured field and that the units in this field represent distal objects of the geographic

\(^{19}\) Ibid., p. 167.

\(^{20}\) Ibid., p. 167.

environment.22 The relation between the physical object or (the given physical situation) and the phenomenal object presents us with an interesting philosophical problem. What is the physical object, if all we experience is a process within the organism which is "representation of the distal object?" The question is whether the phenomenal object is existentially a priori, perhaps dormant in the dynamics of the brain processes to be organized and then responded to under the impact of local stimuli. Kohler, as mentioned earlier, reminds us that the process by which organization is believed to be introduced into the field of vision must exist beforehand in the region in which it is believed to be introduced, "it cannot be imported without existing beforehand" in that region. This position does in effect assume a dichotomy between the real and the phenomenal worlds, with isomorphism a fortunate phenomenon which relates the two together. It is a sort of parallelism, philosophically speaking, which exists between the real and the phenomenal worlds. This is the case despite the fact that Gestaltists speak of a perceptual field in which the organism and its environment are indissoluble components. Thus, Gestalt's theory does not draw upon past experience as a genuine factor in the perceptual process. Says Koffka,

This correspondence between phenomenal and real things is, according to our theory, not primarily a matter of experience—although we do not deny that experience may influence thing properties—but the direct result of organization. Psychophysically, the process distributions which correspond to perceived things must in several aspects be similar to physical things, and therefore we must, on the basis of isomorphism, conclude that behavioral things have autochthonously characteristics similar to real things. Here, as in so many other fields, a purely empiricistic theory is bound to run in a vicious circle.23

It is true that Gestalt has successfully avoided elementarism and pure empiricism but it is difficult to understand how they avoid apriorism, even if we grant that they have done away with Kantian apriorism as Koffka maintains.24 The facts of the case seem to show that Gestalt psychology assumes the existence of things as objects with definable characteristics apart from human experience. Dealing with brightness constancy, for instance, the Gestaltists maintain that white surfaces which emits less light rays than black surfaces may continue to look white and the black to look black and this is so without the effect of past experience. The concept of invariance, which is the tendency of a given part of the field to be responded to in an invariant relation to the rest of the field, provides the gestalt answer to the phenomenon


24 Ibid., p. 305.
of perceptual constancy. The gestalt interpretation seems to overlook the fact that the color of a surface, of whatever shade, does not remain the same under different strengths of illumination. No doubt, from the point of view of physics, illumination makes a qualitative difference in the color of the object as a result of refraction and reflection. If, then, the surface of the object responded to is qualitatively different under different intensities of light illumination, how is it that brightness constancy, for instance, is uninfluenced by past experience? The fact that a given part of the field is always responded to in relation to the rest of the field, does not exclude the possibility that perception of this relation (between a part and the remainder of the field) is a matter of past experience, and this is to say the least. Kilpatrick has pointed up this difficulty fully. His transactional approach has led him to the conclusion that "Gestalt psychology is hardly a theory of perception, at all, it is, in a sense, the modern nativism in which perception is a given based on a relatively determined isomorphic relationship between the properties of the thing perceived and the properties of a physiological brain field." By the same token, the cognitive aspect of perception in gestalt psychology, as far as the active role of the perceiver is concerned, is unsatisfactory. Without going

further at present, with the cognitive aspect of Gestalt,\textsuperscript{26} it might prove of value to consider other positions relevant to our problem which are derived either directly or indirectly from the Gestalt point of view.

It is interesting to observe that Hull, whose system is based on proximal determinants of behavior in terms of S-R, has formulated a postulate which he calls "afferent neural interaction" to overcome the difficulties encountered by a one-to-one correspondence between local stimuli and response. The postulate says in effect that concurrent afferent impulses interact with each other in such a manner as to produce something different from each separately taken. The postulate merely states that every combination of afferent impulses is unique and that combination of stimuli may act differently from the separate stimuli of which they are composed. Thus the postulate does attempt to solve the problem by stating it. It at least implies the recognition of a distal determinant of behavior. It does not satisfactorily explain the organizational factor, however. Hilgard says, "The postulate does not solve the problem, it takes the problem from the field of perception and buries it in the nervous system."\textsuperscript{27} As such,

\textsuperscript{26} This point will be dealt with in Chapter Six of this study.

\textsuperscript{27} Hilgard, \textit{Op. cit.}, p. 82.
cognition is still out of place in Hull's S-R system. This is an illustration of the impact that gestalt theory has had on other systems of psychology. What Hull says here is significant since his system is behavioristic through and through.

The impact of Gestalt psychology on many American systems has been remarkably greater than on that of Hull, however. The influence of Gestalt psychology on other systems varies from one system to the other. Reference has already been made to Tolman's. In general terms Gestalt psychology has introduced some new concepts or brought life to old concepts which were alien to American psychology as represented chiefly by Thorndike during the twenties and part of the thirties of the present century.

Perception is an important behavior phenomenon which was brought to focus after it was almost forgotten as a result of the rise of behaviorism in general. Insight was a relatively new concept introduced by Gestalt and brought faith once again in intelligence as a characteristic of man in his behavior. The molar concept has already been dealt with and although many a behaviorist claims that his is a molar system, yet to the extent that the molar concept is tied up as it really is in Gestalt theory—with the distal representation of objects in the environment, to this extent behaviorism cannot be considered molar from the point of view of field theory. The distal representation of objects in

28 The terms molar and molecular were introduced by Tolman, but they follow directly from the teachings of the gestalt group.
the environment and the distinction between proximal and distal representation is another issue brought into focus as a result of gestalt theory. The physical object versus the phenomenal object, and more generally the geographical field versus the phenomenal field are distinctions which are also attributed to gestalt theory. Other concepts are the field concept, dynamic brain processes, etc.

The impact of gestalt theory on those systems which took after it naturally vary with the concepts those systems adopted and made use of in the interpretation of behavior. Hebb's theory for instance adopts the thesis of perception of what he calls primary forms independent upon past experience, but at the same time he does not throw past experience overboard as gestaltist's essentially do. We have seen that gestaltists have refused past experience as a causal factor in the constancy phenomenon chiefly because of the assumed one-to-one correspondence between stimuli and response which they refuse as elementaristic and atomistic. One may wonder whether the gestalt interpretation is the only possible alternative. Hebb provides such an alternative. We will deal with this aspect of Hebb's theory. Hebb advances a neurological theory to explain his thesis but it is beyond the scope of this study to deal with it.

Other systems represented by Snygg and Comb's theory adopted the phenomenal field approach and thus made subjectivity the
The essence of their system. The problem that such a system has to cope with is the fact that we live in an objective world. We shall consider chiefly this aspect when we consider Snygg and Comb's system.

Another system which we will consider in the following sections is that of Brunswik. His is a system which recognizes the importance of the distal representation of objects. He equally emphasizes past experience. In fact, Brunswik's theory can be called a reinforcement theory. It is treated in this chapter because of its emphasis on cognition and cognitive aspects of behavior.

Hebb's Theory: Primitive Unity and Form Discrimination

Hebb seems to take a middle of the road position between nativism in the case of "primitive unity" and learning and "nonsensory factors" for the discrimination of forms. With respect to primitive unity, Hebb says, "The primitive unity of a figure is defined here as referring to that unity and segregation from the background which seems to be a direct product of the pattern of sensory excitation and the inherited characteristics of the nervous system on which it acts."\(^{29}\) To this extent Hebb goes along with Gestalt psychology in granting phenomenal organization to what he

assumes to be unlearned "primitive unity," as the distinctiveness of figure from background. To support his position, Hebb cites Senden's observations regarding the congenitally blind on the first occurrence of vision following an operation for cataracts (and apparently, also, at first vision by the rat that has been reared in darkness). Says Hebb "The unity and distinctiveness of such figures from their background, then, is independent of experience, or 'primitive'. Now, without going into details with respect to experiments with the congenitally blind or with animals reared in darkness, it suffices here to mention that such experiments do not warrant the generalization Hebb seems to draw from them. On the one hand, cataract blindness is never complete, thus the influence of past experience is not completely ruled out; and, on the other hand, animals reared in the darkness do not develop their visual organs as do animals in normal conditions, so that conclusions drawn from their cases tend to be misleading.

Hebb, however, makes a distinction between unity and identity in perception. Unity may be primitive, as mentioned in the foregoing, that is, it may be sensorily delimited, seen as one, unified and distinct from its surroundings. Identity, however, refers to the properties of association inherent in a perception, and thus

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30 Ibid., p. 20.

by definition identity depends on non-sensory factors, such as experience and learning. Identity seems to refer to recognizability and distinguishability of a given object when it is seen for the second time. Thus Hebb asserts that "unity may be innately determined, an immediate property of sensory dynamics, whereas identity is dependent on a prolonged experience." He then goes on to say that "because these two things have not been separated in the past, it has appeared that perceptual organization is innate."

Experimental Evidence

Hebb attempts to prove the validity of his distinction between unity and identity by drawing upon Serson's experiments with congenitally blind human subjects, Reisen's experiments with chimpanzees reared in darkness and various other experiments. It was shown by Lashley, for instance, that the rat was found readily able to learn to discriminate between an erect and an inverted triangle, whereas he showed consistent difficulty with circles versus squares. The two discriminations are, as Hebb points out, equally easy from the human point of view. Chimpanzees were found by

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32 Ibid., pp. 27-28.
33 Ibid., p. 28.
Gillerman to discriminate a black triangle on a white background after they had learned to discriminate a white triangle on a black background, i.e., they were able to generalize or transfer from the one case to the other. The rats were completely unable to recognize a black triangle, however, no matter how much training had occurred with the white triangle alone. Moreover, Gillerman and Lashley independently found out that perception of a triangle is not generalized by either rat or chimpanzee to include a triangle made up of small circles, whereas such generalization is made by two year old children.

Hebb concludes, therefore, that "the perception of identity is different in different mammals, the perception of primitive unity is practically the same." 34

If it is true that primitive unity is a given, and that it may be perceived without identity, we are entitled to ask what is perceived in such a case? Unity as such, is not by any means a satisfactory answer, for unity is a concept and has content. Without such "content" there is no perception. Thus to say that primitive unity can be perceived without identity is merely to say that primitive unity is perceived without perception. We may properly ask whether Hebb's conclusion with respect to the distinction between the independence of primitive unity perception

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34 Ibid., p. 29.
and identity perception is justified? Lashley gives an explanation for the rat's relative facility in discriminating between vertical and inverted triangles and for his difficulty in learning to discriminate between a square and a circle (cited above) by comparing the rat to a ski-jumper who does not pay attention in his jumps to non-essentials. In other words, the behavioral environment should make a difference in our interpretation of discrimination or what Hebb calls identity perception. Again we must ask, what does an organism, whether human or animal, perceive when he perceives, say, a triangle? Geometrically speaking, a triangle is an area on a plane bounded by three intersecting sides. In actual experience, however, we find all sorts of triangles, varying in area, angles and color. So what is it that a young child perceives, when he perceives a triangle "as identity" and how does this differ from the perception of a triangle as "primitive unity?"

The answer to this question is not provided by Hebb's analysis nor does his distinction between primitive unity and identity perception, as belonging to different orders qualitatively speaking, make it possible to provide an answer. Could this distinction then be a matter of degree of discrimination? There seems to be no other alternative. Hebb himself says, "that perception of the congenitally blind after operation is almost completely lacking in identity." In other words, identity is not absolutely

[35] Ibid., p. 31. (italics mine)
lacking. Hebb, again drawing upon Senden's cases with the congenitally blind after an operation, reports cases in which there was an immediate perception of differences in two figures seen together (which implies identity), but he refers also to one case in which this was not possible. "Thus the patient sometimes saw the difference between a sphere and a cube and sometimes not." It is plausible, therefore, to assume that the distinctiveness of the figures vary in degree. The variation may enable a perceiver to see differences between a sphere and a cube or it may, indeed, be weaker and weaker, until the visual field fades into something corresponding to the "blooming, buzzing confusion" which confronts the infant.

If we allow for the experiential differences between the congenitally blind adult (after operation) and the normal, newly born baby, we are able to discern similarities between the processes both go through. On the one hand, the congenitally blind adult depends essentially on other senses than vision to perceive the world around him. His vision may not allow him to discriminate except between strong illumination and darkness. Following the operation his problem becomes, among other things, one of coordination. This is evident from Senden's reports about his cases. In one such case cited by Hebb: "A patient was trained to discriminate squares from triangles over a period of 13 days and had

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Ibid., p. 32.
learned so little in this time that he could not report their form without counting corners one after another." The normal, newly born baby, on the other hand, faces a "blooming, buzzing confusion" and so he looks, reaches, grabs, licks, sucks, listens and smells all at the same time. In other words, the newly born baby draws upon all his resources and gradually learns to perceive the things around him, and in so doing he not only learns to perceive what they are, but also what they are not (i.e. he learns to discriminate between things). From this standpoint, we agree with Hebb that "activation of the motor system, overt or implicit... contributes essentially to the development of visual integration without being sufficient to it." What is involved is a sensory motor co-ordination. As far as cognition is concerned, though his discussion is none too clear, Hebb's theory seems to allow for distal representation, since it accepts configurational and central factors in perception and to this extent it is in contrast to peripheral connectionism.

Brunswik's System

Brunswik subscribes to a molar approach which differs from gestalt psychology in that formalism is denounced. Moreover, 

37 Ibid., p. 32.

38 Ibid., p. 34.
mediation problems, in the gestalt psychological sense, are not considered important and the details of actual sensory, nervous or motor phenomena are deliberately disregarded. "One and the same means-object may be represented at different times by very different stimulus configurations. And one and the same goal may be reached equally well by very different kinds of movements and means-object manipulation."  

Brunswik sees in the formalism of gestalt theory as represented, for instance, by the law of pragnanz, the revival of some aspects of Kantian formalism. He says, "The dynamic interaction in a closed brain field which is assumed to underlie the tendency towards pragnanz amounts to a kind of self-sufficient encapsulation of the perceptual system."  

**Distal Representation**

Distal representation in Brunswik's system takes the form of patterned cues and sign gestalten. From this point of view Brunswik sees parallelism between his and Hull's system. The habit-family hierarchy and in this parallelism Brunswik (speaking about himself) says that he "seems to have placed himself not only beyond, but in opposition to established Gestalt Doctrine."  

41 Ibid., p. 58.
Faithful to his position, however, Brunswik objects against atomism of any sort. "In the traditional micro-mediational tracing of sensory neural transmission....one may easily lose sight of focal relationships." He objects also to concentration on pairs of variables far removed from each other in space and time, to the exclusion of mediation considerations, as represented sometimes by correlations between mental test scores and mental trait measures. Such an approach he believes to be atomistic in the sense that it stresses the focal arc with no regard to "the scope and intricacy of vicarious functioning through which relative stabilization is alone possible."

Two features stand out in Brunswik's system and may help clarify his position. First, is the recognition of a terminal reference "in behavior," or what he sometimes calls "stabilization of the end stage, which, in his system, is labeled terminal focus. The second feature is the diversity of preceding stages. This feature is exhibited in the ability of the organism to choose one means or the other until the goal or end is reached; consequently, this feature stresses "the equivalence, intersubstitutability of certain activities, habits, sense departments, or bodily organs for one another in behavior. They form 'hierarchies' either in

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43 Ibid., p. 28.
the sense that some of the alternatives may be more useful than others (e.g. by possessing a greater probability of resulting in the end stage) and/or in the sense that some alternatives are better established in the organism than others, e.g., by more effective learning." Hull's system seems, as Brunswik points out, to focus on the latter alternative—i.e. on learned habit; on habit-family hierarchy.

Brunswik believes that "any organism has to cope with an environment full of uncertainties. Forced to react quickly or within reasonable limits of time, it must respond before direct contact with the relevant remote conditions in the environment such as foodstuffs or traps, friends or enemies, can be established." Thus the organism in his interaction with its environment or, as Brunswik calls it, gross organismic coming to terms with the environment, object-cue or means and relationships are never foolproof; but inherently probable in character. In order, therefore, that psychology may secure a measure of objectivity in behavior, Brunswik argues that measurement as observation of point-coincidences in space-time comes closest to fulfilling the requirement for objectivity, so far as methodological physicalism is concerned. He further observes that objectivity or stability of

\[44\] \textit{Ibid.}, p. 22.

\[45\] \textit{Ibid.}, p. 10 f.
agreement of response decreases as we proceed from the observation of point-coincidences, to thing perceptions, images, thoughts, valuations and subjective feelings or moods. He contends that such continuity would help to eliminate any sharp distinction between the subjective and the objective, a distinction or dichotomy which may thus be removed, to use Comte's terminology, from the metaphysical to the scientific level, or to use Lewin's language, from the Aristotelian to the Galileian mode of approach.

From a psychological point of view, "test reliability," as this is used by psychological statisticians, is related to the concept of objectivity as defined in the foregoing. Following this line of thought, "objective, then is a class of responses yielding maximum reliability co-efficients within or between individuals facing a common geographic situation or situational elements." Placing Brunswik's definition of objectivity along with his understanding of the uncertainties in the environment with which the organism has to deal, it is easy to understand how, through his ecological studies of perceptual constancies, he was able to formulate his functional probabilistic approach to the gross organismic coming to terms with the environment. He says:

Since the establishment of veridical distal environment relations is contingent upon the trustworthiness, or statistical validity, of cue-to-object relationship, and since the
'ecological' validity is in turn essentially limited by the erratic nature of the environment, attainment of distal variables can never be better than probable. Environment-oriented objective functionalism thus is necessarily 'probabilistic functionalism'.

Brunswik spelled out his theory by presenting a lens model of molar behavior. The distal stimulus is called the initial focal variable and the accomplished result the terminal focal variable. The initial focus, according to Brunswik, "is not an event within the organism as is motivation, rather, it is an external variable." The organism may in this regard be considered as stabilizer of events or relationships. The mediation between the two foci varies according to the circumstances and is, therefore, "multiple" or "vicarious" or "interchangeable," in terms of a family hierarchy of cues or habits. Cognition is treated as the functional achievement of attaining objects or final goal effects through perceptually guided behavior, and in view of the erratic nature of the environment, Brunswik achieves cognitive correctness, "must be defined in psychology in the generic terms of over-all statistical correlation between variables as classes, rather than in terms of single hits or misses of judgment or action."
Achievement may be defined as functional validity and be measured by a co-efficient of correlation; this is a measure of the probability of an initial focal event to be followed by its terminal counterpart. The organism is here testing his environment by vicariously choosing the means or paths that will more likely lead to the end in view. Perception is quasi-rational.

Thus far Brunswik has been shown to be consistent within his frame of reference of an objective molar system. His approach is as close as any to the transactional approach, in the sense that he treats the organism and its environment as a unity. He seems to deal with motivation, however, as separate from the organism's initial focus; the former being an event within the organism, while the latter is viewed as an external variable. As he puts it, "...in the field of cognitive processes, the initial focus is not an event within the organism as is motivation, rather it is an external variable."

It is true that signs, or cues in Brunswik's terminology, are never absolutely certain; they are possibilities for action. The organism deals with probable things, therefore, but this does not mean that perception, as Brunswik maintains, is quasi-rational, especially from the perceiver's standpoint.

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50 Ibid., p. 18.

51 See Ibid., p. 20.
Snygg and Combs advance a different approach to, or frame of reference for, behavior: It is based on a concept of the behavioral environment, which, unlike gestalt theory, coincides with conscious awareness—i.e., it is not an objective construct.

From the point of view of the behaver himself, behavior is caused. It is purposeful. It always has a reason. Sometimes the reasons are vague and confused, in which case the behavior is equally vague and uncertain; sometimes the reasons are extremely clear and definite, but everything we do seems to be reasonable and necessary at the time we are doing it.52

Consciousness or awareness varies in degree, so that at any moment in the field perceptions may exist at any and all levels of differentiation from vaguest to sharpest. Behavior may seem unreasonable to an outside observer but as far as the behaver himself is concerned, "In any case he feels that his behavior is a reasonable and a necessary result of the situation in which he finds himself."53 Thus, the phenomenal field is perceived by the perceiver at the moment; the objective or the physical situation is not the determinant of behavior. The individual or personal field is not identical with that of any other individual. An

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53 Loc. cit.
understanding of the behavioral field of the individual is, therefore, essential for predicting his behavior, and without this "understanding" prediction is well nigh impossible. "All behavior, without exception, is completely determined by and pertinent to the phenomenal field of the behaving organisms."

Prediction of Behavior

Prediction of behavior is possible, however, in spite of the privacy of different individuals' fields. Common experiences account for the existence of common parts in the behavioral fields of different individuals. This is what makes communication among different individuals possible. The phenomenal field and behavior have by postulation a one-to-one relationship. "Therefore, from a study of the individual's behavior, it is possible to reconstruct, by inference, his phenomenal field." The phenomenal field of any individual is the product of a selection made to satisfy his needs in conformity with the existing organization of his phenomenal field. This selection is meaningful, that is, it implies awareness of the behavior that the object or the situation requires or enables the individual to make. "Indeed a meaningless object would not exist as part of the phenomenal field."\(^{55}\) We

\(^{54}\) Ibid., p. 21.

\(^{55}\) Ibid., p. 23.
are continuously engaged in a process of active search for new meanings in our environment, therefore, to enable us to satisfy our needs and reach our ends more effectively. Thus our fields change continuously.

The Phenomenal Self

Organization of the behavioral fields is in terms of figure-ground relationships, a designation which resembles the focus-and-margin patterns of earlier psychologists. Selection and organization tend to differentiate the figure from the background, the latter being always meaningful even though its meaning may not be very clear and may be described merely as an undifferentiated object. The central concept of this system is the phenomenal self. It forms the part of the behavioral field which is differentiated through the individual's life experience with persons and things and which constitutes the individual's understanding of himself and of his personal frame of reference. As Scheerer puts it, "the role of cognition is markedly tied to an egocentricism of perspective and is placed within a framework of cultural relativism."56

Criticisms

The suggestion that communication and understanding by different individuals of each other's behavior is based on common parts of

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the respective phenomenal field is not very clear. If it is true that certain parts of the respective fields are common, then it follows that those common parts should be defined. They are not and we find ourselves, consequently, facing the problem of how these common parts influence other parts of the phenomenal fields and how they are influenced by them. The phenomenal field may be either completely private and inaccessible to the outside observer or else it may all be common to different individuals and hence fully accessible to outside observers. But no help is given on this score. The same problem appears also when Snygg and Combs speak about group structure and action in terms of normative principles.  

Philips, discussing the treatment of these authors of normative principles, notes that either "the principles apply to all individuals in connection with group affiliation and action, differing only in degree from one person to another, which can be understood in terms of the larger framework, or they do not apply to all individuals, constituting a normative principle, which would make them inconsistent with the point of view presented by the authors."  

It seems, therefore, that the finality of Snygg and Combs' subjective premises and their procedure of inferential construction are


not as sound as they may at first appear. The distinction between "mine" and "thine" is as much an objective phenomenon as it is a product of personal experience. There is not anything in the nature of psychology, as contrasted with natural sciences, which makes objectivity in that science impossible, i.e., in the sense that all reference to behavioral or even physical correlates to the phenomenal field should be rejected. Neither is objectivity in the physical sciences merely a matter of instruments which make accurate observations and which, in turn, make prediction possible, as Snygg seems to imply. Snygg says that "Accurate prediction is possible only when the casual entities are open to inspection."^ 59

Objectivity does not depend merely on accurate observation of causal entities, neither is it established via a consensus reached through a nose counting of phenomenological fields. Final causal entities are never observed even in physical sciences. Objectivity, in whatever field, is built on working hypotheses or theories in terms of consequences. It is indeed true that, whether we are dealing with physical sciences or psychology, we always deal with them in the context of our experiences. But objectivity is possible in the physical sciences because things bear meanings in terms of the use made of them in common experience and because these meanings

are verified as a result of testing them within this experience.

It is not clear how it is possible for Snygg and Combs to rely completely on the phenomenal field, which they identify with awareness or consciousness, and at the same time escape introspectionism as they maintain they do. It is hard to understand how a counselor in a counseling situation could do without introspection, if his therapeutic approach demands that he ask himself, Snygg and Combs suggest, "Under what circumstances would I have done that?" A further point relating to objectivity is their rejection of the usage of symbolic constructs. The phenomenal field of which Snygg and Combs speak seems to be an hypothetical construct itself. They say that: "it is possible to reconstruct, by inference, (the individual's) phenomenal field by studying his behavior." This hardly appears to be a simple descriptive act.

The psychological problem, as the foregoing makes clear is not a matter of choosing between the phenomenal field approach and the objective approach. What is involved here is the bringing of these together, understanding each in terms of the other. A consideration of behavioristic approaches may help advance this conclusion. The next chapter will, therefore, be devoted to the study of behaviorism.

61 Ibid., p. 34.
CHAPTER III

ASSOCIATION THEORIES 'BEHAVIORISM'

Introduction

In the current literature of behaviorism such terms as association bond formation, the law of effect, rewards and punishments, reinforcement, need tension, drives and derived drives, mazes and boxes of different kinds are predominant. Cognitive concepts, such as insight, foresight, thinking and the like, are not basic because they are not primary phenomena so far as behaviorism is concerned. Behaviorism, being reductionist in its approach, tends to seek the simplest terms by which behavior may be explained. When cognitive concepts are dealt with in behavioristic literature they are considered merely as complex forms of simple genetic origin and are reduced to their simple origin, i.e., S-R bonds or connections, conditioning, reinforcement and so forth. Consequently, cognitive concepts in behaviorism do not have the significance they have in cognitive theories.

It is true that Watson, whose name is associated with the rise of modern behaviorism, did not flatly denounce cognitive concepts. He merely claimed he could write a psychology without using them,
sticking strictly to observable phenomena. Ultimately, however, he, as well as those who followed in his footsteps, discarded cognition. Whenever it is referred to it is seen to be no more than physical or mechanical processes.

We cannot speak about behaviorism without mentioning Thorndike, whose pioneer work, though not strictly behavioristic, revealed a tendency in this direction in the later stages of his career. Thorndike represents a transitory stage in the history of behaviorism, and consequently his early work had within it many mentalistic connotations. Hullfish, in his historic critique of Thorndike's psychology, wrote:

> It is evident that he (Thorndike) follows the descriptive method in psychology, that he makes an objective evaluation of behavior...and that he considers behavior always in terms of a stimulus, a connection or bond, and a response. In so far forth he seems to lean decidedly towards the behavioristic movement in psychology. On the other hand, his admission of ideas (undefined) as potent factors in the S-R series places him, on the face of it, in direct relationship with the doctrines of Herbart and James. Satisfaction and annoyance are described as 'potent determiners' of behavior, and unless these be 'ideas' which are capable of causing physical activity, then their status as 'determiners' is a dubious one. But if they are 'ideas' we slip back once again towards Herbart and James, and too, we face the problem of explaining ideo-motor action—a phenomenon which Thorndike scoffs at as impossible.¹

¹ Conditioning bears a similarity to Thorndike's secondary principle of association shifting. Thorndike considered conditioning to be a specific case of this principle and did not believe that the development of the concept affected his system.
The historic picture of behaviorism would not be complete without mention of Pavlov's famous work on conditioning. Pavlov was the first to introduce the term 'conditioned reflex'. This, in his terms, was a process of stimulus substitution, in which a previously neutral stimulus (unconditioned) acquires the power to elicit a response which was originally elicited by a different stimulus. The change occurs when the neutral stimulus is repeatedly followed or 'reinforced' by the original effective stimulus. Pavlov also studied the conditions under which the effect of conditioning disappeared, whether under experimental conditions or otherwise. He called the Phenomenon "extinction."

Modern Behavioristic Theories

Watson, in his zeal to eliminate mentalism from his system, rejected Thorndike's law of effect because of the mentalistic connotations of the satisfiers and the annoyers. His system was based chiefly on frequency and recency. When Pavlov's work came to his notice he adopted the principle of conditioning and made it the cornerstone of his system. In order that he could remain within his framework of empirical positivism, he had to assume that 'thinking', for instance, was inner speech, merely the inner movement of the tongue and vocal organs. The concept of movement-produced stimuli became basic in the behavioristic system, as will be seen later.
Guthrie's system is also based on conditioning. He, too, rejected the law of effect in the sense that Thorndike used it. Although he uses the term reinforcement, he does not mean by it 'need reduction', as does Hull or Mowrer, for instance. He also makes use of movement-produced stimuli. His basic principle is based on 'recency', since to him association between a stimulus and a response takes place in one try. The organism will do in the same situation in the future exactly what he did last in that situation.

Skinner's system is also based on conditioning and reinforcement. Reinforcement, however, is defined operationally. It is defined in terms of the conditions which lead to the evocation of specific responses, without specifying their physiological correlates as Hull, for instance, does. Skinner, however, breaks away from conventional S-R theories by making the distinction between elicited responses and emitted responses. The former have identifiable stimuli; the latter do not. The stimulus in the latter case, that is, in emitted or operant responses, is the occasion for, not the cause of, emission of responses.

Hull's system is also based on conditioning and reinforcement. Reinforcement means primary need reduction. Hull differs in this respect from Pavlov. He considers the essential factor in conditioning to be the reduction in the drive-receptor impulse which accompanies the reduction of the need. Pavlov, in contrast,
considers the occurrence of the unconditioned stimulus the essential factor in conditioning. He often referred to the unconditioned stimulus as a sign. Hull tries to unify Thorndike's law of effect with Pavlov's conditioning principle. In the following pages a sample of behavioristic systems will be considered in the following order: Hull's, Skinner's and Guthrie's.

Clark L. Hull

Hull presents a systematic approach which is highly mathematical. He compares his system with Euclidean geometry and starts with postulates, or primary principles. From this basis, secondary principles, or theorems, are developed which serve (1) to aid in the prediction of behavior and (2) to test the original postulates or primary principles. Hull says, "A theory is a systematic derivation of the secondary principles of observable phenomena from a relatively small number of primary principles or postulates, much as the secondary principles or theorems of geometry are ultimately derived as a logical hierarchy from a few original definitions and principles called axioms." \(^2\)

Hull's system is, in fact, mainly concerned with the inter-relationships of intervening variables, between the original

\(^2\) Clark L. Hull, Principles of Behavior, p. 2.
stimulus and the final response. These intervening variables, as will be seen later, are dealt with in terms of peripheral proximal boundary conditions. This is the case in spite of the inclusion in the system of the postulate dealing with afferent neural interaction, a postulate which, as mentioned before, is relegated to the peripheral nervous system.\(^3\) In other words, Hull's system suggests a straight chain of events that starts with the onset of a stimulus provided by the outside environment and ends with a response to the environment. All intervening processes lie exclusively within the organism. Even the two first postulates, especially the second, in Hull's system, which are closest to the molar approach, are in effect treated in terms of proximal stimuli and describe happenings exclusively within the organism.

