A METHODOLOGICAL INVESTIGATION WITHIN THE FRAMEWORK OF ROTTER'S
SOCIAL LEARNING THEORY OF THE VALIDITY AND UTILITY OF
CONCEPTUALIZING BEHAVIORS SEQUENTIALLY

DISSERTATION

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To:
Bonnie and Tom
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Chapter I
INTRODUCTION

Though the problem of predicting and controlling his own and others' behavior has concerned man since time immemorial, it has been only recently that he has applied those techniques he calls science, which he has evolved for answering many other questions, to this most personal and vital of his problems. In the past century, however, great progress has been made in outlining some of the problems of a science of human behavior. Today many psychologists are concentrating on the problems of developing hypothetico-deductive systems, of establishing laws of learning, of doing psychotherapy, and of building personality theories, whereas 100 years ago they were trying to establish the relationship between mental events and physical events through the use of psychophysical methods.

However, since psychologists' questions have been many, and their answers relatively few, they have borrowed much from other sciences, perhaps without fully questioning clearly what their needs were. Since the different psychologists borrowing had different interests and different sources of knowledge, they borrowed different things and have applied them in different ways, so that today there are numerous inconsistencies in our psychological knowledge and many consequent controversies.
It is from thinking and reading about two such questions and potential answers to them that the present study evolved. Those questions are: What unit or units of behavior, or perhaps what criteria for delimiting units of behavior are best for describing human behavior for predictive purposes? And, how can the effects of behaviors so delimited best be combined to provide a basis for predicting and controlling human behavior? These questions are certainly not unrelated; in fact, they are almost inseparable, since the ways behavior is delimited will determine to a certain extent how the effects of those behaviors will need to be combined for predictive purposes. Nevertheless, they are sufficiently independent to warrant separate consideration and are discussed separately in the next chapter.

It can only be admitted that the tentative answers offered here are a function of the writer's own personal philosophy and interests, his academic training, and his awareness derived from his clinical experience of the need for immediate applications of psychological principles to the solution of human problems. Since a psychologist is no less a human being for having become a psychologist, the best solution seems to be to make one's biases explicit insofar as is possible, and accept that the approach suggested here is undoubtedly limited by these factors. In addition, the value of such an approach can only be determined by empirical tests far more extensive than this particular study; nevertheless, the questions raised do seem to have implications for the developing of a systematic science of human behavior and it is largely on that basis that such studies as this are felt to be justified.
CHAPTER II
BACKGROUND OF THE PROBLEM

In this chapter the theoretical framework in terms of which this study is formulated will be outlined, and the recent research related to this study will be reviewed. In addition, the implications of, and tentative answers to, the two questions raised in the introduction will be discussed further. The topics as presented are: (1) The question of units; (2) the combining of units; (3) social learning theory; and (4) relevant research.

The Question of Units

The answer to the question, what unit or units of behavior should be used in setting up a theory of personality, will undoubtedly be a function of our purposes in setting up a personality theory; therefore, it might be well to start with them. Presumably the purpose of a personality theory is to predict "personality" behaviors; that is, such behaviors as asking for a date, going to college, being aggressive or withdrawing, being tolerant or prejudiced, or in general, those behaviors that can be called learned purposive behaviors. The first question to ask in seeking a basic unit for describing such behaviors might be: Is behavior described in such terms amenable to scientific analysis or must it be "reduced to more elementary terms"? Actually there seem to be no necessary reasons for such a "reduction"; rather, the idea that attempting to explain events so described in other terms is a "reduction"
is fallacious. If we accept the generally held scientific position that all knowledge is gained by experience it then follows that there is no logical reason for contending that any kind of knowledge (such as physiology) is any more basic than any other kind (psychology). In other words, of our only source of knowledge is experience, no class of facts is any closer to the real nature of events than any other, since all facts are equally a function of human experience and equally subject to the limitations inherent therein. The next question might then be: Even though such a reduction is not logically necessary, is it not more parsimonious to establish a consistent scientific framework including both psychology and physiology? It is true that eventually, in a science of sciences, such an integration is to be desired. Even so, it presumably would not be on the basis of accepting physiology as the reference point and requiring psychology to be modified to the extent of conforming to physiological formulations; rather, presumably both would be modified in some respects. In addition, there is the very pragmatic consideration that both sciences are relatively undeveloped at this point and more would seem to be gained by the members of each of these sciences attempting to work within their own defined limits to improve prediction and control at their respective levels of investigation. In conclusion, it seems that there is no sound logical, pragmatic reason for not describing personality behaviors at the level of learned purposive behavior for purposes of developing a theoretical framework of personality. On the contrary, there seems to be much that could be said in terms of parsimony and pragmatic value for such a direct attack on the prediction and control of personality behaviors.
Assuming that it is potentially best to approach the problem of predicting human behavior by operating solely at the psychological level of description, the next problem is that of determining the basis to use for delimiting behavioral units within that framework. One approach has been that of the associationists such as Hull and Spence who have advocated that all complex behaviors are reducible to additive combinations of simple, single, discrete, objectively defined behaviors. They define their basic unit as a single act-reinforcement, or possibly as a single choice, or at most as a series of acts terminated by a single reinforcement. An example is Hull's treatment of temporal stimulus patterning (13). He sees such a phenomenon as the linking of successive stimuli through the interactions of perseverative neural traces and as limited by the occurrence of a single reinforcement. While Spence (34) would deny the need to resort to physiology for an explanation of such a psychological phenomenon, he too would presumably utilize the same approach in explaining patterning.

At the other extreme are phenomenologists such as G. Allport (1) and Snygg and Combs (33) who contend that each person's experience is unique and unanalyzable by a normative approach. Allport, in discussing the nature of traits as the most acceptable unit for the investigation of personality, states: "The doctrine of traits differs also from the theory of factors or any other system of common dimensions into which every individual is fitted categorically. Conceptualized nomothetic units (factors, instincts, needs, and the like) stress what is universal in men, not what is organized into integral, personal systems. The doctrine of traits emphasizes complete individuality" (1, p. 339f). Similarly, Snygg and Combs reject the normative approach as an adequate
basis from which to predict human behavior and contend that to do so it is necessary to understand the "phenomenal field" of the behaver.

It seems to the writer that a better answer lies somewhere between these two extremes. Certainly it is true that if our only source of knowledge is experience, each of us does have unique experiences, since each of us had had a unique behavioral history. On the other hand, we do assume a basic commonality of experience when we make any attempt to communicate with each other, and to the extent that such communication is useful the normative approach has presumably been justified. In other words, the inferences we make about what anyone else means by what he says or does when he is communicating with us are normatively derived from our own previous experiences. It is true that such inferences are inaccurate to the extent that our experiences relevant to the specific matters of communication differ from his; however, the very fact that we can and do communicate is evidence of the usefulness of making such inferences.

On the other hand, the reductionistic approach at the other extreme seems unduly rigid in its contention that all experiences are necessarily delimited in exactly the same way by everyone. Certainly if we think in terms of the unique behavioral history of each of us, we would wonder if there were not at least minor differences, and if our experiences might not be differentiated or organized somewhat differently as a function of these unique histories. That is not to say that there are not commonalities or principles for analyzing others' experiences and predicting their behavior; rather, it is merely to say that the logical necessity of such a rigid approach seems unjustifiable.
The alternative suggested here which serves as the basis for this study is that we do need to recognize the uniqueness of the experience of each of us as a function of our unique behavioral histories, but that, on the other hand, the only basis from which to work toward the scientific prediction and control of behavior is the assumption of commonality in our experiences. Starting with that assumption we attempt, by the process of approximation and correction, to increase the amount of commonality and thereby increase our degree of prediction and control. Further, the writer would question whether or not such basic units as advocated by the associationists might not better be thought of as limiting cases in the sense that it is not feasible to reduce further such units at the psychological level of description, and that further reduction would lead to units which lack "meaningfulness." For example, the behavior of turning a corner or even that of taking a step may be thought of as a "psychologically meaningful" unit of behavior in that it is purposive; but if either of these units is broken down into a number of contractions and extensions of the person's legs, etc. that "meaningfulness" is lost as far as being descriptive psychologically of that person's behavior.

The above statements are not meant to deny the utility and necessity of conceptualization in terms of single acts or choices; in fact the word sequence implies that larger complexes are made up of these single choices. This approach does, however, deny the logical necessity of single act conceptualizations as the only kind of unit that can be used. For instance, a choice behavior at any one point might be for any individual so much a function of some larger sequence that it has not been differentiated out by that person (though it may have been so done
by an observer) as a choice. For example, a Christian may not think of the alternative of becoming a Moslem as a choice; nor for that matter does the Moslem think of becoming a Christian as one. Or two people might respond to a fairly complex situation (such as college) in quite different ways, since it is seen by each as a part of a quite different and very complex sequence. Consequently, one of them might date frequently, join a fraternity, attend few classes, etc.; the other might study late every night, never cut a class, and engage in very few social activities. In fact, a person's total life might be thought of as a sequence in which the choices made differ markedly, depending on whether that person believes in a life after death.

Operational evidence of the advisability of including such sequential concepts in a psychological system and of the inadequacy of the reductionistic conception would be provided by demonstrating the occurrence of choice behaviors which are predictable only as a function of their relative sequential position in a series of events. The special case with which this study itself is concerned is a situation wherein choices, as a function of their previous mutually exclusive further choice consequences, are predictable only in terms of a sequential conceptualization which embodies consequences in terms of choices within that sequential conceptualization as it is defined both theoretically and operationally. The "previous mutually exclusive further choice consequences" are established operationally in this particular study by setting up invariable sequences of choices in which each choice determines the succeeding choice. That is, looking at the sequence from the point of view of any given second choice, it can be seen that the second choice cannot occur unless the "proper" choice is made the first time.
An attempt is made to outline an approach to these problems by discussing the theoretical formulation of appropriate sequential formulations; and by stating conditions when different kinds of sequences will be learned and then making appropriate predictions.

The Combining of Units

The second major question is: What principles are necessary for combining the effects of these units in conceptualizing experience for the prediction and control of future behaviors? Or, in other words, if we assume that present behavior is predictable from knowledge of past behavior, how shall we combine those previous experiences, or calculate their "effect," to give us the best prediction?

The question has become an increasingly important and controversial one as emphasis has shifted in psychology to the study of changes in behavior that occur with experience; i.e., to the problem of learning. A great deal of time and effort has been expended in almost innumerable attempts to find some conclusive answers to the problems of the effect of specific behaviors—or to the problems of reinforcement, the usual term employed in the psychological literature to refer to this phenomenon—on future behaviors. Unfortunately, answers are all too few, and those available are all too tentative.

A central question in formulating a further principle as to the relative effects of behaviors has been whether it is a necessary condition to learning (i.e., modification of an organism's behavior as a function of some stated behavior) that the behavior being learned have

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1 The writer is indebted to Jessor (14) who presented a similar discussion of this same problem in a somewhat different context.
satisfying consequences or be rewarding in some way. According to Postman (27) the idea that satisfaction makes a difference is grounded in philosophical hedonism; however, it was first formulated systematically as a psychological principle by Thorndike. In his "law of effect" he stated at some length that success (or satisfaction) stamps in responses and failure stamps them out. The elementaristic and associationistic implications of his formulation are evident, but will be overlooked for the time being in order to consider the hedonistic principle further. It has been criticized on the basis that there is a need for an independent definition of the nature of satisfaction beyond the empirical fact that learning occurs after certain states of affairs and not after others. It seems to me that this criticism is not necessarily a valid one in that it is possible to state operationally, on the basis of such evidence, principles as to when satisfaction shall have been said to occur, and to make predictions on that basis. Such an approach is valid, and is, in fact, the approach used in making any scientific predictions. So it may be possible to say that the principle of hedonism has been used incorrectly, but insofar as it has been utilized in the manner outlined, it has been used legitimately in that previous observations provide the "independent criterion" needed as to what shall or shall not be considered in any situation to be satisfying.

Another sort of criticism levelled at the effect principle is its retroactive nature; i.e., the acting backward on a response of its effects. This criticism is valid only if such a retroaction is necessary to account logically for such an effect, and it does not seem to be. Logically, an equally adequate formulation would be that the "effects"
operate in the manner of a "trace"; that is, they influence future behaviors of the organism, not past ones.

Even so, the hedonic principle alone is not sufficient basis from which to formulate all the conditions of learning. Another question then is: Does that satisfaction act merely to strengthen the connection between the stimulus situation and the response (the behavior)? As is obvious from Thorndike's "law of effect" he felt that it did. Unfortunately, however, his elementaristic-associationistic formulation of the law has given rise to even more criticisms.

Further criticisms leveled at the hedonic principle outlined above may be pertinent to it only as it has been coupled with this elementaristic-associationistic formulation. For instance, it has been contended and demonstrated that punishment facilitates learning (26) and that learning occurs without the occurrence of reinforcement (latent learning), as defined by Thorndike (27). However, it is suggested here—and will be discussed later—that a broader conception of the reinforcement principle formulated in other terms can explain adequately these phenomena.

Nevertheless, in order to evaluate the associationistic-effect approach, a more detailed presentation of it seems advisable. Hull (13) has been its most systematic modern proponent; he has done much to systematize it and overcome its earlier logical and empirical shortcomings. He postulated a stimulus trace which persists over a short time interval in the nervous system and enables integration of stimulus and response effects. By so doing he offset the retroaction criticism, but so complicated any formulations as to make handling complex long-range human
behaviors almost impossible. He accepted the differentiation between learning and performance and set up a construct of habit strength, referring to acquisition of behavior, and one of effective reaction potential, referring to what might be called performance availability. Motivation (a state of tension) is, however, an integral part of both of these constructs, so they are definitely tied to reinforcement and to that extent can hardly handle all of the latent learning findings. The reasons for this are outlined in more detail in a quote from Meehl and MacCorquodale (24) presented later (p. 14). Hull has explained the relevant findings concerning the facilitating effect of punishment on learning on the basis of the assumption that learning is contingent on tension reduction. In other words, a punishing situation sets up the conditions for reward because it creates tension, or a state of discomfort or imbalance. The reduction or escape from this state of affairs is then what defines a reward. Of course this whole explanation rests on the initial premise of Hull's system, the "law of primary reinforcement":

"Whenever an effect or activity occurs in temporal contiguity with the afferent impulse or the perseverative 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 the 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." (13, p. 80)

Hull then defines reinforcement as restoration of biological tissue balance, or at least, reduction of imbalance, and sets it up as a necessary condition to learning. In order to explain learning that occurs without such immediate need reduction he has formulated an auxiliary principle, the principle of "secondary reinforcement."
"...the power of reinforcement may be transmitted to any stimulus situation by the consistent and repeated association of such stimulus situation with the primary reinforcement which is characteristic of need reduction. Moreover, after the reinforcement power has been transmitted to one hitherto neutral stimulus, it may be transferred from this to another neutral stimulus, and so on in a chain or series whose length is limited only by the conditions which bring about the consistent and repeated associations in question." (13, p. 97)

For Hull, then, all reinforcement reduces ultimately to physiological tension reduction. But, as Hilgard points out (12, p. 107) the equating of reinforcement to need reduction is at this point only a hypothesis, and one for which there is a substantial amount of conflicting evidence—for example, the latent learning experiments. Another limitation to such a position is the great difficulty, if not impossibility, of relating many complex human behaviors to physiological need reduction even in a very indirect manner.

An attempt has been made by Mowrer (25) and by Dollard and Miller (8) to extend Hull's theory to handle some complex human learning problems. Dollard and Miller in particular have attempted to outline a Hullian interpretation of, and approach to, long term psychoanalysis. The inferential leaps required to do so would be tremendous under any circumstances; but unfortunately, the bases from which they make these inferences seem themselves to be open to considerable question. Consequently their answers seem more tenuous. They have attempted to explain personality behaviors on the basis of learned drives and learned rewards, using as the basis for explaining how these drives and rewards were learned reasoning by analogy from their explanation of how fear serves as a learned drive, and its reduction as a learned reward in rats. Even without questioning their lack of verification of their
behavioral effects is that provided by the expectancy theories. Proponents of expectancy theories say that "reinforcement" is confirmation (or negative confirmation) of what the organism expected to be the end result of some pertinent behavior. A further distinction between associationistic theories and expectancy theories is pointed out by Meehl and MacCorquodale:

"This property (of experiments) which is not found in the designs easily assimilated by S-R theory, is that during the acquisition phase no increase in the (subsequently to manifested) preference can be observed. Whenever such an increase is observed during the so-called "latent" phase, the experiment is not disturbing to an S-R theorist. Now if we ask why Tolman is happy with positive outcomes in such designs, we find that he can assume an increase in the S-R bond by an operation other than the running off of the S-then-R sequence ...."

"Let us suppose, to take a concrete example, that a food-satiated rat runs a T-maze with symmetrical social incentives. No differential strength is observed. Then the hungry rat is placed (not having run) in one end-box and allowed to eat. 'Appropriate' choice in a subsequent run is prima facie embarrassing to non-expectancy theories. It appears that the feeding experience was the operation that strengthened one S-R bond over the other; yet this operation does not involve the occurrence of the sequence S-then-R. This seems to us the real reason that it is embarrassing to non-expectancy theories."

(24, p. 231)

Tolman explains such behavior on the basis of the association of the two stimuli, the goal-box, and the food. The rat does not have to run to the goal-box so many times with food as a reward for it to learn that response; if it "knows" how to get to the box, and if the motivation is supplied (hunger), it will behave accordingly.

In other words, learning proceeds by the building up of an expectation that a particular sign in the environment will lead to a certain outcome by means of a behavior route; further, this expectation may be built up by other means than the actual transgressing of that route in
results at the human level, very basic questions can be raised as to whether there are not definite differences between situations in which fear is operant and its reduction serves as a reinforcement of an escape or avoidance behavior, and situations of a positive nature in which people learn complex tasks (algebra or geometry) for a positive symbolic reward. Dollard and Miller use the example of Cowles' chimpanzees learning to solve a problem for food tokens as an example of the operation of a positive learned drive-learned reward situation. Dollard and Miller, however, define reward in terms of a sudden drop in the strength of a stimulus; yet the chimpanzees hoard the tokens, handle them, put them in their mouths, etc. during the period of time before they are redeemable, thereby suggesting that the strength of the stimulus (i.e., the tokens) does not drop after reward--after the chimpanzee gets the tokens. It seems then that before Dollard and Miller's attempts can be considered adequate to explain human behavior, they will have to formulate more adequately their conception of the origin and function of learned drives and rewards.

