EXPECTANCY FOR EVENTUAL SUCCESS AS A FACTOR IN PREDICTING PROBLEM SOLVING BEHAVIOR

DISSERTATION

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By

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EXPECTANCY FOR EVENTUAL SUCCESS AS A FACTOR IN PREDICTING PROBLEM SOLVING BEHAVIOR

CHAPTER I
INTRODUCTION

In predicting human learning behavior two factors usually considered to be most relevant are the difficulty of the task being learned, and the amount of experience the individual has had in performing the same or a related task. Another factor very seldom investigated, but which may be relevant, is what might be called a "situational" expectancy for solving a specific problem. Such an expectancy might be learned in a situation where the possibility of immediate success or failure is not apparent, a condition which is quite frequently characteristic of real-life situations. That is, in almost all instances in which the individual is faced with performing any type of task there is some uncertainty as to the eventual outcome; consequently he develops an expectancy ranging from complete certainty of eventual success to complete certainty of eventual failure as he performs that task. As conceptualized for the present study, the overall "situational" expectancy refers to the individual's attitude toward eventual success or failure derived from his experiences in that situation.
The present study is an attempt to demonstrate the role of such an expectancy in predicting human learning behavior. Although the problem is concerned with the effect of an overall expectancy for success on problem solving behavior, it seems necessary to think in terms of the operation of three interacting expectancies in this particular situation. First, an expectancy for right or wrong responses (E_1), which is controlled for all subjects (the average number of right and wrong responses for each group is approximately equal). Second, an expectancy for improvement in performance (E_2), which is varied by manipulating the verbal reinforcement. And third, an overall expectancy for eventual solution of the problem (E_3), which is a combination of both E_1 and E_2. Since the expectancy for right or wrong responses (E_1) is controlled in this situation, then the overall expectancy (E_3) will vary directly as a function of the expectancy for improvement (E_2), and both of these will be a product of the verbal reinforcement given.

E_1 is usually the independent variable in studying expectancy. In this study, it is controlled in order to demonstrate that in certain types of problem solving situations there is an expectancy developed which is different from the expectancy resulting from the individual's actual experience with right and wrong responses. In addition, it is hypothesized that with the establishment of a high or low expectancy for positive reinforcement to occur following
a response, the decision time for making each discrete response will vary. More specifically, there will be an inverse relationship between the time required for making a response and the expectancy for positive reinforcement to occur in conjunction with that behavior.

The problem to be solved requires the conceptualization of a mathematical pattern according to which a series of lights is flashed. The three experimental groups are variously reinforced during the first thirty trials of the experiment. One group is verbally encouraged following each response, whether right or wrong; a second group is verbally discouraged, whether right or wrong; and a third group is treated inconsistently by being given equal amounts of encouragement and discouragement. Nothing is said to the control group. The problem is too difficult to be solved during the thirty verbally reinforced trials, so following these the subject is given a hint about the solution and is allowed fifty more trials without verbal reinforcement in which to solve the problem.

Demonstration of significant differences in problem solving behavior between the three experimental groups would suggest that there is developed a "situational" overall expectancy for success or failure in a problem solving situation which may be considered to be a relevant factor in predicting performance. Such differences would tend to further substantiate the already demonstrated relationship
between expectancy and learning. Moreover, they would sug-
gest the importance of further investigation of this rela-
tionship, particularly with expectancy conceptualized as
the individual's perception of the probability of his suc-
cess, rather than as a product only of the number or propor-
tion of actual success experiences.
CHAPTER II
HISTORY AND RELEVANT RESEARCH

The present study is concerned with predicting behavior in a problem solving situation on the basis of an overall "situational" expectancy for eventual solution of the problem. Expectancy for solving the problem is varied by the use of differential verbal reinforcements.

There has been no research which specifically attempts to measure the effect of expectancy for solution of a problem on the actual solution of the problem. There are, however, several general areas of investigation which may be considered relevant. One group of studies, for example, deals with the effect of anxiety on problem solving behavior. The present problem is related to these studies in that here the subjects are placed in an intellectual problem solving situation, some under conditions of encouragement, designed to create an expectancy for eventual success, and some under conditions of discouragement, designed to create an expectancy for eventual failure. The latter condition would presumably lead to an "anxiety state", if anxiety is conceptualized as a generalized expectancy for punishment or negative reinforcement to occur.

The areas of current writing and research which might in such a fashion be considered most relevant to the present
problem can be categorized roughly into three general classes: (1) conceptualizations of expectancy; (2) the effect of anxiety on problem solving behavior; and (3) the effect of praise and reproof in problem solving situations.

**Conceptualizations of expectancy**

The concept of expectancy has been employed for some time in the field of psychology. In 1901 Hobhouse (21) explained behavioral changes on the basis of an expectancy principle. Pavlov (42) discussed expectancy as a conditioned response or a heightened anticipatory tension. Likewise, Mowrer (40) more recently has concluded that conditioned responses can be established or abolished in human beings merely by controlling the subject's state of expectancy.

Tolman (51) maintains that the recurrence of certain environmental stimuli create in an organism "field expectations", and that any movement in the direction of successfully attaining a goal is the function of an expectancy on the part of the organism that certain behaviors will lead to certain goals. Thorndike (50) also stresses the primary importance of a principle of expectancy in learning when he states that the expectation for an annoying or satisfying after-effect will itself acquire the power to evoke the after-effect.

Meehl and MacCorquodale (37) point out that several factors which have been historically related to Tolman's
formulation of an expectancy theory seem logically unrelated to the basic concepts of an expectancy theory. In attempting to define the "core" concept of an expectancy theory, these writers discuss those behavioral phenomena in experimental situations which cannot be handled by non-expectancy theories. The central phenomenon they point out that can be predicted by expectancy theories but not by S-R theories is the occurrence of improved performance in the terminal phase of a learning situation when there is no observed increase in preference for the behaviors in question during the latent phase. On the other hand, if an increase is observed during a latent phase, the behavior can be explained by the S-R theorist. Meehl and MacCorquodale then suggest that considerable effort toward more rigorous formulation of an expectancy theory would be warranted by the positive research results that have been obtained in that direction. They have suggested a systematic definition of the concept of expectancy, and have set up systematic postulates relative to this definition, as well as postulates concerning its acquisition, extinction, etc.