### The Postulates

The first of these postulates refers to the perseverative stimulus trace. This means that upon the impingement of a stimulus on a receptor the activity of the generated neural impulse continues in the central nervous system for some seconds before it fades away. The activity of the neural impulse, in other words, continues after the cessation of the stimulus. Events inside

\(^3\) See Chapter Two in this study.
the nervous system, consequently, may associate together in time, despite their temporal separation as far as the outside happenings are concerned. The second postulate deals with afferent neural interaction. This enables Hull to derive the properties of patterned stimuli.

In order to see Hull's system more clearly it is necessary to follow the sequence of happenings after the onset of the stimulus. The impingement of the outside stimulus on the receptor gives rise to afferent neural impulses which are propagated along connected fibrous branches of nerve cells in the general direction of the effector organs via the brain. Afferent neural impulses rise to a maximum of intensity and then fall and decay (postulate 1). At the same time concurrent neural impulses interact and each is changed to something partially different from the original (postulate 2). Among the forces that decide the direction or sequence of events, i.e., affect responses to stimuli, are the drives which operate in order to lead to need reduction. The stimulus has a drive value. According to the third postulate: "Organisms at birth possess receptor effector connections...which render combined stimulation and drive... have the potentiality of evoking responses." not at random, but those

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4 C. L. Hull, Ibid., p. 383.
5 C. L. Hull, Ibid., p. 66.
"more likely to terminate the need..." Also, habits which have been built in the past on the basis of drives affect responses to stimuli in like manner. Postulate 4 deals with habit strength and reinforcement. This postulate states that whenever an effector activity and receptor activity occur in close temporal contiguity, and when these are consistently associated with a diminution of need (primary reinforcement) or are associated with a stimulus which is itself consistently associated with need reduction (secondary reinforcement), the result will be an increase of habit strength.

The sequence of events, it will be seen, starts with the representation of the stimulus in afferent neural processes, as represented by the first two postulates. The second step is a reinforcement which leads to increase in habit strength, i.e., S-R connections in accordance with their stimulus response proximity to need reduction (postulates 3 and 4). The next phase deals with generalization as represented by postulate 5. This postulate is derived from Pavlov's concept of generalization as a result of discrimination thresholds between stimuli. A habit may thus be aroused by a stimulus other than the one originally involved in conditioning. This will depend upon the similarity between both stimuli, in terms of units of discrimination thresholds.

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6 Loc. cit.
This postulate accounts partially for transfer of training. It implies that learning is never completely specific to the situation in which it originally arose.

The next phase in the sequence is the reaction potential which depends on the interaction between the habit strength and the drive. Postulate 6 says that "Associated with every drive--is a characteristic drive stimulus whose intensity is an increasing monotonic function of the drive in question." The effective habit strength is sensitized into reaction potentiality by all primary drives acting at a given time (postulate 7). The next phase deals with the inhibitive factors that reduce the reaction potential as a result of a negative drive which is created and which has innate capacity to inhibit the reaction potentiality to that response. (postulate 8). At the same time, stimuli associated with the cessation of a certain response become conditioned inhibitors (postulate 9). In other words, reaction potential may be reduced to effective reaction potential as a result of reactive inhibition and conditioned (or learned) inhibition. The inhibition potential oscillates in amount from instant to instant according to the law of chance and the reaction potential oscillates accordingly (postulate 10).

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Ibid., p. 253.
Thus far we have followed the sequence from the onset of the stimulus to the moment of response. The next phase in the sequence of events naturally deals with response evocation. Responses are evoked if the effective reaction potential exceeds the reaction threshold. (postulate 11). Such responses may be measured according to the probability of striated muscle reaction (postulate 12); the latency of a stimulus working a striated muscle reaction in an inverse proportion (postulate 13); resistance to extinction, depending on the strength of the effective reaction potential (postulate 14); or amplitude of responses mediated by the autonomic nervous system, which also depends on the strength of the effective reaction potential (postulate 15). And, finally, "when reaction potentials—to two or more incompatible reactions—occur in an organism at the same time, only the reaction whose momentary effective reaction potential is greatest will be evoked (postulate 16)."  

The Chain of Events

To recapitulate, the chain of events in behavior in general, starts with the impingement of stimuli on receptors. This starts neural processes in the nervous tissue. The reaction of the

8 C. L. Hull, Principles of Behavior, Ibid., p. 344.
organism depends on innate receptor-effector connections and habits formed in the past. The responses of the organism are not random. They are aroused under conditions of stimulation and drive and thus are more likely to terminate the need of the organism. Habit strength is a product of direct or generalized reinforcement (which terminate the need). The reaction potential created thereafter is a positive function of habit strength and drive. The reaction potential oscillates in strength so that reaction potential oscillates accordingly. Finally, evocation of responses depends on whether or not the reaction potential, that is, the momentary reaction potential, is above the threshold of reaction. In case two incompatible responses occur in an organism, the one with the greatest reaction potential will be evoked.

**Gradient of Reinforcement and Goal Gradient**

Hull's system enables him to deal with the concept of gradient of reinforcement, as well as with a goal gradient concept. Gradient reinforcement in this system provides an advancement over classical conditioning theories which only took into account the separation between the stimulus and the response. Hull deliberately postponed the reward or goal object (in this case, obtaining food) which provides reinforcement and the act to be rewarded (in this case, running down an aisle, through a maze, or pushing a lever).
Hull believes, as a result of his experiments with rats in lever pressing boxes, that the basic gradient of reinforcement does not exceed 30 seconds. Wolfe and Spragg, however, found that learning on the part of white rats occurring in a simple alley maze might be effective with much longer delays of reward up to 20 minutes. Such a gradient is what Hull calls goal gradient, as distinguished from the above mentioned shorter gradients of reinforcement. The gradients of reinforcement, and not the goal gradients, are the primary gradients, from which the longer goal gradients are formed. But once the goal gradient is established, it serves its former purposes in the explanation of more complex learning. Thus "responses nearer the goal would be more strongly conditioned than those farther removed, so that short paths would be preferred to longer ones, blinds near the goal would be eliminated more readily than blinds farther away, longer blinds would be more readily eliminated than shorter ones, etc."12

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9 See Hull, Ibid., p. 142.

10 See C. L. Hull, Ibid., p. 142.


12 E. Hilgard, Ibid., p. 93.
The goal gradient concept is not one of the primary postulates in Hull's system, therefore, but is conceived at an intermediate level and is itself derived from more basic principles, chiefly postulate 4.\textsuperscript{13} To this extent the goal gradient does not represent a molar but a molecular approach. The means–end category in philosophy, seems to play an important role in this concept of goal gradient, although the means are treated as primary and the end as a rather mechanical achievement through a path of primary reinforcement gradients via secondary reinforcements.

\textit{Habit-Family-Hierarchy}\textsuperscript{14}

Another derived principle is the 'habit-family' or 'habit-family-hierarchy'. This is also a principle which is at an intermediate level. Hull recognizes that there are multiple routes to every goal position which lead to need satisfaction. The different alternative routes, which may get integrated into a family "by way of a \textit{common fractional anticipatory goal reaction}, present as each alternative is active."\textsuperscript{15} And the fractional

\textsuperscript{13} See page 78 of this chapter.

\textsuperscript{14} For a critical evaluation of the concept 'habit-family-hierarchy' in terms of the 'distal-proximal issue' see Chapter Two in this study.

\textsuperscript{15} E. Hilgard, \textit{Ibid.}, p. 94.
anticipatory goal reaction provides a stimulus to which all overt responses get conditioned in a differential manner in the sense that responses of longer routes are less reinforced than those of shorter routes. A hierarchy is formed, within which the shortest routes (or more favored) are usually chosen unless they are blocked and then longer routes may be taken instead. Moreover, when a member of the family is reinforced in a new situation, the other members at once show a tendency to be evoked as reactions in that situation.

Cognitive Concepts

As mentioned earlier in this chapter, Hull attempted to explain cognitive processes in purely physical terms. "Knowledge," he said, "is mediated by several fairly distinct habit mechanisms." To start with, a chain of stimuli elicits a chain of responses, until the end result is reached by the elicitation of the final response. During the process, however, each response produces an internal stimulus. The internal stimuli are called pure stimulus acts because their sole function is to serve as stimuli for other acts in the chain. This ability of the pure stimulus act to elicit the following response in the chain of events is

supposed to be brought about by a redintegrative process which brings together, in a dynamic stimulus complex, the outside stimulus and the internal stimulus act produced by the previous response. Once this has been well established, i.e., once the stimuli complexes have been well redintegrated, a habit is formed. The impingement of the external chain of stimuli in the original sequence is no longer needed for the elicitation of the final response, since the pure stimulus acts will be able to elicit the corresponding responses once the chain of reactions has been started by any one outside stimulus along the chain. "Henceforth the organism will carry about continuously a kind of replica of this world segment. In this very intimate and biologically significant sense the organism may be said to know the world." 17

Foresight is explained on the same basis. Once the stimuli complexes have been established, the organism can respond to the situation without going through the original chain. In other words, the organism is seen to respond in advance as, for example, in emergency situations. What adds to the efficiency of the organism's defense reaction in such emergency situations is the fact that "the tempo of the acquired subjective parallel to the outer world sequence is not limited to that of the latter." 18 Hull goes

17 C. L. Hull, Ibid., p. 524.

18 Ibid., p. 514.
on then to say that there is evidence that the tempo of the acquired subjective parallel to run at a higher speed than that of the world sequence which it parallels. This explains foresight.

Purposive behavior, in like manner, is explained in terms of pure stimulus acts. An internal stimulus drive, e.g., the hunger drive, is added to the original chain of events and persists throughout. This stimulus drive, once the chain is completed, tends on later occasions to elicit anticipatory goal reactions along the chain. These anticipatory goal reactions tend to be the strongest nearest to the goal. Another kind of internal stimuli, the fractional goal stimuli, are henceforth elicited by the anticipatory goal reactions. The stimulus complex will then include four kinds of stimuli: the outside stimulus, proprioceptor stimulus, the drive stimulus and the fractional goal stimulus. It is the persisting drive stimulus component which is the main characteristic mechanism of purposive behavior. The fractional anticipatory goal reaction, the resulting excitatory potentials being stronger nearer the goal, enable the final act of the original series to be evoked earlier than it would be if the original series were followed in full, "thus producing what is rather inappropriately called 'short circuiting'." 19 The final act of the original series may thus be evoked at once and with success, after the first act of

19 C. L. Hull, Ibid., p. 524-525.
the series. But the organism may not be able to do this, as when
a rat in a maze has to move through the routes of the maze before
it reaches the goal. The immature invasions of anticipatory goal
reactions are, however, manifested by the rat's turning towards
the goal before it is actually reached. This phenomenon is also
exhibited by young children and naive adults.

Ideas are thus conceived in purely physical terms. As
Hull puts it: "fractional anticipatory goal reaction is the
actual basis of what has long been known as ideomotor reaction....
this means that ideomotor acts are not caused by ideas. On the
contrary they are themselves ideas." Hull then goes on to say
that pure stimulus acts are the physical substance of ideas. And
in terms of anticipatory goal reaction he defines "the physical
basis of the somewhat ill-defined but important concept of purpose,
desire or wish."^21

On the basis of the pure stimulus act Hull was able to explain
insightful learning in an experiment carried out by Maier.22
Hull's explanation centers on the building up, or conditioning of
habits, in connection with a drive stimulus. The experiment

20 C. L. Hull, "Goal Attraction and Directive Ideas,"
21 C. L. Hull, Loc. cit.
22 See C. L. Hull, "The Mechanism of the Assembly of Behavior
Segments In Novel Combinations Suitable for Problem Solution,"
constituted a white rat running in a maze. The maze is represented diagramatically as follows:

The starting point is box R. Food is found only in box X. Boxes H and U provide water. The rat learns to go from R to H, from R to X, from R to U and from U to X, but never from R to X via U. But when the route R-X was blocked at B, the hungry rat was found to choose route R-U which leads to X more often than R-H.

The frequency of the choice of RU, rather than, RH, was found to exceed chance by a significant margin. Maier's explanation was in terms of a gestalten formed by the combination of routes RU and UX to lead to food, whereas routes RH and UX do not fuse. Hull refuses this explanation because it naively begs the question, since to him the deduction of this fusion from more basic principles is the essence of the problem. Hull's explanation is this: of the two competing routes, when the hungry rat is at R, RU has more excitatory tendencies than its competitor, RH. At bottom, in short, there is the excitatory potential towards U which is

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elicited by the responses to the external stimulus at box R in the route RU and also by the drive stimulus (in this case, hunger) at the first reaction in the chain of route UX. The excitatory potential at R favors the rat's following route RU rather than RH. It is significant to note that in his system Hull is able to explain insightful behavior when, and only when, fragments of behavior have been at least separately learned or conditioned into habits. Insightful behavior is merely a matter of the assembly of behavior segments, as is evident from the title of the article discussed above. Kohler's experiment with Sultan, an ape that was able to utilize two relatively short sticks to reach for a banana after he had fitted them end to end apparently by chance, cannot be explained in terms of Hull's system. Hull contends that unless the chimpanzee had previously formed the habit of fitting the two sticks together, a fact which was neither asserted nor refuted by Kohler, the solution of the problem could not be explained in terms of his system. In other words, genuine insight, or creativity, has no place in Hull's system.

General criticisms

Hull's system is undoubtedly the most elaborate, and currently the most acclaimed of all behavioristic theories. This does not mean, however, that it is above criticism, even by fellow behaviorists. Skinner, for instance, criticizes it on more than one score. He
rejects the 'neural interaction' postulate on the grounds that it obviates the empirical rigor characteristic of the advanced sciences. Moreover, Skinner does not seem to think that the time is ripe for the elaborate quantification of the science of psychology characteristic of Hull’s system. He points out that Hull, in his concern to achieve quantification, has neglected precision and accuracy. One third of the curves in Hull's Principles of Behavior represent hypothetical cases. Moreover, Skinner has pointed out that Hull has taken too much freedom in formulating his laws. In one case, for instance, three constants were postulated to determine three variables.\(^{24}\)

Other criticisms of Hull's system come from different quarters. Leeper, for instance, criticized Hull of choosing non-representative samples to fit his curves and equations.\(^{25}\) And from a molar-molecular standpoint Hull is criticized by field theorists to be molecular, although he claims to be molar in his approach. We have seen how in his system the chain of events in a given act starts with outside independent stimuli, each one following the other and each eliciting a response, with each response in its turn eliciting an internal stimulus, which again elicits an internal goal reaction and so on. The chain of events is given


\(^{25}\) Some other aspects of Leeper's criticisms will be discussed in Chapter IV. of this study.
coherence by a common persistent or drive stimulus and by a
redentegrative process. From this standpoint Hull's system is not
only molecular but also mechanistic, or, philosophically speaking,
'transactionistic.'

E. F. Skinner

Introduction

Skinner subscribes to a behavioristic system. His view,
however, breaks away from conventional behaviorism, since
responses are considered to belong to two different classes.
The conventional concept of a response is that it is necessarily
elicited by a prior stimulus. This may or may not be the case
in Skinner's system. Responses which are elicited by known
stimuli, as in the case of simple reflexes (e.g., the knee jerk
or pupillary constriction to light) are called respondent responses.
Respondent responses are distinguished from responses designated
"operants." These are not correlated with any known stimuli.
By and large, according to Skinner, human behavior is operant
rather than respondent in character.

Respondent and Operant Behavior

To point up this distinction between the two kinds of behavior,
we need to consider the organism in its interaction with its

26 This point will be treated in Chapters V, VI, and VII of
this study.
environment. "The environment," says Skinner, "is so constructed that certain things tend to happen together."Behavior changes when the organism gets in contact with that environment. The change is called conditioning. "There are three principal cases. (1) Certain events—like the color and taste of ripe fruit—tend to occur together. Respondent conditioning is the corresponding effect upon behavior. (2) Certain activities of the organism effect certain changes in the environment. Operant behavior is the corresponding effect upon behavior. (3) Certain events are the occasions upon which certain actions effect certain changes in the environment. Operant discrimination is the corresponding effect upon behavior."

Conditioning

In case (1) "respondent" conditioning is supposed to strengthen the magnitude of the response elicited by the conditioned stimulus and shorten the time which elapses between stimulus and response. In cases (2) and (3) the operant is conditioned by making the response more probable or more frequent. These two forms of conditioning exhaust the possibilities. Skinner holds that "an organism is conditioned when a reinforcer (1)

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28 Ibid., p. 125.
accompanies another stimulus or (2) follows upon the organism's own behavior. Any event which does neither has no effect in changing a probability of response." In operant conditioning, which is by far the more important of the two types, the environment builds the basic repertoire or reserve with which we are able to behave appropriately. It is thus that the efficiency of our behavior is improved and maintained in strength.

The difference in conditioning of the two types of behavior lies in the fact that a reinforcer is paired with a stimulus in respondent behavior; whereas, in operant behavior, a reinforcer is contingent upon a response. Moreover, in respondent behavior, conditioning simply increases the magnitude of the response elicited by the conditioned stimulus and shortens the time which elapsed between stimulus and response. In operant conditioning, on the other hand, an operant is strengthened in the sense that a response is made more probable or more frequent. The operant, in short, does not require a stimulus for its elicitation; the stimulus, however, may be described as the occasion for the elicitation. "This dependence upon the posterior reinforcing stimulus gives the term operant its significance—The operant—becomes significant for behavior and takes on an identifiable form when it acts upon the environment in such a way that a reinforcing stimulus is produced." In this sense, the organism

29 Ibid., p. 65.

is treated as active from the very beginning and, in accordance with this view, Skinner's system is mainly concerned with situations in which the response of the organism produces the reinforcing agent.

Experimental designs are so planned as to measure the strength of a reflex (a term Skinner applies to operant behavior, also) in terms of reinforcement. Reinforcement, such as the delivery of a pellet of food, is supposed to bring about an increased reservoir of responses, which remain to be emitted. Reflex strength, therefore, is to be estimated in terms of the rate of response, and this is relative to the size of the reserve. But the momentary rate of responding may vary in proportion to reinforcement and motivation and other conditions of the organism. It is important, therefore, to find out how large reserves are built up. One way is that of reinforcement at standard intervals of time. In other words a pellet of food is delivered (to the rat in the box) after certain intervals of time. "The most efficient means of building a reserve with a given number of reinforcements is to administer them periodically." Another way of building up high reserves is to deliver the reinforcer (the pellet of food) after a standard number of responses.

In experiments with reinforcement at standard intervals (of 3, 6, 9 and 12 minutes) Skinner found that the more frequent the reinforcement, the more rapid the rate of responding, although

\[31\] Ibid., p. 137.
each rate is relatively uniform. Experiments dealing with reinforcement at a fixed ratio (reinforcement per 8, 96 and 192 responses respectively) showed that, although very high rates of responding develop, the highest rate was found with the lowest frequency of reinforcement, with, that is, 192 responses per one reinforcement as compared with 48 or 96 responses. The high rate of responding in general is interpreted by Skinner as a result of the secondary reinforcement of each response (such as lever pressing) by a discriminating stimulus in the early part of a run. The responses are made not "because they produce food, but because they bring the production of food nearer." The discrepancy in the rate of responding or the delay after each reinforcement is explained in a twofold way. First, there is a negative factor associated with reinforcements which are separated in time. It looks as if the rat discriminates the time relationship and says to himself, "I've just been fed; there's no use working since nothing will be forthcoming for a while." Second, the reserve is weakened by the "strain" imposed upon it by the preceding run. The whole picture will seem like this: response accompanied by reinforcement; the reinforcement creates a negative factor and the reserve is weakened as a result of

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strain; hence, delay in response occurs until the negative factor is decreased and the strain is overcome. With the increase in the secondary reinforcing factors, the next reinforcement is approached and the preceding one is left far behind; then, a positive acceleration is shown.

It is of significance here to note that Skinner recognizes the complex relationship between habit strength and reinforcement. Habit strength is not merely dependent upon the number of reinforcements but also upon the pattern of the distribution of primary and secondary reinforcements and non-reinforcements, the number of previous conditionings, extinctions and so forth.

**Needs and Drives**

Skinner rejects the concept of need in common usage when it refers to an inner cause. In fact, a need is either inferred from behavior itself, as when we observe some one drinking large quantities of water and assert without hesitation that he possesses a great thirst, or it may be inferred from the operation responsible for thirst, as when we say that someone who has had nothing to drink for several days must be thirsty and probably will drink. The terms want, wish, desire, and the like are objected to for the same reason. He denies a status to such inner causes. The

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35 This is comparable to Hull's goal gradients.

term drive, however, has a certain advantage. It has fewer connotations. A drive, as Skinner uses the term, refers neither to a mental or a physiological concept. "The term is simply a convenient way of referring to the effects of deprivation and satisfaction and of other operations which alter the probability of behavior in more or less the same way."37 A drive is not a stimulus.38 "Thus we cannot identify the hunger drive with the hunger pangs of an empty stomach as a stimulus... such stimulation is not closely correlated with the probability of eating."39 Ordinarily, we neither wait to eat until hunger pangs are felt, nor do we stop eating right after the first mouthfuls of food have stopped whatever pangs may have occurred. A drive is not a physiological state. Knowledge of the physiological state, Skinner asserts, even if it were possible to arrive at it, is not likely to be available at the time it is needed to control the behavior of the organism. The weight of the organism is sometimes controlled in laboratory experiments to give an index of food deprivation. But since we change weight by changing the history (hours of deprivation) we cannot dispense with the history in practical control. In like manner, drive is not identified with a psychic state," since deprivation affects behavior whether or not anything is 'felt,' the feeling is not a secure basis for

37 Ibid., p. 144.

38 Notice the difference between Hull's Drive Stimulus and this.

39 Ibid., p. 144.
 Lastly, drive is not simply a state of strength; the probability of response may be due to many different kinds of variables, where deprivation plays a minor role.

In order that the term drive may be understood more clearly, the relationships between drive, reinforcement, reflex reserve, and reflex strength will be considered. Reinforcement, as noted before, affects both strength (rate of response) and reserve. Drive affects strength, only. If an animal is pre-fed before an extinction series (weak drive) strength (rate of response) will be slow at the beginning of the series but would tend to catch up (with a hungry rat) by the end of an hour's run, or until the reserve is exhausted. The relation is not this simple, of course. With hungrier rats (stronger drives) the reconditioning effect of a single reinforcement increases and the reserve is replenished more quickly. "The net result of reinforcement is not simply to strengthen behavior but to strengthen it in a given state of deprivation."  

Emotions

Emotion as a psychic cause of behavior is also rejected in this view. So also, is the James-Lange theory of emotions rejected. In other words, emotion (as with motivation) "is not to be

\(^{40}\) _Ibid._, p. 145.

\(^{41}\) _Ibid._, p. 162.
identified with physiological or psychic conditions. In fact, 
Skinner sees emotion and motivation as very close to each other.
"They may, indeed overlap." Emotion is defined in terms of a 
special response related to the history of the organism. It is 
a "conceptual state, in which a special response is a function of 
circumstances in the life history of the organism." As pre­ 
disposition, emotion shows an increased probability of the indivi­ 
dual behaving (responding) in a certain manner. Responses thus 
 vary together in emotion. Some emotions involve the whole 
repertoire, as in exciting or depressing emotions; others still 
probably involve the whole repertoire, as in fear or anger, but 
specific features of the environment become especially affected, 
such as the objects of fear or anger. Still other milder emotions, 
such as embarrassment, sympathy and amusement, may be localized 
more narrowly in small subdivisions of a repertoire. In any 
case, there appears to be no over-all classification which will 
be applicable to specific forms of emotions. "Depending upon a 
variety of circumstances, the result may be close to fear or rage 
or sorrow." Even with respect to a single emotion, the emotion 

1. Ibid., p. 163.
2. Ibid., p. 165.
3. Ibid., p. 162.
4. Ibid., p. 162.
5. Ibid., p. 165.
6. Ibid., p. 165.
(anger) produced by one circumstance, therefore, may differ from that produced by another circumstance. Conditioning is at least partially responsible for the grouping of responses which define an emotion, such as anger. Behavior which brings, say, damage to the object of anger may be reinforced and thus come under the control of the conditions which control the emotional state. But apparently some of the behavior involved in an emotion is unconditioned. The explanation of the grouping of responses in this latter case is to be sought in the evolutionary process.

Punishment

Punishment is explained by Skinner either as withdrawing a positive reinforcer or presenting a negative one. This is exemplified by taking candy from a baby or spanking him. When we present a negative stimulus, such as severely pinching the child to stop him from giggling in the church, the negative stimulus (pinching) elicits responses, some of which often are emotional. These are incompatible with laughing and are powerful enough to suppress it. But since this situation does not exhaust the reverse, the effect is only temporary. It may happen, however, that "as a second effect of punishment, behavior has consistently been punished because of the source of conditioned stimuli which evoke incompatible behavior."

The child's own behavior (the

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start of giggling in the above example) may supply conditioned
stimuli which evoke opposed emotional responses. Furthermore,
"any behavior which reduces this conditioned aversive stimulation
will be reinforced." The most effective means of punishment,
then, is to establish aversive conditions which may be avoided by
doing something else. But if the punishment is repeatedly
avoided, the conditioned reinforcer undergoes extinction; and,
since punishment in the social sense depends on the behavior of
other people, it is likely to be intermittent and very rare
actions that are consistently punished. Skinner is in agreement
with Thorndike, therefore, in not considering punishment a sound
or effective tool for learning or for the control of behavior.
In fact, he believes that punishment, insofar as it evokes
emotional behavior which may conflict with the operant to be
punished, may do more harm than good. He offers some other
alternatives to punishment, such as extinction techniques,
forgetting by lapse of time, and conditioning incompatible
behavior through positive rather than negative reinforcement.

Skinner's system, especially in terms of operant behavior,
which is at least an implicit recognition of the active role the
organism plays in his environment, advances in the right direction.
Unfortunately, Skinner does not go far enough. Instead, he focuses

Ibid., p. 188.
his whole attention on the study of behavior constants, such as reflex reserve, extinction rate, etc. He compares his own system with physical chemistry, contrasting it with Hull's, which he compares with Newtonian mechanics.

Because Skinner bases his system mainly upon the operant mode of behavior and thus recognizes the role of the consequences of action instead of the pull and push of external stimuli upon further action it could be elaborated in terms of a cognitive theory. Skinner, however, insists upon a mechanistic system. In this connection, Hilgard says, "Because of the correlation between responses and their consequences, it would not be hard to impose a cognitive interpretation upon operant behavior, but Skinner does not do so."[49]

In treating human behavior, Skinner brings in the tools he elaborated in his studies of rats in the box named after him. One may wonder with what success this is done. One citation from his writing may be suggestive. In speaking about abstraction as discrimination and reinforcement, he offers the following illustration:

The word 'change' for example, comes from a word which referred to the fall of a die or coin. A conspicuous feature of such an event is the indeterminacy of the result, which is similar to the indeterminacy of other events in which nothing falls—for example, of the suit of a card drawn from

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a deck. The metaphorical transfer of the term for falling, on the basis of indeterminacy, is the first step in isolating this important property. The referent of the term is further refined—perhaps through centuries of changing practices in a verbal community—until in the hands of the modern mathematician the term comes under the control of a very special property of nature, the modern referent of the word 'chance.'

We are supposed to believe that cognition does not enter into the picture.

E. R. Guthrie

Introduction

Here we find a system of psychology designed to interpret behavior in terms of sheer bodily movements. All behavioral phenomena are ultimately reduced to movement. Guthrie is not interested, therefore, in end products or achievements, as such. His is an interest, rather, in the movements which produce the end products. Consequently, movement produced stimuli, i.e., internal stimuli are basic for the system. They are the true conditioners in Guthrie's approach.

The Law of Association

Guthrie's fundamental law of learning is the law of association. It states that "a combination of stimuli which has accompanied a movement will on its reoccurrence tend to be followed by that movement." Association, in this sense, refers to a stimulus

and a response. The stimulation thus becomes the occasion for the response. A corollary of this law of association is the thesis that "we learn only what we do."\(^{52}\)

**Reinforcement**

Guthrie believes in a reinforcement principle, though he differs from both Hull and Skinner. In his view reinforcement does not work in terms of primary need reduction. He considers the concept of need reduction unscientific. "If needs explained or caused their own satisfaction the world would be a place very different from what it is."\(^{53}\) Reinforcement, in Guthrie's terms, does not add to his principle of association. Only the mechanical arrangement of a situation, for instance, is altered as a result of reward. To understand his position, fully, with respect to reinforcement, we need to understand the difference between his and Hull's system on the matter of the effect of repetition. Hull, as we have seen, believes that habit strength is a cumulative function of reinforcement, whether the latter is primary or secondary. For Guthrie, however, "A stimulus pattern gains its full associative strength on the occasion of its first pairing with a response."\(^{54}\) The function of reward, therefore, is to remove the animal from the situation and, hence, to leave


\(^{53}\) Ibid., p. 45.

\(^{54}\) Ibid., p. 30.
the product of association intact, ready to reoccur when the organism is confronted with the same situation in the future. In other words, the organism will do precisely the same thing it did last in the situation, so long as nothing interferes with the association already established.

The Effect of Practice

If Guthrie believes, as he does, in a single trial learning, how does he account, one may ask, for the improvement of performance by repetition or practice? Guthrie acknowledges the effect of repetition but maintains that "The effects of practice do not depend on mere repetition, but on the conditions of repetition, and these conditions vary enormously in different learning situations." In the acquisition of a given skill, no single stimulus is associated with a given response; rather, virtually thousands of stimuli are associated with thousands of responses or movements. A skill is not one act but many. Thus, the effectiveness of practice is contingent upon the association of the correct responses with the cues or stimuli in a variety of situations. The slightest change in the stimulating situation will alter the response. Practice is needed, therefore, for ascertaining that all required movements will be associated with the stimuli inherent in the situation. Strictly speaking, then,

55 Ibid., p. 30.
there is no transfer of training as an outcome of learning; there is only the repetition of prior behavior in exactly the same stimulus situation. "Effective practice," according to Guthrie, "is conducted in the general situation in which we desire the future performance to be given." 56

**Forgetting and Associative Inhibition**

Guthrie's interpretation of forgetting is simple enough. Forgetting is a matter of associative inhibition. By associative inhibition Guthrie means the interference of new responses which get associated with the old cues or stimuli. When the old situation reoccurs, therefore, the animal responds in terms of the newly formed association, not with the older form. Hence, the way to protect a habit from inhibition is to remove the organism quickly from the situation in which it responds; otherwise, the cues may get associated with other responses. There is no evidence, Guthrie holds, that thus protected, a habit will ever be forgotten. Forgetting does not occur simply by lapse of time, but by associative inhibition. Recovery from extinction of responses inhibited by animals, when brought back to the laboratory, is a case in point.