Mowrer's approach is in many respects similar to Dollard and Miller's. However, he does place much greater emphasis on the breadth of function of "anxiety" or learned fear as a secondary drive. In fact, at times he seems almost to consider anxiety the only secondary drive. That anxiety is the only secondary drive certainly remains to be demonstrated, and if it is not Mowrer faces the same problem Dollard and Miller do of trying to account for the development of positive secondary drives.

A quite different conceptualization of the basic mechanisms of be-
its entirety with all of the relevant conditions present. Repetition per se affects only the probability that an expectancy will be fulfilled. Reward functions in determining performance, or utilization of responses, but not in learning.

Such a molar conception seems much more adaptable to the problems of predicting human behavior, particularly since it overcomes the difficulties of the need-reduction principle and is, in general, potentially a much more flexible approach. Nevertheless, until recently expectancy theories were considered at least mildly disreputable, since they were thought of as "teleological," and their proponents thought of as guilty of "anthropomorphizing." It is true, of course, that quite legitimate criticisms can be leveled at expectancy theories. One question is, how can expectancies be quantified? Are they a direct function of probability; if so, of environmental probability or subjective probability? Tolman and Lewin have been proponents of expectancy theories, and their formulations seem adequate to outline how this question might be handled. Lewin (21) feels that the subjective probability with which a person views things is of crucial importance because that degree of certainty influences behavior. Brunswik (2) has formulated the Tolmanian position and contends that expectations develop as a function of the relative probabilities that environmental signs precede certain outcomes. "All a finite, sub-divine individual can do when acting is...to make a posit, or wager. The best he can do is to compromise between cues so that his posit approaches the 'best bet' on the basis of all the probabilities, or past relative frequencies, of relevant inter-relationships, lumped together." (2) Lewin has criticized this emphasis on objective prob-
ability on the basis that each person's predictions are based on only the events of his life-space. While this may be true, presumably they are related; in fact, Brunswik (2) has commented that one of the neglected tasks of a molar environmental psychology is an investigation of the relationships between individual and environmental expectations. One limited area of investigation pertinent to the quantification of subjective probability (and in some instances, its correspondence to objective probability) has been that of the "level of aspiration" studies which deal with goal setting as related to success and failure. Lewin, et al (22) analyzed the extant studies in 1944 in terms of subjective probability and valence, and the formulations they derived seem adequate to explain the data they reviewed. It might be noted that, judging from his analysis and other writings (21), Lewin seems to see learning as a matter of restructuring cognitions and changing valences or values as a function of the occurrence of events. Insofar then as "restructuring cognitions" is related to external events, albeit their effect is mediated by the structure of the "life space," the Lewinian concept of subjective probability is related to Tolman and Brunswik's formulations or probability which emphasize objective probability, but recognize that probability for each individual may have less than a one-to-one correspondence with it.

Lewin's valence theory is something else again. The introduction of values avoids the most basic criticism of pure expectancy theories. As Stephens has so aptly pointed out:

"...this principle (expectancy) will have trouble whenever the expectancy is at odds with the 'hopes,' 'wishes,' or well-being of the organism. If by some response the organism stumbles unexpectedly on a valuable outcome, will the failure of the response to confirm an expectancy prevent it from recurring? Conversely, if a response is followed by an expected
evil will the confirmation of this expectation reinforce the response? It is not sufficient for an outcome to confirm an expectancy. The outcome must also be valuable or acceptable. It is not necessary for an outcome to confirm an expectancy. An unexpected but valuable outcome will produce reinforcement." (35)

This criticism has also been leveled by others (27) and seems to be a very damaging one. Apparently a pure expectancy theory cannot account for choice behavior, or "appropriate action," since any behavior would presumably confirm equally the expectancies pertinent to it. Evidently in an attempt to avoid the difficulties of a need-reduction principle the expectancy theorists have fallen into an equally dangerous position.

Possibly the answer lies in formulation of a multiple-factor reinforcement principle such as Lewin's formulation of both subjective probability and valence as necessary to prediction. Postman (27) concludes in his review of the law of effect that this will probably be necessary. It seems to the writer that the logical and empirical evidence which shows that an associationistic need-reduction system cannot handle certain important problems of the acquisition of behavior (Meehl, Hilgard, etc.) is quite convincing, as is the evidence that a pure expectancy formulation cannot handle the problem of predicting choice behavior (Stephens, Postman). Yet each can handle the problems the other one can't. Perhaps the best answer at the moment would be to attempt to construct a system incorporating both kinds of principles: expectancy principles to explain how previous experiences are combined; hedonistic or effect principles to explain choice behaviors. The further qualification that these hedonistic principles be based on other logical grounds than on a principle of physiological tension-reduction also would seem advisable. Rotter has attempted such a formulation in his
social learning theory, and the present study is couched in terms of his coordinate reinforcement value—expectancy concepts. The theory itself is outlined in the next section.

Social Learning Theory

Rotter's social learning theory of personality is based on a monistic philosophical principle to the effect that there is but a single event (or kind of event) whose ultimate nature is unknowable, but which is potentially describable for different purposes by different sets of constructs. More specifically, the various sciences are distinguished in that each science consists of a set of integrated constructs, or a level of description (Rotter's term), which is used to abstract from the nature of events using a consistent orientation. The nature and limitations of such constructs are a function of their purpose; i.e., the nature of the predictions and the controls for which they are to be used. Any statements of interaction among these various systems of description are rejected on the basis that they necessarily imply there is more than one kind of event; that the systems are not just different descriptions of the same event.

The goals of psychology are the prediction and control of human behavior; consequently, the unit of investigation for personality research is the interaction of the individual and his meaningful environment. This interaction forms the basis for the development of, and changes in, personality; hence, the study of personality is the study of learned behavior. Behavior is assumed to have directionality toward security or psychological homeostasis. Following from this assumption, behavior is systematically conceptualized in terms of directionality abstracted from
behavior-reinforcement sequences. Rotter calls generic statements of behaviors so abstracted needs, and the environmental referents toward which they are directed goals. The organization of needs is a function of the previous behaviors of the individual interacting with other individuals within the framework of a social milieu or culture. Since human needs and goals are a function of satisfactions from interactions with other people, they are oriented toward and are in terms of other people; hence, a social learning theory of personality. Note that there is no implication of any vitalistic force within the individual in the above formulation; even the basically assumed directionality is conceptualized as a function of the interaction of the individual and his meaningful environment.

Within such a broad framework principles must be developed to account for such phenomena as the acquisition of, retention of, disappearance of, and change in specific behaviors; the relative preference values of alternative behaviors, changes in these preferences, etc. As previously mentioned, a pertinent central concept in social learning theory is that of need, which refers to the abstracted directionality of behavior. In attempting to clarify what he means by needs, Rotter states:

"Even from the beginning they (psychological needs) differ from unlearned needs or goals in that tendency toward movement is determined by the presence of the correct cues or stimuli rather than by some cyclical internal condition describable only at a physiological level. . . . Essentially, this view holds that learned needs are different from so-called primary drives, and their maintenance and relationship to the behavior of the organism as described from a more molar level is different from the relationships of primary drives to other behaviors of the organism. This social learning approach rejects the theory that such psychological goals must be explained in terms of their leading to the satisfaction or neutralization of a physiologically described drive and resulting in reduction of that drive. We find it sufficient
basis for prediction to state that behavior directed toward the attainment of a learned goal or external reinforcement may be predicted through a knowledge of the situation the organism is in and from a knowledge of his past learning experiences." (30, p. 2)

Needs and goals then acquire their efficacy for an individual as a function solely of the previous learning experiences of that individual.

Of course the question as to how to evaluate and integrate the effects of these previous experiences remains to be answered. Rotter utilizes the principles of "functional relationships," along with that of "reinforcement," to attempt to solve this problem. In other words, the effects of behaviors (reinforcements) are directed along lines of functional relatedness, functional relatedness being defined in certain specific ways in order to make it operational. For instance, a group of behaviors functionally related in that they lead to the same or similar reinforcement(s) is called a need. Such a group of behaviors is conceptualized as having a potential for occurring (Need Potential) as a function of a composite expectancy (Freedom of Movement) that the behaviors involved will lead to the pertinent reinforcements, and of a preference or importance value (Need Value) of those reinforcements. In the absence of any further measures, the E and RV for any of the behaviors included in a need formulation would be considered to be those of the need potential itself. On the other hand, any behavior or reinforcement may be part of a number of functional relationships.

"Abstractions regarding the potential of a set of behaviors all leading to the same kind of reinforcement (need potential) or abstractions of the similarity of a set of reinforcements in given situations are derived from specific behaviors in complex situations. Any single need abstraction is not the only representative of the values and relationships which could be derived from these behaviors or reinforcements. Any behavior may be a part of many systems of behaviors or any
reinforcement may be a part of many systems of reinforcement. The psychologist treats those systems which are relevant to his particular purposes at any time." (31, p. 4)

Further, any group of reinforcements, or need, may in turn be considered similar to a larger organization of reinforcements which is even more inclusive, and the classification broadened even further until there is a single organization of directionality for the person. This overall organization is referred to as **security** or **psychological homeostasis**, and within it all behaviors are functionally related to all others, though at a very low level of specificity in most instances.

Rotter has also outlined three specific concepts for dealing with functional relatednesses among external reinforcements. They are: stimulus generalization, mediated stimulus generalization, and generalization of expectancy changes. Stimulus generalization refers to original functional similarity among external reinforcements or goals. Mediated stimulus generalization accounts for the functional relationship among behaviors yielding the same reinforcement. Lastly, generalization of expectancy changes, which seems to be a special case of mediated stimulus generalization, deals with changes in expectancy of behaviors as a function of the reinforcement of another behavior functionally related to them on the basis of "similarity of reinforcements and behavioral similarity determined by the similarity of the reinforcements which usually follow the behavior" (31, p. 2).

It has probably become apparent by now that a key concept in the structure of this whole theoretical development is that of reinforcement. Because of its central importance and its relevance to the present problem, the discussion has been so organized as to point toward a
treatment of it as the final part of the theoretical background for the problem. As used here, reinforcement in its broadest sense might be thought of as the effect on the individual (as described psychologically) of any interaction of that individual with his meaningful environment. However, to make such a concept useful, it must be defined more narrowly in an operational sense so that its implications, and indirectly the concept itself, can be tested. Rotter has tentatively set up and defined operations for two coordinate concepts as a basis for organizing peoples' experiences in order to make predictions about what these people will do subsequently. He states that the probability of any behavior occurring with reference to satisfying any given need or attaining any specified goal (the Behavior Potential of that behavior) is a function of the Reinforcement Value of that behavior and the Expectancy of the occurrence of that Reinforcement. In other words, the probability of any given behavior occurring with respect to satisfying any given need for any person is a function of that person's previous history of reinforcements with that behavior and the extent to which that behavior has satisfied (i.e., has led to perceived movement toward homeostasis) the need in question.

To help clarify the exact nature, function, and interrelationships of these concepts, some of Rotter's formulations will be quoted here. His tentative formulation on reinforcement has been revised somewhat, and it might be noted that the term Behavior Potential has supplanted the term Availability, but is approximately equivalent to it. The formulation:
1. The Nature of Reinforcement

"a. Internal reinforcement may be ideally defined as an experience (or perception) of movement toward or away from a goal or a change in the relationship of the individual and the goal resulting in a changed expectancy of the future occurrence of some event or events leading to the goal.

"b. External reinforcement is the occurrence of an event or act which is known to have predictable reinforcement value for the group or culture to which an individual belongs. As examples: praising an adolescent for demonstrated skill in games, giving a child candy, giving affection to a group of children who are suffering from "love deprivation." The relationship between external and internal reinforcement is not assumed to be one-to-one for any individual, but is considered to be a subject for study varying the individuals and conditions of reinforcement.

"An act may be considered an external reinforcement for any single individual, even though it has no known 'group' or 'cultural' value, when the study of the previous history of the individual demonstrates that this act has previously resulted in internal reinforcement for this individual.

"c. The expectancy of potential success or the availability of a given behavior for satisfying any need or complex of needs in a specific situation is a function of the nature (positive or negative), number, order and strength of previous (internal) reinforcements of this act in the same or closely similar situations.

"One can speak of availability of an act for a defined group in the same way. A concept of potential positive availability may be useful in describing acts that could easily be increased in actual availability for any individual or group because of the compatibility of the behavior and the social organization of the group. In psychotherapy the problem is frequently one of making such potential positive availabilities truly available to the patient.

"d. Reinforcement acts or external reinforcements usually may be ordered on continua and described as being at a higher or lower level. Both the level and the nature of the continua (based on the needs the acts are related to) are determined by studying the group or culture. For example, an A is a better grade than a B; for young children waiting for their father to come home, being picked up and kissed is better than a pat on the head; and for a child trying out a new phrase or concept, a non-committal grunt from a parent is less of a reinforcement than an excited request for a repetition followed by a proud announcement to the family.
"e. When considering such a continuum of reinforcement acts there is a point on the continuum where for any individual the occurrence of the act will increase the availability of the response, but the next step down on the continuum will decrease the expectancy of satisfaction or success. This specific act may be called the minimal level of reward or satisfaction. Reinforcement acts at this level or higher would be positive; lower would be negative. When this point is determined in the group, one can then speak about negative or positive reinforcement acts.

"f. The strength of a reinforcement is a function of the difference (or distance on the continuum) between the actual reinforcement act and the minimal satisfaction act. The minimal satisfaction reinforcement act may have different potentials of expectancy for the individual. Two children in the same family whose parents only reward an A in school work may have a minimal goal of A, but they may have quite different expectancies of reaching that goal, based on different past experiences. The same would be true of any goal on the continuum. The difference between the individual's expectancy of the occurrence of a specific reinforcement act and the actual occurrence is also a determiner of the strength of a reinforcement. Strength of reinforcement, then, is a function of the distance on the continuum between the minimal satisfaction goal and the actual reinforcement act and the difference between the individual's expectancy of the occurrence of the act and the actual occurrence.

"g. The effects of order, frequency, direction and strength of reinforcement may be measured not only in the change of expectancy or availability of the behavior being reinforced, but also by the degree of generalization or changes in the availability of other responses." (29, p. 1f)

Note the incorporation of concepts of both internal reinforcement and external reinforcement, and the distinction between them. Such a distinction permits conception of the individual's experience as unique, yet also outlines operations for dealing with this uniqueness by beginning with measurable "cultural" referents. The importance and necessity of this distinction will become more apparent later when this particular study is discussed in detail.

It seems advisable also to look more carefully at the two predictive concepts based on reinforcement that Rotter has set up, and the tentative quasi-mathematical formulae he has established to outline
their relationships in a behavior formula. The following formulations are quoted from more recent and more extensive writings than the one quoted above; therefore, where there seem to be discrepancies of meaning, the ideas presented in these latter quotes should be accepted. The concepts are defined as:

"Behavior Potential: Behavior potential is the potentiality of any behavior or act of the individual occurring in a given or explicit situation or situations, in relation to a given or explicit external reinforcement or external reinforcements. That is, behavior potential is an abstraction which is an attempt to calculate the likelihood of a particular behavior occurring in a given situation or situations having a directionality or moving toward a specified goal or goals.

"Expectancy: Expectancy may be defined as the probability (internal) held by the individual that a particular external reinforcement will occur as a function, or in relation to, a specific behavior in a specific situation or situations. Expectancy is independent of the value or importance of the external reinforcement.

"Reinforcement Value: The value of a reinforcement or its importance to the individual may be defined in terms of its preference position with expectancy held constant. That is, any reinforcement may be considered to be of higher value than another reinforcement if the expectancies are equivalent and the first reinforcement is chosen by the subject. Reinforcement values can be calculated when the expectancies are known, or when they are constant in that they are the same, such as in a situation where the subject knows that he may have either one of two reinforcements merely by stating a choice." (32, p. 1)

From the above it can be seen that a general statement of the behavior formula in quasi-mathematical terms is:

\[ \text{B. P.} = f(\text{E. and R.V.}) \]

where:

- \( \text{B. P.} \) is behavior potential,
- \( \text{E.} \) is expectancy, and
- \( \text{R. V.} \) is reinforcement value.

Further, from the above and the reinforcement formulation quoted, it follows that:
E = f(E' and G.E.)

where:

\[ E' \] is the reinforcement history, and
\[ G. E. \] is the generalization effect from other situations.

The entire strength of reinforcement formulation outlined earlier (p. 24) has been revised. At present, the effect of the occurrence of any behavior and any consequent reinforcements on expectancy is conceptualized in the following way:

\[ \Delta E = f(1 - E_1) \]

and

\[ \Delta E_n = f(1 - E_1 & D.N.S.) \]

where:

\[ \Delta E \] is the change (or increment) in \[ E_1 \] as a function of the occurrence of the reinforcement.

\[ \Delta E_n \] is the change in any other given E (\[ E_n \]) as a function of the occurrence of the reinforcement pertinent to \[ E_1 \].

\[ 1 - E \] is the difference between expectancy and the actual occurrence (unity) of the reinforcement.

\[ D.N.S. \] is the degree of need related similarity between the reinforcement which occurred and the reinforcement which the behavior being predicted is expected to lead to.

There has been no systematic formulation made yet as to the change in Reinforcement Values, although it has been stated that the values of reinforcements (or R.V.'s) do change as those reinforcements are paired with other reinforcements having higher or lower reinforcement values. Actually, the important thing to note here, particularly since the formulation of this particular formula is not relevant to the present problem, is not that some specific formula remains to be developed, but
rather that the outlines of the system are comprehensive, and principles for solving specific problems such as this one have been set forth.

**Relevant Research**

It is difficult to delimit what should be included here as research relevant to the problem in question as there is actually very little research directly related to it; yet in a broader sense, there is a great body of concept formation, cognitive, and problem solving material that can be thought to be related, at least inferentially. The compromise solution arrived at here is the selective inclusion of studies that serve to outline the nature of the relationships between the sort of research they are representative of and the present study. The studies themselves may be grouped under several general headings: (1) Concept formation studies, (2) Hypothesis (or cue) studies, (3) Set-influences-solution studies, and (4) Studies of sequences.

Recently there has been a comprehensive review (20) of material on cognitive processes which has suggested an approach to "cognition" somewhat different from the traditional one. Leeper, in his discussion, points out that:

"In other words, the functional properties of many processes (aside from the one property of being conscious) seem to be the same even though the process is conscious in one case and unconscious in another. The question is, therefore, whether we should define cognitive processes, perception, thinking, concept formation, and the like in terms of conscious processes exclusively, or whether we should say that consciousness may be present or absent, as the case may be, and that all these processes are to be defined in terms of their other functional relations.