Brunswik (9) describes expectancy as a probability phenomenon. He stresses the study of the objective or the environmental probabilities of certain behaviors occurring, as determined by objectively describable past events. Consistent with this approach, Brunswik includes in his area of study certain physical and sociological factors, which he
analyzes statistically. He also includes subjective probability as constituting relevant data of an "expectancy", although of lesser importance than objective probability, and points out the need for consideration of the relationship between subjective and objective probability. Brunswik does stress, however, the importance of first determining environmental probabilities.

Lewin (31), on the other hand, emphasizes only subjective probability as the basis for predicting behavior. He considers the expectations of the subject, which he presumes to be present as a function of past experience, to be more important than the objective expectations. For example, in discussing his approach, as opposed to Brunswik's, Lewin points out that he is concerned with studying a driver's ideas about the probability of his being killed, whereas Brunswik is concerned with studying the accident statistics which report the objective probability of the driver's being killed.

Rotter (44) likewise defines expectancy in probability terms. He states that expectancy is the probability held by the individual that a particular reinforcement will occur as a function of a specific behavior in a specific situation. His concept of expectancy is described as involving an "internal" probability, calculated by measuring variables such as generalization effect, patterning, effects of past experiences on expectancy, ambiguous
The use of a construct of expectancy has been questioned in many instances. Hull (22) criticizes the use of expectancy because of the failure of most writers to define objective operations for its measurement. His most recent writings, however, would suggest that he has accepted to some extent an expectancy construct, in that he utilizes a construct of fractional antedating goal reactions to explain the apparent anticipatory behavior of rats.

Sheffield (46) has explicitly criticized theorists for using expectancy in a "commonsense" way; she criticizes Humphreys' work (23, 24, 25, 26) in particular for this type of approach, and for what she describes as his use of ex post facto explanations based on his empirical findings. Humphreys' so-called "commonsense" explanation of expectancy, utilized to handle his results in partial reinforcement situations, is as follows: "Responses are given because the subject expects (or learns to expect) reinforcement to occur. In extinction after 100% reinforcement the response drops out quickly because the shift from 100% reinforcement to 0% reinforcement leads to a rapid change to expectation of no reinforcement. In post-partial extinction, the subject continues to expect reinforcement to occur, so he continues to respond" (29, p. 228).

Further criticism has been aimed at the use of a principle of expectancy in a partial reinforcement context (15,
17, 41, 42, 47, 49), again because of a lack of rigorous
definition, lack of generality, and the tendency to anthropomorphize in using such a concept.

The writer would agree that the principle of expectancy
sometimes has been used quite loosely in a variety of situa-
tions with little attempt made toward an adequate definition
of the concept itself, or of the conditions under which it
operates. Miller (38) has suggested that use of the term
expectancy "is circularly based upon the type of behavior it
is trying to explain rather than upon certain explicitly
stated principles" (38, p. 446). The present writer would
agree that this has been true in some instances, but does
think, however, that expectancy can be a very useful con-
cept if incorporated into a systematic formulation of a
theory. In attempting to explain human behavior it would
seem logical, as well as utilitarian, to employ some con-
struct dealing with the effect of the anticipation of
future reinforcements. The fact that experimentalists such
as Hull deem it necessary to attempt to handle anticipatory
behaviors in a learning situation would tend to substan-
tiate the necessity for such a construct.

The effect of anxiety on problem solving behavior

In a problem solving situation, the question is fre-
quently raised concerning not only the effect of being
right or wrong, but also concerning the effect of rein-
forcement of an expectancy for eventual success, or
eventual failure, on the discovery of an adequate solution to the problem. Conceptualizing this latter question in expectancy terms, two basic problems are raised: (1) to what extent will encouragement or discouragement affect an individual's expectancy for solution of a problem; and (2) once established, what effect will this expectancy have on the actual solution of the problem?

As mentioned earlier, neither of these specific problems has been handled in the literature. There are a number of studies, however, which deal with the effect of anxiety on problem solving behavior. Although they are not conceptualized in terms of the effect of anxiety on the individual's expectancy for solution of a problem, they are relevant in that they are concerned with problem solving behavior under conditions of stress or anxiety which are characterized by a highly probable punishing outcome. These situations might well be conceptualized as situations where the individual expects punishment to occur.

Several of these studies are concerned with rigidity in problem solving behavior as a function of anxiety or stress factors. Cowen (13) investigated the hypothesis that there is a direct relationship between the amount of experimentally induced stress and the amount of problem solving rigidity. He found that under conditions of no stress, mild stress and strong stress his groups showed differences in rigidity in a problem solving task, with a no-stress
group being least rigid, and the strong stress group being most rigid. Maltzman, Fox and Morisset (34) likewise found a positive relationship between high anxiety and rigidity, rigidity being defined as the inability to shift behavior to a more adequate solution of the problem. Studies by Bahrick (2) and by Bahrick, Pitts and Rankin (3) show that failure to shift attention to new cues is often the effect of increased incentive to solve a complex learning problem. It may be that under certain conditions increasing the incentive has led the individual to react in terms of a stress or anxiety situation. For example, in an experimental situation in which the incentive was of such a nature as to produce a relatively weak need for success or for avoiding failure, Gebhard (18) found considerable variation in subjects' reactions to success or failure (measured by changes in attractiveness of the task being performed). However, when there was a strong need to be successful, or to avoid failing, there was little variation in the subjects' reactions to success or failure. One might predict an increased reaction to success or failure when the need is stronger for success; yet, as other results have suggested, it may be too that under certain stress conditions (such as here, where the individual strongly needs to experience success) behavior becomes less flexible and an individual reacts primarily in terms of one primary goal of success.