An understanding of the foregoing principle of associative inhibition serves not only to provide insight into how a habit

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may be protected and maintained intact, but also into how undesirable habits may be broken. One way is to present the cue along with the stimuli for inhibitory responses. "The dog that has pursued and eaten chickens has often been cured by tying the corpse of a chicken about his neck."57 Another way is to repeat the stimulus until, with the coming of fatigue, the response ceases to occur. A new response will then be associated with the cue or signal. A third way is to introduce the stimulus associated with the response in such a faint degree that it will not elicit the response. By gradually increasing the magnitude of the stimulus, the organism will eventually learn to do something other than what was associated with the stimulus.

Motives

Motives are not taken seriously by Guthrie. They enter into learning theory only because they determine the vigor of the movements which may enter into association with cues. The significance of rewards has been referred to above. They are viewed merely as factors which affect the mechanical arrangement of the situation. The organism will likewise do what it last did on the recurrence of the same situation, whether rewarded or not. Guthrie does not seem to note the host of experimental data which shows that reward enhances learning situations as compared with

57 Ibid., p. 27.
Neither does he give consideration to the essential difference between reward and punishment. His simple formula that the organism will do the last thing it did in the situation does not explain the effect of punishment. It is reasonable and logical enough to say, as Guthrie does, that the effect of punishment depends upon what the organism will do in the punishing situation. But to stop at that and consider that the effect of reward and non-reward is essentially the same is hardly adequate. It is that which the organism does in a punishing situation that needs to be explained.

Cognition

With respect to cognition, Guthrie has nothing more to offer than his law of association. Purposes and intentions are dealt with in terms of patterned movements as a result of past experiences.

The essence of an intention is a body of maintaining stimuli which may or may not include sources of unrest like thirst or hunger but always includes action, tendencies conditions during and past experience—a readiness to speak, a readiness to go and readiness to read and in each case a readiness not only for the act but also for the previously rehearsed consequences of the act. These readiness are not complete acts but they consist in tensions of the muscles that will take part in the complete act. 59


The main distinctive features of this position are the reliance on the assumed tension in the muscles. Although Guthrie insists upon dealing only with observable behavior, the fact remains that these assumed muscle tensions are merely a matter of conjecture and speculation. They are not demonstrable. On this score, Guthrie is at one with other behaviorists. By the same token, goal directed activities are treated as patterned movements associated with external and internal stimuli. "Goals do not determine activity but stimuli may incite activity because the stimuli remain associated with the movements that ended in the good attainment."\textsuperscript{60}

Guthrie's experimental work is reported in CATS IN A PUZZLE BOX.\textsuperscript{61} This was a series of experiments which were conducted in which cats were led to enter a puzzle box from which they could escape by merely touching a small pole in the middle of a glass covered cage which had exit doors in its front. The movements of the cats were recorded in detail on film by a camera set for this purpose. The filmed records of the cats' movements tend to support Guthrie's theoretical explanations. Guthrie and Horton state,\textsuperscript{60}

\begin{footnotesize}
\begin{itemize}
\item \textit{Ibid.}, p. 36.
\end{itemize}
\end{footnotesize}
It has been our conclusion from our observation of this series of experiments that the prediction of what any animal would do at any moment is most securely based on a record of what the animal was observed to do in that situation at its last occurrence. This is obviously prediction in terms of association.62

In other words, Guthrie and Horton seem to have demonstrated the stereotype of the behavior of cats in a particular kind of maze. The question is whether we are warranted to generalize from this study to provide an explanation for the behavior of cats, or of other organisms, including humans, in different situations. Guthrie seems to believe that association by continuity, as represented by this experiment, is common in learning of all organisms, though what is learned may differ. Human beings, of course, have the advantage of symbolic learning; but even so, his law of association is assumed to account for such learning, too.

General Evaluation of the System

The above experiment has limitations. These were prescribed by the structure of the puzzle box. Although limitation of this character is a common feature of no matter what kind of puzzle box or maze is used in learning experiments, the fact that the experimental structure involves its own limits should warn us against misleading generalizations. In the above experiment, the puzzle

62 Ibid., p. 42.
box was so structured as to render escape very easy. At the same time, the clue to the release from the box was not clear. There were no serious tries in the face of difficulties or failures; the pole, the key to escape, was set in such a position that the cat in the box was sure to touch it. From a cognitive standpoint, there was nothing in the situation to prompt the cat to change its behavior in the next try, once it had succeeded in escaping from the box by a certain pattern of movements. It is significant here to note that Guthrie meant to obscure the goal so that apparent purposive action would not interfere with his orthodox associationism. This was, in effect, a criticism of those psychologists who speak of goal-directed behavior, often suggesting that the goal is a cause, when, in fact, the goal may not exist until it is produced by the activity. "The confusion arises," according to Guthrie, "because there are so many instances in which the sight of the goal to be reached is one of the incentives to, and directors of, action." Thus, in his experiment, Guthrie concealed the clue to the solution so that the goal would not be observed and remain unseen. The earlier question remains, however. Are we warranted to generalize from an experiment of this character, to all other forms of behavior?

One final remark is in order about Guthrie's contiguous conditioning. This feature of his position is not unlike an

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emphasis placed by Hull and Skinner. It is of some philosophical interest. Both Hull and Skinner believe in the importance of the time interval between the conditioned stimulus and unconditioned response. The measurement of that time interval which suggests a gradient is very important in their positions. As was mentioned in the first chapter, Skinner noted that Pavlov had to measure the time interval in order to rule out mentalistic elements as explanatory factors. In other words, without measuring precisely the time interval between the conditioned stimulus and the unconditioned response, there would be room for mentalistic interpretations in terms of the organism's awareness of the significance or meaning of the new stimulus. Guthrie, in keeping with both his own distinction formulations and a strict behavioristic view, has eliminated the 'time interval' altogether: He substitutes for it simultaneous contiguity between the stimulus and the response. This leaves no possible opportunity for any mentalistic elements to interfere.
CHAPTER IV

REINFORCEMENT VERSUS COGNITION

The concept of reinforcement is one of the most, if not indeed the most, controversial issue in behavior theory today. Field theories and cognitive theories in general, as was pointed out in the second chapter, rely upon the distal representation of objects in the environment in terms of cognitive concepts such as perception, reorganizing and structuring the behavioral field, expectancy and the like. Consequently, cognitive psychologists differ from reinforcement theorists in their rejection of fumbling or random movement as the chief directive of behavior. Reinforcement theorists, however, in their insistence upon extreme objectivity in terms of observables, do away with in fact, cognitive concepts altogether. When they do speak in terms of cognitive concepts or ideas, it is only after they have reduced them to their assumed physical or physiological correlates. As such, foresight, intension, purposive behavior and the like, when used by behaviorists, are terms that refer to mechanical habits built upon hypothetical physical or physiological entities.

The issue can be set by this question: What is the most typical mode of behavior from which other modes of behavior can be derived? Cognitive theorists, especially field theorists, find such a concept
in perception. Behaviorists seem to agree that movement — random movement, that is — provides not only the most typical but, also — and this is of special significance — the simplest mode of behavior upon which to build a behavior theory.

Cognitive theorists, by taking perception as their starting point, try to explain other modes of behavior in terms of the same principles by which they explain perception. Edna Heidbreder expresses this point of view with respect to human cognitive behavior. She says, "To say that the perception of concrete objects is the typical reaction in human cognition is to say that human beings in all their other cognitive processes are in some measure doing what they do in perceiving objects...." Learning is, generally speaking, explained in terms of the principles that govern the process of perception. Gestalt psychologists, as will be remembered, explain learning in terms of the law of pragnanz, which was itself originally a law of perception.

When we turn to reinforcement theories, we find that "perception" disappears from the foreground and in its stead learning takes the lead. This is for two main reasons. First, is the mentalistic connotation of perception. Says Berlyne, "Sometimes perception is looked at askance because it has been regarded in the past as an aspect of conscious behavior." And second, is the impression, sometimes given by gestaltists, that perception defies analysis. This impression is at

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least implicit in the gestaltist's contention that the whole is more than the sum of its parts and that the parts derive their properties from the whole. Behaviorists, in their enthusiasm for the rigor of analysis, which characterizes the more advanced physical sciences, found themselves going beyond the phenomenon called perception to what they considered as the ultimate units or elements of behavior. Perception served no essential function for them, therefore. This was especially true during the early days of behaviorism. The Battle of Behaviorism, that famous debate between McDougal and Watson, illustrates the point. McDougal charged that Watson's behaviorism would be impoverished by excluding from the start the study of such phenomena as perception, imagination and the like. The charge was justified in view of the mechanistic and atomistic approach of Watson.

Behaviorism did not stop at the simple level of Watson's formulation, however. As it came to grips with more and more complex modes of behavior, many problems akin to field and cognitive psychologies had to be brought under scrutiny by it. Hull, in his later writings, expresses the need for tackling the phenomenon of perception in terms of his own system. Similarly Berlyne, in the article quoted above, expressed the same need and examined the possibilities of applying Hull's system to problems of perception.

In Chapter 3 we saw how behavioristic or associationistic learning theories try to explain behavior without reference to the distal representation of objects in the environment. The problems which they have to cope with in consequence can be summarized as follows:

1. To establish a system based on local stimulation of receptors independent of the distal environmental determinants.

2. To account for the fact that behavior thus conceived does correspond in some way or another to the distal environmental stimuli.

3. To show that this correspondence is not caused by any cognitive factor or cognitive commerce with the environment. In other words, to show how from among countless stimuli and cues besetting the organism stimuli or cues are favored for fixation, association or conditioning.

Since the organism has no cognitive commerce with objects of the environment, fumbling and random movement should be shown, by some means or other, to account for behavior. Thorndike was undoubtedly a pioneer in this field. His experiments with animals have provided him with a lot of data to substantiate his ideas about trial and error learning. He was criticized, though, on more than one ground. First, was the challenge that his findings from the field of animal behavior did not warrant the use of his generalizations to encompass human behavior as well. Second, and this came mainly from the gestalt camp, was the challenge that his experimental designs limited the experimenter to the observation of only apparent fumblings. In other

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words, this second criticism said, in effect, that Thorndike read into his experiments what had been put in them to start with.

It is suggestive to note that when Thorndike applied his principles to human behavior, he found rote learning to be the most promising field for investigation. This is so, apparently, because of the facility with which such experimentation could be carried on without allowing the older already established habits to interfere in the results. But we may observe that such a state of affairs does not eliminate the objection raised concerning the limiting factors of the experimental situation. The objection, however, could not be taken seriously by Thorndike. His concern, from his own premises, was chiefly the discovery of the conditions under which connections between specific stimuli and specific reactions took place. Cognition, therefore, was dismissed as a significant factor even before experimentation took place. Yet in all fairness to Thorndike one must say that he did attempt to show that learning took place according to his principles without the intervention of cognitive factors, i.e., without awareness. In an experiment in which he collaborated with Rock, the attempt was to show whether or not the subjects would discover the underlying principle. The experiment was designed especially for this purpose, the assumption being that if learning depended on awareness, the subjects would jump to 100 per cent success.

If the subject became aware of the principle according to which the rewards and punishments were allotted or of the two classes of connections, he would, after a little experimentation, change from a moderate percentage of successes to nearly 100%. If the subject increases his percentage of responses that manifest the one tendency
gradually, it is evidence that the tendency is strengthened without his being aware that there is any such tendency.5

The results of these experiments were gradual improvement of learning under conditions of reward. There was no abrupt or insightful leap ahead. Thorndike and Rock took their results as evidence that learning is a result of reward without awareness. A close examination of the conditions of the experiment, however, would show that the results did not warrant this conclusion. To say that the subjects did not understand the principle underlying the problem to be learned is to assume that a principle was present. An examination of the so-called principle reveals the presence of more than one principle and a situation so complicated that a single principle could exist only in the minds of the experimenters. The fact that the subjects learned gradually as a result of reward does not exclude the possibility of awareness of certain principles, even though they may not have been fully articulated by the subjects. It is possible that awareness may function at a low level. It is quite possible that rewards, therefore, do not act merely in a mechanical fashion, but may be used instrumentally by the subjects for extracting information about the problems, especially in the case of human subjects who possess the capability of symbolization. Moreover, "...positive evidence has been offered for the importance of awareness of knowledge of results for successful learning." The logic of the


experiment and the argument is clear enough. The problem situation was too complicated and vague. A rapid or sudden solution was impossible and the inevitable outcome was the gradual improvement of learning. Given these conditions the outcome is naturally taken to support the view that learning starts by fumbling, proximal stimulation of receptor organs and building up the habits through the association of stimuli and responses. Thus we come back to the problems of how fumbling, proximal stimulation without the intervention of cognition, can account for behavior. What makes for the coherence of behavior or habit as a result of learning? In other words, what factor or factors account for the fixation of the right movements and the combination of the relevant stimuli with the successful reactions or responses?

The key to the problem, seen by Thorndike and as was indicated in the preceding chapter, lies in the principle of reinforcement and its ancestor -- the law of effect. The law of effect simply means that success stamps in or strengthens, and failure weakens or stamps out, connections. But success and failure, or satisfaction and annoyance, as mentioned before, carry mentalistic connotations. Allport says "...That satisfaction, being both subjective and physical, cannot legitimately intervene as a causal factor in refashioning neural states." To avoid such connotations, Thorndike put the physiological correlates of success and failure squarely in the neurones. But as a mechanistic principle, the law of effect faced a serious problem. How can an effect work on a connection which has already passed?

The Retroactive Action of the Law of Effect

This problem, besides the subjectivity implied in the law, has been the main classical objection raised against the law of effect. This objection states "that effect is a complete anachronism, since the attainment of satisfaction or pleasure follows after the crucial series of activities, and therefore cannot well work backward in time especially when a long interval of time intervenes between act and effect." Thorndike's answer to this objection was that the physiological correlates of the connection do not vanish instantaneously but continue to be present when the consequence (reward or punishment) occurs. This postulation implies self-action on the part of the neurons as they exhibit satisfaction or dissatisfaction and determine, so to speak, the period of time when this state of affairs will or will not favor association. Let us observe here in passing, that such an assumption is on the speculative rather than on the demonstrative level. The objection, however, still holds, especially when the time interval between act and effect is long enough. Some intervening variables have to be postulated to bridge the gap, which was what Hull did.

Hull's first postulate (the perservative stimulus trace) is a physiological one and is intended to provide an answer similar to that of Thorndike. But before giving Hull's answer to the problem let us consider his principle of reinforcement (primary reinforcement), which

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8 Ibid., p. 343.
corresponds in a rough way to Thorndike's law of effect. This principle states:

Whenever an effector activity occurs in temporal contiguity with the afferent impulse or the perservative trace of such an impulse, resulting from the impact of a stimulus energy upon a receptor, and this conjunction is closely associated in time with diminution in the receptor discharge characteristic of a need, there will result an increment to the tendency for that stimulus on subsequent occasions to evoke that reaction.\(^9\)

Here we find that a specific efferent impulse and a specific reaction (or efficient discharges) associated in time and contingent upon the need reduction at a given moment will get associated in the same situation in the future. A beginning of a habit is born. Hull considers the postulate of the perservative stimulus trace to be of biological importance. It provides an explanation of the influence of events of the recent past on the present of the organism and this is a matter of importance for survival. In other words, Hull's postulate makes the recent past (physiologically speaking) present in the immediate situation, in a sense; hence, the benefit from the feedback of the consequence of behavior in a given event. "This perservative stimulus trace is biologically important because it brings the effector organ in rapport not only with environmental events which are occurring at the time but with events which have occurred in the recent past, a matter frequently crucial for survival." \(^{10}\) The gap is further bridged by the principle of secondary reinforcement, as was shown in Chapter 3.


The principle of secondary reinforcement reads: "The power of reinforcement may be transmitted to any stimulus situation by the consistent and repeated association of such stimulus with the primary reinforcement which is characteristic of need reduction." In this reference to secondary reinforcement Hull speaks of the "stimulus situation," not in terms of afferent impulses. There is no reason, however, to doubt that Hull considers the stimulus situation to be effective as a secondary reinforcer, to be no different in any essential manner from the stimuli considered as primary reinforcers. The only seeming difference lies in the fact that the former depends on the presence of the latter. In fact, however, we do not expect primary reinforcers to be directly effective in all phases of behavior or in the execution of established habits. Secondary reinforcers have acquired their reinforcing characteristic in previous conditioning and act instrumentally in controlling the execution or performance of the habit. The principle of secondary reinforcement thus carries a heavy load in Hull's system, since only final stage of a given act (as in case of a rat running a maze) will be reinforced as a direct result of primary need reduction. Again we must repeat that such physiological explanations are definitely speculative in character. They are far removed from the rigor of experimental verification, at least, on the level at which experimental verification is now possible. This of course is not objected to as such; the point is, other explanations are feasible.

Cognitive psychologists enter the stage at this point. They argue

Ibid., p. 97.
that the feedback is not a matter of movements associated mechanically by a certain effect. "The burned child shuns the fire not because the pain did anything to his movements, but because since that pain, the stimulus has changed, it is now flame plus fear, no longer flame plus curiosity." The change is a change in the stimulus, as well as in the organism, for the stimulus after the first act is no longer the same stimulus. This explanation is in terms of distal representation of the object in relation to the organism in the environment. It is the same argument that Carr puts forth. As he has said, "Those consequences do not influence the portion of the act that preceded them. . . . they do affect the subsequent functioning of the act." Here again the argument is in terms of distal representation of the environmental stimuli. It is instructive that such mode of reasoning follows from James' child-candle instance. This is interpreted in Dewey's reflex arc concept and in Hullfish's treatment of concept formation. The underlying principle is sensori-motor co-ordination. Here we find that there is common agreement regarding the fact that a given act will alter future behavior in some way, but that there is disagreement with respect to the how and the why. It is neurones and connections between discrete neurones influenced by discrete stimuli from the outside; or is it a sort of transaction in which

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13 H. A. Carr, Psychology: A Study of Mental Activity, p. 96.
the "outside" and the "inside" are in a dynamic co-ordination, separable only for the sake of analysis? This is a philosophical question of prime importance and will be considered in the next chapter. Thorndike has said: "How the after-effect of a connection strengthens or weakens the corresponding connection may well be a matter for dispute but that it often does so seems to me as sure as the fact of learning itself."\(^{14}\)

**Nature of Satisfiers and Reinforcers**

Thorndike's conception of a satisfier is equivalent, in a sense, to a driving force whereby the animal strives to attain behavior pattern and preserve it. "By a satisfying state of affairs is meant roughly one which the animal does nothing to avoid, often doing such things as attain and preserve it."\(^{15}\) The hedonistic principle is here turned into a driving force. This definition does not say whether the satisfier can be located inside or outside the organism. It only says that the animal often does something to attain and preserve "a satisfying state of affairs." Nor does the designation of neurones as the physical correlate of satisfaction help. Hull sensed this danger and considered that Thorndike had confused the


\(^{15}\) Ibid., p. 176.
criterion, 'effect or reinforcement,' with 'the striving,' making the striving primary without explicitly saying so. Hull then asked, "But is the 'criterion' the active or essential factor, or is it a mere convenient indication of the active factor? And which of the two variables... is the 'criterion'." The distinction Hull makes here is between two variables, motivation or striving, on the one hand, and learning, in the sense of strengthening or conditioning, on the other. The two variables, Hull believes, are positively correlated, but he insists that a distinction between them must be made in order to decide which is primary and which is secondary or dependent and derivable from the other variable. Hull is inclined to consider "... that the 'conditioning' or strengthening is primary. By this is meant that striving can probably be derived from the principles of conditioning as basic assumption." He further makes himself clear by saying that "States of affairs which organisms will strive to attain are reinforcing agents, not because they will evoke striving, but they evoke striving now because at some time in the past they were potent reinforcing agents, thereby joining stimuli and responses which constitute striving."18

A brief review of the position of other behavior theorists needs to be made before the concept of reinforcement is examined.

17 Ibid., p. 821.
18 Ibid., p. 822.
Skinner's position, for instance, is similar to that of Hull and the gap is bridged by the principle of secondary reinforcement. His principle of secondary reinforcement states, as did Hull's, that any receptor activity which consistently precedes a primary reinforcement will itself become a reinforcing agent. We need not consider Guthrie's position at this point. It adds nothing to the picture and offers no solution to the present problem of the retroactive effect of reinforcement. The question remains—is this distinction between the striving and reinforcing valid and does it help solve the problem? Apparently not. It rather makes it more difficult. We have to deal with successive neural events, the link between which is contingent upon reinforcement, yet reinforcement itself is inferred only from the establishment of such a link. In any learning situation there are a multitude of stimuli and reactions irrelevant to the task being learned. Hull realizes this and says, "every reinforcement mediates connections between a very great number of receptors and effector processes in addition to those involved in the reinforcement process...."\(^{19}\)

Reinforcement of right connections becomes a matter of selection based on the frequent occurrence of the relevant stimuli and reactions and the elimination of the others. This seems logical but on further scrutiny one does not find it as sound as it first

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appears. The problem is why the irrelevant reactions tend to disappear or decrease in frequency. The answer is that the permanent features of the physical situation are those that inevitably present themselves consistently. This may seem to give an answer to the problem of the determinations the organism will have to make in terms of corresponding stimuli. But it does not; when the situation is one of choice among alternatives presented by the physical features of the situation. Such formulation, for instance, cannot explain why the rat in a maze learns to pass through the alley and skip blind ends. As Leeper has pointed out, "... as stimuli blind alleys are more similar to the end-box than is the true pathway. Of course, an entrance in a blind alley is not followed by any primary need reduction. But neither is the passage down a segment of the true path." Thus, by strictly following the principle of reinforcement, we find nothing that will account for learning other than a negative aspect of reward—need reduction that is some decrease of impulse from some drive stimulus. This seems more basic than any positive value of the reward. But common sense shows that the positive value of the reward is often instrumental in learning. A taste of ice cream may make the child who has never tasted it before like it and ask for more. The taste of ice cream, then, creates a need,

it does not reduce one. Yet the child has learned. We may say that the single taste creates a new stimulus situation that demands need-reduction, but this is to play with words. Mechanistic formulations do not provide an answer to our problem. Spencer seems to sense this difficulty and offers a solution by suggesting that it is the particular 'stimulus pattern' at the time of reward which acquires reinforcing properties. Spencer thus attempts to avoid the difficulty of the retroactive effect of reinforcement by a claim that the reinforcing power is generalized to preceding stimulus patterns, according to a temporal gradient. Spence explicitly attributes the difficulty of learning theory to account for the backward effect to the emphasis behavior theorists put on reducing their explanation to neurophysiological mechanisms as mediating behavior. He says that "More recently psychologists have come to realize that explanation of behavioral events does not necessarily involve reduction to its physiological determinants." Such an attempt is a marked deviation from the mechanistic and atomistic trends prevalent in behavior theory. The reinforcement principle, however, still plays the dominant role. Egon Brunswik makes a genuine attempt, as we have seen, to recognize the role played

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22 The emphasis Spence puts on the word 'necessarily' is suggestive. It seems to indicate that Spence is ready to deviate from reductionism when and only when reductionism fails to explain the facts.
by the organism in terms of probability. His is still a reinforcement theory, he conceives the organism as making choices of means, from among various ambiguous means, to a certain end. His assumption as was mentioned before, is that cues, means or pathways to a goal are usually neither absolutely reliable nor absolutely wrong. His experiments are designed in accordance with this position. In one of his experiments, "Rats were used as subjects. A single choice situation was given. In a series of experimental conditions the relative frequency of degree of 'probability' of reward on the two sides was varied." \(^{23}\) It is a wholesome approach in which the organism is not merely viewed as passive, subject to the outside influence of stimuli, but is assumed to be able to diagnose its environment and choose from the multitude cues or signs provided by the situation. That which the organism chooses to do and does in the situation is what defines its behavior.

Brunswick found that "Discrimination increases with the difference of probabilities of success on the two sides, a further influence being superimposed due to the ratio of probabilities...." \(^{24}\) To treat the organism as part of the total situation, and stimuli as cues that bear upon its actions, is a recognition of the transactional nature of behavior.


\(^{24}\) Ibid., p. 196.
In Thorndike's earlier writings, punishment was considered as equally effective in behavior—though in the opposite direction—as reward. But Thorndike reconsidered his position in view of some of his findings later on and concluded that punishment had little, if any, effect on the connections. In The Fundamentals of Learning Thorndike reaffirmed the effect of reward in strengthening the connections, but went on to assert that "There is not a particle of evidence that the announcement of wrong (punishment) weakened these connections enough to counterbalance the strength they gained from just occurring."\(^{25}\) This conclusion naturally does not agree with Hull's principle of reinforcement which is based on need reduction. Hull pointed out that Thorndike's conclusion was not valid statistically. Thorndike reported that the assumed negative effects of punishment did not exceed mere chance, statistically speaking. Hull contended, however, that this result rather affired the effect of punishment, since the connections were already established, and hence to find out that the occurrence of the punished responses were lowered to 50 percent, accounted for the effect of punishment.

Hull's position here can be understood in terms of his principle of reinforcement. Need-reduction implies both reward and punishment, since it is a negative statement. It means in both instances

getting away from the state of tension. Thus, the behavior that is conditioned is that which leads to relief from hunger (reward) or from pain, as in the case of an electric shock (punishment). There is no basic difference psychologically speaking between reward and punishment. The definitions of punishment and reward in Hull's system are questionable. He implies that the behavior which leads to cessation of punishment and, hence, to need reduction, is reinforced when punishment ends. In other words, if punishment does not end, no reinforcement occurs. We know, however, that need reduction may not occur when punishment ends. The effect of a burn does not end with the withdrawal of the burned organ from the flame. It may increase, with the organism learning, nonetheless, not to contact the flame.

With respect to the effect of reward, Leeper observes that the emphasis on the negative aspect of reward, that is, need-reduction to the exclusion of its positive value, is not warranted. A taste of ice cream may lead a child engaged in an otherwise vital activity to ask for more ice cream. Of course, Hull may answer this by maintaining that the taste has created a need to be reduced. Again, however, this will be but a play on words.

Skinner's position in this connection, as we have seen, falls more or less between those of Thorndike and Hull. On the one hand,

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26 Consideration of Dewey's treatment of the child-candle instance will be given in Chapter Six.
he recognizes the effect of punishment. Its effect is to lower the extinction rate, that is, the punished response will diminish temporarily, so long as the punishing situation exists. The reflex reserve remains intact, however, and emission of responses will start again when the punishing situation ceases. Does this imply cognition, one may ask? Does the organism get the meaning of the situation and act accordingly? Skinner's system, as we noted in the preceding chapter, leaves a suggestion of cognitive interpretation, though Skinner himself does not allow for it.

Guthrie's position, as noted earlier, is unique. Neither reward nor punishment are taken seriously in his system. Only the final act in the situation determines what the organism will do next in the same situation. Guthrie disregards, as Hilgard has pointed out, that there is evidence to show that rewards do enhance learning. Guthrie's position, to say the least, leaves the door in this respect open for speculation.

Mowrer's view is similar to Hull's. Mowrer says, "...it is meaningless to say that one type of learning is through 'reward' and another type is through 'punishment'; each is an essential aspect of a dynamic process." In other words, Mowrer asserts that learning is a function of reinforcement, which itself is either the result of need reduction, such as hunger, or of tension induced by punishment.

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Cognitive psychologists naturally differ in their interpretations from the behaviorists. Tolman, Hall and Brentall conducted an experiment to investigate the effect of punishment—electric shock—and came out with a conclusion which to them was a disproof of the law of effect. They found that to add a shock to an auditory signal for right responses did not slow up learning significantly, while the addition of a shock to an auditory signal for wrong responses not only did not speed up learning (of the right response) but, in fact, slowed it down. They concluded that neither the auditory stimulus nor the electric shock stamped in or stamped out connections and that learning is a function of perceptual organization or cognition. Any relatively violent shock may have a disruptive effect and may counterbalance the effect of emphasis (of the signal).

Performance Versus Habit Formation

Hull makes no rigid distinction between performance and habit formation. The distinction is a matter of degree. Repetition of the act strengthens the habit through continual reinforcements, until the habit is well established. Motivation is a prerequisite in each case, that is, whether habit formation or performance is involved.

Cognitive psychologists, however, make a clear distinction. For both Tolman and Lewin a rigorous distinction is made between the acquisition and utilization of habits. The acquisition of habits depends, in Tolman's terms, on the formation of cognitive patterns. For Lewin acquisition depends on structuralization and restructurization of the phenomenal field or life space. Tolman describes the cognitive patterns as 'sign Gestalt expectations.' The important point here is that motivation is not considered a factor in learning or the acquisition of habit, though it is thought to be essential for performance or utilization of habit.

We cannot help but observe that cognitive psychologists, as represented by Tolman and Lewin, fall unwarily into the entanglement of the dichotomy between the emotional or motivational aspect of behavior, on the one hand, and the cognitive aspect, on the other. This fallacy is especially dramatized in the case of Lewin, who insists that the laws of motivation and the laws of cognition should be studied separately, in order to determine the role of each type of factor in different learning situations.

It is significant to note, however, that Tolman in his later writings introduced a general motivational factor, which he

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called the "exploratory drive," to account for both habit formation and performance. This exploratory need is associated with all other forms of needs and activates them, while at the same time it accounts for learning without the identification of specific needs. It seems that this relatively new approach by Tolman is significant. The problem of behaviorists, stems among other things, not from a law of effect or a reinforcement principle as such, but rather from the insistence on specifying certain pressure needs and attributing all observable behavior to that one need. Tolman's position in his 'Psychological Model' recognizes the significance of motivation not only for performance but also for the acquisition of habits and learning. He thus avoids the dichotomy between motivation and cognition referred to above. The exploratory need, moreover, avoids the limitations of behaviorists in specifying a specific need in their experimental research. His exploratory need is a general, ubiquitous need. It is, we believe, a movement in the right direction. It is reminiscent of the postulation of the ether in physics, which solved some problems but failed with many others. This point will be dealt with in the next chapter.