"...It seems better, therefore, to avoid narrow definitions and to say that cognitive processes include all the means whereby the individual presents anything to himself or uses these representations as a means of guiding his behavior." (20, pp. 735-6)
Representative of this functional approach and of concept formation studies in general as an extensive series of studies of concept formation by Heidbreder (10,11). Her chief purpose has been to explore why some concepts are easier to form than others. She studied formation of concrete, number, spatial, and color concepts using originally a memory apparatus but later including sorting problems. Her original hypothesis was that perception of concrete objects is the dominant mode of cognitive reaction due to the phylogenetic priority of locomotive and manipulative capacities of the organism, and that therefore ease of formation of any concepts is a function of their relatedness to concrete concepts. She was forced to reject this hypothesis when she found that in situations where there is mutual interference among the concepts, such a hierarchy breaks down. She did find, however, that in the formation of concepts at a symbolic level there was a direct relation between the semantic efficiency of the verbal tools employed and the speed of concept formation.

From these, and similar studies, it would seem feasible to infer that complex abstractive processes do occur in humans; or we might say, that sequences of responses (for example, sorting behavior) at different levels of abstraction and in terms of different kinds of abstractions are demonstrable phenomena of human behavior. Further, the kinds of concepts (or sequences of responses) developed seem to be a function of organism-environment interactions of a very complex nature.

The "hypothesis" or "cue" studies are different from the Heidbreder approach in that they are formulated more in terms of behavioral theory. They are based on the idea that the organism responds to objects in its
environment as "cues," that is, in terms of their information value based on the organism's past experience with them rather than in terms of their "absolute" stimulus dimensions. Lawrence (18, 19) has done two interesting comparative psychology studies on the acquired distinctiveness of cues in rats. He used a discrimination-jumping apparatus for training his rats and a simple T-maze for testing their learning. The only factor common to the two apparatuses was cues he introduced such as color (black-white), hanging chains—no hanging chains, etc. He found these cues "acquired distinctiveness" in the training apparatus apart from any generalization effects so that on the test problems the rates of learning of the rats varied significantly depending on the function of the cues in that problem; i.e., if the cues that led to reward the first time did so later, learning was much faster than if that were not the case. He concluded that "even though there is equal physical opportunity to become associated with stimuli, that does not ensure equal strengths of association." (19) This demonstration that a cue, once selectively responded to, is more available as a cue than it was previously, has far-reaching implications for the potential complexity of human behavior, particularly since the potential of humans for symbolic activity is vastly superior to that of rats.

Postman (28) and Bruner (3) have formulated tentative outlines of a theory of cognition in which the concept of hypothesis is central. Postman defines hypothesis as:

"...an intervening construct used to account for observed empirical relationships in cognitive behavior. They (hypotheses) are conceived as predispositions or expectancies of the organism which organize and transform selectively incoming stimulus information (perception) and continue to transform it after removal of the stimulus (memory). Hypotheses are anchored opera-
tionally, in discriminable stimulus information on the one hand and various classes of responses (e.g. verbal reactions and motor acts) on the other. (28, p. 250)

While they have outlined a comprehensive cognitive expectancy theory, their research itself has been limited to studies of judgments of size, etc., and to studies of the speed and course of the recognition process, both under varying directive states (i.e., conditions of motivation).

An example which demonstrates one of their main theses, namely, that expectancy influences perception, is their study of the perception of incongruity (5). Using sets of 5 playing cards, some of which were incongruous (black 4 hearts, etc.) which they presented tachistoscopically, they found that the mean exposure time for recognition of the incongruous cards was longer than for the others. The reactions to incongruity were: dominance of "one principle of organization which prevents the appearance of incongruity," compromise, and finally, sudden recognition with usual consequent self-deprecation (5).

Bruner and Goodman's judgment study (4), which deals with perceived size of coins and seems relevant to the problem of strength of Reinforcement Value and its effect on perception, has been questioned by Carter and Schooler (6). They did a similar study and found results somewhat conflicting with Bruner and Goodman's. Nevertheless, there do seem to be some indications that Reinforcement Value is a factor in "perceptual distortion." Lambert, Solomon, and Watson (16) investigated this phenomenon in a rather unique way. Their subjects were nursery school children; the experimental group was allowed to turn the crank of a machine which yielded a poker chip. The chip could then be inserted in the slot of another machine so that it would yield a piece of candy.
The control group also each got a poker chip, but they could not use it for candy. They did, however, receive an equivalent amount of candy though its presentation was unrelated to the poker chips and the machines. The experimental group subjects were required to estimate the size of a chip four times (using Bruner and Goodman's judgment apparatus), once at the beginning of the experiment, then after ten days of reinforcement with the candy, next after extinction (11th day), and finally after reinstatement of reward (12th day). The control group subjects made estimates at the same time. For the experimental group, their second and fourth over-estimates were significantly larger than their first and third. For the control group, there were no significant differences among any of their judgments. The experimental and control groups differed significantly on their second judgment; and there was a near significant difference between them on their fourth judgment, with the experimental group overestimating the size of the chips more in each case. Evidently then the Reinforcement Value of an object does affect the "perception" of that object and tends to distort perception of it in the direction of its value as a reinforcement.

Probably the most exhaustive study of the effects of set on the solution of problems has been done by Luchins (23). His subjects were given a short series of problems of the type: "If you had three empty jars that hold 21, 127, and 3 quarts, respectively, tell how you might measure accurately 100 quarts of water." To solve these problems it would be necessary to fill the large jar, then remove quantities from it using both smaller jars until the correct amount remained. After the initial series of 5 problems, other problems were given, such as:
"Given three jars that hold, respectively, 23, 49, and 3 quarts, tell
how to get 20 quarts." The previous experience led 81% of one group of
college students to solve such problems by the involved method used for
the earlier problems. Control group subjects (with no previous experi-
ence) solved these problems by a simple subtraction or addition using 2
jars. Even when Luchins had a group write "Don't be blind" on their
papers after the training and warned them that he meant by that they
should be cautious and not act foolishly in solving the subsequent prob-
lems, 55 per cent of them used the involved solution. He also tried
introducing verbal explanations of the point of the entire series of
problems, but even then the persistence effect was not completely elim-
inated. Further, in a ninth problem which was insoluble by the more
involved technique, 66 to 87% of the subjects in half of the 29 groups
tested were unable to solve the problem within a 2 1/2 minute time limit.
He did find, however, that when both kinds of problem were included in
the original training this "mechanization" effect was decreased (23,
p. 41).

Johnson (15) reports an unpublished study by Youtz that is some-
what similar to Luchin's. Youtz used four groups of female college
students. They were required to solve different numbers (5, 10, 20, and
40) of arithmetic reasoning problems that were solvable by only one
method (A). Then all were required to solve 10 problems solvable only
by another method (B). Additional practice on the A problems led to
decreased time in solving them as might be expected, but also led to
slower solutions of the B problems. The differences are significant
and Youtz concludes, "One determinant of resistance to a new hypothesis
is number of previous successes on an incompatible hypothesis."

These studies seem to demonstrate fairly conclusively that a person does tend to respond to situations in terms of previous experiences with similar preceding situations, or in other words, in terms of expectations concerning the potentiality of arriving at a correct solution (a reward) by using a given approach, even though it leads at times to behavior which may be considered by others and, under other circumstances, by the person himself, to be maladaptive. They indicate too that the level of abstraction of the expectations involved ranges from that of a fairly stereotyped response pattern (Luchin's problems) to a complex hypothesis for solving arithmetic reasoning problems (Youtz's problems). The question does arise why Luchin's subjects change their behavior at all if they do not change on the first problem in which the alternative solution is available. Theoretically their behavior is reinforced each trial so the tendency for it to be repeated should increase after each time it is rewarded, i.e., yields a correct solution. Presumably if change is to occur then change should occur on the first problem in which the easier solution is available since the tendency for the originally preferred response is weaker at that time than in any of the succeeding problems, and tendencies for other responses are stronger then than on subsequent problems. While this question is only mentioned here, an attempt will be made at the end of this section to suggest a possible answer to it.

The final study to be presented is related to the current research in a different way than the studies previously discussed. This study is also couched in social learning theory terms and has been conducted by
Lasko (17) concurrently with the research reported here. It is concerned with the problem of sequences, but deals with the prediction of discrete behaviors as a function of a sequence of external reinforcements, whereas the writer's study deals with the prediction of sequentially related behaviors as a function of previous and expected sequential consequences of those behaviors. The implications of this distinction will be made more apparent in the discussion of the results of the writer's study.

In formulating his problem Lasko differentiated between experimenter-controlled and subject-controlled situations. He pointed out that in a subject-controlled situation the occurrence of events is a function of what the subject does. (The writer's study is basically of the subject-controlled type, although the experimenter does fix definite limits on the variability of the behavioral consequences of the subjects' acts.) But, in an experimenter-controlled situation, the subject can only attempt to predict what events will occur from his knowledge of what events have been occurring; his predictions, however, do not affect what occurs. They affect only what reinforcements he will receive. As a function of this basic difference from the experiment of the writer, the concept of sequence is defined in terms of different operations in the two studies, so their results are not strictly comparable. Lasko defines a sequence as being made up of an external reinforcement or any number of successive repetitions of that external reinforcement and the first subsequent occurrence of some different external reinforcement.

The task Lasko used is a modification of the classical Humphrey's verbal response partial reinforcement apparatus. In his modification,
however, the sequence of external reinforcements consists of a series of light flashes in which a white (signal) light is always followed by either a red light or a green light. The subject's task is to predict which will appear. For such a situation and using Lasko's definition of a sequence, the following series of lights would consist of these sequences:

<table>
<thead>
<tr>
<th>Series of lights:</th>
<th>RRGRRRGGRRR (X)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequences:</td>
<td>RRG 2</td>
</tr>
<tr>
<td></td>
<td>GR 2</td>
</tr>
<tr>
<td></td>
<td>RRRGG 1</td>
</tr>
<tr>
<td></td>
<td>GGR 1</td>
</tr>
<tr>
<td>R = red</td>
<td></td>
</tr>
<tr>
<td>G = green</td>
<td></td>
</tr>
</tbody>
</table>

Lasko suggests that in predicting the occurrence of these lights, naming red and being "right" is just as rewarding as naming green and being "right," so that a situation such as this one should be distinguished from a partial reinforcement situation and called a differential reinforcement situation. That is, there is no correct response which is rewarded intermittently; but, rather, either response may be either right or wrong depending on its correspondence with the light that occurs, and there is definitely reinforcement on every trial—hence "differential" reinforcement. Further, if the sequences are random in such a situation, there is no way of being "right" every time, so the only basis from which to predict choices is a sequential probability function. Consequently, in such a situation the prediction of occurrence of a given light is a function solely of the expectancy of occurrence of that light on that trial and that expectancy of occurrence is a function of the probability of occurrence of a sequence of external reinforcements.

By way of example, in the diagram just listed the prediction as to
what light would occur at (X) is made as follows: RRG has occurred two
times and RRRG one time; therefore the expectancy for green on trial X
which follows two trials on which red appeared is 2/3 or .67, and the
expectancy for red is 1/3 or .33. Presumably then a green light would
be predicted.

From the sequential expectancy formulations outlined here Lasko
developed several hypotheses. His first hypothesis is that in a situa-
tion such as he used, if the less frequent of the two external reinforce-
ments (lights) is discontinued there will be an appropriate rise in the
prediction of its occurrence. His second hypothesis is that the expec-
tancies for the various sequences will determine the maximum point of
that initial rise.

Lasko's third hypothesis is not specifically sequential in nature
but will be mentioned here. It states that, if over an equivalent
series of trials (same total N, same number of red and of green lights)
different groups of subjects have experienced sequences different num-ers of times, the occurrence of predicting green will be depressed dif-
ferentially as a function of differential generalization effect. This
effect will be evidenced at the point for each group of maximum rise
after the green light is discontinued. Further, the degree of depres-
sion of occurrence of the predictions of green will be directly related
to the amount of generalization effect. Finally, Lasko hypothesized
that if the presentation of sequences is continued beyond the point
where the ratio of prediction of responses corresponds to the ratio of
occurrence of lights, then the ratio of prediction of the less frequent
light will drop significantly below its rate of prediction at the point
mentioned. This hypothesis was tested largely because other researchers had contended that the rate of prediction would stabilize at the level of rate of occurrence, and Lasko's formulations lead to predictions quite different from those.

To test these hypotheses four groups of subjects (Total N = 140) were used. Groups 1 through 3 each received 60 trials with both lights appearing at a ratio of 3 red to 1 green, and then received 40 "extinction" trials which were all red. Group 1 experienced only 4 sequences, Group 2 experienced 6 sequences, and Group 3 experienced 8 sequences. The frequency of occurrence of sequences varied inversely with the number of sequences, since the number of trials was constant. Group 4 received 120 trials with both lights appearing in the same pattern as for Group 3, and with the second 60 trials a repetition of the first 60.

The results supported the first two hypotheses and were significant at beyond the one percent level of confidence. That is, there was an initial rise after the green light is discontinued in the predictions of its occurrence, and the peak in each case occurred at the trial for which the maximum prediction of green had been predicted.

The different maximum points of occurrence of prediction of the green light for the different sequences are depressed relatively as predicted in the third hypothesis. However, the differences are not significant.

In the fourth group the rate of occurrence of the prediction of green is significantly less (less than the 1% level) at 120 trials than it is at 60 trials. This result corresponds to the prediction made from the fourth hypothesis.
Lasko concluded that his sequential formulations conceptualized in Rotter's social learning terms are supported as an adequate basis for predicting choices in an experimenter-controlled differential reinforcement situation.

By way of summary, it seems that several tentative conclusions can be drawn from a review of these studies.

First, evidently people do respond to their environment in terms of its "cue" or "information" value derived from their previous experiences. And apparently "distortions" (this word is used advisedly inasmuch as our "objective" criteria are themselves a function merely of observer agreement) in organizing one's environment do occur as a function of learned expectancies (5) and of learned reinforcement values (16) concerning the nature of one's environment. Further, humans are capable of organizing environmental cues in many different ways (or, in terms of many abstractable stimulus dimensions) (10, 11) and at many levels of abstraction varying markedly in their complexity (10,11,15,23). And, although it seems almost unnecessary to mention it, people respond to their environment as they have organized it (5,15,16,23) even though in doing so their behavior may frequently appear to others and, under other circumstances, to themselves to be maladaptive.

Also, under certain conditions people behave in ways that seem to be explainable only on the basis of some sort of conceptualization of the effect of previous external reinforcements as a function of discriminated sequences, not as discrete and additively combined.

It might be noted too that an analysis of these studies suggests further the need for concepts of both amount of reinforcement and ex-
pectancy of occurrence of reinforcement to explain some of the results obtained. In such instances as the study reported by Lasko, change in behavior potential dominance from one behavior to another can be thought of as largely due to change as a function of the order of reinforcements in the expectancy that a behavior will be rewarded. However, although Luchin's study (23) did not apparently involve sequences, yet the change in behavior of those subjects who did change before the final problem is presumably a function of the fact that the behavior in question has a higher reinforcement value than the previously preferred behavior. Although it is necessary to assume, on the basis of generalization, that some sort of expectancy for a sequential (as defined by Lasko) order of events is present to explain the seeking of other behaviors that leads to recognition of the alternative solution, yet the shift in preference itself is a function of relative reinforcement values inasmuch as the original behavior has always led to and still leads to an appropriate response and reward. Also, the subjects' self-deprecatory comments for having persisted in their original behavior seem to support such an interpretation. It is in this way that it is felt the earlier mentioned question as to why any of Luchin's subjects change their manner of solving their experimental problems can be answered.
CHAPTER III

STATEMENT OF THE PROBLEM

Introduction

There are two major aspects to the problem. The first task is to establish that learning of sequences of behavior-reinforcement combinations occurs. Such sequences are of a quite different nature than those just discussed. Demonstrating that such sequences are learned would constitute further evidence that a conceptualization of behaviors and events as being discrete and their effect solely an additive function is inadequate to explain numerous demonstrable learned behavioral phenomena. The second part of the problem is to outline tentatively some of the conditions for the learning of sequences. It is not feasible to think that one study such as this can provide any extensive answers, nor for that matter can the tentative hypotheses tested here be justified in a clearcut deductive fashion. And too, some of the results can hardly be explained in systematic terms on other than a largely descriptive basis.

The hypotheses are conceptualized in social learning theory terms, and the total formulation of the problems seems consistent with current social learning theory formulations. Therefore, positive findings would suggest a potential avenue of extension of the theory, but negative findings would not reflect on the demonstrated validity of any social learning theory formulations beyond those unique to this particular study.
Social Learning Theory Propositions

To provide a background for discussion of the specific hypotheses tested in this study, certain basic social learning theory propositions, deducible from the formulations given earlier (p. 20ff), will be stated here, and some of their implications noted.

Proposition A: In a situation where the RVs related to several BPs are equal, that BP will be strongest for which there is the greatest expectancy of reward.

(Formula 1: \( BP_{x,s_1,R_a} = f(E_{x,s_1,R_a} \text{ and } RV_a) \))

That is, the behavior potential for behavior \( x \) (BP\(_x\)) in situation \( l \) (s\(_l\)) for reinforcement \( a \) (R\(_a\)) is a function of the expectancy that behavior \( x \) in situation \( l \) will lead to reinforcement \( a \) (E\(_{x,s_1,R_a}\)) and of the reinforcement value of \( a \) (RV\(_a\)).

From this behavioral formula it can be seen that the BP will be highest for that behavior among several in a given situation for which there is the highest E, since the disparity of Es is the only variable factor determining the choice if the respective RVs for those behaviors are equal.

Proposition B: In a situation where several BPs are possible and the Es of reward from the several BPs are equal, that BP will be greatest for which there is the highest RV.

The logic of this proposition is the same as that for Proposition A. The only difference is that this proposition deals with choices when Es are constant and equal and the RVs vary.

Proposition C: In a situation where a given behavior can lead to various RVs, establishment of the strength of a BP requires a consideration of two or more of them.

(Formula 2: \( BP_{x,s_1,R_{a-n}} = f(E_{x,s_1,R_{a-n}} \text{ and } RV_{a-n}) \))

That is, the behavior potential for behavior \( x \) (BP\(_x\)) in situation \( l \) (s\(_l\)) for all possible reinforcements it might lead to \( (R_{a-n}) \) is a function of the expectancy that behavior \( x \) in situation \( l \) will lead to those reinforcement \( (E_{x,s_1,R_{a-n}}) \) and the RV of those reinforcements \( (RV_{a-n}) \).
It would probably never occur that any given behavior in any situation would lead to the possibility of only one reinforcement, so this proposition is a statement of that derivative of the behavior formula which is most likely to be used in figuring actual behavior strengths.

**Proposition D:** To predict behavior in a given situation where more than a single behavior is possible, it is necessary to calculate Formula 2 for each possible behavior.