The results of several studies suggest that the
detrimental effect of anxiety becomes greater as the task being performed increases in complexity. For example, Mandler and Sarason (35), measuring anxiety by a questionnaire dealing with the subjects' attitudes and experiences in a test situation, found that a low-anxiety group made better time scores on the Kohs Block Design than a high-anxiety group. On a simpler task—the digit symbol substitution test—however, the high anxiety group performed as well as the low group. Findings reported by Taylor and Spence (49), Montague (39), and Farber and Spence (16) show that subjects who are high on the Taylor Anxiety Scale have a tendency to do poorly on difficult intraserial learning items, as compared to easy items. Beier (4) found that a "threatened" group did more poorly than a control group on difficult tasks involving abstract reasoning and concept shifting. He concluded that individuals who are in a state of anxiety show a loss of abstract abilities, or of "flexibility of intellectual functioning". Ausubel, Schiff and Goldman (1) reported a low anxiety group to be significantly superior to a high anxiety group on the first trial of a maze, but found that over the course of ten trials the differences dropped out. They concluded that the results indicate a lack of "improvising" ability in the high anxiety group, which they attributed to a "set" to reduce anxiety by reacting in a novel learning situation with familiar and stereotyped responses (1, p. 546). Similar evidence sug-
suggesting a detrimental effect from anxiety on problem solving behavior as opposed to rote learning has been reported by Tomkins (52), Zander (53), and Lantz (30).

One rationale advanced for this observed relationship between anxiety and more complex learning has been suggested by Taylor and Spence (49), Farber and Spence (16), and Montague (39). Taylor and Spence say that in a complex learning situation anxiety increases drive, and that the effect of this increased drive strength depends on "the initial response hierarchy and the relative habit strength of the correct response in the hierarchy". (49, p. 62)

Thus when the habit strength of the correct response is weaker than the habit strength of the incorrect response, raising of the drive level (anxiety) impairs performance, since the drive increases the habit strength of the incorrect response over the correct. In addition, increasing drive has the effect of increasing the number of responses above threshold strength, thus increasing the number of competing responses and the number of errors. Although this explanation has been specifically applied only to intraserial learning, the implication would seem to be that the effect of anxiety in a problem solving situation would be to lead to greater competition of responses, while at the same time to strengthen the strongest response tendency.

The suggestion that increased drive strengthens the strongest response tendency would be questioned by this
writer. It seems quite possible that even if the habit strength of the correct response were initially stronger, the number of correct responses might still be decreased under anxiety conditions, rather than always increased, as this explanation would indicate. There apparently is no experimental evidence to support either viewpoint, since most research ignores the factor of initial habit strength of the behavior under investigation. However, since it has been demonstrated in the majority of relevant studies that anxiety has a detrimental effect on problem solving behavior which demands more than rote performance, it seems to the author unlikely that in all of these cases the correct response was lower in the initial response hierarchy.

Another attempt to explain the relationship between anxiety and performance in a problem solving situation has been attempted by Brown and Farber (8). They suggest an intervening variable of "frustration state" which they say results from competing response tendencies, and which leads to an increased drive. This frustration drive is reduced by the occurrence of either learned or unlearned behavior, or of one of the initial competing response tendencies, if the latter are stronger. This explanation would seem to be suggesting, as the previous one, that under anxiety conditions the strongest response will occur. However, no rationale is given for why it is that the incorrect response is more likely to occur, or for why it will not be extin-
guished as fast or faster than it would be with a lower state of drive.

Some theorists who advocate a perceptual approach to personality study suggest that anxiety results in perceptual "narrowing" or rigidity. However, they give no explanation for why this particular type of behavior occurs. Lucas (33) points out that in looking for an explanation for the effect of anxiety, it is necessary to consider the interaction effect of anxiety and implied failure. He found that in a test of immediate recall the reaction to differences in anxiety was a function of the degree of failure implied in the subject's performance. Lucas concludes that the individual's performance is a function not only of induced anxiety state, but also of a generalized expectancy for failure in that situation, based on the degree of failure implied from past performance.

It seems to this writer that Lucas' inclusion of an "expectancy for failure" factor in his explanation of the effects of anxiety is more meaningful than an explanation based on increased drive. The relationship between anxiety and problem solving behavior might be explained by the conceptualization of anxiety as a generalized expectancy for punishment or failure, or for some kind of negative reinforcement to occur. In other words, so-called anxiety is present when the individual has a high expectancy for something undesirable to occur, and this expectancy then has
some kind of interfering or facilitating effect in problem solving situations, depending on how the individual has learned to react to failure. The differential reactions to anxiety in an "easy" problem solving situation, as opposed to a "difficult" one might be explained in this way: In performing an easy task, the responses required of the subject are familiar and readily executed, consequently, even though S has learned, on the basis of reinforcement received, to expect failure, or negative reinforcement, the resulting anxiety would probably have little interference effect, and possibly even a facilitative effect, since solution of the problem would involve only a familiar or routine response pattern. (For example, Taylor and Spence found learning in a conditioning situation to be facilitated by the introduction of an anxiety factor.)

A difficult problem solving situation, on the other hand, involves more than the use of a well-established, easily available response pattern. Although the problem may not be a completely new experience for S, its solution demands some sort of reorganization of available responses. In other words, a solution must be originated, rather than merely drawn from familiar responses. Therefore, in a complex problem solving situation S quite likely reacts to new associations that have to be made, to the uncertainty of the outcome of attempted responses, to the absence of immediate progress toward solution of the problem, and to the sus-
tained attention demanded over a longer period of time. These factors allow greater opportunity for the operation of a generalized expectancy for failure or punishment in facing what seems to be a "no-solution" situation. As a result it would be expected, as has been demonstrated, that anxiety exerts greater interference in solving a complex problem than in solving a less complex one.

This interference effect might lead to several different behaviors, depending on the individual's learned ways of reacting to similar situations involving high or low expectancies for success or failure. For example, the individual may "give up" on the problem, he may rationalize his errors, he may set up certain defenses for his failure, or he may project blame for his inability to solve the problem. In most instances, these behaviors would interfere with the individual's finding a solution to the problem, since they all reduce the amount of effective solution-attempting time. In other instances, an individual's reaction to making mistakes or to negative reinforcement might be to try other behaviors, or to change completely his approach to solving the problem. This type of behavior would account for the facilitating effects of anxiety for some persons.

No attempt is being made here to explain why the individual learned in the past to react in one of these ways to certain expectancies in a problem solving situation. Rather, the writer is merely suggesting that in trying to
explain the effect of anxiety on performance one might need to take into consideration characteristic modes of response to expectancies for failure or punishment.