Latent Learning

The latent learning issue is tied up with the controversy between cognitive and reinforcement theories over motivation

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versus cognition, as discussed above. It is a significant issue, since it illustrates the philosophical orientation of each group and the influence of this orientation on their experimental work and theorizing.

The problem can be stated simply as follows: If it can be shown that learning may take place without primary need reduction, then the principle of reinforcement as the primary or the only determiner of learning falls. Naturally we would expect the cognitive theorists to carry the burden in this regard. This, they did. A great number of experiments were conducted in support of 'latent learning,' chiefly under the leadership of Tolman.

Blodget in 1929 conducted the following experiment.32 Rats were allowed to run in a six unit T maze provided with gates to prevent retracing. Blodget ran the rats from the entrance to the goal box which was empty (with no food reward) in the first tries. The rats were kept in the goal box for two minutes for exploration and were then taken to another box (not their original home box) and not fed until after one hour had elapsed. This was also a precaution taken to avoid the possibility of reinforcement. Then, after seven tries, food was introduced in the goal box and the rate of learning of the experimental group of rats was then compared with that of a control group which did not have the chance of exploration. Two marked effects were

observed. First, the experimental group learned to some degree to reach the goal box in the early tries without reward. Second, the learning curve dropped rapidly after food was introduced.

These results seem to indicate that learning (latent) does occur without rewards, i.e., as a result of exploration; and that learning is enhanced with the introduction of food reward, i.e., as a result of performance. This seems to support the cognitive position. The reinforcement group, however, have their reservations. They argue that the transference of the rat to a box in which it received food might have functioned as a secondary reinforcer. When the cognitive group deny this possibility, since the food was not introduced until one hour had elapsed, a fact which makes reinforcement improbable; the reinforcement group would still insist, however, that the very fact that the experimenter handled the rats when he took them from the goal box may have been reinforcing. Rats like to be handled, quite as do young children. Moreover, learning, so the reinforcement theorists argue, may occur as a result of the reduction of an exploratory drive; hence, reinforcement is still valid. But here the cognitive group replies that if this is so, then, according to the reinforcement theory, what is reinforced should be a habit connected with exploration and not with food or the hunger drive. It is well to remember that in Tolman's system an exploratory need is general, whereas in reinforcement theories needs are specific. So the argument goes. On the one hand, we find an argument in favor of reinforcement. Even when it fails to account for the facts,
it must be working somehow in some form or other. So the argument goes. On the other hand, we find cognition and a general exploratory drive which accounts for everything. This is not the whole story, however.

In 1945 Reynolds repeated Blodgett’s experimental but arrived at different conclusions. The experimental group of rats learned to some degree to reach the goal box in the unrewarded tries, but there was no drop in the learning curve after the introduction of food. In treating the results of this experiment we will have to recall essentially the same arguments reported in connection with the first experiment.

Meehl and MacCorquodale repeated the same experiment and arrived at conclusions similar to those of Reynolds. Their argument was mainly that taking the rats from the maze and placing them in a cage may have been slightly rewarding. The case could be considered that of a secondary reinforcement, since the place where the rats were taken to was the same where food was obtained one hour later.

Tolman and Honzik conducted a more complicated experiment on a similar basis. The maze was more complex and offered more opportunity for exploration. Instead of one control group they had two. One control group found food in the goal box on every try, while the other found no food at all. Then the two control

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groups were interchanged, so that the group that did not obtain food at first found food with every try, and vice versa. The results of this experiment, in general terms, tend to show that the rats learned to run the maze slightly without a food reward, but learned much more effectively with a food reward.

Buxton conducted another experiment in which he allowed the rats to explore the maze for a long period of time (72 hours) without food reward. A special effort was made to prevent any form of reward. The rats were taken out of the maze from different spots at different times. They received food only in their home cages at night and spent the morning in the maze which was a large twelve unit T maze. The results support the latent learning theory. That learning may occur and be latent and show up when there is need for performance.

An interesting experiment was conducted by Seward in which he used a single T maze. The two goal objects were different from one another. This was to accentuate perceptual cues. One was white, while the other black; one maze had a rough floor, while the other had a smooth one. He gave the experimental group of rats an exploration period of three hours to locate the two boxes. The rats were then deprived of food. He then gave the hungry rats a few bites of food in one of the boxes and then took them

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immediately to the entrance of the maze to see whether they could find their way to the right box. Twenty-eight out of thirty-two were able to do so successfully. The significance of this experiment lies in the emphasis put on the experimental structure and perceptual or cognitive cues or signs. This naturally is of more concern to the cognitive groups than to the reinforcement group, whose concern is primarily, if not completely, with performance as overt movement.

Tolman and Oleitman conducted an experiment in which an electric shock was received in one end box, whereas food (reinforcement) was received at both ends. The result was that 22 rats out of 25 turned away from the side of the goal in which they had been shocked.

Many other experiments were conducted to affirm or disprove latent learning. Rats were satiated either with food and deprived of water (in the exploratory periods) or satiated with water and deprived of food or satiated with both water and food. The results vary from one experiment to the other but, in general, the fact seems to be that the rats seem to learn something as a result of exploration. But what this something is in terms of either theory, it is hard to tell. The reinforcement group justifiably insist that learning and performance go together and that both equally

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depend upon motivation. Their shortcoming seems to be in their exclusive emphasis upon observable movements of the organism, to the extent that they neglect or, rather, undermine the role of the structure of the environment or field in which behavior takes place. The cognitive (field) psychologists, in contrast, emphasize the structure of the field (the experimental set-up) but their tendency is to make a distinction between perception (as structurization of the field or restructurization of the field), which does not depend upon motivation, and performance. This leaves us with an ambiguous mentalistic connotation of their cognitive concepts. To illustrate this point we shall have to refer to a controversy between Leeper (cognitive) and Hull (reinforcement). This controversy is based on an experimental study by each. It did not originate in the domain of latent learning, yet it bears upon it.

In Hull's experiment rats were trained in a simple maze with two goal chambers. The rats were trained to traverse one arm of the maze when hungry; to the goal chamber to find food, and to traverse the other arm to the other goal chamber to find water, when thirsty. In case a rat made a wrong move its run led to a door which blocked access to the single end box. The

result of the experiment was that the rats improved gradually and acquired 80 percent correct choices on first runs, after 25 periods of training of eight days each.

Leeper's experiment was similar to Hull's in all essential points, with the exception that the maze had the two end boxes open for the rats to enter, even if they chose the wrong arm. Food was always found in one end box and water in the other. If the rat made a wrong choice and entered the end box containing the reward material not needed at that time, it was kept there for about half a minute before its next run. By keeping the rat in the end box perceptual patterning was assumed to take place. The result of this experiment was that only one eight-day training period was required before the rats reached 83 percent correct choices on first runs. Hull in a rebuttal suggested that the rats, when allowed to enter the wrong box, may have been slightly rewarded by touching or licking the reward not needed at the moment. Leeper asserted "... on the incorrect runs the rats almost never touched the undesired goal material."38 It is significant at this point to observe that Hull, as Leeper has noted, had made use of his own experiment in his Principles of Behavior, without any reference to Leeper and their different results.

In order to accentuate the perceptual conditions, Leeper conducted another experiment essentially on the basis of the above, with some modifications to allow more opportunity for latent learning. He found that his rats were able to reach 100 percent scores on first trials within five days with hunger-thirst alternations. Leeper concluded

...it seems quite safe to say that it was exceedingly hampering to the rats in Hull's maze to meet a door blocking access to the one-end-box, and that it was definitely helpful to the rats, in the other mazes to come into an end box and find there the goal material not wanted at that time. This suggests that learning is produced at least partly, not by reinforcement, but merely by an opportunity to perceive 'what leads to what consequence'. "39

Leeper further asserts that if it were true, as reinforcement theorists answered, that the exploratory need was rewarding and, hence, that reinforcement was the factor producing latent learning, then we would have expected that 'wondering leisurely into blind alleys, washing themselves and sniffing at cracks, etc!' would be reinforced and not merely reaching the goal box. This seems to be a sound conclusion since Hull's fourth postulate40 tells us that reinforcement establishes connections between receptor activities and the reactions shown in the learning situation.

So much for the latent learning issue. Another problem also illustrates the differences between the two groups--cognitive

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39 Loc. cit.

40 See Chapter 3 of this study.
and reinforcement. This is the 'continuity-discontinuity' issue.

The Continuity-Discontinuity Issue in Learning

Discontinuity theorists are those who interpret learning in terms of a single trial. Such is the position of the Gestalt and field theory group, on the one hand, and Guthrie, on the other. It should be recalled at this point, however, that Guthrie belongs in this category not because of, but despite of his basic principles which are, as shown before, associationistic through and through.\[^{11}\]

Guthrie, as we saw in Chapter III, believes that the association between a stimulus and response takes place in one try. To this extent he belongs to the discontinuity group. The continuity of learning curves do not cause him any trouble. He accounts for this by the assumption that new associations between stimuli and new reactions, each at one try, are continually formed. In contrast, cognitive theorists tend by and large to advocate discontinuity in learning because of the structurization of the behavior field or the patterning of sign (Gestalt). Insight, in terms of Gestalt psychology, falls within the discontinuity camp, for the same reason.

In contrast, continuity theorists interpret learning as a positive growth function of reinforcement. Representatives of this group are Hull and Spence.\[^{12}\] Skinner would belong here, too.

\[^{11}\] See Chapter 3 in this study.
\[^{12}\] C.f. Hull's fourth postulate. (Chapter Three in this study).
To take Hull as an example, he has said:

The postulated relationship of habit strength to the number of reinforcements is that each reinforcement results in the addition of an increment to the habit strength—which is a constant function (F) of the difference between the physiological maximum of habit strength and the habit strength immediately preceding the reinforcement.$^{13}$

The results of experimental work, however, fail to support one or the other group consistently. Sometimes learning seems to occur after one try, as would be expected by the discontinuity theories; and, at other times, it seems to be gradual.

The core of the issue lies in the fact that cognitive theorists assert that subjects selectively abstract or attend to particular aspects of the situation and only those aspects attended to are differentially affected by reinforcement or non-reinforcement. In other words, the development of discrimination is not a continuous process but is contingent upon the subject's attention to relevant clues. Once he has attended, then, and only then, does the reinforcement principle show its effect. The reinforcement group, however, asserts that development in discrimination is a monotonous function of reinforcement and is, hence, continuous.

One of the experiments often quoted in support of the discontinuity theory is that of Kohler's hen which was shown to respond to the darker of two gray boxes rather than to absolute

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brightness. This seems to show that the hen was attending to a relational aspect of the situation and was not merely passively subjected to the amount of reinforcement.

Lashley, in one of his experiments, trained rats to discriminate between the circles varying in size and to respond only to the larger one. He then substituted for the larger circle a triangle (of size equal to that larger circle.) The rats responded to the triangle. Lashley concluded that the rats had reacted to size all along. He then trained the rats to react to the large triangle and not to the small circle (reaction to the triangle was positively rewarded.) He then introduced a triangle and a circle of equal sizes to see whether or not, having made the size constant, the rats would react to triangularity. The rats reacted equally to both without discrimination. Lashley's interpretation was that the rats were equally reinforced with respect to circularity and triangularity and that they seemed to have reacted to size alone.

In another experiment Lashley and Wade trained rats to discriminate between a white circle and a black card. They were then trained to discriminate between two white circles of varying sizes. One of the circles was the one reinforced in the first experiment. The results showed that the previous reinforcement (of the white circle against the black card) made no difference.

in the discrimination in the second case. In fact, there was an indication (in all cases), though statistically insignificant, that the new discrimination was formed more rapidly, when the previous reinforcement was extinguished. These results seem to contradict the expectations of the continuity theory, since discrimination (according to Hull and Spence) should have been continuous with the first reinforcement. These experiments do not tell the whole story, however.

Spence trained the control group of rats on each of the contrasted objects (black and white discrimination) 50 percent of the time. The experimental group was trained on the same discrimination throughout. When the reinforced cues were reversed, that is, when the reinforced cue was non-reinforced and vice versa, it was found that the discrimination of the control group was much faster than that of the experimental group. And since the control group had been reinforced equally with respect to both cues, this was taken to be a continuation of reinforcement of the first phase of the experiment and hence to support the continuity theory.

Many other experiments were conducted along lines similar to the ones cited above. Some seem to favor continuity; others to favor dis-continuity. Where do we stand, then, we may ask?

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The remarkable thing is that almost invariably those who favor discontinuity (cognition), such as Lashley, come out with results which support their point of view. Slight deviations from their expectations are always accounted for in terms of their theory. The same applies to the continuity (or reinforcement) group. Moreover, each group seems to favor one type of experimental design. Osgood observes that "It is significant with respect to methodology in psychological experimentation that, almost without exception, the studies supporting the Lashley view have used the jumping stand while those supporting the continuity view have used the Yerkes-type discrimination box."146

General Comments

We have surveyed in this chapter some of the controversial issues in psychological theories. We have found disagreements concerning crucial issues in understanding human behavior. Most of the experimental work has been done on lower animals, with generalizations drawn to apply to man. The task of choosing among the views is really difficult, if not impossible. The disagreements are sometimes so serious that no choice can be made on the basis of empirical evidence. Moreover, the structural differences between the human organism and lower animals do not seem to be given due consideration. It is known, for instance, that stereoscopic
vision probably does not exist below the primates in the evolutionary scale. Does this make a significant difference in understanding human behavior? We are not sure. We do know one thing, that most experimental work in psychology has been done with rats. Harlow properly asks, "Can anyone seriously believe that the insatiable curiosity-investigatory motivation of the child is a second-order or derived drive conditioned upon hunger or sex or any other internal drive?" He goes on to show that psychologists do not sincerely believe that such principles which they derive from their experimentations with rats apply to their own children. He observes that psychologists "After describing their children's behavior, often with a surprising enthusiasm and frequently with the support of photographic records, then trudge off to their laboratories to study, under conditions of solitary confinement, the intellectual process of the rodents."

The problem of psychological theory evidently goes beyond exiting empirical data. It is a problem of methodology and, as such, it is essentially a philosophical problem. In the next chapter, therefore, we shall consider certain trends of human thought in an attempt to find out their bearings upon the study of behavior.

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CHAPTER V

SCIENTIFIC INQUIRY AS TRANSACTION

Psychologists today show great concern about their own mode and logic of thinking. It is a far cry from the time when they conceived of their task as merely fact finding. This new concern is exhibited in the many articles dealing with the logic of scientific and empirical methods in relation to psychology; which appear in the psychological periodicals and by the tendency of all textbooks on psychology in recent years to present at the beginning a chapter or more on the scientific method. Psychology may be said to be turning back to its source, philosophy, after having withdrawn almost completely from it. It is becoming more and more conscious of its own logic.

The difficulty with the early scientific movements in psychology was their domination by a sterile philosophy. Both

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1 A monograph by H. Gordon Hullfish was published by The Ohio State University in 1926, titled Aspects of Thorndike's Psychology in Their Relationship to Education Theory and Practice. This writing opened a movement of criticism against the structures of behaviorism, as a stimulus-response bond interpretation of human action, for an education appropriate for a democratic world. Following the publication of this monograph Professor Edward L. Thorndike wrote to Hullfish (Nov. 18, 1926) and, after saying that he was "proud to have been chosen as the subject of your analysis and criticism," added, "We are now carrying on experiments which, I hope, will make the factual implications of my associationist account of learning clearer. What its philosophical presuppositions or implications are I have never had time to consider. Perhaps I should have taken the time from other duties." Thorndike indicated that he would not reply; he suggested that "some philosopher devoted to a sort of naturalism would probably do it better."
their subject matter and method were dictated by dualistic and mentalistic systems of thought. These proved inadequate with respect to other physical sciences. Psychology then turned its face towards the newly developing and promising scientific disciplines. In so doing, however, it cut itself at both ends. With respect to subject matter, there was nothing or almost nothing in the way of subject matter in those physical and natural sciences from which the new ambitious science could borrow. Even physiology, the discipline most akin to psychology, could not in its occupation with reactions of bodily tissues, lend a helping hand to psychology at the beginning. Psychologists such as Wundt and Titchner, for instance, who were among the first to work out a scientific psychology, contended themselves with bringing their old subject matter, that is consciousness, to the scientific field of investigation. But this state of affairs did not last for long. The new methods ultimately forced a change in the subject matter itself. The problem of methodology was really baffling at the beginning. The reason is not hard to discover. What methods or techniques could psychologists adopt and apply to their field in view of the many and varied methods and techniques which were at work in the natural sciences? We saw in the first chapter how different concepts and different techniques were preferred by differing psychologists, a fact that led to conflict between the different schools of psychology at the beginning of the present century.
It may prove helpful at this point to investigate the evolution of human thought, in gross terms at least, to note the implications of the newly developing understandings in scientific inquiries for the new science of psychology. The assumption is made here that all sciences are made of one piece and that the advancement in one scientific area of human inquiry affects all others. It is impossible to trace the channels of human thought fully in a study of this nature. Fortunately, however, we can follow the logic of human thinking in terms of those gross concepts which are fairly well accepted by many modern thinkers. These concepts are: self-action, inter-action and trans-action.

Self-Action

One thing at least is certain about human beings as distinct from the rest of the animal kingdom. This is their power of intellectualization. In facing their daily problems, prompted by their daily needs and curiosity to reach for the unknown, man is known always to have engaged in theorizing about the natural phenomena besetting his life. Observations of young children and their endless questions, once they have developed the rudiments of language, illustrate the point. Children's questions are often a cause of bother to their parents, since it is frequently hard to keep up with their continuing curiosity. There is, however, one feature of these questionings psychologists tell us should bear
notice. Children are not interested in the deep logic their parents tend to use in answering their questions or in the completeness of the information they are tempted to provide. Many questions of young children are baffling, indeed, yet the children seek but a simple answer, so to speak. They want nothing more than assurance that the problem makes sense, and this relative to their level of maturity. The concept of a "simple answer" is not a characteristic of young children alone, however. Cantril, in his *The Psychology of Social Movements*, views the need for a simple answer as one of the important factors in social movements. In a general sense, we can say that the same concept applies to human inquiry in general. When confronted with a problem, particularly one difficult to handle, we tend to reduce it to its simplest terms and to start from there. Indeed, it is appropriate and fruitful in scientific inquiries to formulate laws with an eye on economy. A sound law is one which accounts for the facts in its simplest terms, following the principle known as "Occam's Razor."

**Animism**

Primitive man, confronted with problems relatively too difficult for him to handle, reduced them to their simplest terms. Consequently, primitive man envisioned his world as composed of discrete events and happenings, each of which was explainable in isolation from everything else. He could not envision the interdependent
character of his world. He saw only separate items, unrelated. His limited experiential background, did not permit him to understand the interrelatedness of the phenomena of nature he inquired into. This reminds us again of young children, who see different items of their environment as complete in themselves. Some perceptual experiments in which children were asked to describe a given picture, show that they merely enumerated the different objects comprising the picture with little, if any, concern about the relationships occurring between the different objects in the picture.

Animism was a logical outcome of this sort of reasoning. Since every happening or event was conceived as complete unto itself, something within it—a spirit or soul—had to account for it. It is small wonder that primitive man worshipped so many Gods. All natural phenomena which proved stronger than man could control, and which seemed to exhibit a controlling effect upon his life and destiny, was viewed as a God. Primitive man thus worshipped fire, thunder, torrents, winds, rivers, the sun and so forth. There was a 'deus ex machina' for every object and event. Explanation of natural phenomena was simple, therefore. Man had only to name a spirit or soul residing in a given event or object to account for its happening. This is what we call self-action, "where things are viewed as acting under their own power."\(^2\)

\(^2\) John Dewey and A. Bentley, *Knowing and the Known*, p. 108.
Self-actional interpretations of natural phenomena prevailed in human thinking in the past and, moreover, they are still held in disguise here and there. Aristotle's philosophy, with its discrete forms, was self-actional.

Aristotle's philosophy was a great achievement in its time, but it was built around 'substances'. Down to Galileo, men of learning, almost universally held, following Aristotle, that there exist things that completely, inherently and hence necessarily possess Being; that these continue eternally in action (movement) under their own power, continue, indeed, in some particular action essential to them in which they are engaged. The fixed stars, under this view, with their eternal fixed movements, were instances. 3

Causation, therefore, was the influence of one discrete entity upon another. It was this notion of self-action that led to the conception of the element or the atom which was destined to dominate human thought for centuries. Everywhere we turn we find, at the back of human thought substances, elements, cells, forces, spirits and so on to account for different natural phenomena.

Nowhere, perhaps, is the atomistic notion more sharp and dramatic than in the following quotation by Democritus written twenty-three centuries ago.

By convention sweet is sweet; by convention bitter is bitter; by convention hot is hot; by convention cold is cold; by convention color is color. But in reality there are atoms and the void. That is, the objects of the same are supposed to be real and it is customary to regard them as such, but they are not. Only the atoms and the void are real. 4

3 Ibid., p. 110.

4 Quoted from Albert Einstein and Leopold Infeld, The Evolution of Physics, p. 56.
The problem of self-actional concepts does not lie so much in naming or specifying a certain phenomenon or event, but in assuming, after it is so named or specified, that the item signify ascertained truth and, hence, that the known stands distinct from the nature within which it is named or specified, and thus known, and independent from the knower, as truth shining by its own light. It is legitimate, of course, to name an atom, a cell, personality and so on as designating uniqueness and individuality. But, to the extent that such concepts are not meaningful in isolation from a given context, to this extend they, as self-actional concepts, tend to mislead scientific inquiry.

Inter-actionism

With the development of human society, man's thought developed correspondingly and he came to envision his experiences in a wider context, noting that things were explained better when their relationships to each other were understood. Man thus entered a second and richer stage of his mental development. He still conceived of environmental events and happenings as distinct and discrete but he was led, as a result of his wider scope and vision, to see relationships between the items constituting his environment. "For many generations, beginning with Galileo after his break with the Aristotelian tradition and continuing until past the days of Comte, the stress in physical inquiry lay upon locating units or elements of action and determining their mode
of interaction. It may be of some interest at this point to say a few words about Galileo's discovery of the law of the falling bodies. The older physics, being self-actional, attributed to the things in nature such powers as would make the very question, "How do things move?" an absurd one. "Heavy bodies tend toward their home, the earth." The moral is that heavy bodies fall down when let go of, because they tend to fall down. There is no problem here; everyday experience bears this out. The problem with Galileo was that he envisioned the problem of the falling bodies in a wider context, the context of motion in general. He observed, a fact well known before him, namely, that a falling body acquired speed or positive acceleration as it approached the earth. He started to make further observations and experiments in connection with the speed of moving bodies. He studied the acceleration of bodies falling from an inclined plane and found that the acceleration decreased consistently with the angle of acceleration, i.e., as the angle of inclination diminished from 90°. This was just half the picture and Galileo went beyond, coupling his findings with the case of a body thrown upwards in the air. Upward motion was thus conceived in a wide framework or a continuum depending upon the size of the angle of inclination. His experiments bore this out. The case of a falling body was thus shown to be the


6 Max Wertheimer, Productive Thinking, p. 161.
opposite case of a body thrown upwards. The first was a case of positive acceleration, while the latter was a case of negative acceleration. Both cases were aspects of a common phenomenon, the acceleration of motion, which depended on the angle of inclination. The case of motion on a horizontal plane then became easily explainable. It became the case of motion when the angle of inclination is zero. With the angle of acceleration equaling zero, acceleration should be zero and hence a moving body on a horizontal plane should continue its motion at constant velocity if nothing interfered with its motion. This was contrary to the pre-existing axiom—namely, that a moving body on a horizontal plane would gradually decrease in velocity until it came to a standstill. Galileo's law was called the law of inertia. It reads: a mass once in motion continues in motion in a straight line, if not interfered with by other moving masses. This conclusion represented a drastic change in human thought and its importance was far-reaching.

Most important perhaps was the shift it marked from self-explanatory methods, based on self-actional concepts, to experimentation and observation in a wide context. In other words, within self-actional reasoning one isolated case or event sufficed to explain the force, spirit or power responsible for a given activity, with the same force taken for granted as the responsible

7 The old axiom was: "the moving body sooner or later comes to a standstill if the force which is pushing it no longer acts." See Max Wertheimer, Ibid., p. 161.
agent in different situations. In the new approach a single isolated instance no longer sufficed. It was recognized that interpretation of natural phenomena was contingent upon the situation inquired into. Galileo's law contradicted, of course, common sense notions and everyday observations, since then, as now, it was a self-evident fact to the naive person that heavy bodies fall to the ground when not supported and moving bodies sooner or later cease to move when an outside force has ceased to act. These everyday experiential understandings represent isolated cases and, although they may suffice in their narrow and limited scope, they fail to offer any help when applied in a different situation or in a wider context. This raises the problem of knowledge and epistemology, but we will defer this until we have considered the transactional approach.

We need only to say here that this law of Galileo was destined to start a new era in the physical sciences. It is on the basis of this law that Newton was able to formulate his famous laws of mechanics. We may note in passing that, "... the new view was transactional with respect to the situation of its appearance: what, namely, had been an incident or result of something else was now taken up into direct report as event."\(^8\) In other words, motion as caused by an outside actor was now dealt with as an event, a happening which did not demand an outside being to cause

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it. This thus became an occasion for further inquiry. In its wider application, however, as an approach—only the concept of force acting between discrete entities was comprehended and applied to other natural phenomena.

Galileo’s law set the stage for Newton to perfect the inter­actional approach. This approach not only influenced inquiry in physics but transcended physics to almost every area of human inquiry. It may be well at this point to review Newton’s laws of mechanics to examine its wider implications for human thought in general.

The first law was taken directly from Galileo’s formulation of the law of inertia. It stated, "A particle left to itself will maintain its velocity unchanged." The second law dealt with acceleration and the direction of motion. It read: "The acceleration is directly proportional to the resultant force acting on the particle, is inversely proportional to the mass of the particle and has the same direction as the resultant force." The third law dealt with the interaction between different moving particles. It noted that "to every action there is an equal and opposite reaction."

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9 George Shortley and Dudley Williams, Elements of Physics, 1954, p. 85.

10 Ibid., p. 91.

11 Ibid., p. 94.
The philosophical implications of this position are clear. Its effect on human thought and inquiry was dramatic. Thinkers in whatever field set themselves to discover the atoms or elements which constituted any phenomenon in nature as a prerequisite for the discovery of its reactions and interaction. "Throughout two hundred years of scientific research force and matter were the underlying concepts in all endeavors to understand nature."¹² The mechanistic concept in its simple form was a matter of force between two distinct particles. Since the particles were conceived as unchangeable, the force between them depended merely on the distance between them. Such force could either be attraction or repulsion and nothing more. The success of this simple formulation in the realm of mechanics in all its branches led to the belief that all natural phenomena could be described and understood in terms of simple forces between unalterable objects. Helmholtz's position in this regards is illustrative and for our purpose is especially significant. It is illustrative because he lived when mechanistic physics was in vogue. It is significant because of his undebated influence on the science of psychology. Helmholtz said, "Finally, therefore, we discover the problem of physical material science to be to refer natural phenomena back to unchangeable attractive and repulsive forces whose intensity depends wholly upon distance. The solubility of this problem is

the condition of the complete comprehensibility of nature.\textsuperscript{13}

Every physical phenomenon was thus reduced to particular substances and forces determinable by the distance between the particles. The kinetic theory of gases, which originated in the phenomenon of Brownian movement, was directly derived from such a formulation and fitted it nicely. The whole problem was interpreted in terms of the bombardment of particles with each other and with the walls of the container. The phenomena of static electricity was also reduced to a mechanical interpretation. Electric fluids of two kinds, one positive and the other negative, were assumed to exist in any condenser that exhibited the static electricity phenomena. This mechanistic approach was adhered to even in the face of many apparent difficulties. Heat particles, as well as light particles, were found to possess no weight and thus they were considered weightless substances. Electric fluid was also added to the list of weightless substances.

Volta's invention of the electric battery added to the problems that had to be overcome by the mechanistic theory. The difficulty arose from the fact that the potential difference between the Copper and zinc plates (when immersed in sulphuric acid) did not vanish as the plates were connected, a fact to be expected according to the mechanistic theory. "In an attempt to save the fluid theory," according to Einstein and Infeld,\textsuperscript{13} we

\textsuperscript{13} Quoted from Albert Einstein and Leopold Infeld, \textit{Ibid.}, p. 58.
may assume that some constant force acts to generate the potential difference and causes the flow of electric fluid.\textsuperscript{14} This is an advancement over the earlier formulation, since now the medium, that is sulphuric acid, had to be taken into consideration.

There is, however, more to the problem. Heat energy was seen to be created in the wire connecting the two plates. Again the solution was sought in the liquid medium; chemical energy was considered to be the source of the heat energy detected in the wire. The final blow to the mechanistic theory, however, came from Oersted's (and later from Rowland's experiments in which it was shown that the current passing in a wire connecting two plates with different electric potentials deflects a magnetic needle placed underneath the wire in a perpendicular position to the plane of the circuit. The mechanistic approach definitely failed to account for the relation between magnetism and the electric current. Besides, according to the mechanistic view, it could not explain the relation of the magnetic needle in a perpendicular position to the particles of flowing electric fluid in the wire and the magnetic dipoles. According to the mechanistic concept the forces responsible for such deflection act along the line joining the two attracting or repelling bodies. Furthermore, the intensity of the force, Rowland's experiment proved, depended on the velocity of the charge. Certainly there must be something more than

\textsuperscript{14} Ibid., p. 89.
particles and forces which depend merely on the distance. The problem with the mechanistic approach, as will be recalled, was that it reduced all physical phenomena to unchangeable particles and forces which depended merely on the distance between the particles.

The mechanistic principle faced similar difficulties in dealing with optic phenomena. Newton, it will be recalled, faithful to his mechanistic principle, adhered to it with respect to light phenomena. He thus rejected Huygens' wave theory of light in favor of the corpuscular theory. Newton’s description of the light spectrum is well known. In fact, the corpuscular theory of light worked fine in its time, although as Einstein and Infeld say, “the necessity for introducing as many substances as colors may make us uneasy.”¹⁵ But, following the mechanistic theory, men were accustomed to adding one or more substances to the existing list of substances whenever confronted with a problem which could not be accounted for by the substances already named. The final blow to the corpuscular theory of light, however, came as a result of its failure to account for the phenomena of defraction and polarization of light rays.