This proposition is merely an explicit formal statement of the fact that, if behaviors are to be predicted using BP formulations, then the pertinent BP values (i.e., perceived alternatives) must be known in order to make such a prediction with any degree of accuracy.

**Proposition E:** In a situation where the various reinforcements yielded by the several possible BPs in that situation are expected to lead to other Rs, the RV will be greatest for that behavior which in the past has led to reinforcements all of which combined yield the greatest total RV.

\[ (RV_a = f(RV_{b-n}) \]

That is, the reinforcement value for behavior \( a \) (\( RV_a \)) is a function of all the reinforcement values that behavior has led to and is therefore expected to yield (\( RV_{b-n} \)).

The necessity of this proposition is a function of the basic structure of social learning theory. That is, behavior is conceived of as being learned and having the characteristic of directionality towards psychological homeostasis. Reinforcement is a function of "perceived movement toward psychological homeostasis," and the values of reinforcements (RVs) derived from the amount of perceived movement toward that goal they yield. Consequently, the choice value (RV) of a behavior is a function of all the reinforcements it has yielded; that is, of all of the "perceived movements toward psychological homeostasis" that behavior has yielded and consequently is expected to yield.
Note that as this proposition has been stated it does not specify the nature of the relationship among the various Rs the behaviors in question yield. That is, it does not state whether some or all of the Rs are a function solely of the occurrence of the given behavior, or whether those Rs are a function of subsequent behaviors which are themselves a function of that first behavior. An example of the former type of relationship among Rs is evidenced in some of the consequences of passing a grade in school. Passing a grade has an RV in terms of academic recognition plus many other RVs in terms of peer approval, parental love and affection, etc., which are also a function of the occurrence of the original behavior itself.

However, it is also true that the behavior of passing a grade in school leads to further behaviors not possible without its occurrence, and presumably the values of the reinforcements any subsequent behaviors yield are likewise a factor in determining the choice value (RV) of the original behavior (i.e., any behaviors related to passing that grade). However, just how the effect of these expected subsequent reinforcements is to be operationally determined does raise a question. Consequently the proposition which follows has been formulated to provide a specific basis for answering it.

Proposition F: In a situation where the various behavioral alternatives for which there are BPs lead regularly² to other and different

²Note that the proposition concerns a general case in that it states that "BPs lead regularly to other and different choices." Actually, in the study reported here, the sequential relationships are invariable. The question may arise whether such a situation is just a limiting case of "regularly," or whether the fact of invariability makes this instance a special case in the sense that a 100% reinforcement situation is different from a partial reinforcement situation. Certainly further research would be required to answer this question, but no matter what its answer the usefulness of at least the conception of invariable sequentiality will be partially substantiated or refuted by the results of the study reported here.
choices, depending on which of the original alternatives was chosen, then the BPs can be conceptualized as sequences of behaviors which are a function of the learned relationships between the RV consequences of the behaviors making up the sequences.

\[
(BP_{a \rightarrow b \rightarrow n} = f(E_{a \rightarrow b \rightarrow n} \text{ and } RV_{a \& b \text{ to } n})
\]

That is, the BP for behavior \(a\) may be thought of as the BP for the sequence of behaviors \(a\) through \(n\) \((BP_{a \rightarrow b \rightarrow n})\) if \(a\) has in the past led to choice \(b\) which has led to choice \(n\), and alternatives to \(a\) have not. The sequential BP then becomes a function of the \(E\) that \(a\) will lead to \(b\) will lead to \(n\) \((E_{a \rightarrow b \rightarrow n})\) and the combined RVs of reinforcements \(a\) through \(n\) \((RV_{a \& b \text{ to } n})\).

This proposition is in a sense an extension of proposition E in that it too is based on the principle that RVs are a function of what the reinforcements lead to, but it explicitly makes the step into multiple act sequences and in that respect it clarifies the operational nature of some of the implications of proposition E. Note that as used here "sequence" refers to multiple behavior-reinforcement units, but that as Lasko has defined it, it referred to multiple events.

**Proposition G:** All the acts perceived as leading to a reinforcement, whether they be sequentially or directly related, or to the experience of movement toward or away from a goal constitute the behavior reinforced by the occurrence of that reinforcement or that experience of movement toward or away from a goal.

This extension of previous reinforcement conceptions to include selectively multiple sequential acts must be made coordinately with Proposition F to provide a logical basis to account for the formation of sequential BPs through learning. It is freely admitted that the conditions of such reinforcement are undoubtedly complex, and isolation of them will present many problems. Even so, it is felt that there is a need to formulate such a proposition.
The Development of Behavior Sequences:

Although logically the presentation of how sequences develop might better follow after stating some of the hypotheses themselves, it seems better in terms of understanding what is to follow to outline at this point how sequences are thought to develop. However, in order to do this and to understand how the hypotheses are tested, it will be necessary to outline briefly the nature of the specific problem situation utilized to test the hypotheses.

The experimental problem is one of learning how to obtain the most poker chips for a total problem (a fixed number of trials) from a problem box which has a different number of chips in it each trial (each time the door is opened). The number of chips that appear in the box on each trial is, as the subjects are informed, a function of whether the stack of chips was taken out of the box or left in the box on the preceding trial. There is a maximum size (8 chips) for a single stack of chips, and that maximum is also made known to the subjects. In addition, for those subjects in Experimental Group I only, a different set of instructions was used. These instructions included all the points listed above plus the additional one that the frequency with which a reward is taken from the box also affects the person’s score. The specific sequences or patterns for Problem 1 for all groups are as follows: On the first trial a stack of three chips appears; if this stack is removed from the box (thereby adding three to the person’s score) three more chips appear on the second trial. This pattern (Sequence A) continues as long as each stack is removed from the box; i.e., 3 (take), 3 (take), 3 etc.. If any stack of three chips is left in the box
(thereby adding nothing to the person's score), two chips appear on the next trial.

If the stack of two chips is taken, three chips appear again; then if the three chips are left, two appear again, and so on in the order: 3 (leave), 2 (take), 3 (leave), 2 (take), 3 etc. (Sequence B). If, after a stack of three is left, a stack of two is also left, eight chips (the maximum) appear. Then, whether or not the eight chips are taken, three appear on the next trial and the sequence (Sequence C) can be repeated; i.e., 3 (leave), 2 (leave), 8 (take— or leave), 3 (leave), etc.

It should be noted that the basis for choice, either between specific behaviors or among behavioral sequences, is a function of relative Reinforcement Values, since the sequences are fixed and all specific behavior—reinforcement Expectancies are therefore constant and equal.

It may seem somewhat paradoxical that the most chips can be obtained by taking the three chips each time—three chips each trial for three trials equals nine chips; leave three, leave two, take eight equals only eight chips for an equivalent three trials. But suffice it to say here that it is an empirical fact that many of the subjects prefer Sequence A over Sequence C, and that the relative frequencies of subjects who do prefer it vary with the experimental conditions. In fact, the validity of the experimental hypotheses is to be evaluated on the basis of their accuracy in predicting the relative differences in preference for these two sequences under stated conditions, and on the basis of their accuracy in predicting changes in those sequential preferences as a function of stated changes in the experimental conditions.

The other problems used were just like Problem 1 except for the
fact that the size of the largest stack of chips varied from problem to problem. The problems and the sizes of stacks used in them are as follows:

| Problem 1 | 3, 2, 8 |
| Problem 2 | 3, 2, 7 |
| Problem 3 | 3, 2, 6 |
| Problem 4 | 3, 2, 5 |
| Problem 5 | 3, 2, 4 |

The groups of subjects used and the training sequences each group received are as follows:

Experimental Group I (Different Instructions Group) was given the different set of instructions and required to solve Problem 1 only.

Experimental Group II (The Random Training Group) was given the first set of instructions and required to solve Problem 1. Then those who solved it by choosing Sequence C (3 (L), 2 (L), 8 (T)) were required to solve four additional problems. The problem order was: Problem 1 (Pretest--3, 2, 8); Problem 4 (3, 2, 5); Problem 2 (3, 2, 7); Problem 5 (3, 2, 4); and Problem 1 (Post-test) again.

Experimental Group III (The Progressive Training Group) was given the first set of instructions and required to solve Problem 1. Then those who solved it by choosing Sequence C were required to solve three additional problems. The problems were presented in the following order: Problem 1 (3, 2, 8); Problem 2 (3, 2, 7); Problem 3 (3, 2, 6); and Problem 4 (3, 2, 5).

The Control Group was given the first set of instructions and required to solve Problem 1. Then all those who preferred Sequence C on that problem were required to solve an additional problem after ten minutes of interpolated activity, as follows: Problem 1 (3, 2, 6); 10’ interpolated activity (reading popular picture magazine); and Problem 1 again.

Now that the experimental design has been outlined, the exposition of how sequences develop will be resumed. For the three groups of subjects who are given the instructions mentioned above, certain expectancies (descriptively speaking) have been established concerning the forthcoming problems. They are: There will be chips in the box each trial, but the number may vary; they may take them all out or leave them all in;
only those they take out count in their score; whether they take or leave a given stack will determine the size of the next stack; they may get as many as eight chips at one time; the larger the stack of chips the more it adds to their score; they are to get as many chips as they can for the problem, which is a fixed number of trials.

A detailed outline is presented in Appendix B of the expectancies and reinforcement values involved, and of the changes in them that occur during the developing of behavior potentials for sequences of behavior such as those in these problems (e.g., Sequence C—3 (leave), 2 (leave), 8 (take), etc.) However, it seems wise at this point to present only a discussion of the principles involved in forming these sequences. First of all, it can be pointed out that on the first trial of the first problem a stack of 3 chips is in the box. If the subject takes these 3 chips out, then on the next trial 3 chips appear again. So, as a function of the appearance of that stack of 3 chips on the second trial, a sequential B.P. has begun to develop; the subject now knows that taking 3 chips leads to the appearance of 3 more chips. Why then should the subject ever leave a stack of chips in the box? By referring to the main points of the instructions listed above, it can be seen that the subject has been told that whether he takes or leaves a stack determines the size of the next stack, that he can get as many as 8 chips at a time in one way, and that the bigger the stack the more it will add to his score. Evidently then he leaves a stack of 3 chips in the box to see if doing so will lead to getting 8 chips; that is the only alternative, since taking 3 chips did not lead to 8 chips.

But leaving 3 chips in the box leads to the appearance of 2 chips,
not 8 chips. Presumably then the behavior of leaving 3 chips in the box has been negatively reinforced, but the question now arises as to what to do with the stack of 2 chips. Maybe taking them will lead to getting 8 chips the next time, but even if it doesn't the subject will have gained 2 chips, and he has just lost 3 by leaving them in the box. On the other hand, maybe leaving the 2 chips will lead to the appearance of a stack of 8. Of course, if the subject does take the 2 chips he will find that a stack of 3 appears on the next trial. By now, though, another sequential BP is developing; namely, leaving 3 chips leads to 2 chips, taking the 2 chips leads to 3 again, etc.

Note, however, that the subject still hasn't found the stack of 8 chips and that the only untried behavioral alternative is leaving a stack of 2 chips. But to arrive at the choice of leaving 2 chips, it is necessary first to leave a stack of 3 chips in the box. Assumedly, then, the subject will eventually again leave a stack of 3 chips, and then leave the stack of 2 chips. On the next trial after that a stack of 8 chips appears and can be taken, as it probably will be, inasmuch as the instructions point out that 8 is the maximum size stack of chips. At any rate, 3 chips will appear on the next trial, and another sequential behavior potential has begun to develop. This final one is that leaving 3 leads to leaving 2 leads to taking 8.

In conclusion, it would seem logically that in this type of situation the necessary environmental condition for the learning of a behavioral sequence is that the alternatives of some specific choice lead to different subsequent choices whose alternatives themselves lead to mutually exclusive consequences. Further, the theoretically necessary
psychological condition for the learning of sequences seems to be that the individual have an expectation that environmental conditions such as outlined above exist in the pertinent situation; otherwise, all choices would be made in terms of their expected immediate consequences. However, it should be noted that the necessity of such an E is not itself demonstrated in this study, since no group was tested under the conditions of not having such an E established by their instructions. Sequence itself is defined in this situation as any discriminable series of successive behavior-reinforcement combinations. Of course, whether or not sequences will actually be learned in the set of circumstances which comprise the experimental problems remains to be demonstrated in the experiment itself.

Hypotheses and Rationale:

General Hypothesis I:

When a relationship has been established between reinforcement value sequences and their associated behaviors, behavior at any point will be determined by the expectancy for a reinforcement (composite) from the sequence of behaviors and the RV of the sequences of behaviors.

\[ BP_x(\text{point } y, \text{sequence } n), s-1, R_a = f(E_x(\text{point } y, \text{seq. } n), R_a \text{ and } RV_a) \]

That is, the potentiality of a behavior \( x \) occurring at point \( y \) of sequence \( n \) in situation \( 1 \) (s-1) with respect to reinforcement \( a \) (whose internal reinforcement value is a function of the total RV of sequence \( n \)) is a function of the expectancy that behavior \( x \) at point \( y \) in sequence \( n \) will lead to reinforcement \( a \) and of the reinforcement value of \( a \) (RV\(_a\)).

This general hypothesis is deduced from Propositions F and G and
is merely a statement of the behavior formula for a choice at any given point in a sequence of behaviors. Its validity and utility are tested here by setting up a situation where systematic predictions could not be made using non-sequential formulations. The accuracy of these predictions is then empirically tested.

There are two broad types of deductions that can be made from this general hypothesis and two consequent experimental approaches to testing them. Deductions can be made about the effects of expectancies and any such hypotheses could be tested by holding reinforcement values constant and varying expectancies. Or deductions can be made about the effects of relative values of reinforcements (RVs) and tested by holding expectancies constant and systematically varying reinforcement values. The study reported here uses this latter approach.

Hypothesis Ia:

In a situation where specific-behavior reinforcement expectancies are constant and equal, and where the choice alternatives lead to different subsequent choices whose consequences are mutually exclusive; a dominant sequential reinforcement value (and consequently dominant sequential behavior potential) will eventually be established for that sequence of behaviors which is perceived as yielding the greatest total amount of reinforcement if the individual perceives the events in the situation to be so related.

Predictions:

A significantly above chance number of all the subjects will behave on Problem 1 in one of the following ways, thereby indicating that their behavior can be interpreted as sequential in nature:

1. Variability of behavior followed by a change within predetermined limits (before Trial No. 33) to systematic behavior, as defined by its persistence over a specified consecutive number of sequences (3).

2. Systematic invariable behavior throughout the problem of such a nature as to indicate it is sequential; i.e., it must involve initial and continued rejection of some external reinforcement, which rejection can be explained on
the basis of the sequential position of that reinforcement. Example: Always leaving the 3 and the 2 and taking the 8 (Sequence C) throughout the problem (Trials 1 through 33).

This hypothesis is a special instance of the general hypothesis under conditions where expectancies are constant and equal and the reinforcement values are variable; as such the logic behind it seems quite clearcut. Nevertheless, there are certain things that need to be noted. First, the expectancies for a sequential order of events assumed in the statement of the hypothesis to be existent are established by verbal directions. Although hypothesis IIa purports to demonstrate that verbal directions do establish expectancies, just as might "actual" behavioral experience, at this point the validity of that statement has to be assumed. Another point is that the statement in the hypothesis to the effect that a dominant reinforcement value will be established "for that sequence which is perceived as yielding the greatest total amount of reinforcement" can be established within the framework of this hypothesis itself only by verbal report of the subjects. Any outlining of necessary conditions for differential perception of amount of reward to be yielded by any given sequence must await the testing of specific hypotheses concerning those conditions.

Two additional points to be considered are: what is the rationale for considering sequential in nature the kinds of behaviors listed in the predictions as sequential; and further, can the occurrence of such behaviors be explained only in terms such as those outlined here; i.e., in terms of sequential behaviors requiring concepts of both expectancy and reinforcement value to explain their development and continued occurrence.
The first criterion listed for sequential behavior was variability of response followed by a change to a systematic form of response. Such a pattern might be: Take 3 chips for each of 3 trials, leave 3, take 2, take 3 for 2 trials, leave 3, take 2, leave 3, leave 2, take 8, take 3, leave 3, leave 2, take 8, and repeat this latter sequence. First of all it would seem that any incidence of leaving a stack of chips in the problem box would have to be explained on the basis that the subject had an E that so doing would lead to another choice (or other choices) which, with the first one, would yield a higher total reinforcement than taking the external reinforcement originally available. This interpretation seems particularly necessary since the task itself was to get as many chips as possible for the problem. If the subject finally stabilizes his behavior by consistently taking the 8s he is then leaving two consecutive rewards to obtain a third one, and that behavior seems definitely sequential in nature. But, how about the person who stabilizes by taking the 3s; he is taking every reward. If the subject did this from the first trial on it would not be necessary to introduce the conception of sequences of behavior to explain his choices. However, if he has varied his behavior originally it then seems that a better explanation of his preference for the 3s, since it would account for both the initial variability of response and the later stabilization of response, would be that the subject has found this sequence of choices to be the most rewarding.

But can an expectancy formulation alone or a reinforcement formulation alone account for such behavior if it is observed? If, as discussed earlier, it is accepted that an expectancy formulation alone provides
no logical basis from which to predict choices, it then seems to follow
that any such formulation would be inadequate to predict behavioral
choices in this situation. But, could a reinforcement formulation pre-
dict these behaviors? A theory such as Hull's would predict that, if a
stack of 3 chips is taken, then that behavior is rewarded and should
have a stronger tendency to occur the next time. It would seem diffi-
cult for Hull to predict the taking of a stack of 3 chips several times,
then leaving it, then taking it, then leaving it, etc., under the cir-
cumstances of these problems. On the other hand, if the subject begins
by leaving the 3, then the 2, and taking the 8, this behavior is rewarded
and should continue. In other words, Hull could predict completely
systematic behavior in such a situation by contending that the verbal
instructions negatively reinforced (at a secondary reinforcement level)
any stack of chips less than an 8 so they would not be taken. Appar-
ently, however, an S-R formulation would have difficulty accounting for
variability of behavior which involves both taking and leaving stacks
of chips of a given size in a situation such as this one without some
sort of concept of verbally established expectancies for sequential be-
haviors.