One other aspect of problem solving behavior under anxiety or stress conditions was investigated in the present study. It concerned the effect of an expectancy for failure or negative reinforcement on performance time. Relevant to this is the work of Lotsof (32), who tested the hypothesis that the more punishing the alternatives in a choice situation, the longer the decision time would be for making a choice. On the basis of his results he concluded that there is a direct relationship between the "unpleasantness" of the reinforcement values of the alternative behaviors in a choice situation, and decision time.

Combs and Taylor (12) predicted that the introduction of personal threat to subjects in a problem solving situation would increase the time required to solve the problem, as well as increase the number of errors. The subjects were required to translate into code both neutral and personally threatening sentences. They found that, with one exception, the threat sentences took longer to complete and led to greater errors in translation. Along similar lines, Marquart (36) presented her subjects with a no-solution problem in which S was arbitrarily punished, regardless of his responses. Following this a position problem was presented for solution. The results reveal
considerable stereotypy, or lack of flexibility in the responses, as well as noticeably slower learning. Marquart attributes these results to frustration produced by the punishment administered.

All of these studies on anxiety and performance time point out a consistent effect of anxiety, or an expectancy for failure, on performance time. In each instance the results indicate that increased time is required for completing a task under anxiety conditions. Conceptualized in terms of expectancy, when the individual has a high expectancy that a choice or decision may result in negative reinforcement, it is more difficult for him to respond than if his expectancy were that a choice would lead to a positive reinforcement.

The results from the studies described involving the effect of anxiety on behavior in a problem solving situation do not demonstrate a clear-cut relationship between anxiety and performance. They do suggest, however, that anxiety does operate in such a way as to influence performance— in a rote learning situation it frequently motivates improvement, while in a complex problem solving situation anxiety almost consistently results in disorganized performance.

It is this writer's opinion that the most effective approach to explaining this relationship would be to conceptualize anxiety as a generalized expectancy for failure
or negative reinforcement to occur, and then to study: (1) the specific conditions under which anxiety serves to motivate behavior, and the conditions under which it acts to disorganize behavior; (2) the establishment of differential expectancies and their effect on performance; i.e., how low must an expectancy be to be "anxiety" producing, etc.; (3) the generalization effect of an expectancy, once learned, from one situation to another.

Effect of praise and reproof in problem solving

Extensive research has been done testing the differential effects of reward and punishment on learning. The majority of studies have been concerned with measuring the relative effectiveness of certain incentives in animal learning—in particular, reward, in the form of food, and punishment, in the form of electric shock.

Since the present study is concerned with human behavior, no attempt will be made to analyze the results obtained in animal studies. For a complete analysis of the influence of incentives on both human and animal learning, the reader is referred to Hurlock (27) who summarized the work done until 1931. Postman (43) later attempted to define the "status" of the law of effect by presenting a complete review of relevant experimental literature, along with different theoretical interpretations of the law of effect.
Research concerned with the effect of verbal "reward" and "punishment" particularly relevant to the conditions of the present problem is quite limited. There are no studies reported in the literature which deal with the effect of praise and reproof on the individual's expectancy for success or failure, and none which utilize all of the conditions controlled in the present study. However, those studies will be reviewed which involve a systematic varying of verbal reinforcement.

In a study designed to demonstrate the effect of discouragement on performance, Gordon and Durea (20) administered verbal punishment to a group of experimental subjects while they were taking the second form of an intelligence test. Comparison of the results with Form 1 of the test, taken earlier, showed that the mean score of the control group increased from one form to another, but that the mean score decreased significantly for the experimental group.

Two studies involving praise and reproof are reported by Briggs (7), one using over 300 graduate students as subjects, and the other an unknown number of junior high school students. In the first, the results indicate that

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1Those conditions are: (1) individual performance and individual reinforcement; (2) knowledge of the correctness or incorrectness of each response; (3) consistent positive, negative, or positive-negative reinforcement, regardless of the correctness or incorrectness of responses; and (4) a complex problem to solve.
commendation, praise, and encouragement are significantly superior to censure, ridicule, threats and punishment in a learning situation. Likewise, in the second study, 87% of the pupils did better under praise than under conditions of reproof.

Davis and Ballard (14) have published a review of the various incentives used in the schoolroom. The three classes of incentives they included are intellectual, social, and emotional, the latter including verbal encouragement and discouragement. The authors conclude that positive incentives are better for all ages, grades, and intelligences than negative incentives, but that even negative comment is better than none at all.

Contrary to the findings that show verbal punishment to inhibit learning, there is also evidence to suggest that punishment can exert a facilitative effect on learning. It has been demonstrated frequently in infra-human studies that mild punishment exerts a motivational effect on learning. In studies with humans, Chase (10) found that children's performance on two motor tasks, completed in a classroom situation, was best under conditions of "failure-reproof-punishment", next best under conditions of "success-reward-praise", and poorest under controlled conditions.

Forlano and Axelrod (18) used as incentive the marking of test papers either P or G, announcing to the subjects that P meant "you did poorly", and that G meant "you did
very well". Following a second performance on the number cancellation test by the subjects, who were fifth graders, the authors concluded that blame was much more effective than praise.

Some authors have concluded that a combination of verbal reward and punishment constitutes the most effective incentive for learning. This has been demonstrated by Hurlock (28). Others maintain that the effect of either praise or blame is negligible. Schmidt (45) demonstrated this in a classroom situation, with the subjects performing a code substitution test. Likewise, Blankenship and Humes (5) found the effects of praise and blame to be negligible as far as any gains in memory span were concerned. Several other studies have demonstrated a negligible effect of either praise or reproof on learning efficiency (6, 11, 48).

It can be seen that there is some conflict in the results obtained in praise-reproof studies. It has been demonstrated that praise facilitates learning in some instances, and inhibits learning in others; likewise, reproof has been shown both to facilitate and to inhibit learning. In other instances it has been demonstrated that a combination of praise and reproof is the most effective incentive, and at other times that the effect of either is negligible.