It is important, of course, not to exaggerate the progress attained in physics when the corpuscular theory was replaced by the wave theory. The accompanying mental attitude did not change

¹⁵ Ibid., p. 104.
greatly from that appropriate to the earlier corpuscular or atomic concepts. A substance as a medium for the waves to pass through still had to be postulated. This substance was referred as "the ether." Physics, thus, continued to depend on mechanical concepts. The sole difference was that the different particles assumed to represent different light colors were replaced by one substance, the ether and different wave lengths. "The result was merely the concentration of all the difficulties in a few essential points, such as ether in the case of optical phenomena." But the construction of the ether as a substance confronted men with a new insoluble problem. In order to account for the fact that the speed of light differs according to the medium it passes through, men had to assume that ether particles and matter particles interacted in some way. But they found at the same time that interstellar space did not resist the motion of material bodies. How was it, then, that ether, which according to the wave theory of light should occupy all space, interacted with particles in optic phenomena and not in mechanical phenomena? This paradoxical situation really shook the validity of the mechanistic view. At bottom there was the artificiality of the mechanistic assumptions and, hence, the "necessity for introducing so many of them, all quite independent of each other, was enough to shatter

\[\textit{Ibid.}, \textit{p. 125.}\]
the belief in the mechanical point of view."\textsuperscript{17}

We may recapitulate here by saying that the fall of the mechanical view came as a result of the many problems it could not solve. It was discovered in electrical phenomena that when an electric current acted upon a magnetic needle, two unrelated phenomena from a mechanical point of view, the force depended not merely on distance but also upon the velocity of the charge and that the effect was neither repelling nor attracting but perpendicular to the line connecting the needle and the charge.

In the field of optics the assumption of ether as a substance remained without validity so long as the mechanical properties of that substance could not be determined. "But the difficulties in solving this problem are so great that we have to give it up and thus give up the mechanical view as well."\textsuperscript{18}

\textbf{The Trans-Actional Approach}

We have, so far, reviewed the conditions that led to the gradual collapse of the mechanistic view, not that it was ineffective in its domain nor that it fails today to account for certain phenomena with marked efficiency and accuracy. Its main difficulty lay in its growing complexity as it came to grips with

\textsuperscript{17} Ibid., p. 124.

\textsuperscript{18} Ibid., p. 126.
problems of wider scope than the relatively simple ones on which it was built. Furthermore, it faced some problems of its own making. The many independent entities or substances it had to postulate as it went along proved to be irreconcilable. The mechanistic theory finally fell in its own trap, so to speak. A more effective theory had to replace it, one more effective in the sense of being more encompassing of natural phenomena and built on simpler basic assumptions.

The new theory had its start in the electric phenomena referred to in the foregoing exposition, especially in the relationship between electric and magnetic phenomena revealed by Oersted's and Rowland's experiments. Faraday later discovered the induced currents which firmly established the relationship between the magnetic and the electric phenomena. Without going into detail here, it suffices to say that Faraday's discovery simply led him to the conclusion that the electric current was not contained in the condenser box nor confined to the connecting wire. Maxwell treated Faraday's findings mathematically and arrived at his mathematical equations by which those findings could be expressed. The field concept was thus born.

This new concept led to the understanding that it is not the changes nor the particles but the field in the space between the charges and the particles which is essential for the description of physical phenomena. Maxwell's law was instrumental in enabling men to envisage electrical and the magnetic phenomena (their
relationships were a sort of nuisance from the mechanistic point of view) in a new light. A new concept was formulated—namely, the electromagnetic field, which accounted for the two aspects, the electric and the magnetic, and for optical phenomena. The significance and the far-reaching implications of Maxwell's work for human thought may be seen in his own writing.

Physical science, which up to the end of the eighteenth century had been fully occupied in forming a conception of natural phenomena as the result of forces acting between one body and another, has now fairly entered in the next stage of progress—that in which energy of a material system is conceived as determined by the configuration and motion of that system, and in which the ideas of configuration, motion and force are generalized to the extent warranted by their physical definitions.¹⁹

Dewey and Bentley observe that Maxwell not only saw the significance of the new mode of thinking, i.e., the trans-actional, for the advancement of physical sciences more than one hundred years ago but that he even used the very word 'transaction.'²⁰ Maxwell said:

If we confine our attention to one of the portions of matter, we see, as it were, only one side of the transaction—namely, that which affects the portion of matter under our consideration—and we call this aspect of the phenomenon, with reference to its effect, an External Force acting on that portion of matter, and with reference to its cause we call it the Action of the other portion of matter. The opposite aspect of the stress is called the Reaction on the other portion of matter.²¹

¹⁹ Loc. cit.

²⁰ Ibid., p. 106.
Dewey and Bentley further observe that Maxwell used the term aspect in the same sense they use it in connection with the transactional approach they describe.

At Einstein's hands, the field concept was so formulated as to encompass wider and wider physical phenomena in terms of the theory of relativity. We need not here say more about the relativity theory than that it brought the time-space continuum under investigation. We have so far witnessed the beginning effectiveness of this theory and we still have a long way to go. Einstein still believes that the relativity theory has not, as yet, broadened the field concept far enough to encompass all physical phenomena. "The theory of relativity stresses the importance of the field concept in physics. But we have not yet succeeded in formulating a pure field theory. For the present we must still assume the existence of both field and matter."\(^{22}\)

At this point it is proper to ask what is the significance of the theory of relativity for human thought and action? In general, we may say that the theory of relativity has effectively destroyed the absolutistic feature of Newtonian mechanics. Dewey and Bentley put it this way: "Newton's mechanics rose to credal strength in the shelter of its glorified absolutes. Then at the hands of Faraday, Clark Maxwell and Einstein it lost its absolutes, lost its credal claims and emerged chastened and improved. It thus gained the high rating of a magnificent approximation as

compared with its earlier self-rating of eternal certainty. As physical phenomena were dealt with in a wider framework the atomistic and absolutistic conceptions declined. "The concepts of substances, so essential to the mechanical point of view were more and more suppressed." As an instance, say Einstein and Infeld, "The progress of science has destroyed the older concept of heat as a substance. We try to create a new substance, energy, with heat as one of its form." In other words, physical phenomena are treated transactionally, with mass and energy representing different aspects of the same phenomenon. Thus, "Mass is energy and energy has mass. The two conservation laws of mass and energy are combined by the relativity theory into one, the conservation law of mass-energy."

Further citations from the theory of relativity would point up the effect of the new transactional theory on progress in the physical sciences. The more important issue here, however, is the position of the scientist with respect to physical reality or, in other words, to the knower with respect to his position and to the known. Before turning to this problem, however, we

25 Ibid., p. 51.
26 Ibid., p. 260.
shall note briefly how other branches of the physical and natural sciences have followed, in their progress, more or less the same pattern physics has followed, i.e., from the self-actional to the interactional and finally to the transactional approach. We shall start with chemistry.

The self-actional concept can be traced back to ancient Greek thought, when the universe was conceived as composed of entities such as water, fire, air and earth. All other forms of matter were looked upon as a matter of the transformation of these basic elements. Just how those assumed transformations took place was not clear. The second step is usually associated with Dalton's atomic theory. This theory is too well known to be reported here. What is of interest is that Dalton's theory, following strictly a mechanistic or inter-actional approach, dealt with atoms as mechanical entities which were considered unchangeable. Chemical reactions were interpreted in terms of an affinity between unchangeable atoms. The third or transactional stage came gradually as a result of Volta's discovery (referred to previously) that chemical reactions may produce electric currents. In 1923 G. N. Lewis and J. N. Bronsted independently set forth the electronic theory of chemical reactions, referred to as the proton theory. The interaction between chemical compound ions or groups has been found to be influenced by various factors, such as the concentration of the solution, the type of solvent, the structural formula of the compound and so on. The term reaction or interaction, in
chemistry today refers, in fact, to a transaction whereby the constituents in any given system of reactions are electrically interdépendent.\textsuperscript{27} Le Chatelier's law of mass action illustrates the point. The stress on configuration was further enhanced by the advent of the quantum theory and the reinterpretation of Mondelif's periodic system in the light of the electronic theory. Accordingly, chemical reactions are treated in terms of uncompleted orbitals in different chemical systems.\textsuperscript{28}

In biology the movement from the self-actional approach, as represented by the "vital principle," to the interactional and, then, to the transactional approaches has been relatively slow. This, in general, has been the observed trend as we approach areas which directly bear upon human life and human concerns. Our store of archaic self-actional concepts find asylum and free play in these areas. It is not surprising, therefore, to find that the "vital principle" in biology survived until very recently. As far as the interactional approach is concerned, this gradually gained status as a result of Schleiden and Schwann systematizing the scattered discoveries about the cell. The cell was then considered to be the basic unit of life. The interaction of cells in tissues and organs was and still is, to a great degree, the major occupation of the biologist. The study of unicellular


animals and plants was considered as basic to the understanding of the basic unit of life in higher organism—the cell. The tide has changed, however, albeit very slightly. There are no more unicellular animals as such but acellular and multicellular animals. Organismic concepts are gradually being worked out. The study of cells or of tissue interactions are legitimate, of course, but the trans-actional approach demands the investigation together of what belongs together. What is legitimate for study in isolation may be so studied, as long as such investigation returns to the broader field of relationships. Thus in the study of the cell the tissue interactions may be legitimate objects of scrutiny if what is discovered is related back to and broadens our understanding concerning the organism as a whole. The direct study of the organism as a whole may not prove possible. This is not a defect in the transactional approach; it is related, rather, to the sterility of the concept of the whole, especially when it is thought to embrace some self-actional elements in disguise.²⁹

In other words, the cell may be investigated as a cell but in an environment of tissue; tissue interactions may be investigated but as related to the vital organism; and the organism as a whole may be investigated as a unit but in an environment.

The formulation of Mendel's laws of heredity, followed by the identification of the gene, marked a new era in the investigation

²⁹ For further elaboration of this point see John Dewey and A. Bentley, Op. cit., p. 126.
of the phenomena of heredity. The gene was hailed as the carrier of the secrets of life. True to the self-actional concepts, geneticists regarded the gene as the unchangeable entity which goes on unchangeable from generation to generation. The facts of life, however, did not bear out this simple formulation. It is well known that the characteristics of living organisms change from one generation to the other. But the self-actional concept of the gene almost blinded the early geneticists to this fact.

The second or inter-actional stage in genetics may be illustrated by the emphasis geneticists put upon the connection of many factors or genes combining in various ways in the chromosomes to determine biological traits. The third stage, that is, the transactional stage, is still in its infancy. Geneticists are now developing the integrated field stage, in which scientists do not pay so much attention to the genes as predetermined traits. Julian Huxley shows how the genes are no longer considered unchangeable entities which independently determine the biological characteristics of the organism. Genetics has already started to emphasize the importance of the medium and the configuration of all the genes. Says Huxley, "The environment of the gene must include many, perhaps all other genes, in all the chromosomes." In fact, the discreteness of the genes as such is doubtful. Huxley believes that "The discreteness of the genes may prove to

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be nothing more than the presence of predetermined zones of breakage at small and more or less regular distances along the chromosomes. More important perhaps is the fact that the advancement of physiology has rendered the gene concept almost fruitless.

A brief notation about the evolution of psychology will suffice at this point. We shall return to psychology later. The first stage is an old one, indeed, in which an imponderable, non-spatial entity was assumed to encompass psychic phenomena. This entity was called variously the mind, the self or the soul.

The first stage merged into the second in early philosophical systems, and in prescientific psychology in one form or another, depending on the kind of entity assumed to carry the load, or to be the center, of psychic phenomena. The tendency for mentalistic entities to crop out is greater in psychological doctrines, than in other natural sciences; and, in fact, long after such mental entities had become submerged in the sedimentary layers of natural science they held their place in psychology. The story of mental and bodily interaction is long and a painful one. The wavering of psychological thought between sensations and mental states as products of interaction between external and internal factors

31 Ibid., p. 48.
32 See Chapter I for a discussion of this phase of psychological development.
is a long story too well known to be discussed again here. But interaction took still more different forms. It took the shape of statistical formulae indicating the relation between the mental—for example, sensation—and the magnitude of the stimulus or physiological excitation. Still another form of interaction may be illustrated by behavioristic doctrines, especially in their early formulations, where units such as the reflexes were assumed to interact with outside stimuli and thus form the basis of all modes of behavior.

The third stage that is the transactional stage is hardly in evidence. Many psychologists, such as E. Brunswik and G. L. Hull, are showing more and more concern about treating behavior in terms of organism-environment in inseparable unity. This new understanding, let us remember, was stressed by Dewey in an article 'The Reflex Arc Concept,' almost sixty years ago.\(^{33}\)

Another transactional approach, so named, which may prove promising, started as a result of the perceptual experimental work at the Hanover Institute under the direction of Ames. The recognition of the significance and importance of this new approach is evidenced by the duplication of this work in other universities and research centers, of which The Ohio State University Demonstration Laboratory is one example. We shall focus our attention on this new approach in the next chapter.

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At this point we shall look critically at a problem we have so far left in suspense—namely, the place of the knower with respect to reality or the known. This we can best do as we compare the two more recent approaches of inquiry just discussed, the inter-actional and the trans-actional. So far as the self-actional approach is concerned, it is an approach no scientist would now make. When we turn to the inter-actional approach, however, we meet with a different picture. Interactionism seems still to be in full sway, especially with respect to the social sciences. In order, therefore, to throw some light on the problem of selecting one of the two approaches over the other we shall have to contrast them. In doing so we shall draw upon the preceding exposition of the progress in physical and natural sciences.

**Interaction versus Transaction**

Inter-actionism, as we have seen, implies the discovery of events of action, the units of which are assumed to be unchangeable, to be fully defined before the start of inquiry. We have seen that inter-actionism in all areas of inquiry has focused upon the determination of the units of action, whether in terms of material particles, magnetic or electric fluids, genes, cells and the like. Inquiry starts with these entities being adequately named, described and known and has as its purpose to determine
their modes of interaction. In contrast, transactional inquiry is such that description of events is taken as tentative and preliminary. In other words, new descriptions of the aspects and phases of events may be freely made at all stages of the inquiry. In transactionism, in short, inquiry is not directed towards the discovery of eternal qualities which are existentially real. Qualities of objects are functionally determined; they are never viewed as final. In the transactional approach, "It is not postulated that certain qualities always cohere in function. They cohere as dependable evidential signs." \(^3\)

It follows from the above that interactionism is absolutistic, in the sense that inquiry does not touch upon the presumptive objects themselves but only upon their actions and reactions. The unchangeable atom in Dalton's atomic theory is a case in point. Transaction, however, concerns itself with the redetermining and renaming of the objects comprised in a given system. We have seen in the foregoing exposition how the interactionist approach was stultified by its dependence upon presumptive particulars—such as, heat, the calorie (or particulate), light as corpuscular, the gene as an entity and so on. In relativity theory the concept of substance is being more and more suppressed and the particle has gone the way of space and time. It is the field, in which relationships are determinative, that has become the locus of inquiry.

A distinction between interactionism and transactionism can be made accordingly by a contrast of the field concept with the mechanistic concept. Thus, while interactionism treats the interacting constituents as separate from and independent of one another, in transactionism no one constituent can be adequately specified or defined as fact independent of or apart from the specification or definition of the other constituents comprising a unity or a system. "The path of a light ray, without including the environment of the light ray in the description, is an incomplete impression and has no operational meaning."\(^\text{35}\) And to this Phillip Frank adds, "Speaking exactly, a particle by itself without the description of the whole experimental set-up is not a physical reality."\(^\text{36}\)

The interaction approach, by focusing upon discrete entities, may be said to develop "the particularizing phase of modern knowledge." In contrast,\(^\text{37}\) "transaction develops the widening phases of knowledge, the broadening of system within the limits of observation and report."\(^\text{38}\) We need only refer here to the advantages of the transactional approach of Einstein's relativity theory over Newton's mechanistic theory. It not only helped


\(^{38}\) *Loc. cit.*
solve the problems Newton's mechanistic theory had created and failed to solve but led, also, to great advances in atomic physics as a result of its broadening outlook.

Interactionism views things as primarily static. In other words, time is no factor in investigation. Transactionism, in contrast, considers things in action, with action as observable as the objects. In other words, extension in time is as indispensible as extension in space. This distinction is of paramount importance. Under the interactional approach inquiry is assumed to determine the properties of an object as a thing apart from its activity; under the transactional approach, on the other hand, "things and actions are taken as marking provisional stages of subject matter to be established through further inquiry." 39

Up to this point we find the transactional approach quite in harmony with the most advanced physical understandings in physical and natural sciences. In order that we may complete the picture and draw the contrast between the two approaches to its logical conclusion, however, we shall have to consider the place of the knower with respect to reality or the known. This point is of special significance for psychological and philosophical understandings, though it is hardly clear to those who specialize in physical sciences. It is a source of serious confusion, therefore. This confusion leaves its impact upon the science of   

39 Ibid., p. 122.
psychology, since it is this area of inquiry which focuses directly upon the organism in relation to its environment.

The Knower and Reality—or The Known

Here we find ourselves facing an epistemological dilemma, since many thinkers tend to introduce a self-actional concept when viewing the relation between the organism and its environment. This, despite the fact that their approach to the physical environment may be quite transactional. In order to make this point clear we shall consider two critical propositions and examine the logical outcome of each.

First, there is the position that confines the human organism as knower in an position isolated from the rest of the world; or, more specifically, views it as a mental knower. Existence, as such, is then conceived as radically different in kind from the knower and is set over against the known. This does not necessarily imply an explicit recognition of a mental power as knower but, in fact, includes the most mechanistic as well as the most vitalistic points of view. Such a position is forced to postulate some natural laws—whether in physical phenomena, psychological phenomena, logic, etc.—to which knowing must conform. In other words, knowing must somehow conform to external reality through the discovery of natural laws.
The second proposition, which is consistently transactional, conceives of man as an organism, behaving in a world of his origin, with his knowings included. In other words, this second position envisions man with his knowings and knowns within the framework of the theory of evolution. No separation between the knower and the known is hypostatized or considered necessary. Whenever reference is made to the "outside" world, it is only made arbitrarily and refers to an aspect of a given transactional action which may be the locus of inquiry at any given time. A false conclusion is usually made by critics of this premise—namely, that such a position denies reality and consequently denies existence. The critics could hardly be more wrong. Reality qua meaning is nonsensical, but reality qua existence is fact, and by fact, is meant the locus of inquiry, or the matrix of knowing with man a part of it. In other words, inquiry proceeds within an existential matrix; and the matrix is the locus of knowledge; knowledge as an evolving process.10

Before examining the implications of such contradictory positions in their relation to psychological theory, it will be helpful to turn once more to physics. We have seen how Einstein tried and was able effectively to construct the theory of relativity according to a transactional approach. We need not go into any further detail about that here. Our concern at this point is with his position towards the knower and the known. One would

10 John Dewey's Essays in Experimental Logic and Logic: The Theory of Inquiry take their points of departure from this standpoint. Also his article, "The Reflex Arc Concept" written about 60 years ago follows the same view.
assume that Einstein, who so effectively contributed to the
decline of the mechanistic view, would continue with the same
rigor concerning the nature of inquiry. And, indeed, he at
least implies the free play of intelligence so far as physical
phenomena are concerned, as he asserts that, "there are no
eternal theories in science. It always happens that some of
the facts predicted by a theory are disproved by experiment.
Every theory has its period of gradual development and triumph;
after which it may experience a rapid decline."\(^{141}\)

Einstein was neither a philosopher nor a psychologist and
epistemological and behavioral phenomena, as such, were out of
his field. When we come to his position on the nature of reality
we sense at least some contradiction. Thus he seems, as pointed
out by Dewey and Bentley, to set the mind (as knower) over and out­
side the known, in saying "Physical concepts are free creations
of the human mind and are not, however it may seem, uniquely
determined by the external world. In our endeavor to understand
reality we are somewhat like a man trying to understand the
mechanism of a closed watch. He sees the face and the moving
hands, even hears its ticking, but he has no way of opening the
case."\(^{142}\) This suggests that Einstein assumed an outside reality
which in some aspects is unknowable as far as experience is


concerned. The mind, as knower, is presumably supposed to create reality as he looks at it from the outside, though it may never reach it. The illustration of the watch is significant. Einstein failed to see, however, that inquiry, with man in the matrix of existence as locus, not only solves problems but also creates them. The problems which are outside of experience (whatever this may mean) never occur. In other words, Einstein failed to see man as Dewey did, as in and of the world he is inquiring into. He seems, in other words, to conceive of man—as knower—to be existentially different from physical reality which he inquires into. "That reality possesses practical character which is most efficaciously expressed in the function of intelligence, that a reality-to-be-known is a reality-of-use-and-in-use and that 'a reality which is not in any sort of use or bearing upon use may go hang so far as knowledge is concerned," A. Bentley, "Comments and Criticisms, As Through A Glass Darkly," J. Philosophy, p. 438 (italics in original).

Einstein's position may be made still more clear by an examination of his concept of numbers. "The concepts of the pure numbers 2, 3, 4, etc., freed from the objects from which they arose are creations of the thinking mind which describe the reality of our world," according to Einstein. Einstein here, again as a result of his conception of man as knower as being outside of

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Ibid., p. 311.
reality, is forced to conceive of mathematics as a pure form which describes the reality of the world. Many modern thinkers tend to hold to this belief, a belief which may be traced back to Kant in his assertion that the truth of mathematics is independent of experience. A close examination of the concept of pure number, following the transactional approach, will reveal that mathematics is a matter of symbolic organization with respect to ‘naming.’ It does not differ essentially from other forms of linguistic behavior of man. When we say two plus two equals four always and everywhere, independent of experience, and hence claim that this is an absolute truth, we forget that in the equation 2 plus 2 equals 4, we have merely put in both sides of the equation what would make them equal. There may be an element of truth in Hume’s contention that mathematical truth is tautological. We need not go so far, however, as to consider it the only absolute truth or an absolute truth at all. We merely knowingly organize our symbols in such a way as to express our experiences. In other words, we formulate the proposition that 2 plus 2 equals 4 and develop a system following that. This may mean, as some critics point out circularity in reasoning; this the transactional view admists, noting that reasoning is essentially circular, be it in the mathematical realm, the scientific realm or in whatever realm in which man engages in inquiry. There is no escape from this. So long as man keeps his assumption or postulates close to his investigations and findings, and allow both sides to play
back and forth reversely modifying each other and being mutually coherent, he is on safe grounds. No theory, whether mathematical or otherwise is true unto itself without experimental verification. In fact, no theory, as Einstein has pointed out, is ever absolutely true.

An argument between A. Einstein and his associates, B. Podolosky and N. Rosen, on the one hand, and Neils Bohr, on the other, is enlightening. Einstein and his associates maintained that "if no one can predict with certainty the value of a physical quantity" then "there exists an element of physical reality corresponding to this physical quantity." They added that in a complete theory and not merely a correct one .... "every element in the physical reality must have a counterpart in the physical theory." Neils Bohr said, in answer, that the above-mentioned position concerning physical reality contained an "essential ambiguity" when applied to quantum phenomena. He further asserted that while reality had brought a modification of all ideas regarding the absolute character of physical phenomena, "a modification of all ideas regarding the absolute character of physical phenomena,"... "radical revision of our attitude as regards physical reality," is required in view of the still newer features of physics. On commenting on this debate Dewey and

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Bentley said, "What is involved here is an underlying, though not explicitly developed, conflict as to the manner in which mathematics (as symbolic) applies to physics as (fact-seeking). This in turn involves the organization of symbol with respect to name among the linguistic behavior of men."\(^6\)

Interactionism, as shown in the foregoing proposition, views the organism as separate from the environment. It views organism and environment as if they were different forms of existences and, therefore, as far as inquiry is concerned, the organism has, somehow, to discover reality in a state of independence from its own existence. In other words, interactionism assumes an outside reality which interacts with the organism (whether in term of mental or physical entities) to produce knowledge.

Transaction, in contrast, views the organism as in and of the world. Reference to inner or outer with respect to the organism merely signifies the locus of investigation and not a separation between the organism and its environment. Transaction thus views inquiry as an evolutionary process. It does not hold dogmatically to any views as ascertained truths before entering into inquiry.

In summary we may say that the transactional approach does not accept any of the familiar dualisms: subject versus object, soul versus body, mind versus matter or self versus non-self.

\(^6\)

John Dewey and A. Bentley, "Ibid., p. 115."
Knowing, in like manner, is not set off distinctly from the known, nor is the knower separated from the known. No absolutes or entities are assumed to exist outside the experience of the knower to serve as the objects of inquiry and no vitalistic or mentalistic entities are assumed as knowers. "Since we are concerned with what is inquired into and is in process of knowing as cosmic event, we have no interest in any form of hypostatized underpinning. Any statement that is or can be made about a knower, self, mind or subject—or about a known thing, an object, or a cosmos—must so far as we are concerned, be made on the basis, and in terms of aspects of event which inquiry, as itself a cosmic event, finds taking place."[4]

At this point we find ourselves in a position to be able to examine psychological theory in terms of the transactional approach to find out what the implications of such an approach are for the study of behavior. This will be the object of the next chapter.

[4] Ibid., p. 86.
This exposition of psychological theories has confined itself to certain aspects of psychological theory today and some of the persistent problems with which they deal. As a result, it has been confined, by and large, to relatively insignificant issues, if we adopt a wider frame of reference than do most present-day psychologists. Psychology has lived for some time, indeed, for quite a long time, with the rat in his maze. It has done so, the psychologists seem to indicate, in the hope of arriving at fundamental principles that might clear up some of the insistent and crucial problems of our times. But the rat in its maze, and the principles and laws derived from such situations, do not offer much, if any, help when we confront certain crucial problems of our times which are significantly psychological. In a comparable criticism of the state of psychological theory Allport has said, "Public officials, confronted by post-war dilemmas, are urgently seeking the aid of psychologists. Many of us who have been approached are embarrassed by the scarcity of scientific findings, and even of serviceable

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See Chapters 2, 3 and 4 especially.

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concepts and well-formulated problems, that psychology has to offer of the type being sought.²

Psychologists are, indeed, way behind the expectations of a world ridden with fear, anxiety and turmoil. One concept from behavior theories may be illustrative. Behavior is viewed, in one group of behavior theories, as essentially dominated and guided by rewards and punishments. When we inquire into the meanings of these concepts we hardly find reasonable agreement. We have to draw our own conclusions. Reward is essentially a pellet of food at the end of a maze, and punishment has become almost a synonym of an electric shock. It is from such limited envisionment that the sweeping generalizations have been made frequently to provide a basis for the interpretation of human behavior.

We have chosen to dramatize this picture in order to make a point. It would be unfair, indeed, to assume that psychologists are not apprehensive about the readiness of psychology to play a serious role in human affairs. Nor dare we overlook the vital services some branches of psychology, such as counseling psychotherapy and the like are offering. The questioning is more specific, related to the legitimacy of the limitations many psychologists

seem to have deliberately put upon the scope of their inquiry. The problem does not change even when psychologists turn their attention to problems of social importance. They simply bring to such important problems the tools with which they are familiar, tools developed in their preoccupation with animal behavior. "Accustomed to work with animals or with infants, need cathexis psychology labels adult human intentions 'secondary drives,' 'derived drives' or 'drive conversions.'"3 And this despite the fact that essential differences between lower animals and man have been shown and emphasized, especially with respect to one feature, symbolic behavior. Thorndike early in his career made a distinction along this line between lower animals and man. According to him, animals react to things or signs while man thinks about them. In other words, animals may be said to 'think things,' whereas man 'thinks about them.' In making this distinction between these two modes of behavior he contended that man was capable of both but that lower animals were capable only of reaction to concrete objects. "The one sort of attention leads you to think about a thing, the other to act with reference to it."4 This distinction, however, did not turn out to make much difference with respect to Thorndike's system, especially

3 Ibid., p. 160.

in its later development. Thinking was viewed, essentially, to be of the same nature as other modes of behavior. All were reduced to physiological processes. Hence, the laws that applied to animal learning and behavior in general were essentially the same laws that applied to man's. In this connection Thorndike, in a later work, said:

... the right weighting of elements, held in right relations, and connected with right associates, explains correct thinking. Thinking and reasoning are very different from automatism, and custom, and habit in their superficial appearance, and also in their power. But in their fundamental nature they are not the opposite of automatism, custom and habit, but rather are bone of their bone and flesh of their flesh. They show the action of simple general laws of connecting in cases where the connections are with elements of the situation rather than with gross totals and where the connections compete and cooperate in subtle and complicated organizations.5

Thorndike's view concerning thinking is essentially the same view held by contemporary behavior theorists. We have seen, for instance, how Hull interprets ideas by saying that pure stimulus acts are not the cause of ideas but are themselves the ideas. Behaviorists all seem to solve such problems by anchoring or identifying them with physiological processes or physiological entities. What then seems to be the trouble? If behavior theorists seem to be able thus to account for such fundamental concepts, such as thinking and ideas, then it should be merely

5 E. L. Thorndike, Human Learning, 1931, p. 160.
a matter of time before they may come to grips with the more complicated modes of behavior which cause many of the ailments of modern society. Patience, then, is all that a behaviorist need ask for. After all, the science of behavior is barely past its infancy, and exacting scientific inquiry cannot be rushed. Allport's question is here legitimate: "Is it that we are young and need to follow the machine model for a thousand years? Or have we gotten off to a thoroughly bad start through our adoption of root-metaphors that lead away from, rather than toward, the problem at hand?"  

The problem is thus a problem of the psychological model the psychologist selects for his system. The following citation is intriguing:

I believe that robotic thinking helps precision of psychological thought and will continue to help it until psychophysiology is so far advanced that an image is nothing other than a neural event, and object constancy is obviously just something that happens in the brain. That time is still a long way off, and in the interval I chose to sit cozily with my robot, squeezing his hand and feeling a thrill—a scientist's thrill—when he squeezes mind back.  

The machine model then seems to provide the behavior theorist with the only possible scientific framework for the study of both animal and human behavior. If this is so, we must wait patiently

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till physiology has advanced far enough to provide us with the needed data to make the study of behavior full and complete. This argument reminds us of Titchner's argument in support of the supremacy of the study of structuralism until it became possible, on the basis of our knowledge of the structure of consciousness, to study the functional aspect of behavior. We are not oblivious of the difference between the two positions: that of Titchner and that of behavior theory. The similarity in reasoning is, however, evident. Furthermore, while Titchner was criticized by other psychologists for his reasoning, behavior theorists are likewise criticized on the same score. The thesis that the machine model is the only scientific framework for the study of behavior is consistently being challenged.

Importance of the Scientific Model for Psychology

The conflicts between different psychological theories have centered for some time upon the issue raised by the molar and the molecular approaches. This signifies that psychologists from this angle at least have shown some concern about the logic of their scientific models. It is the new trend now to advocate a molar rather than a molecular approach. But this issue of molar-molecular is confusing, since it means different things to different

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psychologists, even as they work within what are said to be identical approaches.