The other criterion listed as indicating sequential behavior is
systematic invariable behavior that involves initial and continued re-
jection of some external reinforcement, which rejection can be explained
on the basis of the sequential position of that reinforcement. Always
leaving the 3 and the 2 and taking the 8 would meet this criterion. It
seems necessary to include this group because of the definite possibili-
ty some subjects might initially leave the 3 and the 2 and take the 8;
then, since they do have a relatively high E that taking the 8s will be most rewarding, they may well just continue responding that way. Their behavior can be considered to be a function of a discriminated behavioral sequence in that it can be contended they would not have left the 3 chips unless they had an E that so doing would lead to other choices that would yield a greater total reward; certainly the chips themselves are no different; the only factors involved seem to be size of stack and sequential position of the stack. However, it is not necessary to conceptualize these subjects' behavior as sequential. As pointed out above, Hull could readily predict such systematic behavior on the basis of the size factor alone by contending that the instructions gave stacks of less than 8 chips a negative reward value. Evidently then the formulations outlined here can account for both kinds of behavior to be considered to be sequential; a Hullian (stimulus-response) approach could account readily for this latter kind of behavior, but would seem to have some difficulty predicting the earlier mentioned variable behavior followed by systematic response.

As for the need for concepts of expectancies for amount of reinforcement from sequences of behavior, and reinforcement values of sequences of behaviors as determining choices in the experimental situation outlined, it would seem that they are required. For instance, to predict the leaving of a stack of 3 chips which leads only to a stack of 2 chips which must be left to get 8 chips, it is necessary to consider both the E that the sequence will occur and the RV of the sequence. As has already been discussed, if a 3 has previously been taken, the later leaving of a 3 in a situation such as this one is explainable only
It is a necessary limitation to any learning formulation—in fact it is a tautology, though not necessarily a meaningless one—that if we assume within the system we are using that all relationships are to be thought of as learned, then in any situation only those behaviors (or cues of any sort) will be considered to be related among which there are learned relationships as determined by the operations we have established. The important consideration in rendering any such formulation meaningful (i.e., predictive) is not the apparent circularity of this statement, but rather whether we can define conditions when we will say \( x \) and \( y \) have been "associated in some way" and are therefore related in such and such a way, and whether we can then make accurate predictions on the basis of those stated conditions. The specific hypotheses that follow are an attempt to state such conditions for the sequential problems used in this experiment and should be evaluated accordingly.

**Hypothesis IIa:**

A behavior potential that responding in terms of the frequency of taking a reward (stack of chips) as related to the total reward a problem will yield will be established for a group of subjects by statement of that relevance in verbal directions. Consequently, such a group of subjects (Experimental Group I) will prefer Sequence A (taking 3s) over Sequence C (taking 8s) in Problem 1 significantly more than will a group of subjects whose instructions differ in that they contain no statements about frequency of reward.

**Predictions:**

Subjects in Experimental Group I (who receive instructions which are different from those given to the other groups in that they indicate the importance of considering frequency of reward—how often a stack occurs—as well as amount of reward—size of that stack) will establish a dominant behavior potential for Sequence A as opposed to Sequence C significantly more in Problem 1 than will members of the other groups.

The stating of this hypothesis raises at least two fundamentally important questions as to how it can be justified within the framework.
of social learning theory. The first of these questions concerns how
the establishment of expectancies and reinforcement values (or behavior
potentials) by verbal statements is to be accounted for; the second is
how the preference of some of the subjects for the sequence 3 (L), 2(L),
8(T) (Sequence C) is to be explained when it is not the most rewarding
sequence. Although these questions and their answers are not completely
unrelated, an attempt will be made, in the interests of clarity, to an-
swer them separately.

To explain how verbal statements can be said logically to establish
expectancies and reinforcement values it is necessary to consider first
some implications of our earlier statements about the psychological
level of description and the concept of needs as used in social learning
theory. At that time it was pointed out that needs are a function of
learned organism-environment interrelationships, and further, that rein-
forcement is a function of perceived movement toward psychological
homeostasis or security, and that the referents for these concepts are
organism-environment interactions as described at a level of psychologi-
cal description. Within such a framework any set of cues which have
learned psychological meaning for the organism would be considered to
be equally adequate to function in structuring organism-environment
interrelationships (needs) or in changing them (reinforcements). If
what has just been said is accepted, it then follows that verbal state-
ments conceptualized as cues which have learned meaning can be thought
of as having basically the same kinds of effects on individuals as any
other learned cues; i.e., money, a handshake, etc. The fact that words
are a specialized set of cues whose potentialities for complexity are
practically infinite does not in the least change the basic nature of their function as learned cues. It is true that the process whereby words gain their meanings is a complex one, but that is not to say that the process consists of anything more than a series of differential consequences as a function of differential responses to these cues. It is true that a few pertinent words may change long established behavior patterns, but there is nothing esoteric about that. They do so as a function of the learned RV and E values of those words (their "meaning"), and as such, the occurrence or non-occurrence of such changes and their nature is subject to study using the formulations outlined here. Their effect is probably to be thought of as mediated through functionality (i.e., mediated stimulus generalization, generalization of expectancy changes), but even so, that mediation is unique only in the methodological problems its investigation presents; it is not a different kind of phenomenon. It would seem to follow then that logically it is justifiable to say that expectancies may be established by verbal instructions.

The next question is: Why do some of the subjects choose the 3 (L), 2 (L), 8 (T) sequence (Sequence C) when they have had some experience with taking 3 and having it lead to another 3 on the next trial? The answer suggested here, although it can hardly be said to have been rigorously deduced, is that the subjects are responding in terms of the sequence which has the highest "perceived" RV for them; i.e., the highest RV in terms of the learned relationships aroused in those persons as a function of their interactions with that environmental situation. Or, in terms of the experimental conditions, the appearance of the 3 and taking it will be less rewarding (i.e., will lead to less perceived
movement toward a goal) if that 3 is reacted to as being less than an 8 and therefore having a lower RV, rather than being reacted to as leading to two other stacks of 3 chips each of which, in combination with it, yield 9 chips and would have a higher sequential RV than the stack of 8 chips which is coupled with two zero rewards. It is on the basis of this reasoning that the smaller frequency of preference for Sequence C (or greater frequency of preference for Sequence A) of members of Experimental Group I is predicted. They are told "how well you do will depend on two things: (1) The size of the stacks you do take, and (2) how many trials it takes you to get a stack...." The statement of the second variable as relevant to the amount of reward a problem will yield establishes a behavior potential for the behavior of responding to the frequency of taking a reward in addition to the behavior potential, which is common to all groups, for responding in terms of amount of reward. Consequently Experimental Group I subjects should respond to the behavior of taking a 3 as more rewarding because it leads to two other 3s on successive trials. The subjects in the other groups, not having had frequency of reward mentioned in their directions, will tend to respond to the taking of a 3 as less rewarding than leaving it and a 2 and taking an 8 since they respond only to the comparative sizes of the stack of 3 chips and the stack of 8 chips.

Hypothesis IIb:

If a series of problems is arranged in such a manner that they are related in some way not previously evident to the subjects as to the amount of reinforcement to be received from those problems, and if there has been established a behavior potential for so responding to that relationship, then the subjects will eventually establish a new dominant RV which, in terms of all the factors now evident, yields the greatest total reinforcement.
Predictions:

In Experimental Group II (Random Training Group) those subjects who preferred Sequence C (took the 8s) on Problem 1 will shift to Sequence A (taking the 3s) from Problem 1 through the post-test (Problem 1 again) significantly more than will the subjects in the Control Group who prefer Sequence C on Problem 1 and then solve only the post-test with no intervening training.

This hypothesis merely states that when the manner in which a person perceives a situation and responds to it is not the most rewarding in terms of the order of events as related to the reinforcements to be obtained from that situation, his perception of that situation and his behavior will eventually change in a predictable direction; i.e., to that of a more "adequate" response.

But when does a person have a behavior potential for responding to the relationships among the problems as related to the reinforcements to be derived from that situation? The operational answer here is that when a person is told in the context of an experimental situation in the directions given him for that experiment that "This test is made up of a series of related problems," such a behavior potential is established. It is recognized that "responding to the relationships among the problems as related to the reinforcements to be derived from that situation" is a behavior of a quite high level of abstraction, and further, that the establishment verbally of such a behavior potential might be questioned. However, our earlier discussions have pointed out the fact that it has been demonstrated that people do respond to cues at many levels of complexity. Further, within such a system as Rotter's, in which the systematic constructs are defined in terms of learned organism-environment interactions, the fact of complexity as such need present no theoretical difficulty, although it may present many methodological ones.
In other words, if it can be demonstrated empirically that people do respond at specific choice points in terms of high level abstractions concerning the relationships involved in the situation, there is no logical reason why Es and RVs cannot be conceptualized at that level.

Also, by referring to the earlier discussion about verbally established expectancies, it can be seen that logically expectancies can be thought to be established verbally and that, by similar reasoning, reinforcement values (and consequently behavior potentials) can also be thought to be.

Hypothesis IIc:

The series of problems for Experimental Group II and the series for Experimental Group III are arranged so that both series are related in some way not previously evident to the subjects as to the amount of reinforcement to be received from those problems, and there has been established by the directions a behavior potential for so responding to those relationships. In addition, the inter-problem relationships of one of the series of problems (Experimental Group III's problems) can also be perceived as due to a systematic decrease in the amount of reinforcement to be gotten from any of the sequences in each problem rather than as a function of the only sequence which actually varies. Under those conditions the subjects who solve the series where the problems change progressively (Experimental Group III) will develop a new dominant reinforcement value less quickly than will subjects who solve the other series of problems (Experimental Group II) where the differences between successive problems are greater and are not progressive.

Predictions:

The subjects in Experimental Group III (the Progressive Training Group) will persist in taking the Ss (Sequence C) to a greater extent through their fourth problem (Problem No. 4), which is systematically related to Problem No. 1 by virtue of the intervening problems, than will the subjects in Experimental Group II through their second problem (also Problem 4).

This hypothesis is different from Hypothesis IIb and an extension of it in that it attempts further to delimit the conditions when perception of a situation and resultant behavior will, or will not, change as a function of experience. Consequently, it is necessary to introduce another group of subjects (Experimental Group III) besides those in the
Random Training Group (Experimental Group II) and give them a different series of training problems. The problems Experimental Group III subjects received are so arranged that Sequence C (3(L), 2(L), x(T)) in each problem yields stacks of chips that are one chip smaller than those that sequence yielded in the preceding problem. It is in that way that the second hypothesized condition above is thought to be met. That is, the subjects could respond to the problems as sequentially related in such a manner that each problem yields progressively less reward (chips). If they do structure the situation in that way rather than responding to the inter-problem differences as a function of Sequence C only, then they should persist longer (through more problems) in their preference for the originally preferred sequence (Sequence C).

This hypothesis is not the only one that could logically be stated at this point; possibly a better formulation would have been the more general one of leaving relative amounts of change to be determined empirically and predicting merely that systematic relationships between events as outlined here will lead to a significant difference in the rate of change between the groups. It is possible that the relative rate of change might vary with different specific problem conditions. Nevertheless, the hypothesis was formulated originally as stated above for the reason that at that time it seemed to the writer to be the most logical possibility. It is true, however, that significantly different changes in the direction opposite to that predicted would have to be explained in some way other than that outlined here.

A null statement of each of the three hypotheses deduced from
General Hypothesis II follows:

Hypothesis IIa:

Different groups of subjects given different instructions concerning the relevance of frequency of taking any given reward (stack of chips) to the total reward they will receive over a series of trials, will not differ significantly above chance in sequence of behavior preferred (i.e., Sequence A or Sequence C) on Problem 1.

Hypothesis IIb:

A group of subjects solves a series of problems arranged in such a manner that they are related in some way not previously evident to the subjects as to the amount of reinforcement to be received from those problems, and even though they have had established a behavior potential for so responding to that relationship, there will be no significantly above chance differences between that group and a group who doesn't solve such a series of problems in the frequency with which they establish a new dominant reinforcement value (and consequently behavior potential).

Hypothesis IIc:

The series of problems for Experimental Group II and the series for Experimental Group III are arranged so that both series are related in some way not previously evident to the subjects as to the amount of reinforcement to be received from those problems, and there has been established by the directions a behavior potential for so responding to those relationships. In addition, the inter-problem relationships of one of the series of problems (Experimental Group III's problems) can also be perceived as due to a systematic decrease in the amount of reinforcement to be gotten from any of the sequences in each problem rather than as a function of the only sequence which actually varies. There will be no significantly above chance differences in the speed with which subjects in those two groups develop a new dominant reinforcement value (and consequently behavior potential) as they solve their respective series of problems.
CHAPTER IV
METHODOLOGY

Subjects
A total of 137 subjects, 75 males and 62 females, ranging in college level from freshman through senior, performed the experiment. The subjects were all students in one of three introductory psychology courses, and volunteered for this experiment to help fulfill a course requirement that each serve as a subject in three psychology experiments. This experiment was described to them simply as a learning experiment whose exact nature could not be disclosed. The major selective factor for choosing this particular experiment seemed to be the fact that it required only a half-hour of time, whereas some of them required a full hour. However, a large majority of the subjects seemed interested and motivated throughout the experiment.

Apparatus
The main piece of apparatus used was the problem box which was made of 3/8" plywood and had the following dimensions: It was 7" wide and 6" high; at the base it was 11" long; at the top, 6" long. The sides slanted at the back end from the top down to the bottom, and the back itself was open. The floor of the box was covered with green felt to deaden any sound from placing the chips in the box. In the front of the

1Psychology 401 (General Psychology), Psychology 402 (General Psychology, a continuation), Psychology 403 (General Psychology for students in the College of Arts).
box was a door set in vertical slots 13" high so that it could be lifted by a brass handle to reveal the contents of the box. A section 7" by 6 1/2" was cut from a piece of plywood 24" long by 20" high and the piece was fitted vertically over the box 5" back from the front to provide a screen between the experimenter and the subject. It was impossible to see over the screen without standing up or to see around it without moving from one's chair. A small white light was mounted on top of the box in front of the screen and was used by the experimenter to signal when a trial was ready. The box itself was painted with clear shellac.

A small box with outer dimensions of 7" by 7" by 3" and a circular hole 2" in diameter in the top was also constructed from 3/8" plywood and painted with clear shellac. It was set to the left of the door of the problem box and was used for the subjects to drop the chips in when they took any from the problem box. This box had an open bottom to facilitate removal of the chips after each problem.

The chips used as rewards were plain white cardboard poker chips. Cardboard chips were used to reduce to a minimum the noise of handling them.

Tasks:

Only one type of problem was employed in the experiment, but there were five variations of it. These specific variations were chosen after considerable pretesting with various problems of this type to determine if they would be practical for testing the experimental hypotheses.

The basic task was the problem of getting as many poker chips as possible from the problem box during a fixed, but unknown, number of
trials of considerable length. Each time the door of the box was lifted was counted as a trial and the subject was required to lift the door each time the E flashed the light. There was a stack of chips in the box each trial, but the size of that stack varied in a predetermined and regular order, depending on whether the subject took the stack out of the box on the preceding trial or left it in the box. The maximum number in any stack of chips was 8, and the subjects were informed in the directions of this limit.

Problem No. 1 for each of the groups was made up of stacks of 2, 3, and 8 chips. A stack of 3 chips always appears on the first trial, then what occurs after that is a function of the choice of the S on the preceding trial. The choices and their consequences are outlined in detail on p. 46f, so will not be repeated here.

Since the subject must make a choice each trial, and since he may make any choice he wished, an almost infinite variety of solutions to the problem is possible. However, on the basis of sizes of stacks alone, there are only three sequences; and of these, only two are ordinarily chosen. The sequences are:

Sequence

A. 3(Take), 3(T), 3(T), etc.
B. 3(Leave), 2(T), 3(L), 2(T), etc.
C. 3(Leave), 2(L), 8(T), 3(L), 2(L), 8(T), etc.

By choosing Sequence A the subject adds 3 chips (3 points) to his score each trial, or 9 chips for 3 trials. Sequence B yields 2 chips every second trial or an average of 3 chips for 3 trials. It might be pointed out here that the stacks left in the box do not count on the
subject's score. Only those stacks he takes out of the box count in his favor. Consequently, by choosing Sequence C the subject gets only 8 chips for 3 trials, since the stack of 3 chips and the stack of 2 chips which he must leave in the box for the stack of 8 chips to appear do not count on his score. Sequences A and C are ordinarily the only two chosen since they both yield a considerably higher score than Sequence B.

The number of trials was fixed within a range of 33 through 40 trials. The need for a range was in part due to the fact that it was deemed unwise to end a problem in the middle of a sequence; i.e., on a trial when a subject had left a stack in the box. Since the subjects did not know exactly when any problem would end there would have been a tendency for them to shift as the problem progressed to taking each reward, regardless of what its value might be, to avoid leaving the problem when they were in the middle of a sequence whose value derived from the receipt of a delayed large reward.

The median number of trials was approximately 35, and scores reported to the subjects were calculated on as nearly 35 trials as feasible; for example, if a sequence ended on trial 34, the score was reported for 34 trials even though more were run in order to reach the criterion of performance on that sequence.

The criterion set up as indicating preference for a sequence was 3 consecutive repetitions of that sequence through trial number 33. For instance, if Sequence C were preferred, it would have to be chosen by trial number 32 at the latest and be repeated 3 consecutive times. To check that eventuality would require running 40 trials. The upper limit
of the range was calculated on that basis and consequently set at 40 trials. At the other extreme, if Sequence C were chosen by trial 25 and repeated 3 consecutive times, the final criterion trial would be trial 33 and the problem would be ended there. If no sequence was clearly established within the limits set, the problem was discontinued and that person's performance was considered negative evidence for the hypothesis that behavior can be considered to be sequential in nature (Hypothesis Ia).

There were four other problems, all of which are variations of the one just outlined, used in the experiment. They differed from Problem I only in that the size of the third and largest stack of chips varied from what it was in Problem 1; the other stacks were the same in size. The sizes of the stacks of chips in each of the problems were:

Problem 2: 3, 2, 7  
Problem 3: 3, 2, 6  
Problem 4: 3, 2, 5  
Problem 5: 3, 2, 4

Two sets of instructions were used. The set used for Experimental Groups II and III and for the Control Group are designed to establish behavior potentials for responding in terms of the relationship of size of specific rewards taken to total reward. Those instructions are:

"This test is made up of a series of related problems. Here are the instructions. It is very important that you get them just right, so listen to them very carefully.

"I will flash the light to indicate a trial, then you open the door (demonstrate). After the trial close the door and wait for the light to flash signalling the next trial. When you take the chips out of this box put them into that one (pointing). The object is to get as many into there as possible; only those you take out of here (indicating) count for you. When we're finished with the problem we'll count how many you got."
"The problem itself goes like this. On each trial you open the door of the box and look in to see how many of these chips are in it (show sample stack of 4 chips). You may then take the stack out of the box or you may leave it in the box, that's up to you; but whichever you do will determine the size of the next stack of chips. That is, if you leave a stack of chips in the box, the next stack will be different in size than it would have been if you had taken the first stack out of the box. You may be able to get as many as 8 chips at one time in one certain way; and of course, the bigger the stack, the more it adds to your score. You see, your score is the total number of chips you take out of the box for the whole problem; the higher the number of chips, the better the score. In any case, of course, you have to check all of the possibilities to find out which way is best. (Would you like me to go over that again?)"