It would seem that considerable confusion could be
expected in the results reported from these studies due to the variety of conditions set up for testing the effects of praise and reproof. This would suggest that an important factor in these studies is the conditions under which the resulting behaviors occur, and that results should be generalized only to similar conditions and situations, rather than to the whole field of learning. If overall principles are to be developed, it would be essential to study the relationships among the various conditions in order to determine which principles would predict under all conditions.
CHAPTER III

STATEMENT OF THE PROBLEM

The present study is an attempt to demonstrate the utility of a concept of expectancy in predicting behavior in a learning situation. Expectancy, as used here, is derived from Rotter's formulation of a social learning theory (44), in which he utilizes three basic constructs in the measurement and prediction of behavior--expectancy, reinforcement value, and behavior potential. Expectancy is defined as the probability held by the individual that a specific behavior will lead to a specific reinforcement. Reinforcement value is defined as the degree of preference for any reinforcement to occur if the possibilities of their occurring are all equal. In its broadest sense reinforcement might be thought of as the effect on the individual of any interaction of that individual with his meaningful environment. According to Rotter's formulation, an expectancy is learned as a result of the occurrence of reinforcement. Of primary importance is the emphasis on interpersonal reward value; that is, reward value in terms of the response it elicits from other people. Such reinforcements might involve such rewards as status, dominance, love and affection, etc. It follows then that expectancies are frequently related to the potential
occurrence of interpersonal reinforcements.

The third basic construct, behavior potential, is defined as the potentiality of the occurrence of any behavior in an explicit situation or situations, calculated in relation to any single reinforcement, or set of reinforcements. The likelihood of any given behavior occurring is measured directly by its actual occurrence in any situation where other alternatives are present, thus resulting in a measure relative to other known alternatives.

The relationships between these concepts may be summed up in the following behavior formula:

\[ B.P. = f(E \& R.V.) \]

where:  
- B.P. is behavior potential,  
- E is expectancy, and  
- R.V. is reinforcement value.

According to this formula, the probability of any behavior occurring with reference to satisfying any given need or reaching a specific 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 the need
in question.

In any empirical investigation one deals directly with behavior. Within Rotter's framework it is possible to do so by dealing directly with behavior potential. Or if either expectancy or reinforcement value is studied separately, one is controlled and the other is varied systematically, in which case the resultant behavior is demonstrated to be a function of the one allowed to vary. The present problem is concerned with predicting behavior on the basis of an overall expectancy for solving a specific problem. In this particular situation, however, it seems necessary to think in terms of the operation of three interacting expectancies. First, an expectancy for right or wrong responses (E₁), which is controlled for all subjects (the average number of right and wrong responses for each group is approximately equal). Second, an expectancy for improvement in performance (E₂), which is varied by manipulating the verbal reinforcement. And third, an overall expectancy for solution of the problem (E₃), which is a combination of both E₁ and E₂.

Since the overall expectancy for problem solution is a product of both the expectancy for right and wrong responses (E₁) and the expectancy for improvement in performance (E₂), and since in this situation E₁ is controlled, then the overall expectancy will vary directly as a function of the expectancy for improvement.
In the present study it is hypothesized that an overall expectancy for success in solving a particular problem can be established which will in turn affect whether or not the problem is solved. The operation defined for establishment of differential overall expectancies in this situation is the stating of different verbal reinforcements to the individual S's in the three experimental groups. It is assumed that verbal comments have an effect on the individual which results in the establishment of an expectancy for improvement in performance and an overall expectancy for solving the problem. The prediction is that significantly more S's who have received verbal encouragement (i.e., whose expectancy for solving the problem is high) will solve the problem logically than will S's who have received verbal discouragement (i.e., whose expectancy for solving the problem is lower than the encouraged group) or than will S's who have heard no comments (control group). While there is no basis for predicting the performance of the S's who have received both encouragement and discouragement in relation to the performance of the control group, it is predicted that their performance will fall somewhere between the encouraged group and the discouraged group.

It is further hypothesized that there will be an inverse relationship between the time required for making a response and the overall expectancy for positive reinforcement to occur. That is, it is predicted that the
average response time for S's in the discouraged group will be significantly longer than the response time for S's in the encouraged group. The operation utilized to test this hypothesis is the measurement of the average decision time per trial for each individual.

The problem solving situation is one in which S attempts to discover the pattern by which a series of lights is flashed. For each trial S flashes the light which he thinks will be flashed by K; following his prediction he is shown the correct light. Once S has discovered the pattern, he is able to predict with 100% accuracy which lights will subsequently be flashed. The primary criterion for adequate solution of the problem is the correct conceptualization of the mathematical pattern by which the lights are flashed; that is, the discovery of a logical, higher order solution. The data are also analyzed on the basis of a criterion allowing for the solution of the problem by either a logical method or by rote memory. It seems likely that those S's with a low overall expectancy for successfully solving the problem will tend to resort to memorizing the discrete responses, rather than attempting to discover a logical, higher order solution. The rationale for this prediction is that under conditions of negative reinforcement which lead to a low expectancy for success on a task, S will experience considerable difficulty if the problem solving situation involves a high level conceptualization; he may then turn to
a more familiar method with which he has had more success, and with which he has a higher expectancy for success.

The three experimental groups receive different verbal reinforcements during the first thirty trials of the experiment. One group is verbally encouraged following each response, whether right or wrong; a second group is verbally discouraged, whether right or wrong; and a third group is treated inconsistently by being given equal amounts of encouragement and discouragement. No comments are made to the control group.

The problem is purposely made too difficult to be solved in the first thirty verbally reinforced trials; during this time each experimental subject hears thirty comments designed to establish a particular expectancy regarding his eventual solution of the problem. Following these "no-solution" trials S is given a hint about the solution and is allowed fifty more trials without verbal reinforcement in which to solve the problem.

Hypotheses:

General Hypothesis I:

When controlling the expectancy for right and wrong responses, and varying the expectancy for improvement and the overall expectancy for success, the number of individuals who solve the problem logically will vary significantly between the groups as a function of the effect of the establishment of an overall expectancy for success.

More specifically, significantly more S's in the verbally encouraged group (high overall expectancy for suc-
cess in solving the problem) will solve the problem logically than will S's in the verbally discouraged group (low overall expectancy for success in solving the problem), or than will S's in the inconsistent group, or than will S's in the control group. Also, significantly less S's in the verbally discouraged group (low overall expectancy for success) than in the inconsistent or control groups will solve the problem logically.