Hull, for instance, is said to be molecular in his approach, especially by those who incline towards perceptual theories. He, himself, however, makes it clear that his is a molar approach. He asserts that his aim is to describe, "... the basic molar behavioral laws... the uniformities discoverable among the grossly observable phenomena of behavior as contrasted with the laws of the behavior of the ultimate 'molecules' upon which this behavior depends."^9

But Hull, in this respect, does not mean what some other psychologists mean by the term molar. Fundamentally, he interprets habit—a central concept in his system—as a relatively simple mechanical connection between the two peripheral events of stimulation and effector reaction, saying "... reinforcement leaves within the organism a relatively permanent connection between the receptor and the effector associated in the original reinforcement. It is this which in the present system is meant by the term 'habit,' a technical adaptation of the common-sense concept that goes by the same name."^10 In the same manner, Hull

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^10 Ibid., p. 117.
speaks about stimulus generalization, response generalization and stimulus-response generalization.

It is significant at this point to remember that Hull does not make much use of his first two postulates, especially the second one (afferent neural interaction), only giving a warning to the effect that we may not get the results expected from the peripheralist connections. In defense of his position, Hull contends that he focuses on small segments of behavior to insure the accuracy of prediction. He says, "It would seem, however, that the smaller the molar segment employed, the less will be the uncertainty regarding the conditions and so the smaller will be the probabilism in molar dynamic outcomes." The difference between the significance and implications of the molar units for different psychologists may be seen if we contrast Hull's conception of molar units with that of others with a gestaltist bent. Krech and Crutchfield say:

In the absence of molar units, the description of behavior can be little more than an enumeration of unsystematized bits and pieces of momentary, limited, and unrelated responses. Viewed wholly, in the context of needs and goals, on the other hand, the behavior of the individual can be seen as meaningfully organized. The unity implied in the molar description is not the individual as he behaves; the individual is a dynamic unity, a whole person, and it is as such that he takes part in social phenomena.\footnote{Ibid., p. 121.}

A brief reference to other behavior theorists may here suffice. Skinner holds with Hull the concern about the importance of relatively gross behavior segments. But his system is definitely molecular, if we take the above citation as a frame of reference. Guthrie, however, seems to go to the extreme in the direction of molecular behavior in view of his attention to bodily movements rather than to achievements.

The molar versus molecular issue, although a symptom of disagreement and perhaps some dissatisfaction with respect to psychological systems, does not really diagnose the problem. This is chiefly because the issue goes deeper than that. Litman and Rosen present seven meanings of the issue. These are:

1. Interaction: By which term is meant the distinction between experiments and observations employing many variables in interaction with each other as contrasted with the classical experiment of one independent, and one dependent variable in isolation from all others. The former approach is molar, the latter molecular.

2. Action units: The molar unit of description is one which starts by a need and ends by cessation of behavior by achievement of a goal. For a behavior unit to be molar or molecular, therefore, depends on its meaningfulness as a functional unit. This in turn depends on the system.

3. Levels: This refers to the physiological correlates of behavior; if in terms of ultimate units, it is molecular and if in terms of gross concepts, it is molar.

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4. **Construction:** This refers to phenotypic vs. genetotypic explanations. Genetotypic explanation is considered more molar than phenotypic, since the former focuses on the observables only, while the latter transcends the merely observable to intervening variables and constructs.

5. **Phenomenal:** This criterion considers as molar those theories which treat data as given; putting its emphasis on the appearance of the variables and the process by which they are observed, rather than on their derivation or analysis, which is considered molecular.

6. **Urgency:** This criterion is a moral one. Problems deemed significant for society are considered molar, otherwise they are molecular. This criterion, therefore, emphasizes methodology only insofar as it leads, or does not to the investigation of significantly social problems.

7. **Holism:** An old and ambiguous criterion. If the behavior phenomenon is treated as a whole, it is molar; otherwise it is molecular.

We do not seem to benefit much from these distinctions. For some the issue is basic; for others it is relative, a matter of degree. At bottom is the psychological model which this or the other psychologist prefers for the interpretation of behavior; this, in turn, depends on his general philosophical outlook. One may say, referring back to our historical introduction, that behavior theorists, in an attempt to save the science of psychology from the entanglement of the mysterious mentalistic processes which its historical orientation had led it into, and in keeping with a purely empirical methodology, emphasized the observable and only the observable. And the observable ultimately became the mechanical.
On the other side of the fence we find a different philosophical orientation, and hence a different psychological model. We have seen how the gestalists, in their emphasis upon sensory organization, have undermined the importance of past experience and hence learning. The whole is emphasized, perception is a given or almost a given. The extreme case of such an approach is found in Wheeler's organismic psychology in which he goes beyond Gestalt and rejects the theory of memory trace to account for memorizing. And as we saw in our analysis in the preceding chapter his concept of the organism comes close to a self-actional system.

Conceptual Framework of Psychological Systems

What is it that a science of psychology does or should do in order to fulfill its social and moral task and at the same time keep itself scientific and not regress to the entanglements of metaphysics. This question has to be considered carefully before we venture to pass judgment on any given system. Is positive empiricism a safe guarantee? One hesitates long before saying "Yes" or "No" to this question. One may be exacting so far as fact finding is concerned without being fully scientific. At the same time, one may be very scientific in dealing with problems which do not count much so far as their social function and significance are concerned. It is neither the method alone nor
the content alone that make or break the significance of the scientific method. The choice of the problem to be inquired into is as much a concern of the scientific method as the most accurate findings. In a sense, the choice of the scope of inquiry is of more importance than the results of investigation. We need to focus on the context of psychological systems as a preliminary step for their evaluation. For this purpose we will have to envision the organism in its environment and analyze the situation in the hope of finding out the possible loci for investigation. In doing this, we do not imply that such loci are independent entities, or that they constitute dichotomies in such terms as inners and outers environmentalistic and organismic. They are mere abstractions and as such they are arbitrary.

The organism is active; and it lives in an environment. It is surrounded by environmental objects and things. It has had its past experiences and it faces a future—immediate and remote. On this simple descriptive level we seem to have said almost nothing new. But it is essentially this picture that a psychologist has to adapt and manipulate for his purposes. The following categories may help clarify this point.\(^{14}\)

1. Remote past.
2. Immediate past.
3. Concrete objects in the environment. (Things and/or organisms as distal representation.)

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\(^{14}\) Adapted from E. Brunswik, "The Conceptual Focus of Some Psychological Systems," Journal Unified Sciences, 1939, 8, 36-49. The analysis that follows, however, is not based on Brunswik's but on the philosophical background presented in the preceding chapter, i.e., in terms of self-action, inter-action and transaction.
4. Local stimuli impinging upon the skin boundary of the organism (including stimuli on the retina and other receptors) organs such as the skin proper, tongue, etc.

5. Central events within the organism (whether conceived of in terms of nervous, brain or mental processes.)


7. Immediate effects of muscular reactions (in terms of satisfactions, rewards, punishments, goal achievements, etc.)

8. Consequences of reactions and their effects.

Accepting this as an adequate representation of the total situation, we may proceed to analyze different psychological systems briefly with respect to their points of emphasis.

First Field Theories—Mainly Gestalt

Gestalt theorists do not pay much attention to remote past experience. They emphasize the immediate past to the extent that it designates a state of disequilibrium or a gap to be closed. In other words, the immediate past is continuous with the present in terms of motivation. They do emphasize concrete objects in the environment as distally represented. In fact, this point in Gestalt psychology influenced the whole system. The emphasis on distal representation of objects in the environment is not so much in terms of the manipulation of these objects as it is in terms of what is perceptually given. With respect to proximal
stimulation, Gestaltists emphasize organization. Instead of limiting themselves to local stimulation of receptor organs in terms of a single stimulus, they extend the notion of a stimulus to the stimulus pattern, or sensory organization, which is independent of past experience, whether in terms of interpretation or of learning, as is emphasized by learning theories. Perception does not correspond to local stimulation. Hence a gap is created between what is "out there," i.e., the object or event in the environment and what is actually perceived by means of central brain processes which are summed up in the principle of isomorphism. This is to say that there is a sort of parallelism between the structure of the outside world and what goes on in the brain.

The term "outside world" advisedly, since the organism does not actively participate in what happens to him. The outside world is described in terms of the field concept and so is the organism, and in between the two seemingly separate fields, there are mediation processes which are described by the law of Pragnanz. When we come to areas of learning we find the concept of insight, which dawns on the organism somehow after the brain has fulfilled its task in representing the happenings outside and hence the gap is closed. There is no interest in muscular reactions as such, although when it is dealt with as by the organismic psychologists the locus of interest lies in following its development from the
whole—that is—the unstructured whole—to the parts through structurization. The immediate effects of muscular reactions is of secondary importance to insight and structurization. Once the situation is perceived in a certain fashion, then action follows. Learning is abrupt, not as a result of transaction, manipulation of the objects of the environment, but as a result of perceptual closure.

It is significant here to note that psychological theories which are influenced by Gestalt theory, such as Tolman's molar behaviorism, lean heavily towards this sort of interpretation. The cat in the maze learns the position of the food—what leads to what—without eating or even touching it. Perceptually, the cat somehow gets to know that that is food by merely seeing it (even though it may not need it and, hence, not look for it at that time,) and that a particular route leads to it when needed. And finally the consequences of reactions and their effects are also tied up with the concept of insight. In a future occasion, the stool which the chimpanze has used before as a chair to sit on, for instance, becomes as a result of insight in a problematic situation, a tool by which a banana hanging from the ceiling may be reached. As a part of the phenomenal field, it is no more just a chair, it is now a tool to use in reaching the desired

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15 Refer to latent learning, Chapter IV.
banana. This is certainly a sound feature of Gestalt psychology so far as it goes, but in reference to the premises from which the phenomenal field originates, it represents a dangerous sign, as it is built on an implicit mental actor which is the knower and which controls behavior. Such a state of affairs reaches its extreme in the case of psychological theories which adhere only to the phenomenal field in interpreting behavior, such as the theory advanced by Snygg and Comb, and thus, as Hullfish says, tend to fall into the entanglement of sollipcism.

In a sense Gestalt psychology, though a field theory, seems to be, as Brunswik calls it a fragmentary theory. Brunswik says, "Gestalt psychology, though totalitarian or molar is, however, still fragmentary insofar as it is in its most elaborate parts, a psychology 'from the retina inwards' so to speak." The present writer does not fully agree with Brunswik's interpretation. It is true that as generally formulated the Gestalt theory, seems to focus, to a large extent, on the area from the 'retina inward.' But as a matter of fact, the laws by which they describe the inner processes did not come primarily from a direct physiological analysis of the inner field but from the outside environment. Thus, without concerning themselves much with the activities of the organisms, Gestaltists attributed to that which lies "from the retina inward" a sort of a self-actional mechanism which copies, so to speak, reality as it exists outside. The law of Pragnanz,
and its sub-laws of similarity, continuity, closure, etc., refers to the distal or the structure of the outside world. Thus, the Gestaltists, generally speaking, do a good job when they analyze the outside field, but because they fall unwittingly in the dichotomy between the inner and the outer they fall short of the transactional approach. In commenting on Wertheimer’s analysis of Galileo’s search, Dewey and Bentley say,

Wertheimer concentrates our attention on the 'structure' or 'Gestalt' which governed Galileo's search. Seen as a stage of development in understanding and presentation in the cultural setting in which it was produced, this is in the line of our treatment. Seen, however, as Wertheimer has continued to see it, as a mental activity of self-actional parentage applied to an outer world of objects, it falls far short of the manner of statement which we believe to be necessary. The 'mind' Wertheimer relies on is far too reminiscent of the older days in which the 'physical' opposed to it was an all too solid fixture.¹⁰

We turn at this point to consider behaviorism as represented especially by Hull's system, the most widespread of all behaviorist theories today.

Second, Behaviorism

Behaviorism emphasizes the remote as well as the immediate past. Behavior is considered as a positive multiplicative function of habit, drive, reinforcement and strength of stimulus, and

negative function of inhibitory reactions learned or unlearned and oscillation. The following sketch may help for illustration:

$$\frac{dE_R}{dt} = SH_R \times D \times K \times V - IR + SIR + SOR$$

Where $S_R$ represents excitatory potential at a given moment which determines whether or not a certain reaction will be evoked.

$H$ represents habit strength

$D$ represents drive

$K$ represents reinforcement (constant depends on individual difference)

$V$ represents stimulus strength

$IR$ represents unlearned inhibitory reaction (the natural tendency for any reaction to seize by itself)

$SIR$ represents learned inhibitory reaction

$SOR$ represents oscillation

$N$ represents number of reinforcement

$D$ represents history of deprivation (in terms of number of hours without food for instance)

$Q$ represents quantity of incentive (food for example)

$PI$ represents physical intensity of stimulus

$f$ represents mathematical function
The above sketch shows that behavior depends on remote past experience in terms of habit strength and on immediate past experience in terms of drive and inhibitory factors.

The concrete objects in the environment are utilized only so far as they are tied up with primary reinforcement in terms of primary need reduction or (when they are not directly tied up with primary need reduction) they are assumed to play the role of secondary reinforcers if they are consistently associated with primary reinforcement. The structure of the outside world is of no great moment at this point, since all that counts is whether or not an object is reinforcing. As a consequence, local stimuli impinging upon the skin boundary of the organism are considered the main instigators of behavior. But since these are not observable they are inferred from bodily movements. With the exception of the two first postulates of Hull, the system is essentially peripheralistic, that is, it depends on mechanical connections of segments of behavior. So far as central events within the organism are concerned, only peripheralistic events count. Muscular reactions are important in so far as they are terminated by reinforcement, or a reinforcing state of affairs, and they are the events by which sensory processes are inferred. The consequences of reactions and their effects are treated in terms of habit strength as it reveals itself in future tries.
The Two Systems Contrasted

We have seen how the Gestaltists emphasize distal representation of the objects in the outside environment. As a result, behavior patterns, so far as the organism is concerned, are taken for granted to represent the structure of the outside field. Paradoxical as it may seem, by taking their point of departure from the outside environment they become (with respect to the organism) the nativistic group. This should not prove surprising since by approaching the problems of behavior in the traditional dichotomy of organism vs environment, they were forced to start with one side of the dichotomy and assume that the other should conform. They happened to focus their analysis on the environment. Similarity and proximity, for instance, are not features observable in the organism but are characteristics seen in the objects in the environment. The organism turned out to be natively endowed with the predispositions to behave in accordance with the principles with which they described the environment, or so it was assumed. Consequently, when they observed the behavior of organisms in their experimental studies, they saw these principles work. It is an illustration of the autistic factor which Gardner Murphy, Bruner and Postman, Klein and many others have shown to play an important part in perception.
Behaviorism, roughly speaking, can be shown to have followed the opposite direction. Following an empirical approach, behaviorists emphasized the observable in behavior, stimuli and responses, with the one causing the other. Hence, the machine model. By focusing attention on the bodily movements of the organism behaviorists came to opposite conclusions from those reached by Gestaltists. This is well illustrated by the development of Thorndike's system. As he gradually came closer to the machine model, and after he had stripped his system from its earlier mentalistic and cognitive contents, he became more and more attentive to the detailed reactions of the behaving organism. He became, in other words, more and more environmentalistic. Neither the organism nor the environment in isolation from each other can adequately provide us with an intelligible explanation of behavior. If we make the organism our starting point, we find that the behavior of the organism cannot be explained by itself, especially as we reject explicit self-actors or mental entities as the causal factors of behavior. We turn, then, to the environment to provide the answer. We tend to limit our understanding of the behaving organism by the limitation we put upon the environment we provide for the experimental animals. As Skinner has said in another connection, the learning curves we draw for rats in mazes, actually represent the mazes more than the rats' behavior.
The moral is that unless we make our starting point the organism in and of its environment we tend to err. Almost all psychologists currently emphasize the relation between the organism and its environment and, sometimes, they go so far as to claim that the separation between them is artificial and serves only for analysis. By and large these proclamations amount to little more than lip service, the psychological models not expressing this understanding. This understanding, however, should be instrumental in reformulating the psychological models. It is not the task of this study to perform this reformulation. Some suggestions are possible, nonetheless.

A Transactional Approach to Psychology

In his historical article, "The Reflex Arc Concept," Dewey raised his voice to warn psychologists against the danger of duplicating, in the name of the reflex arc concept, the older dualism of prescientific psychology. Dewey said, "The older dualism between sensation and idea is repeated in the current dualism of peripheral and center structures and functions; the older dualism of body and soul finds a direct echo in the current dualism of stimulus and response."17

His attack on atomism, made more than half a century ago, is surprisingly valid today.

Instead of interpreting the character of sensation, idea and action from their place and function in the sensori-motor circuit, we still incline to interpret the latter from our preconceived and preformulated ideas of rigid distinctions between sensations, thoughts and acts. The sensory stimulus is one thing, the central activity, standing for the idea, is another thing, and the motor discharge, standing for the act proper, is a third.\(^{18}\)

We need only replace the word "idea" in the last sentence by the term "pure stimulus act" to have a perfect description of the state of affairs of behaviorism as it stands today. It is only when we atomize the organism that we tend to interpret behavior in terms of a machine model. Random movement and fumbling thus become major elements of behavior. But when we view the different senses, as well as the motor activities, as aspect of behavior in co-ordination, fumbling and trial and error in their derogatory meaning will have no place. Dewey, speaking of the instance of the child responding to the candle, said, "Now if this act, the seeing, stimulates another act, the reaching, it is because both of these acts fall within a larger co-ordination; because seeing and grasping have been so often bound together to reinforce each other, to help each other out, that each may be considered practically a subordinate member of a bigger co-ordination."\(^{19}\)


Dewey prefers to speak about an organic circuit rather than a reflex arc with disjointed distinct existences brought together by the pull and push of an outside environment by something outside the process of experience itself, such as an actor within. "This circuit is more truly termed organic than reflex, because the motor response determines the stimulus, just as truly as sensory stimulus determines movement." To this he added, "The fact is that stimulus and response are not distinctions of existence, but teleological distinctions, that is distinctions of function, or part played, with reference to reaching or maintaining an end."

To conclude, Dewey in one breath, aimed a blow at both of our groups of psychology. He showed the distinction between the inner and outer to be false and unreal. In Bentley's words one may say that Dewey effectively destroyed the dermal boundary of the body so far as knowledge or behavior were concerned. Knowledge is not a chain of mechanical events located inside the body as Hull would have us believe. It is instructive at this point to recall how Hull as a consequence of his mechanistic interactionistic approach was led to hypostatize an inner chain of actions and reactions to constitute knowledge.

20 Ibid., p. 359.
21 Ibid., p. 361.
22 See Chapter III in this study.
abiding within the organism. An outside stimulus elicits a response which acts as an inner stimulus, and the inner stimulus in turn initiates an inner goal reaction and so on along the chain till the evocation of the goal response which, by necessity, is a matter of mere chance. In order to lend coherence to the chain in terms of habit, Hull had to postulate an inner stimulus drive which functioned throughout the chain. But in view of his interactionistic outlook even this new entity had to be fractionated or fragmentized so as to correspond to the segmental character of the chain. The difficulty evidently lies in the split made between the organism and the environment as a starting point. It is true that Hull claims that organic needs and organic environment should be "somehow jointly and simultaneously brought to bear,"\(^\text{23}\) upon organic movement. The fact of the matter remains that the split he occasioned between the organism, on the one hand, and the environment, on the other, forced him to bridge the gap as Dewey and Bentley have pointed out "by a series of intervening variables of a fictional, pseudo-logical character."\(^\text{24}\)

As far as gestalt theory is concerned it suffices here to emphasize once again the artificality of the distinction made between the sensory and the motor aspects of the organic circuit Dewey has so aptly elaborated. In their preoccupation with formal


structure, the gestalt group overemphasized the sensory aspect of the circuit, in terms of dynamic sensory organization, to the negligence of the motor aspect. An account of knowing in terms of a self-actor independent of experience, is inadequate even though the self-actor is termed "dynamic brain processes."

Viewing the problem from a philosophical point of view we may conceive of the psychological problem as an outcome of the philosophical problem of knowledge and knowing. The distinction, historically speaking, was made between four entities—namely, knower, known, knowing and knowledge. Philosophical systems were able to specify and locate three of these four entities. The knower was described either in terms of soul or psyche and located internally. The known was located somewhat as outside reality. Knowing was a mediator, a process inside the organism which brought together the two separate entities, the knower and the known. The fourth entity, however, defied localization or specification in terms of substance as inner or outer and consequently caused philosophers a lot of headaches. Along these lines Bentley says:

> With soul weakened into psyche, and with psyche yielding to body as its 'stand-in,' 'knowing' could in a way be viewed as psychological process within the skin. This supplied a confused pretense of definiteness to three of four terms, viz., to knower, known and knowing. But what kind of definiteness could then be given to the fourth term, 'knowledge,'? 'Knowledge,' substantively viewed, was left to bear the brunt of the inquiry: Was
it inside the skin, or out? Was it flesh, or spirit? Was it fact, or thought, or word?25

Here we find that psychology and philosophy both face one and the same problem, no matter how different the terminology. In this area at least the basic problems of both psychology and philosophy have common roots. Thus, in a reconstruction of either philosophy or psychology we must bear in mind the danger of dualism in all forms. It is this need which has made a transactional frame of reference promising.

Human Behavior as Transactional

We have seen that the main differences and conflicts between different psychological systems arise as a result of the different points of emphasis psychologists of different points of view place on the explanation of behavior. More specifically, we found that while one group puts its emphasis on the observable behavior of the organism, with little attention to the structure of the environment of the behaving organism, the other group does precisely the opposite. A transactional approach should treat the structure of the environment as well as the observable behavior of the organism as inseparable aspects of a dynamic process. If we fully comprehend this position we can no longer separate perception from action. To do so would be to assume some sort of

self-actor to account for such phenomenon. Nor can we separate action from perception. To do this would be to admit a dualistic philosophy of action versus knowledge or between the motor and the sensory. Dewey pointed out that in reaching for the candle flame, the child's seeing (perception) is directed by his movement in as much as his movements are directed by his seeing. He further pointed out, with respect to auditory perception, that, "The movement and posture of the ear, the tension of the ear muscles, are required for the 'reception' of the sound." 26

A transactional approach to the study of behavior should, therefore, be inclusive of the different aspects of any event under investigation. Naturally, investigation requires analysis and specification of certain aspects of a given event, but such analysis or specification should always be referred as fully as our means and techniques allow to the total event. Cantril has described transaction as follows:

Each transaction of living involves numerous capacities and aspects of man's nature which operate together. Each occasion of life can occur only through an environment, is imbued with some purpose, requires action of some kind and the registration of the consequences of action. Every action is based upon some awareness or perception which in turn is determined by the assumptions brought to the occasion. These assumptions are in turn determined by past experience. All of these processes are interdependent. No one process could function without the others. 27

In general terms, this citation from Cantril falls in line with the transactional approach as this is conceived in this study. Yet, while Cantril emphasizes the dependence of action upon "awareness or perception," he does not seem equally to emphasize the reverse dependence of "awareness or perception" upon action. Instead, he emphasizes the dependence of "awareness or perception" upon assumptions which are determined by past experience. This is not to stretch a point which may seem to be merely verbal. It is true that past experience may imply action. But the problem is so delicate that precision is needed. The danger is that the term "assumption" may carry mentalistic connotations and lead us into trouble as it actually did with A. Ames. We shall return to this point after considering the experimental work directed by Ames, the transactional point of view in his study of human behavior. To do this we shall examine a representative sample of his experiments.

Chair demonstration

The subject looks (sees) through three peep-holes on the front side of a box. When he looks (monocularly) through these apertures, one after the other, he sees what appears to be a chair.


29 The implications of this experiment apply also to binocular vision.
in each case. If he then goes behind the screen, he will find, to his surprise, that the objects he took to be identical chairs were actually an assortment of black wires with white strings strung on them; different in size and shape and at different distance from the peep-holes. "The wires and strings are arranged so that identical, or nearly identical, retinal images are formed when the subject looks through each of the three apertures."

By a certain procedure, the images of the three objects, by means of lenses focused on ground glass plates, are made to correspond to the images formed on the retina of the eye. The three images will be found to be quite identical, therefore.

Conclusions

The similarity between what is perceived, the 'visual awareness' of the three chairs, must be related to the similarity between the three retinal images. The similarity between the retinal images must, in turn, be due to physiological phenomena related to the light rays impinging on the retina. The light rays are reflected by the objects outside the perceiving organism. But what were perceived as identical objects were in fact different. Hence, the perceiver must have contributed something to what he

30 Mary Alice Price, Teaching Mental Hygiene With Visual Demonstrations, p. 11.

perceived or to his 'visual awareness.' Ames makes the distinction between visual awareness (what a person is subjectively aware of) and the thing out there, independent of perception or awareness. Ames says, "The expressive term 'what is in your visual awareness' will be used to refer to what you are subjectively aware of as distinguished from its occasion out in your environment." He goes on to assert that "Such phrases as 'what you see' or 'what you perceive' or 'what you are aware of' do not make this differentiation. They refer both to the content of your perception and its unperceived occasion 'out there,' and hence do not specify which of the two is being referred to."\(^{32}\)

Here, once again, it is necessary to voice a word of caution. The distinctions Ames makes above may presuppose existential distinctness between "the something out there," the stimulus pattern and bodily processes, and the subjective contribution of the perceiver to it. Such presupposition may lead to the identification of the thing out there with physical reality, as distinct from the physiological reality of the body or the organism, and these two categories from consciousness or awareness. They may imply a mentalistic concept which Ames does not mean. The emphasis of Ames is on the necessity of bringing our knowledge with respect to the different aspect of behavior to bear upon our problem. With respect to our knowledge about the above—

\(^{32}\) Ibid., footnote, p. 18 (my italics).
mentioned categories. Ames says,

While modern physics has disclosed a great deal about certain aspects of the 'something out there,' and while modern physiology has disclosed a great deal about our stimulus patterns and bodily processes, relatively little has been learned about the nature of what we ourselves 'subjectively' contribute to our perceptions of the 'something out there.'

It is, of course, legitimate and necessary to bring our knowledge of physics and physiology to bear upon psychological inquiry, as complementary phases of human experience. It is also legitimate to choose as our locus of inquiry the study of physical phenomena and of physiological phenomena. Yet it is well to remember that they are but aspects of one broad process, human experience. Our understandings of physical phenomena, for instance, are as much dependent upon what Ames calls "our subjective contribution to the something out there" as are the demonstration experiments or our common day experiences. The only difference lies in the locus of inquiry, the knowledge we have, the purpose of the inquiry, and, perhaps, the techniques we use and the means we possess for checking results. Such also is the only legitimate distinction we can make between common sense and science.34

With this orientation we may view the other samples of the experimental work conducted by Ames in a more suggestive perspective.

33 Ibid., p. 20.
34 See J. Dewey and A. Bentley, Op. cit., Ch. X.
Star Point Demonstration

In this experiment, two star points of light in an otherwise darkroom appear at equal distances from the observer. The observer looks monocularly at the star points with his head stationary. The brighter point is perceived as nearer to the observer.

Conclusions

Since the distances are 'objectively' equal, the observer must have contributed to his perception by assigning a shorter distance to the brighter point. The difference in brightness is used as a clue to the relative positions of the two points. In other words, the observer assumed that the two points were of equal brightness. In general terms, "The assumption is that similar things are identical." 36

The assumption of identity, however, does not arise solely from similarity but is also related to direction as is seen by changing the relative positions of the two bright points. If the two points are of equal brightness, and one is located one foot above the other, the upper one will be perceived as farther away than the other, if both are situated near the floor, and as

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36 Franklin P. Kilpatrick, Some Aspects of Assumptions to Perception, p. 2.
nearer, if they are situated near the ceiling. Thus, in these instances, assumption coincides with our common everyday experiences with visual objects. When we look at things on the ground, the objects located at a farther distance are seen as upper and vice versa, when we are looking at the horizon. So, too, in drawing and painting we locate the objects which lie further away above the object which lies nearer to us, when they are on the ground and vice versa when they are in the horizon.

**Size-Brightness Demonstration**

In this experiment, two partially inflated balloons are illuminated from concealed sources. The balloons are stationary in position and are one foot apart from each other. By a certain device, one or the other of the two balloons, or the two together may be increased in size. Another device permits the brightness of the two balloons to vary in the same way. The room is kept dark and the observer looks at the balloons monocularly, with his head stationary. When the two balloons are equal in size and brightness, an observer, ten feet or more removed, sees them as two glowing spheres equal in size and at equal distance from him. When brightness is left equal, with their sizes fixed at their maximal possible difference, most observers will see the larger balloon as somewhat nearer and the smaller as somewhat farther
away. When the sizes are made to vary continuously, one balloon getting larger and the other smaller and vice versa, the larger one appears to move much farther forward and the smaller one to recede farther away than is the case when their size difference remains constant. When, however, the sizes are kept constant, with brightness varied, the apparent movement, though still perceived, diminishes in degree. The apparent movement reaches its maximum when both size and brightness vary simultaneously and in the same direction.

Conclusions

In this instance the observer's assumption—some sort of average of his past experience—is that when things move nearer, they become brighter; hence, when they become brighter, we may assume that they have moved nearer. The same applies to variation in size. The above experiments show, however, that by and large men assign more weight to the change in size than to that of brightness. It is not very common to observe stationary things growing or diminishing in size, though their brightness may vary due to shadows, multiple sources of illumination, etc. This discrepancy between the weights we assign to brightness versus

See Franklin P. Kilpatric, Ibid., p. 3.
size depends on past experience. Kilpatrick says,

The relative weights given to size and brightness differ for a small percent of observers, apparently in line with specialized experience they have had. For example, of approximately 150 people who have seen the balloon demonstration in our laboratory, three have seen distance change with changes in brightness, irrespective of size. One of these observers was a well known motion picture photographer, and the other two were architects specializing in interior lighting for buildings.38

The demonstration further shows that in the dynamic situation when size and/or brightness vary continuously as compared with the static situation in which the difference between the two balloons in brightness or size is constant the 'prognostic' reliability is high.

The Thatness—Thereness Demonstration39

This experiment illustrates the interdependence of the perception of the distance of an object and its characteristic properties. Two cubes are suspended by invisible wires, one at twelve feet and the other at three feet from the observer. Two sides and a part of the upper side of the nearer cube are seen binocularly. The same view of the farther cube is seen monocularly. If the head is then adjusted so that the vertical edges

38 Ibid., p. 4.

39 Loc. cit.
of the two cubes coincide, the distant cube will be seen to move forward to an even position with the nearer cube. As it is seen at a position even with the near cube, it appears smaller in size than when seen farther away. Moreover, not only its size changes but also its shape.