The other set of instructions are used for Experimental Group I and are designed to establish behavior potentials for responding in terms of both size of specific reward and frequency of taking that reward as relevant to total reward. They are as follows:

"This test is made up of a series of related problems. Here are the instructions. It is very important that you get them just right, so listen to them very carefully.

"I will flash the light to indicate a trial, then you open the door (demonstrate). After the trial close the door and wait for the light to flash signalling the next trial. When you take any chips out of this box put them into that one (pointing). The object is to get as many into there as possible; only those you take out of here (indicating) count for you. When we've finished with the problem we'll count how many you got.

"The problem itself goes like this. On each trial you open the door of the box and look in to see how many of these chips are in it (show sample stack of 4 chips). You may then take the stack out of the box or you may leave it in the box, that's up to you; but whichever you do will determine the size of the next stack of chips. That is, if you leave a stack of chips in the box, the next stack will be different in size than it would have been if you had taken the first stack out of the box. The maximum number of chips you can get at any one time is 8 chips, but note that since the more chips you get for the whole problem the better your score, how well you do will depend on 2 things: (1) the size of each stack of chips you do take, and (2) the number of trials it takes you to get each stack you take; that is, the number of stacks you have to leave
before the stack you take appears. In other words, in figuring out which way you will get the most you have to count how many times you have to open the box to get a stack of a certain size in order to know whether taking that stack will give you the most for that problem. In any case, of course, you have to check all the possibilities to find out which way is best. (Would you like me to go over that again?)"

For all groups the instructions were repeated and questions were answered if any were asked. An attempt was made always to answer within the framework of what had already been given in the instructions. For example, if a subject asked if the object of the problem was to find out how to get the 8s, he was told that the object was to get the most for the whole problem, but that 8 was the size of the largest stack there would be in the problem.

For subjects of Experimental Groups II and III and the Control Group, who were required to solve more than one problem, the following instructions were read before the second problem was begun:

"The instructions are the same for the rest of the problems except that some of the stacks of chips may be different in size from what they were the first time. There may not be as many as 8 chips in some problems, but there will never be more than that."

The problems to be given to each group were determined by the function of that group in the experimental design. The groups and the problems each solved were presented in detail on p. 48 so will not be repeated here.

Assignment to Groups:

An attempt was made as the experiment progressed to keep the groups balanced on the basis of two criteria—psychology class enrolled in and sex. In other words, the experimenter tried to have an equal number of males and females from each class (Psychology 401, 402, and 403) in each
of the four groups. Assignment to groups was determined by keeping a running tally of the subjects and, before each subject arrived, assigning him to a group on some basis such as: the next Psychology 401 male should go in ___Group, the next Psychology 401 female should go in ___Group, etc. This procedure was followed until the following numbers of subjects were obtained:

Experimental Group: I: 25 subjects who met the criteria established for sequential behavior after first having experienced all of the sequences.

Experimental Group II: 25 subjects who met the criterion for sequential behavior by choosing Sequence C (3 (L), 2(L), 8(T)).

Experimental Group III: same as Experimental Group II.

Control Group: same as Experimental Group II.

General Procedure:

The following procedure was characteristic for all subjects, although of course there were variations from group to group as a function of unique features of the procedures for those groups. The experimenter (the writer) met the subject in a waiting room and accompanied him to the experimental room. Upon entering the room the subject was facing the front of the experimental apparatus as it sat on a table. He was asked to sit down at the table.

The experimenter walked around to the other side of the table back of the apparatus; he then asked the subject his name, college year, college, age, and psychology class. The E then assigned the subject to a group on the basis of the previously outlined scheme, using the subject's class and sex as criteria.

The experimenter then explained to the subject that this was a
learning experiment, that its exact nature could not be disclosed at this time, that after the experiment was finished the E would explain the rationale for the tasks, and that the E would now give the instructions.

If the subject had been assigned to Experimental Group I he was read the second set of instructions, his questions were answered, and Problem 1 was begun. After he had completed the problem the subject was asked: Why did you take the ones you did and leave the ones you did? His answer was recorded and any additional questions deemed necessary to clarify his meaning were asked. A definite effort was made not to ask questions which were in any way leading. Finally, the purpose of the experiment was explained and the subject was asked not to tell anyone else about it.

If the subject had been assigned to Experimental Group II or Experimental Group III the first set of instructions was read to him, his questions were answered, and Problem 1 was begun. After it was finished, if the subject had preferred Sequence C, the E counted the chips, told the subject his score, and read the additional instructions (p. 71). Then the next problem was begun. After each problem the E counted the chips and gave the subject his score before beginning the next problem. After the final problem the subject was asked, as in Experimental Group I, why he took the ones he did and why he left the ones he did. Finally, the nature of the experiment was explained and the subject was asked not to disclose anything about it.

If the subject had been assigned to the Control Group the first set of instructions was read to him, his questions were answered, and
Problem 1 was begun. After it was completed the E counted the chips in the box, and told the subject his score; then the E explained that it would be some time before the next problem and gave the subject a magazine to read. Ten minutes later the E read the additional instructions to the subject and Problem 1 was repeated. As in the other groups, the subject was asked why he did what he did, the experiment was explained to him, and he was asked not to tell anyone about it.

In each case the subject was asked if he had heard of the experiment before and told he would get credit for it even if he had, but that he could not be a subject. Several subjects did sign up for the experiment a second time, but apparently all who did so admitted it, as there was no duplication of names on the score sheets, and the only way the subjects could get class credit for participation was for the E to turn in their names to their instructors.

The Experimental Design:

The data necessary for testing the hypotheses were the frequencies of those in each group who chose certain sequences on specified problems. With the exception of Hypothesis I, for which it is impossible to compute theoretical frequencies, the hypotheses were tested by use of a chi-square test of significance. A chi-square formula for a $2 \times 2$ distribution and one for a $j \times 2$ distribution were used; both are described in Edwards (9). The 5 percent level of significance is the criterion used in this study as a referent for rejecting the null hypothesis. Of course in those cases where the prediction is directional and a one-tailed test of significance is legitimate, using the 5 percent signifi-
cance level as a criterion actually amounts to rejecting the null hypothesis at the 2.5 percent point of significance.
CHAPTER V
RESULTS AND DISCUSSION

The predictions made as a function of the experimental hypotheses were predictions as to the pattern, or type of sequence, of behavior that would be preferred by the subjects under different experimental conditions. Due to the nature of those predictions the data necessary for testing them are the relative frequencies of preference for those sequences of behavior. A copy of a test protocol with a typical pattern of performance marked on it is included in Appendix D, but it should be noted that the only information used from such a record for the analyses that follow was the sequence preferred for each of the pertinent problems.

Results:
The questions asked are listed in order, and the corresponding data necessary to answer each of them are presented in tabular form. The discussion of the results will follow the presentation of all the data. The experimental groups will be listed again for convenient reference:

<table>
<thead>
<tr>
<th>Group</th>
<th>Experimental Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Group I</td>
<td>Second Instructions, Problem 1</td>
</tr>
<tr>
<td>Experimental Group II</td>
<td>First Instructions, Problems 1 (Pretest), 4,2,5,1 (Post-test)</td>
</tr>
<tr>
<td>Experimental Group III</td>
<td>First Instructions, Problems 1,2,3,4</td>
</tr>
<tr>
<td>Control Group</td>
<td>First Instructions, Problem 1 (Pretest), Interpolated Activity, Problem 1 (Post-test)</td>
</tr>
</tbody>
</table>
(1) Can the behavior of the subjects of this experiment be considered to be a function of those subjects having learned sequences of behavior-reinforcement combinations?

Since there is no criterion from which to estimate a set of theoretical frequencies for sequential versus non-sequential behaviors, or for any of the specific behavioral patterns, other than by computing the total number of combinations of behavior possible (undoubtedly an astronomical figure) in 35 trials on Problem 1, it seems neither practical nor necessary to evaluate this hypothesis statistically. Consequently, only the sequential frequencies and the non-sequential frequencies are presented. (Criteria for sequential behavior are given on p. 52)

TABLE NO. 1

BEHAVIORAL PATTERNS ESTABLISHED BY ALL SUBJECTS ON PROBLEM NO. 1 (N = 137)

<table>
<thead>
<tr>
<th>Group</th>
<th>Sequential Behavior</th>
<th>Non-Sequential Behavior</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Group 1</td>
<td>28 (3)*</td>
<td>3</td>
<td>31</td>
</tr>
<tr>
<td>Experimental Group 2</td>
<td>33 (3)</td>
<td>4</td>
<td>37</td>
</tr>
<tr>
<td>Experimental Group 3</td>
<td>35 (5)</td>
<td>0</td>
<td>35</td>
</tr>
<tr>
<td>Control Group</td>
<td>33 (4)</td>
<td>1</td>
<td>34</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>129 (15)</strong></td>
<td><strong>8</strong></td>
<td><strong>137</strong></td>
</tr>
</tbody>
</table>

*Figures in brackets indicate how many subjects behaved in a systematic invariable way, yet whose behavior met the criterion for being considered sequential in nature, since it involved consistently leaving one or more external reinforcements.*
(2) Does the establishing of differential behavior potentials by verbal instructions lead the subjects to prefer correspondingly different sequences (Sequence A versus Sequence C) of behavior?

Before any observed differences in relative preferences on Problem 1 for Sequence A versus Sequence C can be accepted as valid evidence for testing this hypothesis, it is first necessary to demonstrate that there are no significant differences between the samples being compared other than the differences in preference for these two sequences. The data presented in Table No. 2 are pertinent to this point. These same data can also be thought of as relevant to answering whether the two sets of directions are equivalent in all respects except for the hypothesized differences between them.

### TABLE No. 2

**DIFFERENCES NOT A FUNCTION OF DIFFERENTIAL INSTRUCTIONS RECEIVED BETWEEN FREQUENCIES OF PREFERENCE FOR BEHAVIORAL PATTERNS ON PROBLEM NO. 1 (N=137)**

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Pattern Preferred</th>
<th>Sequence A or C</th>
<th>Sequence A, over Seq. B*</th>
<th>Non-systematic Never left stack*</th>
<th>Behavior</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp. Gp. 1 (Second Instructions)</td>
<td>25</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Other Groups (First Instructions)</td>
<td>94</td>
<td>7</td>
<td>2</td>
<td>3</td>
<td>106</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chi square</th>
<th>df</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.629</td>
<td>3</td>
<td>&lt;.10</td>
</tr>
</tbody>
</table>

*These persons cannot be included in the comparisons of preference for Sequence A and Sequence C since their behavior is not a function of such a choice due to the fact that they have not behaved in such a way as to have been exposed to Sequence C.
Two comparisons of the significance of the differences between the groups due to the instructions have been made. The first comparison (A, Table 3) includes the three final behavioral patterns listed in Table No. 3; the second (B), includes only Columns 1 and 2 (Preferences for Sequence A and Sequence C).

**TABLE NO. 3**

DIFFERENCES BETWEEN FREQUENCIES OF PREFERENCE FOR BEHAVIORAL PATTERNS ON PROBLEM NO. 1 AS A FUNCTION OF DIFFERENTIAL INSTRUCTIONS RECEIVED.  \( (N = 137) \)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Pattern Preferred</th>
<th>Pattern Preferred</th>
<th>Pattern Preferred</th>
<th>Pattern Preferred</th>
<th>Pattern Preferred</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sequence A</td>
<td>Sequence C</td>
<td>Sequence A, over Seq. B</td>
<td>Sequence A, Never left stack</td>
<td>Non-sys-tematic Behavior</td>
</tr>
<tr>
<td>Exp. Gp. I (Second Instructions)</td>
<td>13</td>
<td>12</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Other Groups (First Instructions)</td>
<td>19</td>
<td>75</td>
<td>7</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Chi square</th>
<th>df</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (all patterns included)</td>
<td>13.257</td>
<td>4</td>
<td>&lt;.02</td>
</tr>
<tr>
<td>B (Sequence A &amp; Sequence C)</td>
<td>8.596</td>
<td>1</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

(3) Does additional training with related problems lead subjects to change from the sequence originally preferred (Sequence C) to a more rewarding sequence (Sequence A)?

The significant comparison in testing this hypothesis is that between
the relative frequencies of preference for Sequence A as opposed to Sequence C on the Post-test of subjects in Experimental Group II and subjects in the Control Group. The hypothesis predicts that Experimental Group II will prefer Sequence A significantly more; however, before any differences (Table No. 5) can be accepted as valid, it is necessary to demonstrate the samples have been drawn from the same population. Therefore, the comparison recorded in Table No. 4 has been made.

**TABLE NO. 4**

**DIFFERENCES BETWEEN FREQUENCIES OF PREFERENCE FOR BEHAVIORAL PATTERNS ON THE PRETEST (PROBLEM NO. 1) OF EXPERIMENTAL GROUP II SUBJECTS AND CONTROL GROUP SUBJECTS. (N = 71)**

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Pattern Preferred</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sequence A</td>
<td>Sequence C</td>
</tr>
<tr>
<td>Experimental Group II</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Control Group</td>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chi square</th>
<th>df</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.878</td>
<td>4</td>
<td>&lt;.60</td>
</tr>
</tbody>
</table>

**TABLE NO. 5**

**DIFFERENCES BETWEEN FREQUENCIES OF PREFERENCE FOR SEQUENCE A AS OPPOSED TO SEQUENCE C ON THE POST-TEST (PROBLEM NO. 1) OF EXPERIMENTAL GROUP II SUBJECTS AND CONTROL GROUP SUBJECTS. (N=50)**

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Pattern Preferred</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sequence A</td>
<td>Sequence C</td>
</tr>
<tr>
<td>Experimental Group II</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Control Group</td>
<td>5</td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chi square</th>
<th>df</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.253</td>
<td>1</td>
<td>&lt;.05</td>
</tr>
</tbody>
</table>
(4) A group of subjects is given a series of problems arranged in such an order that progressively less reward is obtained on each successive problem from the originally preferred (though inadequate) response. Will this arrangement of problems tend to minimize the inadequacy of that originally preferred response, so that these subjects will consequently persist in that behavior longer than a group of subjects whose problems are ordered in such a way that the differences between their successive problems are greater?

Here again it is necessary to establish that there are no significant differences (Table No. 6) on Problem No. 1 between the performances of the two samples (Experimental Groups II and III) before evaluating any differences (Table No. 7) relevant to testing the hypothesis. The significant comparison, however, is the one between the relative frequencies of preference for Sequence A over Sequence C of subjects in Experimental Group II on Problem No. 1 (their second problem) as opposed to the relative frequencies of preference for Sequence A over Sequence C of subjects in Experimental Group III on Problem No. 4 (their fourth problem). From the hypothesis it would be predicted that the subjects in Experimental Group III would prefer Sequence A significantly less than would the subjects in Experimental Group II at the respective points indicated.
TABLE NO. 6

DIFFERENCES BETWEEN FREQUENCIES OF PREFERENCE FOR BEHAVIORAL PATTERNS ON THE PRETEST (PROBLEM NO. 1) OF EXPERIMENTAL GROUP II SUBJECTS AND EXPERIMENTAL GROUP III SUBJECTS. (N = 72)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Pattern Preferred</th>
<th></th>
<th></th>
<th>Non-systematic Behavior</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sequence A</td>
<td>Sequence A, over Seq. B</td>
<td>Never left a stack</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental Group II</td>
<td>5 25 3 1 3 37</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental Group III</td>
<td>9 25 1 0 0 35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chi square df Level of significance

6.092 4 < .20

TABLE NO. 7

DIFFERENCES BETWEEN FREQUENCIES OF PREFERENCE FOR SEQUENCE A AS OPPOSED TO SEQUENCE C ON THEIR RESPECTIVE PROBLEMS NO. 2 OF EXPERIMENTAL GROUP II SUBJECTS AND EXPERIMENTAL GROUP III SUBJECTS. (N = 50)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Pattern Preferred</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sequence A</td>
<td>Sequence C</td>
<td>TOTAL</td>
</tr>
<tr>
<td>Experimental Group II</td>
<td>6 19 25</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Experimental Group III</td>
<td>14 11 25</td>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>

Chi square df Level of significance*

4.083 1 < .05

*Note that the relative frequencies of preference are opposite to that predicted on the basis of the experimental hypothesis.
The data in Table No. 8 are presented to provide a basis for dis-
cussion of the negative results obtained in the test of this final
hypothesis.

**TABLE NO. 8**

DIFFERENCES IN INTER-GROUP AND INTRA-GROUP PREFERENCES ON SUBSEQUENT
PROBLEMS FOR SEQUENCES A AND C OF THOSE SUBJECTS IN EXPERIMENTAL
GROUPS II AND III WHO PREFERRED SEQUENCE C ON PROBLEM 1

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Sequence Preferred</th>
<th>First Problem (No. 1)</th>
<th>Second Problem (No. 4)</th>
<th>Third Problem (No. 2)</th>
<th>Fourth Problem (No. 5)</th>
<th>Fifth Problem (No. 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp. Gp. II (Random)</td>
<td>A</td>
<td>0</td>
<td>6</td>
<td>7</td>
<td>15</td>
<td>13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Sequence Preferred</th>
<th>First Problem (No. 1)</th>
<th>Second Problem (No. 2)</th>
<th>Third Problem (No. 3)</th>
<th>Fourth Problem (No. 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp. Gp. II (Random)</td>
<td>A</td>
<td>0</td>
<td>7</td>
<td>12</td>
<td>14</td>
</tr>
</tbody>
</table>

**COMPARISON**

<table>
<thead>
<tr>
<th>Chi square</th>
<th>df</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intergroup</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second Problem</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Third Problem</td>
<td>1.358</td>
<td>1</td>
</tr>
</tbody>
</table>

| Intragroup |     |                       |
| Exp. Gp. II, 2nd & 3rd Problems | 0 | 1 | --- |
| Exp. Gp. III, 2nd & 3rd Problems | 1.358 | 1 | <.25 |

The chi square formula used in computing the significance listed in
Table No. 8 is the same as that used for analyzing the other data. It
is the appropriate formula because our interest is in whether a signifi-
cant number of subjects change from preferring Sequence A to preferrin
Sequence C from problem to problem. If our interest were in whether there is a significant relationship between how a person solves Problem No. 2 and how he then solves Problem No. 3, the chi square for correlated proportions would be the appropriate statistic to use. Since very few subjects ever changed from preferring Sequence A back to Sequence C, and those who did so later verbalized that the reason they did so was because of an arithmetical miscalculation on their part (such errors count for the reverse shift in preference between the 4th and 5th problems in Exp. Gp. III), it was considered that such an analysis was not indicated, but rather that the validity of the hypothesized sequential effects could be assumed.