The concept of expectancy for right or wrong responses refers to the probability held by S that a certain discrete behavior (flashing of a light) in a series of behaviors will lead to a reinforcement—in this instance, the reinforcement of being right or wrong. This expectancy for right or wrong responses is controlled in that the average frequency with which each group gives the correct responses is approximately the same. It is assumed that it would be equally satisfying to each individual to give the correct response. (Actually the value of being correct is a relative matter, its perceived value varying for each S. It can only be assumed that the groups are randomly selected.)

General Hypothesis II:

The decision time for making a response will vary inversely with the expectancy for a positive reinforcement to occur in conjunction with that behavior.

More specifically, the average decision time required for a response will be significantly less for S's in the
verbally encouraged group than for S's in the verbally discouraged group, or for S's in the inconsistent group, or for S's in the control group. In addition, the average decision time required for a response will be significantly greater for S's in the verbally discouraged group than for S's in the inconsistent group or in the control group.

As pointed out in the definition of expectancy presented earlier, the individual learns a probability that a behavior will lead to a certain type and amount of reinforcement. In this situation it is predicted that S will learn a high or low expectancy for eventual positive verbal reinforcement to occur, as a function of the experimenter's comments. For example, S's in the encouraged group will develop a high expectancy for eventual positive reinforcement to occur following each response, whether right or wrong. On this basis, then, it would be predicted that there will be less hesitancy on the part of S's in the encouraged group in making a response than in the other groups. On the other hand, if S has learned a low expectancy for positive reinforcement to occur following each response it would be predicted that he will delay his decisions in an attempt to postpone or avoid the expected consequences. For the discouraged group, then, it is predicted that the average decision time will be longer than for the groups with a higher expectancy for positive reinforcement.
In analyzing the data in testing this hypothesis an analysis will be made of the thirty verbally reinforced trials as well as of the subsequent non-reinforced trials.

Clinical Observations:

Since this study is in part exploratory in nature, behavioral observations are made during S's performance which may suggest future areas of research and provide useful clinical information. Comments made by S while he is solving the problem are recorded, and the approach used by each S for solving the problem is noted. Further descriptive data is obtained from S in an interview following his performance, during which he is questioned concerning his reaction to the problem and to the verbal reinforcement. Each S is also asked to state what his expectancy had been during his performance for successfully solving the problem.
CHAPTER IV
METHODOLOGY

Subjects

A total of 120 subjects, 60 males and 60 females, ranging in college level from sophomore through senior, performed the experiment. The subjects were all students in introductory psychology, and took part in the experiment to fill a course requirement that each participate in two psychology experiments. Since there were only two experiments in progress during this quarter, it was felt that there was no selective bias in the sample.

Figure 1
Experimental Design

The device pictured above is used in this study. The subject sits at one side of the table, facing the experimental apparatus, and the experimenter sits directly opposite him, facing the other side of the apparatus. In front of each is a row of ten buttons which controls one of the rows of lights at the top of the board—S controls the bottom row and E controls the top row.

The learning task for S is to conceptualize the pattern by which E is flashing one light at a time in the top row of lights. On each trial S attempts to predict which light E will flash next (S always makes the first prediction, which is followed by E's flashing the correct light). Once S has discovered the pattern E is using he is able to predict accurately which light will appear next.

The learning series consists of 30 no-solution trials, which are verbally reinforced, followed by a maximum of 50 solution trials, during which the solution of the problem is made easier by providing a hint as to the nature of the mathematical pattern being used. In this design the solution is actually "available" once the pattern has been completed (three trials); however, the problem is of such difficulty that it is almost impossible for S to solve it until after the hint is given following the first 30 trials, thus allowing time for the thirty comments made to each S in the experimental groups. The subject is constant-
ly working toward discovering the solution by being shown the correct response each time that he makes a response, whether he is correct or incorrect.

At the beginning S is given these directions:

"The buttons in front of you are for turning on the lights in the bottom row. There is a button to correspond to each light. Go ahead and try them.

Now I am going to turn on one light at a time in the top row, in a certain pattern, and you are to try to figure out that pattern so that you can predict what light I'll turn on next. When we start, you will decide which light I'll be most likely to turn on the first time. You show me which light you think it will be by flashing the light in your row which is directly under the one you think I'll turn on. Then I'll flash the correct light in the top row. Then you indicate which light you think I'll turn on next, and I'll again flash the correct one in the top row. We continue doing this for several trials so that you can learn the pattern.

Let's practice a minute. You go ahead and flash the light which you think I'll turn on first." (After S's response light 1 is flashed in the top row as the correct choice.) "No (or yes), one was correct. Now keep trying until you think that you've discovered the pattern." (Light 2 is flashed as the correct choice, then 3, then 4, etc. until S is able to verbalize that the correct pattern is an increment of 1 each time, beginning at 1.)

"All right, let's begin now. Remember there is a definite pattern in the way I'll flash the lights in the top row, and you are to discover that pattern so that you can predict each time, by flashing one of your lights, which light will be turned on next. Speed is not important here. Do you have any questions?" (Questions are answered relevant to the directions already given.)

"It will be best if you don't ask any questions during the experiment. After we're through I'll explain to you what it's all about. You go ahead now and flash the light which you think I'll be most likely to turn on."
S is then given 30 trials (one trial is made up of S's prediction and E's flashing the correct response). These 30 trials, all verbally reinforced, make up the "no-solution" period, since the pattern being used by E is of such difficulty that it is almost impossible to discover it in 30 trials.

During the no-solution trials the following types of verbal statements are made:

Encouragement group - After each prediction made by S the correct light is flashed and S is encouraged, whether his response is right or wrong. A standard list of encouragements (Appendix A) is used; it includes "you're doing fine; it's very confusing at first; keep trying, you'll get it"; etc. In addition, whenever S makes a correct response, he is told "good".

Discouragement group - After each prediction made by S the correct light is flashed and S is verbally discouraged, whether his response is right or wrong. The standard list of discouragements (Appendix B) includes: "wrong again; you're not doing very well; you're having more trouble than most people have; you should have solved it by now"; etc. In addition, when S makes a correct response he is told, "it's about time you got one right". (If a correct response is made in the first five trials, or if there are two consecutive correct responses, where the above would be inappropriate, S is told, "that was just luck".)
Inconsistent group - After half of his predictions S is encouraged, and after half he is discouraged, whether his response is right or wrong. These statements are given in a previously determined random order, the same for each S. The statements used for this group (Appendix C) are taken from the standard list of encouragements and discouragements used for the two other experimental groups.