Conclusion

Coincidence of contours suggests that the objects observed lie spatially together. In other words, perception in this case is based on an assumption that coincidence of contours means "togetherness."

Anisekonic Glasses Demonstration

Anisekonic glasses produce visual distortions. They produce different size images on the two retinas. With these glasses on, an observer looking at an ordinary room does not perceive the room to change substantially in shape. When, however, the observer looks at a rectangular room covered from the inside with green leaves, it seems to be drastically distorted in shape. A room so designed reduces monocular cues and the observer has to rely chiefly upon binocular cues. He sees, when focusing on the whole room, that the back and side walls slant towards him.

at the top and farther away from him at the bottom. The leaves on top appear smaller than on the bottom. The ceiling looks lower and nearly horizontal, with its leaves relatively small. The floor drops away, being also horizontal and its leaves large. This shows that the size of the leaves depends on their localization in space. If they seem nearer than they are, they appear large in size and vice versa. If the observer focuses his gaze to the floor, it appears nearer to him and tipped up at an angle of about 45°. To dramatize this phenomenon we may compare the perception of a large body of water with that of a large area of level lawn, with the same glasses on. The water appears as horizontal, although farther away than its position, whereas the level lawn appears tipped.

Conclusions

Without fully discussing the effects of the anisokonic glasses, some relevant conclusions seem to be pertinent. First, there seems to be an interdependence of the perceived sizes of the leaves and their assumed distance. Second, there is the discrepancy between the perception of a normal room as compared with that of the specially designed leaf room. The normal room does not suffer much distortion, perhaps, among other reasons, because of past experience. The leaf room, in contrast, is not a matter of everyday experience and its perception exhibits
marked distortion. Furthermore, when the observer looks at the room as a whole the floor looks approximately horizontal. This suggests that the assumption that he is looking at a room somehow suggests the floor be horizontal. It is unlikely that a room will have a tipped up floor. But when the observer focuses on the floor, rather than on the room as a whole, the necessity for a horizontal plane is not needed. At this moment the observer is not looking at a room. The effect of past experience is in evidence when we compare the perception of the large expanse of lawn with that of a body of water. The assumption that water takes a horizontal plane is so strong that the distortion does not affect it. The lawn might be tipped, however, and, hence, it suffers the distortion. All this seems to add up to the suggestion that the observer chooses from among the many 'cues' in his environment, as best as he can, those which coincide with the expectations that are a result of his past experience.

The Vertical Lines of Light Demonstration

In this demonstration, a black light box with slits of vertical lines of different lengths cut in its face, confronts the observer. Two lines are at the same distance from the observer, with their middle points at the same level. The observer, looking at these two lines in an otherwise dark room, will see the longer line.

line nearer to him than the shorter one, although objectively both are at the same distance from him. If the observer now takes a wand with a luminous tip and tries to touch each of the two lines, he will fail at the beginning. After repeated trials, the subject will eventually succeed in touching the two lines with accuracy. When he so succeeds, his perception changes and the two lines appear at equal distance from him.

Conclusion

The observer at the beginning seemed to perceive the two lines as identical (that is lengthwise) and hence his visual awareness attributed to them the difference in distance. After action based upon that assumption failed, the assumption and, consequently, his perception of distance changed according. This demonstration illustrates the effect of action upon perception, assumption or visual awareness.

A modification of this experiment, illustrates another point. If the observer is allowed to see the two lines while the light in the room is on, and then the light is turned off as the demonstrator says 'telephones pones', the shorter line is seen to fall back in distance. This modification illustrates the fact that as the observer accepts the assumption, suggested by the demonstrator, that the two lines represent telephone poles, their
relative lengths are taken as cues for their relative positions.

The Distorted Room Demonstration

In this demonstration a box representing a room has its size distorted in such a fashion that the observer looking at it from the outside can see quite clearly that it does not have the shape of a normal room. The floor slopes from the front down to the left. The ceiling slopes up and also the left. The rear wall recedes from right to the left. The rear wall has two windows both trapezoidal in shape and different in size. The window located to the right is smaller than the one to the left. In the middle of the floor there is a trough with a groove in it. The trough slopes upwards from the front to the back relative to the floor but the slope is still downwards with respect to the horizontal plane.

After viewing the distorted room from the outside and observing, or being guided to note, the specific distortions, the observer, if asked to look monocularly at the inside of the room from one particular point, the distortion disappears and the room looks quite normal. Under these conditions, if the two hands of a person are shown simultaneously through the windows

in the rear wall, the one seen in the right window appears much bigger than the one in the left. Similarly, if two faces are seen through the two windows, the one to the right looks much bigger than the one to the left. Further, if a marble is permitted to roll through the grove in the trough it will be seen to move uphill. Finally, and critically, if the observer holds a stick and tries to touch the four corners of the room he will fail at the beginning. After repeated tries, he will gradually succeed, increasing his accuracy through trial. It is significant to note at this point that as the observer manages to touch the corners of the room with success, his perception changes accordingly and he eventually perceives the room as distorted.

**Conclusions**

This demonstration illustrates the fact that the unicular stimulus pattern is not an outcome of just one configuration in space. The stimulus pattern of the distorted room was similar to that of a normal room. An infinity of configurations in space may yield similar stimulus patterns. Furthermore, the demonstration shows that predetermined knowledge about the situation may fail to influence the perception. The significance of action, however, is dramatic. In the first place, action was determined by perception. In the second place, the consequences of action (the failure to touch the corners), were effective in guiding future action and perception as well.
The Demonstration of The Rotating Trapezoidal Window (The Surety Demonstration)

This demonstration is especially significant for this study, since it reveals some interesting and pertinent observations. Two millioned planes with gray markings on them corresponding to shadows resulting from illumination from one side of the room and considerable above the middle of the planes. They look like windows but one is rectangular while the other is a trapezoid. Both planes are parallel to one another and both are attached to a mechanism by which they can be made to rotate clockwise. A pipe is so fixed as to project through the plane (or window) in the trapezoidal shape at an angle of $45^\circ$. When the light in the room is turned off and the two planes are permitted to rotate, the observer is allowed to watch them monocularly for four or five minutes. The observer will report that one window (triangular in shape) appears to rotate clockwise, while the other (trapezoidal) appears to rotate a half-turn clockwise and then change direction, rotating a half-turn counterclockwise. The observer will report that the pipe moves clockwise and cuts through the window, as the window reverses its direction of movement. Ames has studied the stimulus patterns which are formed on the retina in the case of the trapezoidal window by means of an artificial

See A. Ames, Rotating Trapezoidal Window Demonstration, 1950, Hanover.
eye "consisting of a lens corresponding to the dioptic system of the eye, and a ground glass which is marked off in rectilinear squares corresponding to the retina."\textsuperscript{44} His study revealed that the images on the ground glass go through a series of varying trapezoidal forms which are never rectilinear; that there is no change in the speed of the trapezoidal pattern to correspond to the apparent change in speed or direction of the trapezoid; that there was no change in form or size of the stimulus pattern to correspond to the apparent change in form or size of the trapezoidal window. The rectilinear window also showed "the same general characteristics as the images of the trapezoidal window."\textsuperscript{45}

This demonstration clearly shows that perception does not correspond to a fixed pattern in the outside world. In other words, perception does not copy 'external reality as it is.'\textsuperscript{44} The trapezoid was seen to oscillate back and forth, covering an apparent angle of 100°. The trapezoid, however, did rotate around an angle of 360°.

The trapezoid has a short edge and a tall one; but, since it is assumed to be a rectangle, the assumption is that both edges are equal. \textbf{When the trapezoid is seen in a horizontal plane, the difference between the lengths of the two edges is noticeable.}

\textsuperscript{44} \textit{Ibid.}, p. 10.

\textsuperscript{45} \textit{Loc. cit.}
Hence, with the conclusion reached that it is tilted in position, the shorter edge is assumed to be farther away than the larger edge. As the trapezoid then rotates around its axis the lengths of the two edges should vary (under the assumption that it is a triangle), according to past experience, the shorter edge becoming taller as it comes nearer and the taller shorter as it moves farther away. This does not happen, since the dimensions of the trapezoid are so made as to be seen (in perspective) as a trapezoid no matter in which position (relative to its distance from the observer) it is. The observer sees the motion clock-wise, until the point when the relative lengths of the window (assumed to be rectangle) are to be reversed. Since they do not, the window is seen to come to a standstill, reversing its direction of motion to conform to the expectations of the observer (perceptive), apparently as a result of his past experience. The pipe, however, does not suffer from the same illusion. In fact, it is tied up with a certain clue or sign which insures its perception in a rotary movement. It projects through the trapezoid, covers a certain portion of it and revolves around with it. The portion of the trapezoid it covers is supposed, if it is to follow the apparent oscillation of the window, to continue in view. But it does not. It disappears and the other part of it on the other side appears instead. To resolve these conflicting signs or clues, the pipe is seen to cut through the
window as it starts on its apparent counter-clockwise movement. So strong is the assumption that the window is a rectangle that it dominates and conditions other features of the perceptual process.

In this experiment we see the importance of past experience and of its role as "assumption" in Ames' terminology. We see again that the stimulus pattern on the retina does not correspond to a fixed pattern in the outside environment but may be produced by multitudinous patterns. Hence, perception cannot be accounted for in terms of the structure of the outside world in independence of the human organism. The experiment, however, raises some questions. What if the observer knows that the window is a trapezoid and not a rectangle? What if he is allowed to touch the window and find for himself that it is a trapezoid and not a rectangle (as was the case with the Distorted Room Demonstration)? Furthermore, what would be his reaction if he were asked to concentrate on the shape of the window, to find out through his observation what shape it was or, in other words, instead of having his assumption of a rectangle taken for granted, make it the locus of his observation? What if, instead of a pipe inserted in the window, a rectangle of wood were inserted to offer some conflicting cues or signs relevant to the shape of the window? And with respect to past experience, what would the response of young children be to this demonstration? Can we experiment on children young enough who have not yet developed the
assumptions that cause the illusory perception? In other words, is there any difference in this respect with different age groups? Of course, we may find that when the children have reached the age at which they can participate in such a demonstration, they will have developed the assumptions which account for the illusions. The answer, however, remains to be found out. In any case, the above questions are relevant to the problem of perception and human behavior in general and experimentation will be needed if they are to be answered.
CHAPTER VII

CRITICAL ASPECTS OF AMES' TRANSACTIONAL EXPERIMENTATION

The demonstrations reported on briefly above are very significant from the psychological point of view; and, indeed, from the philosophical point of view. Some of the important insights revealed by these demonstrations are worthy of further consideration. They are presented below.

1. Perception cannot be accounted for merely in terms of the structure of the outside object. We have seen, for instance, in the chair demonstration, that the observer saw chairs where no chairs existed. The only plausible explanation of this, is that the observer's past experience with chairs accounts for the fact that a similar stimulus pattern led to the perception of a chair. We cannot predict what his perception would have been if he had not had experiences with chairs.

Most of the demonstrations bear this out. Take for example the trapezoid demonstration. We may justifiably say that the observer perceives a rectangular object as a rectangle, even though the stimulus images on the retina scarcely represent a rectangle but almost always a trapezoid because of an invariance factor, as Gestaltists say. This explanation, however, cannot account for the fact that a trapezoid is perceived as a rectangle.
unless we take past experience into consideration. In fact, an invariance factor would lead us to believe that a trapezoid should be perceived as a trapezoid no matter from which position we look at it. The distorted room demonstration seems to show clearly that it is not merely the distal object physically described that accounts for our perception. We venture to say here again that if the rooms the observer had been associated with were of the same form as the distorted room described in the demonstration, then, if under the conditions prevailing in the demonstration, the observer were presented with a normal room, he would perceive it in terms of his past experience as distorted. He would have then exhibited reactions parallel to those referred to in the demonstration. These conclusions are mere deductions, but they seem plausible enough in terms of what the demonstrations reveal.

2. The demonstrations seem to disprove the dictum theory that to be is to be perceived. For every retinal image, there may be conceived innumerable distal stimulus patterns. We do chose. From the many different stimulus patterns in the environment the organism chooses those which coincide with his past experience. The demonstration with the anisekonic glasses bear this out. This conclusion seems to lend support to James' and Dewey's contention that our perceptions are of probable rather than real things (epistemologically). We shall return to this point presently.
3. The demonstrations reveal the role of action in human understanding in a way that is reminiscent of Dewey's description of experience. It is the "doing" and the "undergoing" of the consequences of "doing" combined that constitute the basis for the reconstruction of experience or learning. Prior knowledge of the structure of the distorted room, as we have noted, was not enough to guide action. Knowledge is knowledge only in use and of use. Dewey's conception of knowledge finds strong support, therefore, from Ames' demonstrations.

4. Concerning the nature of reality, the demonstrations seem also to support Dewey's position concerning knowledge. This problem is a source of much confusion and it is beyond the scope of this study to deal with it in a comprehensive manner, though it deserves further study. Dewey, contrary to a common misconception of many of his critics, does not deny the existence of reality, epistemologically speaking. He asserts, "There is, of course, a natural world that exists independently of the organism, but this world is environment only as it enters directly and indirectly into life functions."¹ This is a bold statement. It means, simply, that reality qua existence is a fact but qua meaning it does not exist outside of human experience.

This does not mean that we live in an illusory world. Our world is real; it is the world we are part of and it is the world which constitutes our transactions and knowledge. It is the active connections between the human organism and its environment that constitute our knowings and knowns, i.e., knowledge. "The organism is itself a part of the larger natural world and exists as organism only in active connections with its environment." There is no knowledge that exists apart from these active connections. And, as a matter of fact, no has ever been able to know a thing in itself, or a thing as it is existentially. Things are known only as they are experienced. Experiences may vary and, indeed, as is done every day in scientific laboratories, we may vary the conditions of experience deliberately, but it remains a fact that the knowledge we arrive at is experiential.

From the psychological point of view, the problem is dealt with in terms of veridical versus non-veridical perception. The realist would distinguish between the significance of the thing perceived and its essence and would equate the essence with veridical perception, or would hold that by knowing the laws of perception the essence of things can be disclosed by reasoning.

2 Ibid., pp. 33-34.

3 This problem is dealt with by Eugene Freeman in a paper entitled The Transactional Theory of Perception, which was read at the meeting of the American Academy of Optometry held in New York on December 9, 1951; mimeographed copy borrowed from Ross Mooney, The Ohio State University.
"It is in these terms" says Freeman, "that I am impelled to conclude that in its very laudable efforts to point out the vital significance of perceptions as meaningful symbols, the transactionists confuses significance with essence and tend to treat one as though it were the other. A realist, however, would judge that it is a transparent and fatal mistake to do so."¹

But how can we even know the essence of the thing in a realistic sense? The experiments seem to prove that we perceive and deal only with signs; signs, in other words, which point to something more than the brute thing itself can disclose, signs that are not themselves knowledge, for our knowledge about them changes when we act upon them. And this is true even when we come at such demonstrations with knowledge about the veridical quality of the objects perceived. Ames has shown that knowledge of the fact that the balloons change in size and do not move in the size-brightness demonstration does not help. The distorted room demonstration confirms this. But we have not yet fully answered the question of veridical perception, which, from a realist's point of view, is the crux of the matter. Freeman says, "The fundamental postulate of critical realism holds that perception, unless it is proven to be non-veridical, is a genuine disclosure of the nature of external reality—in short, that veridical perception discloses things as they really are."² He further

¹ Ibid., p. 13 (italics in original)
² Ibid., p. 15.
adds, "When conflicting testimony is presented, instead of repudiating the validity of all perception, he (that is, the realist) takes stock and reasons out the nature and source of the error." 6

The question now is what veridical perception is. We will have to resort once more to the chair demonstration. The observer, as we mentioned before, saw chairs where no chairs really existed. For him, what he saw was real. May we say that in this situation his perception was true? By what right could we conclude otherwise? So long as the observer does not exhibit any doubt about what he experiences, it will remain true. When, however, there is doubt (and in the demonstration the demonstrator occasions doubt by having the observer look in upon the strings)7 the problem is settled by bringing more connections to bear upon the problem until it is resolved. From then on the newly arrived at knowledge is accepted as true until doubt is again aroused and more connections are brought to bear up the problem. This is the scope of inquiry, a process without end and it describes the method of scientific inquiry in all fields of natural science. Dewey says,

When there is doubt as to an alleged representative relative and it has to be settled by inquiry into its connections with other things, we are obviously in a realm where 'appearance' has an intellectual significance .... In this meaning there are further relations involved

6 loc. cit. (italics mine)

7 It is worth noting that the presence of the demonstrator, and his purposes, provides a public situation which places a check upon the observer's perception. This is characteristic of all perception in which action is involved, verbal or otherwise. What men claim as knowledge has to stand a public, a relational, test.
than in the second case where manifestation or exhibition is taken as an undoubted part of the situation. 8

Inquiry, starts, therefore, when things do not appear as they are believed to be, when in the course of experience things do not seem to work out as they were expected to. There is then doubt as to their significance. They become objects of inquiry and serve as signs to direct it, necessitating that new observations be brought to bear upon the problem thus posed. Signs function to bring more connections into the situation and create thereby a broader envisionment for the problem. This is the function and office of human inquiry or of reason, if we chose to use the term. Thus inquiry in Dewey’s term is out-reaching, going beyond what is immediately presented. In this sense inquiry is in and out of the matrix of human experience.

We may here again ask, "Who has ever been able to know a thing in itself?" And we may ask of Freeman what beyond this he means when in the instance of "conflicting testimony" the realist "takes stock and reasons out the nature and source of the error."?

The chair demonstration seems to be of great significance in this connection. When the observer was held to the observation of the objects in the confinement of the experimental set-up, he exhibited no doubt, no curiosity, no surprise, etc. There was nothing, in short, to conduce him to further inquiry about

the validity of his perception. When, however, he was permitted to look behind the screen, a significant change in his attitude occurred. In this connection, Ames says, "Why we are surprised when we see things that we know are not there when we are not surprised if we don't know what we see is not there deserves further inquiry."  

A final word about the nature of reality is in order at this point. This is the implicit identification of scientific inquiry with veridical perception and, hence, the alleged claim that science discloses the true nature of reality as existence. Veridical perception from a realistic point of view is considered the perception of objects as described scientifically. The tacit assumption here is that science and common sense are of different orders. Dewey has dealt with this problem and pointed out that, although there are marked differences between the two categories, they still are of the same order. Both are human activities, and are part and parcel of the matrix of experience. Psychologically speaking, Dewey has pointed out this fact in terms of the reflex arc concept. Awareness is a function of the transactional process described in terms of the sensori-motor circuit.

Perhaps the important difference between common sense and science is the level of understanding or knowledge from which man operates in each case. An example from physical science may

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be illustrative. According to Newton's mechanics, light travelled in straight line and time was a static entity, not effecting the event. Einstein has shown that light does not travel in straight line and that time is a factor along with space. Consequently, according to Newton, two observers would see a certain event at the same time no matter where their positions were. According to Einstein this is not true. Newton's position would have been considered as revealing an absolute truth, or a disclosure of nature independent of experience. But this is no longer true from the point of view of modern physics. We may say now that Einstein's position represents the truth or the essence of reality. But by what right? It is true only insofar as it works as part of man's experience. If we only remember that, whether it is Newton's or Einstein's position we are dealing with, each position rests on reliable knowledge secured through observations within experience, the problem of the true essence of reality becomes meaningless. The problem is indeed, meaningless, unless we assume that 'reasoning' can transcendent actual life experience. This can be explained only in terms of a "Being" which exists outside the sensori-motor-circuit which Dewey described. Hence this "Being" must be a self-actor; that is a soul, a spirit or mind.
Assumptions and The Assumptive World

We have again and again mentioned the word assumption in connection with Ames' work. The term needs clarification. Kilpatrick says, "By assumption is meant that generally unconscious aspect of the transactional process which may be described as a 'weighted average' of past experience in dealing with those portions of the impingements from the environment to which it is related." The emphasis on the general unconscious nature of assumptions needs some clarification, especially in view of the fact that the world we live in is considered by this approach to be an assumptive world. Kilpatrick says, "Taken all together, our assumptions form our 'assumptive world' on which our assumptions are based; therefore, the only world we know is determined by our assumptions." This seems to be Ames' position. He wrote to Dewey saying, "The observer's visual sensation does not correspond to the 'externality' as disclosed to him by later action. Now in every case his illusion is due to specific assumptions the observer makes that he is not aware he is making." Ames further made the distinction between assumptions and the


11 Loc. cit.

12 Dewey-Ames Correspondence on The Nature of Knowledge and Semantics; a letter from Ames to Dewey dated May 26, 1946, p. 1.
sensations an observer is aware of in actual transactions of living. He says, "... these assumptions are inherently different from the sensations of which we are aware in an actual occasion or 'transaction of living.' Sensations and perceptions are presumptions, i.e., prognostic."\(^{13}\)

The difficulty with this terminology is that it implies a mentalistic entity. An assumption is in ordinary usage intellectual awareness, or intellectual possession. The problem becomes complicated when assumptions are considered as largely unconscious. The same difficulty applies to presumption, which also implies a mentalistic connotation. Dewey pointed out in his reply to Ames that "the main trouble with traditional philosophical terminology is that it has dropped out the primary active sense and left a thinned-out intellectual usage as if it were exclusive."\(^{14}\)

Thus "to assume," Dewey pointed out, had an early usage (from Oxford Dictionary "to adopt into partnership, service, use."\(^{15}\))

As for presumption, Dewey noted that in its historical usage it meant, "... seizing without right, usurping; then to take upon oneself without authority--then to dare, venture; passing into

\(^{13}\) Ibid., p. 2.

\(^{14}\) Dewey--Ames Correspondence on The Nature of Knowledge and Semantics, a letter from Dewey to Ames dated May 28, 1948.

\(^{15}\) See Loc. Cit.
the intellectual sense—to take for granted; to take as proved till
the contrary is proved—to be presumptuous is to take liberties."¹⁶
These usages are evidently not what Ames intended. On the one hand,
there is the implication of mentalistic connotation in present day
usage, which does not go with the transactional approach; and, on the
other hand, there is the unconscious connotation which Ames
demonstrated and which is not intended by the common use of the
terms. He said, "... the objection to both 'prognostic' and
'presumptive' is that in themselves they don't give any sugges-
tion of action, which is the very essence of the phenomena."¹⁷

The problem, to recapitulate, is a matter of semantics and
the difficulty arises from the connotations of the terms used and
the meanings they are intended to signify for the description of
behavioral phenomena. By assumption is meant mental awareness,
but no action. But in Ames' usage of the term assumptions are
largely unconscious, and action plays a fundamental role in their
formation. Kilpatrick says, "Assumptions are probabilities which
are built up by action, checked by action and modified by action."¹⁸
There is more to the problem, however. How can we reconcile
between the fact that assumptions are based on action and that
at the same time they are unconscious? Does this mean that
action itself is largely unconscious? If so, what then is

¹⁶  
Loc. cit.

¹⁷  Dewey-Ames Correspondence, Ibid., a letter from Ames to
Dewey dated June 9, 1918, p. 2.

conscious action, if there is any? The difficulty here again is one of semantics, it concerns the connotations of the word 'unconscious.' What does unconscious here mean? Does it imply Freud's concept of the 'unconscious'; Ames does not accept that meaning. Does it then mean non verbalized or non reflective behavior? We shall come back to this problem in relation to the process of inquiry.

'Presumption or prognosis' suffer also from the same difficulties. Moreover, the term prognostic implies knowledge, but as is intended in Ames' usage, it connotes a directive to knowing because, "... we don't know as yet." 19

All this means that the usage of these terms may lead us to the entanglements of the traditional philosophical treatment of the terms, assumption-presumption.

For while the traditional philosophical logical treatment deals with them as if they were cognitive from the start and inherently, the idiomatic usage makes the 'practical' sense primary—that is, treats them as attitudes or dispositions which give direction to subsequent so-called responses, or, better, to the course of behavior of life conduct already entered upon and engaged in. 20

The problem may be clarified if we treat it in terms of the theory of inquiry. 21 Inquiry starts when something arises in the

19 Ibid., p. 1.

20 Dewey-Ames Correspondence, Ibid., a letter from Dewey to Ames dated July 18, 1948.

21 It is not within the scope of this study to deal with the theory of inquiry in detail, but only briefly insofar as it bears on the present problem.
course of living transactions—that is, in the course of the continuity of life activities—which renders the continuity or smoothness of these activities difficult or impossible. In other words, so long as life activities are smoothly carried on, the need for 'intellectual' inquiry does not arise. There needs to be a hitch or blockage to further activity for intellectual inquiry to arise. Inquiry finds its origin in a practical situation. "This 'hitch' or blockage is then primarily 'practical' in the sense that it tends to evoke the forms of behavior called fear and rage which, as specifically seen in animal behavior, are respectively withdrawing and aggressive, and in less intense instances curiosity, a kind of ambivalent mixture of an attacking movement with readiness to withdraw."22 In the demonstrations, the perceiver as we have seen, does not confront a hitch or a blockage unless the things he observes represent signs and these signify different meanings from what they have meant to him in his past experience. This is especially true when he reacts to 'things' as signs and the action does not conform to his expectations with respect to what is signified. By signs here we mean that the 'things' observed are meaningful as a result of past life transactions. Signs refer to and signify things not immediately observable, i.e., a block cloud means rain, a knock on the door means a guest or a visitor.

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etc. It is interesting to observe at this point that Pavlov in his experimentations on conditioning used the term sign for 'the outside' unconditioned stimulus. Furthermore, as Bentley has observed, Pavlov did not make the sharp distinction made now by behaviorists between the inner and the outer, that is between the outside stimulus and the inner reaction.  

To return to our discussion, we see that signs are out-reaching, being contained neither in the 'thing' nor in the organism; and, moreover, they are dynamic, not static. Inquiry starts, as suggested, in a situation made problematic because the significate of the sign (or signs) does not correspond to the expectations of the organism in a given transactional process or, to use Whitehead's terminology, in a given occasion of life. Hence, inquiry is wide in scope, and its aim is to envision the occasion in a wider context than heretofore was necessary. It searches out, so to speak, for new connections to bear upon the problem at hand. It is only when we enclose the organism in the confinement of a maze or a tight box that we tend to describe its behavior in terms of a rigid chain of events which start with a stimulus and culminate in reinforcement and, hence, in learning. These conditions are not without their value and significance, but we should understand them for what they are, in their limited scope. Faraday over one hundred years ago discovered that the electric current

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was not confined merely in the wire connecting the two poles of an electric battery and his discovery has been instrumental in changing the history of physics. It would seem to be time for the significance of this discovery to be realized in behavior theory. As for Gestalt psychology, it is time to take the searching attitude in perceptual behavior seriously. Ever since Gottschtadt performed his perceptual experiments with the concealed figures, and arrived at the conclusion that past experience does not enter into the perception of forms, Gestalt psychologists have capitalized on his findings and ignored the role of past experience. Experiments which deviate from Gottschtadt's have been attributed to a searching attitude. But this reasoning begs the question. The searching attitude is as potent an element in perception as is the structure of the perceived object; as such, it should be considered as essential for the study of behavior.

To return again to our original problem, we find that by and large behavior is a function of signs and that signs refer to something beyond that which is immediately observable. "Whenever a thing becomes a sign of something else it is said to have a meaning, the meaning being that which is pointed to, suggested, or indicated."

In a problematic situation, where signs do not work as expected, fear, bafflement, confusion, surprise or curiosity may result, as the case may be. To enter into search or inquiry means that there are new aspects of the situation to be found and examined.

But this is possible only insofar as there are already signs to
give direction to further behavior or action. In other words, the
problem solving process does not occur if the situation is in a
complete state of chaos. There must be some anchorage for behavior
or search to be initiated. The meanings of the signs may not be
ture in the occasion, but they are taken for granted, so to speak,
as a result of past action, with the consequent behavior being led
astray. This is another way of interpreting some aspects of Ames'
demonstrations. The locus of search in the trapezoid demonstration,
for instance, was not the form of the window; this was taken for
granted as a rectangle, with the resulting illusions following.
It is true that the 'assumption' involved was not consciously
formulated, but this merely means that its significance was not
acted upon, nor was it the locus of search. In like manner many
verbal puzzles can be explained. "The cock laid two eggs to
be divided among three persons so that everyone takes one whole
egg; how come?" The skill of the person presenting the puzzle
lies in his ability of concealing the clue so that it may be so
taken for granted that it does not become an object of scrutiny.

The function of signs—or assumptions, to use Ames' termino-
logy—in the above sense is to give permanency and coherence to
behavior. In the case of men the use of language is of such
importance that it may be said justifiably that man stands alone
in reference to the rest of the animal kingdom. Human inquiry is
unique and deserves special attention. It may not be basically different from other modes of animal behavior but, as a result of its dependence on artificial signs and symbols (as language), it makes man a human being in the full sense of the word. Dewey says:

In the human animal conditions are such (I would imagine because communication with others of the species takes the form of language) that curiosity becomes directed inquiry in which the 'hitch' in question becomes stated, i.e., a problem, the articulated formation of which is all one with the movement toward what is taken as its resolution—and hence the restoration of the ongoing continuity of behavior which has temporarily been diverted into reflective or into intellectual processes: inquiry, examination, observation, reasoning out, search, tentative following of clues (a process logically called hypothesis) etc., the practical aspect of behavior turning into manipulation of conditions to improve observations and thereby providing better clues for reasoning to follow, while the direct emotion of curiosity becomes an interest ..., in finding out; that is, an inquiry—discovery as itself amount to a life concern.  

Language, Thinking and Perception

We turn now to the implications of the foregoing for language, thinking, perception and conception. Behavior can be conceived in general terms as communication with the environment. The function of signs, whether natural or artificial, including the highly developed forms of symbols, the thinking process, may thus be seen in its proper place, that is, as an aspect of human behavior.  

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The question as to whether all thinking is verbal is by no means a settled one. Some of those who do not limit "thinking" to the verbal level believe that "verbal thinking" renders creativity impossible. Korzybski says, "If we 'think' verbally, we act as biased observers (perception) and creative work well nigh impossible." Granting that verbal thinking may limit the thinker's creativity, and that thinking may go on without the use of the spoken or written word, it does not follow, however, that "thinking" can all occur without the manipulation of some sort of meaning-endowed signs or symbols. This is evidently clear, since thinking, as Boyd H. Bode has phrased it, is "the finding and testing of meanings."  