It will be recalled that verbal reports from the subjects concerning why they took out the chips they did and left in those they did were recorded. Sample responses are given in Appendix C. In summary, though, in all cases where the behavior was systematic and met the criteria for being considered sequential in nature, the verbal report corresponded to the explanation suggested in the hypotheses as to the reasons the respective sequences would be chosen. That is, the person reported he chose the sequence he did because it was the most rewarding with respect to the entire problem ("You get the most by taking the 8s," or "I finally figured out that three 3s give 9, and I only got 8—or 7, or whatever—by taking the big stack," etc.). The verbal reports of those few whose behavior was unsystematic indicated what could be termed idiosyncratic interpretations of the nature of the task, or just lack of understanding of it.
Discussion of the Results:

(1) Can the behavior of the subjects of this experiment be considered to be a function of those subjects having learned sequences of behavior-reinforcement combinations?

This question cannot be answered statistically in terms of the theory of negative probability since there is no way of determining any theoretical frequencies of occurrence of patterns of behavior on such a problem as the one used here. Consequently, since the behavior of better than 94% of the subjects met the criteria established as defining sequential behavior, it would seem logical and of considerable heuristic value to consider the question to be affirmatively answered and to proceed accordingly. The behavior of 15 of the 129 subjects whose behavior was considered sequential could be explained by a Hullian formulation as well as within the framework of the formulations presented in this study. But the behavior of the 114 subjects who met the other criterion for sequential behavior was such that a conception of Es and RVs for behavior sequences seems to provide a better basis for predicting those subjects' behavior than would a straight stimulus-response formulation.

On the basis of the results quoted above it seems legitimate to conclude tentatively that people do learn to respond at choice points on the basis of the sequential relationships they have learned to expect to obtain between those choices themselves and preceding ones and/or potential succeeding ones. That is, the usefulness of the sequential expectancy and reinforcement value conceptions outlined here have been tentatively substantiated.

It should also be noted that even though a formulation involving
sequential Es and sequential RVs is necessary to account for the behavior observed in testing this hypothesis, there is a limitation to the conclusions that can be drawn from these findings in that corresponding predictions are not made concerning conditions when sequences will not be learned. So, while it is legitimate to say that under these conditions and those stated as pertinent to the other hypotheses sequences are learned, it cannot be said that these conditions are necessary to the learning of sequences or that sequences will not be learned under other conditions. It can only be said that behavior sequences were learned under these conditions.

(2) Does the establishing of differential behavior potentials by verbal instructions lead the subjects to prefer correspondingly different sequences (Sequence A over Sequence C) of behavior?

The data presented in Table No. 2 establish that there are no differences not attributable to chance between the groups used to determine the answer to this question other than those hypothesized since preferences for Sequences A and C were placed in the same category in this test of differences in behavior between the groups in question. These data also establish that there are no extraneous differences not within the limits of chance occurrence between the two sets of instructions used to establish the differential behavior potentials which resulted in different frequencies of preference for Sequences A and C. Consequently any significant differences between the groups tested in relative preferences on Problem 1 for Sequences A and C can be attributed to the establishment of differential behavior potentials in the instructions. The chi square for comparison A in Table No. 3 is significant, so the null
hypothesis can be rejected. Further, the chi square for comparison B in Table No. 3, which is a direct comparison between preferences in Problem 1 for Sequence A and Sequence C only is also significant. This fact would suggest even more strongly that the hypothesized differential behavior potentials were established by the different sets of instructions.

There have been studies such as Heidbreder's (10) in which the cue value of words or groups of words have been studied (in that case as a basis for concept formation); there have also been studies such as Youtz's (15) where a series of problems has been used to establish a "set." But this study seems to be somewhat different in that it has attempted (in terms of expectancies and reinforcement values) to relate in a predictive fashion the cue value of verbal symbols and different consequent choice behaviors. The positive findings for the above hypothesis would seem to provide tentative confirmation of the validity and operational feasibility of such an approach.

(3) Does additional training with related problems lead subjects to change from the sequence originally preferred (Sequence C) to a more rewarding sequence (Sequence A)?

Again, in order to accept the validity of any pertinent differences between the experimental groups it is necessary to establish that they are not significantly different before the introduction of the independent variable to the one group. The data analysis presented in Table No. 4 established just that; the groups are not significantly different in their performance on Problem 1. The data analysis presented in Table 5 shows, however, that there is a significant difference
between the two groups after Experimental Group II has received the additional training problems and that the direction of that difference is as predicted; i.e., more Experimental Group II subjects shifted to a preference for Sequence A. Consequently, the null hypothesis can be rejected and the hypothesis can be considered adequate to explain the differences obtained.

Then in answer to the question, under what circumstances are originally inadequate responses changed to more adequate ones, the answer derived from these results would be that under the circumstances specified, such responses are changed when the person has additional experience with problems like the original one which tend to magnify or enlarge the inadequacy of that response. The stated limiting conditions for such a prediction are that the differences among the problems be related to the factor(s) not previously perceived as relevant to the problem solution; and further, that a behavior potential for so responding to those differences has been established.

The confirmed results of this hypothesis and of the preceding one set up tentative outlines for formulating some conditions from which to predict the original learning of behavior sequences and the progressive modification of the ones learned to more appropriate ones.

(4) A group of subjects is given a series of problems arranged in such an order that progressively less reward is obtained on each successive problem from the originally preferred (though inadequate) response. Will this arrangement of problems tend to minimize the inadequacy of that originally preferred response, so that these subjects will consequently persist in that behavior longer than a group of subjects whose
problems are ordered in such a way that the differences between their successive problems are greater?

It can be seen from Table No. 6 that there are no significant differences between the groups before the differential training is begun. Examination of Table No. 7 reveals that on the test indicated (comparison of preferences for Sequence A and Sequence C on Problem No. 4) there are significant differences between the groups. However, contrary to what was predicted, the subjects in Experimental Group III preferred Sequence A more, not less, than did the subjects in Experimental Group II.

How then are these negative results to be explained? First of all, it should be noted that the different sequences of problems did influence the rate of change since the chi square obtained was significant at beyond the 5% level of confidence. The best explanation seems to be that the subjects did not respond to the relationships among the problems as it was hypothesized they would. Possibly they responded to those inter-problem differences as a function of differences in Sequence C only. If that was true, then the progressive nature of the decrease in reward Sequence C yielded from problem to problem could well have led to a more rapid lowering of the behavior potential for that sequence, a consequent locking for an alternative solution by the subjects, and a resultant shift on their part to a preference for Sequence A. If this interpretation is correct, then certain relationships should maintain within each group and between the groups (Experimental Groups II and III). For instance, the shift of subjects from preference for Sequence C to preference for Sequence A should be regular and progressive
in Experimental Group III. Under any circumstances, in Experimental Group II (the Random Training Group) progression in change would be expected, but not regularity. Such comparisons as these can be made to provide a tentative check on the explanation suggested even though the training series of these two groups are not completely equivalent except for the deliberately established differential order of training problems received. Examination of Table No. 6 shows that the subjects in Experimental Group III did change their preferences in a regular and progressive fashion (7, 5, and 2 subjects changed on the second, third, and fourth problems respectively); but that the subjects in Experimental Group II did not change at a regular rate (6, 1, 8, -2 subjects changed on their second, third, fourth, and fifth problems respectively). Further inspection shows that the frequency of shifts on the second problem for each group is practically the same in spite of the greater absolute reward decrease in that problem for the subjects in Experimental Group II. Also, though none of the chi squares reach statistical significance, some of the inter- and intra-group differences do indicate trends. The chi square between the relative frequencies of preference for Sequences A and C on the third problem each group solved is significant at the 25% level in the direction of indicating a more rapid shift by subjects of Experimental Group III. Here too the amount of reward Sequence C has yielded the subjects of Experimental Group II has been less than the amount it has yielded the subjects in Experimental Group III. Yet the Experimental Group III subjects have changed more by that point because of the relatively large number who change on the third problem (the change between the second and third problems for Exper-
mental Group III is significant at the 25% level) as compared to Experimental Group II, where only one subject changes on their third problem—possibly because Sequence C in that problem is more rewarding than it was in the second problem for that group.

But even though these observations do support the explanation suggested for the negative results obtained, that explanation is admittedly post hoc so can hardly be considered to be anything more than suggestive. Actually, to test it would require giving two groups of subjects training on a series of such problems in which only the order of presentation of those problems varied. For instance, one group might be trained in the order, Problems 1, 2, 3, 4, and 1 again; and the other group be trained in the order, Problems 1, 4, 2, 3, and 1 again. The appropriate comparisons could then be made.

The only definite conclusion that can be drawn from these results is that the relationships among a series of related problems in such a situation as that outlined here does affect how soon people will respond to not previously perceived relationships that existed in the original problem as well as in the subsequent ones. The implications of these results go one step beyond the findings of Luchins (23) and Youtz (15) in that they show persistence of "set" in solving problems varies as a function of the relationships among the experimental problems. Luchins and Youtz demonstrated only that there is such persistence.

Several conclusions of a more general nature than those just discussed can also be derived from the results of this study. First, these results corroborate the utility of concepts of both value of reinforcement (reinforcement value) and expectancy of occurrence of reinforce-
ment (expectancy) for predicting human behavior, since neither sort of formulation alone would have been adequate for predicting the results obtained here. Secondly, these results substantiate the utility and validity of conceptualizing behaviors sequentially within the framework of social learning theory, since by so doing the relevant results can be adequately explained. The one possible negative indication, the results for the test of Hypothesis IIc, can hardly be considered strong negative evidence concerning the social learning theory formulations themselves, since there are several indications that the test situation did not meet the conditions specified in the hypothesis as necessary to test it.

Finally, these findings seem of some heuristic value in that they suggest the definite need for, and potential fruitfulness of, further investigation of the conditions of formation of sequential behavior relationships; both at many levels of complexity and in terms of many kinds of conceptual relationships. The problem of levels of abstraction of conceptualizations and of the occurrence under different conditions of specific behaviors as a function of those various levels of conceptualization has been pointed up in the discussion of related research and in the rationale given for the experimental hypotheses. It is suggested that this study outlines tentatively an approach to investigating this problem.
CHAPTER VI

SUMMARY

The present research is an investigation of certain tentatively proposed methodological extensions of Rotter's social learning theory of personality. Its aims are two-fold. The first major purpose is to establish the need of sequential conceptualizations for predicting human behavior, and to demonstrate the utility of Rotter's social learning theory formulations for predicting such sequential behaviors. The second aim is to establish some of the necessary operational conditions for the formation of sequential conceptualizations of behaviors.

For purposes of orientation, the problem of delimiting units of behavior for prediction of behavior within the framework of personality theory was discussed. It was suggested that the conceptualization of personality behaviors in terms of "learned purposive behaviors" seems most appropriate for dealing with the problems of predicting such behaviors. A methodological approach to personality prediction of incorporating single-choice behaviors as functional parts of larger units, i.e., sequences, was outlined, and criteria which would indicate the necessity of such a formulation were noted. The basic criterion for requiring such a conceptualization would be the demonstration of the occurrence of choices predictable only as a function of their relationship to preceding and/or expected succeeding choices.

As background for a suggested approach to the combining of behavioral units for predictive purposes, the concept of reinforcement and
associationistic-effect and expectancy approaches to it were discussed. The former approach is best represented by Hull and his associates who equate reinforcement to tissue need reduction and conceptualize its effect as being an additive function of occurrences. Such an approach is of questionable value as a basis for prediction of personality behaviors because of the difficulty of relating many complex behaviors to need reduction, and because of certain limitations in prediction of such an approach (e.g., partial reinforcement, latent learning, etc.). The expectancy approach, i.e., reinforcement merely establishes an expectancy (it tells the person "what is where"), has been espoused by Tolman, Lewin, and others. While such an approach seems potentially to be more adaptable to the problem of predicting personality behaviors, it is limited in that it provides no basis for predicting choices or in any way predicting the activation of an organism. That is, even though a person learns what to expect under certain circumstances, and we know what he has learned, it is also necessary to assume that what occurs will make a difference to him, and to determine what difference it does make, before we can predict what he will do.

Rotter has formulated a social learning approach to personality which seems, as a function of its dual-factor reinforcement conception, to be subject to none of the criticisms leveled at the one-factor approaches mentioned above. The factors Rotter considers necessary in predicting personality behaviors are Expectancy of occurrence of any given reinforcement irrespective of its value; and the value of that reinforcement (Reinforcement Value) to the individual in terms of perceived movement toward a goal. He has set up a basic quasi-mathematical
formula for predictive purposes, namely, B. P. (Behavior Potential) =
f (E and RV).

Since social learning theory has defined the unit of investigation for personality theory as the interaction of the individual and his meaningful environment, it has not specifically excluded the possibility of sequential behavior conceptualizations. However, most social learning studies to date have been conceptualized in terms of specific behavior units and there have been no prior systematic attempts to incorporate sequential formulation into the theory. This study attempts to do that by extending the B.P. formula so that it includes sequential relationships of behavior-reinforcement combinations in it as a factor in evaluating expectancy and reinforcement value strength, and consequently behavior potential strength.

The experimental problem is one of learning how to obtain the most poker chips for a total problem (a fixed number of trials) from a problem box which has a different number of chips in it each trial (each time the door is opened). The number of chips that appear in the box on each trial is, as the subjects are informed, a function of whether the stack of chips was taken out of the box or left in the box on the preceding trial. There is a maximum size (eight chips) for a single stack of chips, and that maximum is also made known to the subjects. In addition, for those subjects in Experimental Group I, a different set of instructions was used. They included all of the points listed above, plus the additional one that the frequency with which a reward is taken from the box also affects the person's score. The specific sequences or patterns for Problem 1 for all groups are as follows: On
the first trial a stack of three chips appears; if this stack is removed from the box (thereby adding three to the person's score) three more chips appear on the second trial. This pattern (Sequence A) continues as long as each stack is removed from the box; i.e., 3 (take), 3 (take), 3 etc. If any stack of three chips is left in the box (thereby adding nothing to the person's score), two chips appear on the next trial. If the stack of two chips is taken, three chips appear again; then if the three chips are left, two appear again, and so on in the order: 3 (leave), 2 (take), 3 (leave), 2 (take), 3 etc. (Sequence B). If, after a stack of three is left, a stack of two is also left, eight chips (the maximum) appear. Then, whether or not the eight chips are taken, three appear on the next trial and the sequence (Sequence C) can be repeated; i.e., 3 (leave), 2 (leave), 8 (take—or leave), 3 (leave), etc. It should be noted that the basis for choice, either between specific behaviors or among behavioral sequences, is a function of relative reinforcement values, since the sequences are fixed and all specific behavior-reinforcement expectancies are therefore constant and equal.

The other problems used were like Problem 1 except for the fact that the size of the largest stack of chips varied from problem to problem. The problems and the sizes of stacks used in them are as follows:

Problem 1—3,2,8; Problem 2—3,2,7; Problem 3—3,2,6; Problem 4—3,2,5; and Problem 5—3,2,4. The groups of subjects used and the training sequences each group received are as follows:

Experimental Group I (Different Instructions Group) was given the different set of instructions and required to solve Problem 1 only. (N = 25 who chose Sequence A or Sequence C)
Experimental Group II (The Random Training Group) was given the first set of instructions and required to solve Problem 1. Then those (N=25) who solved it by choosing Sequence C were required to solve four additional problems. The problem order was: Problem 1 (pre-test); Problem 4; Problem 2; Problem 5; and Problem 1 (post-test) again.

Experimental Group III (The Progressive Training Group) was given the first set of instructions and required to solve Problem 1. Then those (N=25) who solved it by choosing Sequence C were required to solve three additional problems. The problems were presented in the following order: Problem 1; Problem 2; Problem 3; and Problem 4.

The Control Group was given the first set of instructions and required to solve Problem 1. Then all of those (N=25) who preferred Sequence C on that problem were required to solve an additional problem after ten minutes of interpolated activity, as follows: Problem 1; ten minutes interpolated activity (reading popular picture magazine); and Problem 1 again.

The experimental hypotheses test the effects of systematically varying reinforcement values under conditions where specific behavior-reinforcement expectancies are constant and equal. The first hypothesis asks simply whether the behavior of the subjects in this experiment can be described as being a function of learned sequences of behavior-reinforcement-combinations. It cannot be answered by quoting a statistical level of significance, since there are no theoretical bases from which to estimate how many people would learn such sequences by chance. All that can be done is to evaluate qualitatively, on the basis of the relative number of subjects whose behavior is explainable only within the framework of an expectancy-reinforcement value formulation of sequences of behavior-reinforcement combinations, whether such an explanation of their behavior seems justified. The criteria for considering behavior sequential are listed and discussed. It is pointed out that in this situation variable behavior followed by systematized behavior can be
explained only within a framework such as that outlined. Further, sys-
tematic invariable behavior that involves leaving one or more external
reinforcements can be explained in the terms outlined here as well as
by a Hullian formulation.

The following three specific hypotheses are all derived from the
general hypothesis that people will respond only to those relationships
in any situation that they have learned are relevant to the rewards to
be obtained from that situation. More specifically, the first of these
hypotheses (Hypothesis IIa) tests whether the establishing of differ-
ential behavior potentials by verbal instructions leads the subjects to
prefer correspondingly different sequences. It is tested by comparing
the relative preferences for Sequences A and C on Problem 1 of Experi-
mental Group I subjects (Different Instructions Group) and the other
groups combined. Hypothesis IIb tests whether additional training with
related problems leads the subjects to change from the sequence they
originally preferred (Sequence C) to one which is more rewarding. Its
validity is tested by a comparison of the relative preferences for
Sequences A and C on Experimental Group II subjects and the Control
Group subjects on their respective post-tests. The final hypothesis
(Hypothesis IIc) tests whether the subjects will persist in their pref-
ereence for their originally preferred sequence longer under the first
set of the following conditions than they would under the second set.
One group of subjects is given a series of problems arranged in such
an order that progressively less reward is obtained on each successive
problem from the originally preferred sequence; the other group of sub-
jects is given a series of problems in which the differences in reward
from that sequence from problem to problem are greater and not progressive in nature. This hypothesis is tested by comparing the relative frequencies of preference for Sequences A and C of Experimental Group II (Random Training Group) subjects on their second problem (Problem No. 4) and Experimental Group III (Progressive Training Group) subjects on their fourth problem (Problem No. 4).