Control group - S’s in the control group begin at the beginning of the no-solution trials and continue through both the no-solution and solution trials with no comments made to them. This group serves as a basis for determining the relative effect on the experimental groups of encouragement, discouragement and inconsistency.

After the 30 no-solution trials S is given a hint which makes the problem easier to solve. Every S is told:

"Since you haven't discovered the pattern yet, I'm going to give you a hint about it. The pattern is in three steps--first you multiply by a certain number, then you subtract a certain number, and then you add a certain number. Then this whole procedure is repeated again--you multiply by a number, you subtract a number, and then add a number. If it should go beyond ten, you come back to the beginning again. For example, if it goes to 16, you come back to 6."

"With this hint to help you it should be easier. Now try again to discover the pattern, so that you can tell me what you multiply by, what you subtract, and what you add. Remember, you multiply, subtract, and add. Go ahead and make your first prediction."

S is then allowed 50 trials in which to solve the problem. These trials make up the "solution" period. The
correct pattern is: multiply by 2, subtract 1, and add 2. Thus the correct responses given by E throughout both the no-solution and solution periods are: 1, 2, 1, 3, 6, 5, 7, 4, 3, 5, 10, 9, 1, 2, 1, etc. repeated for 30 trials, and then for 50 trials or for as many less than 50 as are required by S to solve the problem with the hint. In the no-solution period the correct responses begin with light 3; in the solution period the correct responses begin with light 1 (see Appendix D).

The primary criterion for adequate solution of the problem demands that S be able to conceptualize the pattern (i.e., multiply by 2, subtract 1, and add 2); the data are also analyzed on the basis of a criterion allowing for either a logical solution or a memorized solution to the problem. After S has predicted correctly for 10 trials he is asked to tell what the pattern is. If he can verbalize the pattern he has met the primary criterion. If he repeats the series of numbers from memory and is unable to conceptualize the pattern, he is credited with solving the problem according to the second criterion, which allows for rote memorization. If S attempts unsuccessfully to verbalize the solution before completing 50 trials, he begins again where he stopped. If he attempts to verbalize the solution at the completion of 50 trials and fails, he has not met the criterion.

Following his performance S is asked these questions,
and his answers are recorded:

1. What was your reaction to the problem before the hint was given?
   1a. How did you feel about the problem?
   1b. Did you think you'd be able to get it— that is, before the hint was given?

2. What do you remember about what I said while you were trying to solve the problem, before the hint was given?
   2a. Was what I said helpful, or critical?
   2b. Remember I said things like: (3 examples given) What was your reaction to those?

3. How did you feel about the problem after the hint?

4. (Following the explanation of the experiment by E): Under which of those conditions do you think you would have worked best?
CHAPTER V
RESULTS AND DISCUSSION

The major purpose of this study is to demonstrate that an overall expectancy for success in solving a particular problem can be established which will in turn affect whether or not the problem is solved. Significant differences between the groups in number solving the problem would indicate not only the establishment of an expectancy, as operationally defined in the present study, but also indicate the effect of such an expectancy on behavior in this specific problem solving situation. In this chapter the specific hypotheses regarding the above will be examined and evaluated in the light of the data.

Hypothesis I: Is there an expectancy established which results in a significant difference between the groups in the number of S's solving the problem? Results relevant to this hypothesis are presented in Table I and Table II.

It can be seen in Table I that all of the hypothesized differences occur in the direction predicted in Hypothesis I (p. 31). The difference between the encouraged group and the discouraged group is significant beyond the 5% point (P = .039), and three other differences approach...
TABLE I

NUMBER OF SUBJECTS REACHING A LOGICAL SOLUTION
(CONCEPTUALIZING THE MATHEMATICAL PATTERN)

<table>
<thead>
<tr>
<th>Group</th>
<th>Solved</th>
<th>Not solved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I - Encouraged</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>Group II - Discouraged</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Group III - Inconsistent</td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td>Group IV - Control</td>
<td>16</td>
<td>14</td>
</tr>
</tbody>
</table>

TABLE II

CHI SQUARE AND SIGNIFICANCE POINT OF DIFFERENCES
BETWEEN GROUPS IN NUMBER OF LOGICAL SOLUTIONS*

<table>
<thead>
<tr>
<th></th>
<th>Group I ENC.</th>
<th>Group II DISC.</th>
<th>Group III INCON.</th>
<th>Group IV CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$x^2$</td>
<td>$P$</td>
<td>$x^2$</td>
<td>$P$</td>
</tr>
<tr>
<td>Group I</td>
<td>3.30</td>
<td>.038</td>
<td>2.400</td>
<td>.065</td>
</tr>
<tr>
<td>Group II</td>
<td></td>
<td>.074</td>
<td>1.684</td>
<td>.100</td>
</tr>
<tr>
<td>Group III</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group IV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Probabilities are stated in terms of probability point, since directionality is predicted, thus allowing for the use of a one-tailed test of significance.

significance (Table II). These are between the discouraged group and the control group ($P = .062$), between the
encouraged group and the inconsistent group ($P = .065$), and between the inconsistent group and the control group ($P = .10$).

It should be noted that there is little difference between the number of S's in the control group and in the encouraged group who solve the problem, while the difference between the control group and the discouraged group approaches significance ($P = .062$), as does the difference between the control group and the inconsistent group ($P = .10$). These results would seem to indicate that in this particular problem solving situation, individuals perform better under conditions of "no expectancy" (that is, where no deliberate attempt is made to establish an expectancy for success in solving that particular problem) than under conditions which are designed to create a low expectancy for success in solving the problem. In other words, it appears that here more solutions occur by keeping quiet than by criticizing.