It is only when we conceive of thinking as a mechanical process that we may dismiss meaningful symbols as playing an essential role in the process of thinking. But in this event the whole notion of creativity, in any genuine sense, would be out of place. Thus, the fact that Jacques Hadamard's observations indicate that the majority of outstanding mathematician reported that they think in terms of visual structures, does not exclude the interplay of ideas and

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28 This is Bode's definition of the thinking process and it is in line with our foregoing discussion. See Boyd H. Bode, *Fundamentals of Education*, Ch. VI.

meanings through the medium of these "visual structures." Hadamard found further\textsuperscript{30} that most generally images are used, very often of geometrical structure. This is to say, in other words, that these mathematicians simply used a language of their own; a language characterized by its own distinctive symbols, and one which is learned.

The conclusion seems warranted, then, that language is essential for thinking; or that thinking is impossible without language. We must recall that "language includes much more than oral and written speech. Gestures, pictures, movement, visual images, finger movement—anything deliberately and artificially employed as a sign is logically language."\textsuperscript{31} We may come back, then, to Korzybski's assertion that "verbal" thinking makes "creative work well nigh impossible" and ask whether the same statement applies to all other kinds of language? Apparently, Korzybski does not seem to think so, since to him only "verbal" language tends to keep us "in our rut of old orientations." The distinction here implied between verbal symbols or signs and other kinds is not at all clear.

Thought deals not with bare things, but with their meanings, their suggestions; and meanings in order to be apprehended, must be in sensible and particular existences. Without meaning, things are nothing but blind stimuli, brute things, they must be anchored by attachments to some physical existence. Existences that are especially set aside to fixate and convey meanings are symbols.\textsuperscript{32}

\textsuperscript{30} \textit{Ibid.}, p. 111.

\textsuperscript{31} John Dewey, \textit{How We Think}, pp. 230-231 (italics supplied).

\textsuperscript{32} \textit{Ibid.}, p. 231.
If, then, signs or symbols are essential for thinking to take place at all, the question becomes what are the factors that render the written or spoken word and not the other signs, such as visual images, limiting to creativity in the thought process? The fact that signs bear meaning is not the distinguishing factor in this regard. All kinds of signs stand for specific meanings, and thinking does not depend upon signs, as such, but upon their meanings. Thus Dewey asserts, "In the case of signs, we care nothing for what they are in themselves, but everything for what they signify—it makes no difference what the outward thing is, as long as the meaning is presented."^33

One might speculate, however, that because of its conventionality verbal language does not lend itself as easily as some other signs to manipulation and change and that, in some cases, oral and speech language falls short of conveying the meaning of certain experiences because of the lack of appropriate words."^34 We often hear it said, "I just can't say it. I just don't find the words to describe this (or that) experience." But when the words to describe the experience are at hand, the word "selects, detaches, a meaning from what is otherwise a vague flux and blur."^35

^33 Ibid., p. 231.

^34 Verbal language is, nevertheless, the most versatile of all symbols with respect to communication in almost all spheres of human associations.

How the word as visual or auditory stimulus carries its load of the meaning in the occasion or transactional event is still, of course, an unexplored problem. Associationism explains this in terms of stimulus substitution, but this explanation does not answer the problem as here conceived. All we can say is that so long as the word, as a sign, is lacking, the experience remains a vague flux and blur and the act of thought, if initiated, cannot be completed. One may justifiably conclude that this is equally true of other signs, as in the case of geometrical images, and the like. In other words, in some experiences "some meaning seems almost within reach, but is elusive; it refuses to condense into definite form; the attaching of a word somehow... puts limits around the meaning, draws it out from the void, makes it stand out as an entity on its own account." It seems that all other signs, where they function instrumentally in the thinking process, do exactly the same thing—namely, put limits around the meaning of the experience that is had and, insofar as they do, they limit the scope of the phase of the experience attended to. Thus, paradoxical as it may seem, the process of attaching meaning to signs, whether verbal or otherwise, makes the thinking process possible, on the one hand, and yet, on the other, limits the scope of thinking and, perhaps, also limits creativity. This, of course, does not rule

—Loc. cit.
out the value of signs and symbols, whether verbal or otherwise, in their appropriate functions.

In order to pursue this problem further, let us consider an experiment which was designed, in a way, to show the relationship between oral language and perception, or, rather, the influence of the former on the latter. Strictly speaking, the authors, Carmichael, Hogan and Walter, attempted to control reproduction of visually perceived form by means of language. A series of 12 ambiguous figures were presented to two groups of subjects. The subjects were instructed to draw the figures as accurately as possible after the series had been viewed. Just prior to the presentation of each figure, the experimenter said, "The next figure resembles...." (and offered one of the two names of the figure). The result was that the reproduced figures were markedly modified to conform with the names suggested to each group of subjects. It is worthwhile to note, however, that the change from the original in the reproduced figures varied from a slight change to almost an complete one. The drawings were rated upon a five point scale by two judges. In commenting on the results of their experiment Carmichael, Hogan and Walter said:

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Ibid., p. 87.
If a verbal, stimulus-form and a visual stimulus-form are presented to a subject in certain temporal relationships the processes in question may be modified, or rather a new, total process may result, which is in certain respects unlike either of the previous sets of processes. On subsequent arousal by any 'past' stimulus the reproduction is thus a complexly determined total, and not either of its compound processes.

The results of this experiment and the conclusions of the authors seem to show that the spoken word has its effect on the reproduced figures and most probably on the perceived object, also. The authors infer, therefore, that verbal stimuli affect perceptual processes.

The effect of the spoken word is not a direct one so far as our problem is concerned, however. On the one hand, the spoken word was introduced by the experimenter as a co-stimulus with the visual form. On the other hand, the experimenters were interested in the reproduction of visual forms rather than with perception as such. The fact that the subjects were instructed to draw the figures as accurately as possible seems to indicate that the subjects in general did accept the verbal stimulus as representing the visual stimulus form to some extent at least. Some measure of this acceptance could have been secured by estimating the degree of change of the reproduced figures as compared with the original. Such an estimate could be checked by a report given by the subjects about their opinions concerning the accuracy of their original images. An experiment designed
on the same basis as the one referred to above and so modified as to include a control group with no oral stimuli, with a report given by the members of the experimental group concerning their acceptance of the verbal stimuli should prove valuable. To inquire into the relationship between the spoken word and the visual figures further, the aforementioned experiment could be carried out with subjects who have a special experimental background in geometrical figures or drawing, such as engineering or drafting. Such an experiment should prove valuable in deciding on the influence of the spoken word on the perception of visual figures against an experiental background of similar visual figures. The assumption here is that subjects having experiences with drawing or geometrical figures may prove less susceptible to the influence of the verbal stimulus, hence, the change in the reproduced figures might be minimal. The purpose suggested here is the exploration of the different conditions under which the subject accepts or does not accept the verbal stimulus as a sign for the visual stimulus and the extent to which his past experience affects this acceptance.

So far it has been argued that signs or symbols, as bearers of meaning, are essential for perception and thinking. More pertinent to our problem are Bartlett's classical experiments dealing with visual perception. The material used in these experiments was graded in character, and passed from simple
shapes and patterns, through designs, the complexity of which was considerably greater, to concrete representational picture material. Bartlett then had his subjects immediately reproduce and/or report on their percepts. In commenting on the results Bartlett classified the schemes of settings which make perceiving possible in the following manner:

(1) The first reaction to material of very simple construction to be observed was the assignment of a name. "The names were, as a rule, given as soon as the designs were exhibited." Bartlett adds further that "the name thus unreflectingly given may, and in many cases demonstrably does, determine what is perceived."^1

(2) In case of relatively more complex objects, there is often a search for analogical material, to which, when found, a name is given which acts as in the former case.

(3) In this case the setting or ground is given (by the subject) in the response to a plan, or order of arrangement, which does not demand naming at all and the process may be unreflective and immediate as in the first case.

(4) This is the case of complex representational material. Here there may be hesitation, followed by the emergence of a definite sensory image which at once constitutes the necessary ground "for perception."

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39 See Bartlett, Remembering, p. 32.

^1 Ibid., p. 32.
If we accept the reports of Bartlett's subjects as indicated above, we may conclude that naming is usually concomitant with perceiving when a name is available. In this case, the name may determine, or at least influence, what is perceived. Unlike the former experiment by Carmichael, Hogen and Walter, the name here is not introduced by the experimenter but is given by the subject, but with almost identical outcomes. In Bartlett's experiments, however, a name was not always given. A name, according to him, was immediately given only in the case of familiar material with simple construction. We may assume, therefore, that naming in such cases, is nothing but a process of finding meaning in whatever visual structure is presented. When no name directly fits the object presented, especially when it is unfamiliar, the subject tries to find meaning in the perceptual object presented by searching for analogical material and then giving the name, which then functions as in the previous case. The perceiver, in other cases, may respond to a plan or order of arrangement. Such would be the case when the visual stimulus is constituted of geometrical lines and designs. We may assume that this kind of response serves the same function that naming serves in the previous instances, to give meaning to whatever is presented and that it is the setting that makes perceiving possible. The subjects may still be considered to be using language but not overt verbal language. Perhaps the inadequacy (that is, for
the lack of appropriate terms) of the verbal language in such cases accounts for the use of a different and more adequate medium to grasp the meaning of whatever is presented to him.

Another experiment which is of some significance here is that of the line demonstration. In this experiment the relationships between the verbal stimulus and the visual stimulus are demonstrated. It was shown, for instance, that when the verbal stimulus was accepted as a sign for the visual stimulus it affected it drastically. The short line of light was seen to move backward in space to correspond to a telephone pole. But when the stimuli (verbal and visual) could not be made to fit in the total pattern the conflict that arose between the different stimuli as signs rendered perception unstable. This was the case when a shorter line was named a fencepost and the longer line simply as a line. The moral is that words are signs or rather, in their elaborate forms, are symbols and their functions are those of other signs. Mooney says, "Words are perceptions. They are learned in the same way as other perceptions are learned and they have the same function. Verbal cues will therefore affect visual perceptions and visual cues will affect verbal perceptions."

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43 Ibid., p. 9.
This is to say that signs, whether natural or artificial, as well as symbols, function as instruments for man's cognitive commerce with the environment. In general terms, in short, they are means for communication, they are tools.

We do not learn, as it is usual to think, one language so much as we learn different languages to fit and express different kinds of experiences. Certainly objects of art are languages. "For each art has its own medium and that medium is especially fitted for one kind of communication. Each medium says something that cannot be uttered as well or as completely in any other tongue."

It would seem to follow, then, that the language we use for a certain kind of experience is the language we have learned to use in just such sorts of experiences. Hadamard's mathematicians reported that they used images of geometrical structure in their mathematical work simply because they had learned to use the language which fits best their area of inquiry. It would be impossible for them to use verbal language alone as completely or as well in their work. It may befit the present situation to cite an example to show the relationship between naming and perceiving as represented by Bogoras' study of the Chukchee. Bogoras found that in spite of their extreme impoverished color nomenclature,

\[44^4\] John Dewey, Art As Experience, p. 106.

\[45^4\] See W. Bogoras, The Chukehee.
ture, as reindeer herding people, the Chukchee were able to apply more than two dozen names to the task of distinguishing the patterns of reindeer hides, many of which at the outset looked identical to him. This instance, as many others, helps to illustrate the instrumental value of names as signs in perception. The hides as "external" stimuli were the same for Bogoras as they were for the Chukchee people, but he was unable to see what they saw. The past experiences of the Chukchee people in herding reindeer accounts for their remarkable perceptual ability in this instance. This is only to say, however, that they acquired a language which made their successful adjustment to differences in hides possible.

The speech language may, and does, vary from culture to culture. Corresponding words may differ in meaning and the grammar of one language may so differ from another as to render the meaning conveyed by such a language vary differnt. The language of the Hopi Indians, for instance, differs from the English language, among other things, by the fact that its verb is timeless (i.e., the verb does not distinguish between the present, the past or the future). It must always, however, indicate what type of validity the speaker intends his statement to have. The statement may report an event, expectation of an event or a generalization or law about events. The Hopi language
does not have a concept of dimensional time and the universe can thus be described without recourse to such a concept. Whorf suggests that without T (time) or V (velocity) a physics could be perfectly constructed by the Hopi language, though, of course, it would require a different ideology and perhaps a different mathematics. He further suggests that since the Hopi language has no word really equivalent to our "speed" or "rapid," a new term, "I" (intensity), would have to be introduced in this new physics to describe anything or any event, whether as moving or as just enduring. "Perhaps the I of an electric charge will turn out to be its voltage or potential." In other words, with such a language one would have a different outlook on life, a different ideology, different meanings. It would still be a proper language, however, available for use by those who spoke it in coping with life situations and with natural phenomena.

Concept and Concept Formation

Reference to concepts, or to concept formation, has been deferred up to this point on purpose. The reason is that the word "concept" is a word of such varied meaning that it ends up

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Ibid., p. 217.
frequently almost meaningless. A "concept" in ordinary usage may mean a notion, an idea, a rule, etc. The term, however, is widely used and is found everywhere in scientific writings. The difficulty apparently lies in what seems to be a carry-over from its old scholastic usage as an item of knowledge, considered as a static structure. But as Bentley has pointed out, "Its old scholastic implications have long since disappeared and we may properly demand of the modern user of the word, "Where can you show us a sample of these concepts you talk so much about?"

We get no answer whatever in any modern sense.... at its best it is a mere schematic term."48 Bentley has conferred with both Bridgman (a physicist) and Dewey concerning the use of the term. Their responses confirmed the contention made above that, in general, the term is overworked.

Professor Bridgman once checked a portion of his own unpublished manuscript in which the word concept appeared fifty-three times, and found that without any sense of loss he could omit it in all but four cases; in two of these forms, the casual word 'notion' did service, leaving only two resistant cases out of the fifty-three.

The same applies to Dewey's writings. "Professor Dewey has written that he has made sufficient examination to convince him


49 A. Bentley, Ibid., p. 14 (footnote)
that 'the word is useless at least four-fifths of the time—my own included.' 50

All this is not to say, however, that the term is without value when used in its proper place. The vague usage we have shown to prevail may provide a partial clue, at least, as to why the term has been largely neglected by modern psychologists. Even when it is used in psychological terms it is treated, in the same of its scholastic usage, as a rather static structure, an end product, not as a dynamic term. "On Dewey's basis 'concept' may appear as forward looking, a possibility—realizing 'idea' or 'rule' or 'habit' of behavior, or alternatively it shows itself as a name for certain intricate language behaviors." 51 Concepts and concept-formation from this point of view are important tools for the understanding of the higher levels of human behavior. But as we have indicated, they are not given any genuine attention as phenomena to be investigated on their own merits by modern psychologists. Where they are dealt with they seem to be treated implicitly in terms of principles derived from lower modes of behavior.

It remains for us to find out, in terms of modern psychological theory, how these modes of behavior may be interpreted.

50 Loc. cit.

51 Ibid., p. 15 (footnote)
Hullfish pointed out wherein Thorndike's psychology failed to give an adequate account of concept formation, centering as it did on the principle of common elements. He aptly showed that if the (physical) common elements are taken away from a series of squares of different sizes, nothing would remain to account for the concept 'squareness.' The alternative, he showed, would be to imply a mental entity to account for the concept. Explicitly, Thorndike did not allow for such an entity. He had to resort to some physiological correlate of 'squareness' in order to account for the concept. But this alternative was as ambiguous as was the mentalistic concept. By the same token Hullfish showed the inadequacy of James' treatment of the concept of 'rotundity.' The fallacy, he insisted, lay in treating learning as a matter of analysis and analysis only. Hullfish said,

> When Thorndike says that 'all learning is analytic,' he assumes that the 'elements' which direct behavior are present whether the organism knows it or not, and are capable of suddenly popping into view and becoming prepotent determiners of conduct. The organism, as these elements emerge, reacts to first one and then another, until finally an element appears that directs the completed reaction.\(^5^2\)

In this citation, Hullfish reacted against the atomistic approach of Thorndike, as well as his dualism between the stimulus and the response. His criticism is particularly valid in this respect,

especially when we consider Guthrie's system. Guthrie's treatment of concept formation would essentially be in terms of new additions of associations between new stimul and responses. Meaning, naturally has no place in such a mechanistic system. Hullfish said of Thorndike—and the same would seem to apply equally well to Guthrie—"... Thorndike entirely neglects the implications or meanings, which are known experientially to guide the bulk of man's conduct. Meanings are given no work to do. There is no significant 'making over' of the situation."\(^{53}\)

When we turn to Hull we find essentially the same state of affairs as in Thorndike's and Guthrie's psychologies. If we seek a lead to the understanding of concept formation in his treatment of habit, for instance, we have to contend with a mechanical static structure defined ultimately in terms of primary reinforcement. We have seen that Hull recognizes that the stimuli playing upon the organism are many and that repetition of the mode of behavior in a given situation makes for conditioning only to those stimuli which are consistently present and hence relevant to the response. If we take our clue from this concept formation becomes a matter of sorting out irrelevant stimuli or cues. The forward-looking aspect of a concept is almost completely out of place. Hull's treatment of stimulus-generalization, response-

\(^{53}\) Loc. cit.
generalization and stimulus-response-generalization does not help, since it is equally mechanistic. Perhaps the nearest Hull comes to an explanation of concept formation as here considered is in his treatment of the habit-family hierarchy. This falls short of our understanding of concept formation and, in any case, Hull, as Brunswik has repeatedly pointed out, does not make much use of the hierarchy. It certainly is not as dynamically treated as is Brunswik's cue-family hierarchy nor does it have the significance of Brunswik's emphasis on vicarious functioning.

Skinner's position leaves us confused. We can see some possibility in his concept of reflex reserve, but its rigidity, together with the mechanistic meaning Skinner gives it, makes it useless. When we turn to the field theory, as represented by the Gestalt position, we find ourselves confronted with the rigidity of the 'physical Gestalten' and the mentalistic connotation of the process of perception. This latter difficulty reaches a peak in such a system as that of Snygg and Combs.

From the transactional point of view the problem is seen differently. We know that words are alive. They are like living creatures, in the sense that they have their birth, they grow and eventually they may die. The dictionaries are full of archaic words which may be called dead so far as today's usage is
concerned. To some extent, at least, this evolution may be observed in an individual's usage of words. As human beings become acquainted with new words they may be at first on a level of sheer memory and not usable. In time, however, they may become an integral part of the individual's vocabulary. Later these same words may languish and die. What we are interested in here is the birth and growth of the meaning of a word. The meaning of a word depends, of course, on the past experience of the individual who uses it. This should not prove surprising since, as mentioned before, words are percepts, so far as their origin is concerned and percepts, as has been shown, depend on past experience. We have then to reject the fallacy of 'one word, one meaning.' It is impossible to fixate the meanings of words. Dewey taught this lesson long ago and, more recently,

Hayakawa has said:

Everyone, of course, who has given any thought to the meanings of words has noticed that they are always shifting and changing in meaning. Usually people regard this as a misfortune, because it 'leads to sloppy thinking' and 'mental confusion.' To remedy this condition, they are likely to suggest we should all agree on 'one meaning' for each word and use it only with that meaning. Thereupon, it will occur to them that we simply cannot make people agree in this way, even if we could set up an iron clad dictatorship under a committee of lexicographers who could place censors in every newspaper office and a dictaphone in every home.54

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Hullfish in treating the growth of the word "dog"—the "concept of dogness"—in the life experience of a young child, showed how, after the child had acquired the word "dog" as a sign for that animal, the sign kept shifting and changing its meaning as the child had new experiences with dogs. Where is the concept "dog," one may ask, in the above example? Is it in the word "dog" as such? Obviously not. Is it in the physical thing as described by physics? We have to say "No" to this question, also. As a concept, the dog is a possibility, a forward-looking sign for action. Is it a friendly dog to play with, is it a harmful one that may bite? There is a question mark? This is the case with all concepts.

Conceiving carries the function of cognition a step—or many steps—beyond perceiving, freeing the organism from what is immediately given, here and now, enormously increasing both the refinement and range of its operations, enabling it to work symbolically with the absent and the distant, with the past and the future, and to go beyond the actual and construct the merely possible.55

In other words, the experiential background becomes part and parcel of the present event.

Of the concept 'dogness,' for instance, as it functions in a new situation, we must note that, "The entire background of experience serves as a guide in bringing out the meanings of the puzzling stimulus."56 This state of affairs signifies that


we cannot draw a sharp line between perception and conception; they are not of different orders psychologically speaking. The demonstration experiments have made this point clear. This reminds us also of Kant's assertion that conception without perception is empty and perception without conception is blind. Kant's position, however, is based on a form of apriorism. From the present point of view apriorism is out of place. Perception may then be defined as that cross-section of the transactional process of the here and now in reference to the organism and objects of the here and now. Yet it is not completely contained in the here and now nor is it confined to the immediate event or occasion which forms its locus. Conception is characterized by its ongoingness. It is not determined completely by one event or occasion. We need to observe here the use of the word 'assumption' in the transactional approach as set forth by Ames. He treats it as some sort of weighted average of past experience. In this definition, the meaning of the 'weighted average' will bear watching. We have seen that as a result of action, relatively limited, in the case of the distorted room, the illusion disappears. The consummatory affect of the present action included--needs further inquiry to clarify the significance of this notion of 'weighted average.'
An examination of the thinking process will reveal that the relationship between perception and conception finds a corresponding relationship between induction and deduction. The traditional distinction between the two aspects of the thinking process is invalid; they are not "separate forms of thinking."\(^{57}\) They are as are perception and conceptions, "at most distinguishable aspects of a process that presents the same general features everywhere."\(^{58}\) We cannot see where induction as such starts in the steps of the process of reflective thinking. Without a hypothesis, the particulars of the situation are mute, meaningless, and hence provide no lead for thinking. This does not mean, however, that the distinction is without its function. A hypothesis is necessary to guide our action, to give meanings to our percepts and to bring new connections to bear upon the problem. The hypothesis serves as a guide for the finding of certain facts which become meaningful as they relate to the hypothesis and confirm it. In the process, however, facts may be come upon which do not support the hypothesis as formulated and hence may necessitate a change in, or modification of, the hypothesis. It is always because of a hypothesis that facts become meaningful, whether they confirm the hypothesis or invalidate it. The


\(^{58}\) *Loc. cit.*
distinction between induction as the gathering of facts and deduction as generalization is artificial and, at best, arbitrary. "The reason why induction has seemed as different from deduction and as independent of it is presumably that the gathering of facts has loomed up large in the sciences." The mistake arose from the assumption that facts speak for themselves, which they do not do. We may make a proper distinction between deduction and inducation along with Bode by noting that they represent aspects of the one process of reflection, as follows, "... induction may be defined as a name for the methods of arranging or regulating evidence," whereas "deduction, accordingly may be defined, as the process of drawing out the implications of meanings." The foregoing exposition was intended to shed light on two points. The first is the direct implication of the foregoing for the understanding of the highest cognitive level of human behavior—reflective thinking—within the framework of the transactional approach. The second point is indirect. It is the implication of this approach for psychological theorizing. Dewey has referred to "the reflex arc" as a concept, a concept that helps us organize our knowledge with respect to human behavior. Strangely enough, 

59 Boyd H. Bode, Ibid., p. 423.

60 Ibid., p. 126.

61 Ibid., p. 125.
Skinner early in his career, treated the concept "reflex" in more or less the same manner. He wrote:

We have been proceeding, of course, upon an unnecessary assumption, namely, that there is a flexion reflex which exists independently of our observation, and which our observations approximate. Such an assumption is wholly gratuitous, but it is remarkably insistent—If we remain at the level of our observations, we must recognize a reflex as a correlation. But the immediate uncritical reaction to a definition on that basis is not enough. There is an urge toward solidification, clearly evident, throughout history. We turn insistently to the reflex arc for material support.

It is clear, then, that if we conceive the 'reflex arc,' not as a self-actional entity but as a construct or concept, that its effectiveness will depend on the breadth of our envisionment of behavior. Skinner, however, as we have seen, has kept his envisionment narrowed to reflex reserve, extinction rate, etc. From this limited envisionment, he generalized his findings with respect to rats or birds in the confinement of a box (Skinner's box) to account for all human behavior. This practice has been the case, unfortunately, with respect to human inquiry in general. Bridgman says, for example, referring to the concept of the electric field, that

In the first place, an examination of the operations by which we determine the electric field at one point will show that it is a construct in that it is not a direct datum of experience. Now nearly every physicist takes

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the next step, and ascribes physical reality to the electric field, in that he thinks that at every point of the field there is real phenomena taking place.... (The field concept) is considered the most fundamental concept of all modern electrical theory. Yet in spite of this I believe that a critical examination will show that the ascription of physical reality is entirely without justification.... There can be no question whatever of the concept of the electric field as a tool....

Here we find a genuine psychological problem which pervades human thought in general. It is the task of psychology not only to reckon with the problem of describing behavior, but also, and perhaps primarily, to reckon with the logic of psychological systems. Holt attributes this difficulty to the reifying power of words. Yet he points out that this explanation in terms of the reifying power of words simply "names a psychological phenomenon which may be said to underlie the logical fallacy which we are now considering.... But if I supposed myself to have really explained the fallacy by adducing the reifying power of words, I should be committing that very fallacy—why words tend to be taken for things is what would still need to be explained."(61)

This is an area which is yet to be explored. When it is, if the conclusions of this study are correct, the cultural, historical and experiential background of words and their use will have to be taken as facts relevant to the inquiry. The


hypothesis is advanced, therefore, after this study of the problems of perception, conception and thinking that the answer will be found to lie within the terms suggested by the transactional approach in the study of human behavior.

**Conclusion**

Thus far we have surveyed some possibilities of the transactional approach in psychology. We have seen how with this approach the highest levels of human behavior, such as conception, reflective thinking, and inquiry in general, may be treated psychologically as natural phenomena along with other modes of behavior. This is a very promising sign. Without such an approach the psychologist on occasion, unwittingly reveals a split between his general approach to psychology and his psychological formulations and findings. In fact, he is disposed to leave the former to the philosopher and devote himself to the perfection of laboratory techniques and the reporting of such findings as these uncover.

Psychology will continue to fumble uncertainly in the darkness, it seems evident, so long as the higher levels of cognitive behavior remain outside the domain of psychological inquiry. The problem will not be solved by coming at these cognitive modes of behavior after the problems of the lower forms of behavior,
especially animal behavior, have been settled in one way or another. The moral is that the psychologist should no longer leave the analysis of, and inquiry into, the methods of thinking which give his experimentation meaning to the philosophers. His own mode of thinking, his logic included, inasmuch a matter for his reflection as is the experimentation in which he engages. The split he now occasions between his methodological approach (philosophically speaking) and his psychological formulations inevitably channels his thoughts. The former imposes itself upon the latter and, consequently, the psychologist finds himself "consciously" or "unconsciously" moving in a vicious circle.

Communication between psychologists of different methodological approaches becomes, as a result, a very difficult task, when it is possible at all. We have observed that most of the different psychologists agree that the scientific method is the only legitimate approach to psychological phenomena. But this is as far as they go in their agreement. They differ in their understanding of the implications and significance of the scientific method, in their psychological models, in their experimental designs and interpretations. This situation is unfortunate, being unparalleled in any of the natural sciences. Psychology has to overcome this difficulty if it wishes, as it does, to assert itself as a natural science.
To illustrate the point we may refer to our previous analysis. We have seen how behaviorism, particularly in its early days, insisted upon empirical positivism and the rigor of scientific empiricism. Hence, it focused its attention almost exclusively on observable phenomena, that is, bodily movements. But the behavior of the organism must (according to the mechanistic law of causation) have a cause. The environment provided that cause in terms of stimuli. Behaviorism thus, by taking its point of departure from the organism's reactions, ended by becoming an environmentalistic psychology. In contrast, we have seen that gestalt started by making perception the central object of study. The focus of the gestaltists was on the structure of the objects perceived. They thus inquired into the structure of the objects of perception and the environment in general; and, in order to account for the organism's behavior, they had to assume it to be natively equipped with dynamic structures which copy, so to speak, the structure of the outside world. This is done by intermediary processes, such as sensory organization, the law of pragnanz and its sub laws, the principle of isomorphism and the invariance factor. In other words, gestalt reverses the reversal of behaviorism. It starts from the structure of the outside environment, yet ends by becoming the nativist psychology.
There is no suggestion here, of course, that the vast wealth of psychological study and literature is useless. What is needed is reinterpretation in a new and wider envisionment. The transactional approach has within it this promise. It does not throw away the past; it builds upon it and out from it.

We believe that the basis for this new envisionment of psychological phenomena lies in the long neglected article by John Dewey, "The Reflex Arc Concept in Psychology," written in 1896. The recent experiments conducted by Ames at Hanover Institute throws some light on the problem, showing that neither the organism taken alone, nor the environment taken independently of the organism, can provide an adequate explanation of behavior. His work appears to substantiate the contention of the transactional view that the environment, the medium within which the organism reacts includes, in fact, the organism as part of its total character, and as a totality becomes the locus of inquiry.

Ames' transactional approach has been so far concerned with perceptual illusions. It provides solid ground, as we have seen, for the understanding of the meaning and significance of the transactional processes of life. But it must move forward from its present level, if it is to serve the purpose of providing a wider framework for the study of behavior. So far as the knowledge of the present writer goes nothing has been done within this approach to inquire into the growth aspect of experience or,
to use Dewey's terminology, into that reconstruction of experience which is learning. The transactional approach, in other words, should follow the growth of experience, perhaps along two lines. First, by experimenting with different age groups; and, second, by a follow-up of the responses of single individuals over lengthy periods of time, so that the ambiguity of the "weighted average of past experience" may be cleared.

One further remark about Ames' transactional approach is that it should become more concise in the use of its terms such as "assumption," "presumption," and "prognosis." This it needs to do in order to rid itself of traditional "mentalist connotations." The present study has attempted to suggest a new linguistic basis for explaining behavior in terms of John Dewey's theory of inquiry, psychologically expressed in his conception of transaction as a substitute for the now repudiated conceptions of self-action and inter-action.
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I, Naguib Iskander Ibrahim, was born in Cairo, Egypt, August 2, 1919. I received my secondary education in the Cairo public schools. I received the B. Sc. in chemistry and zoology from the University of Cairo in 1943. I received the Diploma of Education and Psychology from the Graduate Institute of Education, Cairo, in 1945. I taught for one year in Asswan High School and one year in the Demonstration School, Orman, Giza. I taught for four years in the Graduate Institute of Education and the College of Education, Cairo, Egypt.

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