Analysis of the results reveals that 129 of 137 subjects met the criteria established for sequential behavior (i.e., 3 consecutive repetitions extending over trial No. 33 of any sequence of behavior). Further, the behavior of 114 of those 129 subjects could be explained only within the framework of an expectancy-reinforcement value formulation of sequences of behavior-reinforcement combinations. It was concluded consequently that the behavior of the subjects in solving Problem 1 could be described as sequential in nature (Hypothesis Ia).

There were no significant differences (chi square level < .05) not attributable to the hypothesized differences, as a function of the instructions, between the frequency of preference for the total of Sequences A and C on Problem No. 1 of Experimental Group I subjects and the subjects of the other three groups combined. But the hypothesized differences were significant (chi square level < .02); that is, Experimental Group I subjects preferred Sequence A significantly more. These data are considered substantiating evidence that differential BPs established by verbal instructions do lead to different choice behaviors.

No significant differences (chi square level < .60) were found in performances on Problem No. 1 of Experimental Group II and the Control Group, so apparently the subjects in those groups who received the
additional training are not significantly different in any way; consequently, any post test differences can be presumed to be due to the intervening training (or lack of it). The post-test differences are significant in the predicted direction at the 5 percent level, so it is concluded that, under the conditions specified, additional experience will lead subjects to abandon an originally inadequate response in favor of a more adequate one.

Similarly, Experimental Group II (Random Training Group) and Experimental Group III (Progressive Training Group) subjects did not vary significantly on Problem No. 1 (chi square level <.20). They did, however, differ (chi square level <.05) in their preferences for Sequences A and C on the test comparison (Problem No. 4 for each group), but the Experimental Group III subjects shifted more, not less as was predicted, than the Experimental Group II subjects. It is tentatively suggested that these negative findings may have been a function of the subjects in the Progressive Training Group having responded to the differences between their problems as a function of differences in reward to be gained from Sequence C only. If they did respond in that way, a regular progressive shift to Sequence A from problem to problem would be expected in that group, and such a shift did occur. Further, even though the change in amount of reward from the first problem to their second one was greater for Experimental Group II subjects, there was practically no difference between the groups in the number who shifted to Sequence A on the second problem. But even though the results noted support the interpretation offered, this interpretation is *post hoc*, so can be considered only suggestive.
More general conclusions are that the results of this study seem to substantiate further the need for concepts of both expectancy of occurrence of reinforcements and value of reinforcements (RV) for predicting human behavior, since it appears that neither sort of one-factor formula could alone predict the results of this experiment. Secondly, these findings corroborate the utility and validity of methodologically conceptualizing social learning theory formulations operationally as including sequential formulations, since by so doing the results obtained here can be explained. Finally, it is suggested that this study is of some heuristic value in that it points up the need for further investigation of the conditions of formation of sequential relationships.
BIBLIOGRAPHY


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   3. The functional relationships among external reinforcements.

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TABLE NO. 9

PROGRESSIVE CHANGES IN PREFERENCE FROM SEQUENCE C TO SEQUENCE A OF SUBJECTS IN EXPERIMENTAL GROUPS II AND III AND THE CONTROL GROUP

<table>
<thead>
<tr>
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Subjects (by Number)

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Sequence Preferred by Subjects of Experimental Group III

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Sequence Preferred by Subjects of Control Group

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APPENDIX B
The exposition that follows is designed to outline how behavior-reinforcement sequences of the kind considered in this problem are thought to develop. This discussion is most pertinent to the behavior of the subjects in Experimental Groups II and III and the Control Group who received instructions that establish the following expectancies (descriptively speaking) concerning their forthcoming problems. Since Experimental Group I subjects receive somewhat different instructions, modifications in the explanation that follows would be necessary to explain their behavior, but basically the situations are quite similar so only the situation for the larger group of subjects is to be discussed. Their expectancies are: There will be chips in the box each trial, but the number may vary; they may take them all out or leave them all in; only those they take out count in their score; whether they take or leave a given stack will determine the size of the next stack; they may get as many as eight chips at one time; the larger the stack of chips the more it adds to their score; they are to get as many chips as they can for the problem, which is a fixed number of trials.

The following BP formulations outlining how sequences develop are based on the propositions previously listed as they apply to the specific conditions of this situation:
$B_{T}(3), s_1, R_{1-n} = f(E_T, s_1, R_1 \ ((presumably = 1))$ and $RV_1 \ ((presumably = 3))$, and $(E_T, s_1$, \rightarrow a behavior whose $RV > 3$ and the RV of that behavior), and $(E_T, s_1$, \rightarrow a behavior whose $RV = 3$ and the RV of that behavior), and $(E_T, s_1$, \rightarrow a behavior whose $RV < 3$ and the RV of that behavior), and $(E_T, s_1$, is unrelated to subsequent behaviors and their respective RVs—this is something of a "wastebasket" category at this point, but presumably there is such a factor involved.)

$B_{L}(3), s_1, R_{S_1-n} = f(E_L, s_1, R_1 \ ((presumably = 1))$ and $RV_1 \ ((presumably = 0))$, and $(E_L, s_1$, \rightarrow a behavior whose $RV > 3$ and the RV of that behavior), and $(E_L, s_1$, \rightarrow a behavior whose $RV = 3$ and the RV of that behavior), and $(E_L, s_1$, \rightarrow a behavior whose $RV < 3$ and the RV of that behavior), and $(E_L, s_1$, is unrelated to subsequent behaviors and their respective RVs).

The resultant behavior would be a function of the relative strengths of these BPs. Assuming for the moment that the BP for taking would be stronger, one might examine the result of its occurrence. The next trial would present the same choice again, but presumably the BPs would have changed in the following manner:

$B_{T}, s_2, R_{s_1-n} = f(E_T, s_2, R_1$ and $RV_1$) and

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<th>Changes</th>
<th>Description</th>
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<td>E is lower now since did not occur.</td>
</tr>
<tr>
<td>E is higher now since did occur.</td>
<td></td>
</tr>
<tr>
<td>E is lower now since did not occur.</td>
<td></td>
</tr>
<tr>
<td>E is possibly slightly lower, effect largely indeterminate at this point.</td>
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</table>

*It is to be understood that the maximum reinforcement is eight chips, so no specific mention of that limiting factor will be made.*
\[ \text{P}_{L,s_2,RS_{1-n}} = f(\text{E}_{L,s_2}, \text{R}_1 \text{ and } \text{RV}_1) \text{ and} \]
\[ (\text{E}_{L,s_2} \rightarrow \text{a behavior whose} \]
\[ \text{RV} > 3 \text{ and the RV of} \]
\[ \text{that behavior),} \]
\[ \text{E is higher now since there} \]
\[ \text{is an E for an RV } 3 \text{ and} \]
\[ \text{the other alternative did not yield it.} \]

\[ (\text{E}_{L,s_2} \rightarrow \text{a behavior whose} \]
\[ \text{RV} = 3 \text{ and the RV of} \]
\[ \text{that behavior),} \]
\[ \text{E is lower now since the} \]
\[ \text{other alternative had this} \]
\[ \text{consequence.} \]

\[ (\text{E}_{L,s_2} \rightarrow \text{a behavior whose} \]
\[ \text{RV} < 3 \text{ and the RV of} \]
\[ \text{that behavior),} \]
\[ \text{E is higher now since there} \]
\[ \text{is an E for an RV } 3 \text{ and the} \]
\[ \text{other alternative did not yield it.} \]

\[ (\text{E}_{L,s_2} \text{ is unrelated to} \]
\[ \text{subsequent behaviors} \]
\[ \text{and respective RVs).} \]
\[ \text{Effect largely indeterminate} \]
\[ \text{at this point.} \]

Even though the person still took the three chips on this trial, the above outlined changes would continue progressively so that the \( \text{BP} \) for leaving three chips would eventually exceed the \( \text{BP} \) for taking them, and the person would leave the three chips in the box. On the next trial thereafter there will be two chips in the box; their occurrence will presumably negatively reinforce leaving the three chips as such, but it will also have other effects too, among these that of adding another choice point. The relevant \( \text{BPs} \) for that choice follow:
$$BP_{1(2)}, s_3, Rs_{1-n} = f(E_{T,s_3}, R_3 \text{ and } RV_3 (=2)) \text{ and}$$

$$\quad (E_{T,s_3}, \rightarrow \text{a behavior whose } RV > 2 \text{ and the } RV \text{ of that behavior}),$$

No change

Resultant of fact similar behavior in past has not been so rewarded (would make it lower) and fact that there is an $E$ for an RV higher than 3 and some alternatives whereby it might have been gotten have been eliminated (would make it higher).

Higher $E$ since did occur in a similar situation previously.

Resultant of fact similar behavior not so rewarded before (would make $E$ lower) and fact are less ways can occur (would also make $E$ lower).

$E$ is lower since at previous choice point were differential consequences.

Changes

No change

$E$ resultant of fact similar behavior in past has not been so rewarded (would make lower) and fact is $E$ for an RV higher than 3 and some alternatives whereby might have been gotten have been eliminated (would make higher).

$E$ is lower since did not occur in a similar situation previously.

$E$ resultant of fact similar behavior so rewarded previously (would make higher) and fact are less ways can occur (would make lower)

$E$ is lower since at previous choice point were different consequences.
If at this point the BP for taking the two chips was higher, the person
would take them and the three would appear again. The BPs for that
choice are as follows:

\[ B_{PT}(3), s_{L4, R_{S1-n}} = f(E_T, s_{L4} \text{ and } RV_{L4}), \text{ and} \]
\[ (E_T, s_{L4} \rightarrow \text{a behavior whose } RV > 3 \text{ and the RV of that behavior}), \]
\[ (E_T, s_{L4} \rightarrow \text{a behavior whose } RV = 3 \text{ and the RV of that behavior}), \]
\[ (E_T, s_{L4} \rightarrow \text{a behavior whose } RV < 3 \text{ and the RV of that behavior}), \]
\[ (E_T, s_{L4} \text{ is unrelated to subsequent behaviors and respective RVs}) \]

Changes

- No changes
- E is lower and will continue to drop as it does not occur.
- E is higher and will continue to rise till it approaches 1.00
- E is lower and will continue to drop as it does not occur.
- E is lower and will continue to drop until it approaches .00.

\[ B_{PL}(s_{L4, R_{S1-n}} = f(E_L, s_{L4}, RV_{L4} \text{ and } RV_{L4}), \text{ and} \]
\[ (E_L, s_{L4} \rightarrow \text{a behavior whose } RV > 3 \text{ and the RV of that behavior}), \]
\[ (E_L, s_{L4} \rightarrow \text{a behavior whose } RV = 3 \text{ and the RV of that behavior}), \]
\[ (E_L, s_{L4} \rightarrow \text{a behavior whose } RV = 2 \text{ and the RV of that behavior}), \]
\[ (E_L, s_{L4} \rightarrow \text{a behavior whose } RV = 2 \text{ and the RV of that behavior, plus the BPs for taking or leaving the 2 and the behaviors that leads to (see below; the 2 BPs listed there are those for the alternative consequences of this choice and as such are an integral part of the choice sequence.)} \]

No changes

- E is lower and will continue to drop as it does not occur.
- E is lower and will continue to drop as it does not occur.
- E that will lead to 2 is higher and will continue to rise till it approximates 1.0, but the alternative of leaving the 3 may develop a dominant BP eventually as a function of the RVs (following from leaving the 2.
\[ E_P(2), s_l, r_s - n = f(E_T, s_l, R_T^2 \text{ and } RV_T) \text{ and } \]
\[ (E_T, s_l) \rightarrow \text{a behavior whose } \]
\[ RV = 3 \text{ and the } RV \text{ of } \]
\[ \text{that behavior}, \]
\[ (E_T, s_l) \rightarrow \text{a behavior whose } \]
\[ RV = 2 \text{ and the } RV \text{ of } \]
\[ \text{that behavior}, \]
\[ (E_T, s_l) \rightarrow \text{a behavior whose } \]
\[ RV < 2 \text{ and the } RV \text{ of } \]
\[ \text{that behavior}, \]
\[ (E_T, s_l) \text{ is unrelated to } \]
\[ \text{subsequent behaviors and relevant } RV \]
\[ \]
\[ E_P, s_l, r_s - n = f(E_L, s_l, R_T^2 \text{ and } RV_T) \text{ and } \]
\[ (E_L, s_l) \rightarrow \text{a behavior whose } \]
\[ RV > 3 \text{ and the } RV \text{ of } \]
\[ \text{that behavior}. \]
\[ (E_L, s_l) \rightarrow \text{a behavior whose } \]
\[ RV > 3 \text{ and the } RV \text{ of } \]
\[ \text{that behavior}. \]
\[ (E_L, s_l) \rightarrow \text{a behavior whose } \]
\[ RV = 2 \text{ and the } RV \text{ of } \]
\[ \text{that behavior}, \]
\[ (E_L, s_l) \rightarrow \text{a behavior whose } \]
\[ RV < 2 \text{ and the } RV \text{ of } \]
\[ \text{that behavior}, \]
\[ (E_L, s_l) \text{ is unrelated to sub- } \]
\[ \text{sequent behaviors and respective } RVs) \]

When, and if, the BP for leaving the 2 becomes greater than the BP for taking it, then the stack of 8 chips will appear on the next trial.

After this has occurred and the sequences have been established, the formulas for them may be stated in simpler form, as follows:
BP taking 3 → taking 3 → etc. = f(E taking 3 → taking 3 → etc., & the RV 3 + 3 + etc.)

BP leaving 3 → taking 2 → etc. = f(E leaving 3 → taking 2 → etc., & the RV 0 + 2 + etc.)

BP leaving 3 → leaving 2 → taking 8 → etc. = f(E leaving 3 → leaving 2 → taking 8 → etc.
and the RV 0 + 0 + 8 + etc.)

Choices in the situation then are a function of the perceived RVs of the sequences since the Es are equal. Why, as mentioned, the third sequence is generally preferred will be answered more completely at a later point. The purpose of this outline has merely been to show how sequences develop and what is meant by a sequential BP; i.e., it is simply a shorthand way of writing the relationships outlined above that exist among the various choices in such a situation.
SAMPLE VERBALIZED RATIONALES FOR BEHAVIOR DURING THE EXPERIMENT

Preferred Sequence A, Problem 1

Exp. Gp. I, Psychology I401, Female:

"Why did you take the ones you did and leave the ones you did?"

Well, wasn't the object to get the most in the least tries? (Yes, why?) I thought at first there were 11 chips in the big one, but there were only 8, so you should take 3 each time, the other way it averages only 2 2/3.

Exp. Gp. III, Psychology I401, Female:

(Why........?)

Well, I figured I'd get 9 for 3 by taking the 3s; the other way you go for 3 trials and get only 8.

Exp. Gp. I, Psychology I402, Male:

(Why........?)

Well, the first time there was a 3, I thought I'd leave it and see; then a 2, and then an 8 came up. I took the 8 several times, then I wondered what if I took the 3 or the 2, what next? Both led to 3s. I finally decided that 3 3s equal 9; 8 for 3 equals 8, you get more by taking 3s.

Preferred Sequence C, Problem 1

Control Group, Psychology I403, Male (No change, posttest)

(Why........?)

Because they (8s) seemed to be the largest. (Why did you prefer the largest?) I was to get as many as I could each problem.

Exp. Gp. II, Psychology I402, Male (No change, posttest)

(Why........?)

Well, I started right off and I got the exact amount (8) so I kept it up (i.e., leaving the 3s and the 2s). On the second problem, I tried other ways to see if I could get higher as there were less chips after I left the 3 and the 2. But I found if I left a 3 and a 2, the highest one followed and I'd get the most on it. (Most for the whole problem?) Yes.
Exp. Gp. II, Psychology 402, Female (changed, posttest)

(Why........?)

Well, I don't remember why at the beginning, but on the last two I thought I would get more if I took 3 each time rather than waiting for a stack of 4 or 8 every 3 times. (Subject changed to Seq. A on the next to the last of her problems.)

Experimental Group I, Psychology 401, Female

(Why........?)

Well, the first two times I wasn't sure, but if I left 3 and left 2, then a whole pile came up and I took them. (Could you have gotten more any other way?) Yeah, I think so. (How?) No, I guess if you took the pile you probably got more.

Experimental Group III, Psychology 401, Male (changed, Problem No. 2)

(Why........?)

Well, on the first problem I didn't realize I'd get more by taking the 3s than by taking the 8s. On the second one I took the 3s.

Preferred Sequence A as opposed to Sequence B, never left stack of 2 chips

Exp. Gp. II, Psychology 402, Male

(Why........?)

The few times I left them (3s) you decreased them, so I couldn't see that so I kept taking them (3s). (Did you ever think of leaving the 2?) I thought it would decrease again.

Control Gp. Psychology 401, Female

(Why........?)

When I left a stack you took 1 away, so I quit leaving them. (Did you ever think of leaving the 2?) No.

Never left a stack of 3 chips

Control Gp., Psychology 402, Female

(Why........?)

Well, the score was determined by the number I put in the box (box into which subjects put chips they took), so I just kept putting them in. (Did you consider leaving a stack?) Yes. (Why didn't you?) I didn't know what would happen.
Non-systematic behavior

Exp. Gp. II, Psychology 402, Female:

(Why........?)

I was trying to figure it out and I didn't get it figured out. (How did it go?) I think it was a sequence you were supposed to pick up at one certain time. (Which ones would have given you the most?) I don't know.

Exp. Gp. I, Psychology 401, Male:

(Why........?)

I don't know. It was just a matter of chance. There is a pattern; if you take the 3s, you always get 3s. If you leave a 3 and a 2, you get 8, leave it and you get 3 again. I don't know, somehow I seemed to prefer the low numbers, perhaps it was a feeling of not wanting to get too many chips in the box. So I took far more 3s and 2s, somehow I didn't want to run up my score too high.
APPENDIX D
<table>
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AUTOBIOGRAPHY

I, Forrest B. Tyler, was born in New Albany, Indiana, December 6, 1925. I received my secondary education in the Georgetown, Indiana, Consolidated Schools. My undergraduate training was at DePauw University and I was awarded the degree Bachelor of Arts in 1948. During 1948-49 I was a Graduate Assistant at Ohio State University, and during 1950 I was an Assistant. The degree Master of Arts was received in 1950. In 1951 I served as a Veterans' Administration Clinical Psychology trainee. In 1949-50 and in 1951-52 I received U.S. Public Health Service Clinical Psychology Fellowships. I have specialized in the department of psychology while completing the requirements for the degree Doctor of Philosophy.