The similarity in the performance of S's in the discouraged group and in the inconsistent group (Table I) suggests that the use of a combination of encouraging and discouraging statements in this particular problem solving situation has about the same effect as the use of discouraging statements alone. In other words, in terms of the operations used here for defining expectancy, it is demonstrated in this situation that a low expectancy for
success in solving a problem can be established by intermit­tent discouragement as readily as by 100% discouragement, in spite of the fact that the intermittent discouragement is accompanied by intermittent encouragement.

As can be seen in Tables III and IV, when the cri­terion for adequate solution of the problem allows for either a logical solution or a memorized solution, the differences between the groups in number solving the problem are not significant. In other words, the factor which operates to differentiate the groups in number solving the problem seems to be the solving of the problem on a logical basis.

TABLE III
TOTAL NUMBER OF SUBJECTS SOLVING THE PROBLEM EITHER BY A LOGICAL METHOD OR BY ROTE MEMORY

<table>
<thead>
<tr>
<th>Group</th>
<th>Solved by either method</th>
<th>Not solved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I - Encouraged</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>Group II - Discouraged</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td>Group III - Inconsistent</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td>Group IV - Control</td>
<td>16</td>
<td>14</td>
</tr>
</tbody>
</table>
TABLE IV

CHI SQUARE AND SIGNIFICANCE POINT OF DIFFERENCES BETWEEN GROUPS IN NUMBER OF BOTH LOGICAL AND MEMORIZED SOLUTIONS TO THE PROBLEM

<table>
<thead>
<tr>
<th>Group</th>
<th>ENC.</th>
<th>DISC.</th>
<th>INCON.</th>
<th>CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td>x²</td>
<td>P</td>
<td>x²</td>
<td>P</td>
<td>x²</td>
</tr>
<tr>
<td>Group I</td>
<td>1.66</td>
<td>.10</td>
<td>1.66</td>
<td>.10</td>
</tr>
<tr>
<td>Group II</td>
<td>0.00</td>
<td>.60</td>
<td>.23</td>
<td>.60</td>
</tr>
<tr>
<td>Group III</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group IV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hypothesis II: Is there an inverse relationship between the decision time required for making a response and the expectancy for positive reinforcement to occur? The data relative to this question are presented in Table V and Table VI.

TABLE V

AVERAGE RESPONSE TIME PER TRIAL FOR 30 NO-SOLUTION TRIALS AND FOR THE SUBSEQUENT SOLUTION TRIALS

<table>
<thead>
<tr>
<th>Group</th>
<th>No-solution trials</th>
<th>Solution trials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time</td>
<td>σ</td>
</tr>
<tr>
<td>Group I - Encouraged</td>
<td>9.40&quot;</td>
<td>3.680</td>
</tr>
<tr>
<td>Group II - Discouraged</td>
<td>15.26&quot;</td>
<td>6.260</td>
</tr>
<tr>
<td>Group III - Inconsistent</td>
<td>14.33&quot;</td>
<td>6.573</td>
</tr>
<tr>
<td>Group IV - Control</td>
<td>9.73&quot;</td>
<td>3.270</td>
</tr>
</tbody>
</table>
TABLE VI

SIGNIFICANCE OF THE DIFFERENCE (t TEST) BETWEEN THE GROUPS IN AVERAGE RESPONSE TIME FOR THE NO-SOLUTION TRIALS

<table>
<thead>
<tr>
<th></th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
<th>Group IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I - Encouraged</td>
<td>4.346**</td>
<td></td>
<td>3.517**</td>
<td>.5187</td>
</tr>
<tr>
<td>Group II - Discouraged</td>
<td>.5206</td>
<td></td>
<td></td>
<td>4.2193**</td>
</tr>
<tr>
<td>Group III - Inconsistent</td>
<td></td>
<td>.5206</td>
<td></td>
<td>3.3710**</td>
</tr>
<tr>
<td>Group IV - Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Significant beyond the 1% point.

It can be seen in Table V that differences between the groups in average response time occur only during the verbally reinforced trials (no-solution period). Table VI shows that in four out of six of the group comparisons for the no-solution trials the average decision time\(^2\) is significantly larger for the groups with a low expectancy for

\(^2\)Average decision time is computed by recording for each S the total time required for the thirty no-solution trials and the total time required for the solution trials. The time consumed by the thirty verbal comments is subtracted from the total no-solution time. The average time per trial for each S is computed by dividing each total time by the number of trials. The number of trials may vary for the solution period, since some S's solve the problem in less than the allotted fifty trials.
positive reinforcement to occur (Groups II and III) than it is for the higher expectancy group (Group I), as predicted in Hypothesis II (p. 32).

Since the differences between the groups for the solution trials are so slight, an F test is applied to evaluate the differences between the four means, rather than attempting to compare each group with every other group. Under these conditions an F of 2.68 would indicate a probability level of 5%; an F of 3.94 would indicate a 1% probability level. The F obtained here for the mean differences in response time during the solution trials is .093, indicating no significant differences.

It was suggested in the previous chapter that S's with a low overall expectancy for solving the problem would in many instances resort to memorizing the series of discrete responses, rather than attempting to conceptualize the pattern. This was borne out in the results, as shown in Table VII.

It can be seen in Table VIII that significantly more subjects in the low expectancy groups (Groups II and III) attempt to memorize the responses than do S's in the high expectancy group (Group I). The differences are significant beyond the 5% point. The difference between the discouraged group and the control group is also significant beyond the 5% point. These differences in the number of S's resorting to the lower level conceptual approach of
TABLE VII
ANALYSIS OF THE METHODS UTILIZED IN ATTEMPTING TO SOLVE THE PROBLEM (REGARDLESS OF OUTCOME)

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of S's attempting to conceptualize the pattern</th>
<th>No. of S's attempting to memorize the responses</th>
<th>Not clear as to the method used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I - ENC.</td>
<td>21</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Group II - DISC.</td>
<td>13</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>Group III - INCON.</td>
<td>14</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>Group IV - CONTROL</td>
<td>19</td>
<td>10</td>
<td>1</td>
</tr>
</tbody>
</table>

*Information as to method of solution used by each S was obtained during the interview following his performance. In a later analysis of the data, however, E was unable to accurately ascertain the method used by four of the S's. In each of these four cases S did not solve the problem.

rote memorization are important due to the fact that the directions following the hint specifically ask for a logical solution to the problem.

As mentioned earlier, the expectancy for right and wrong responses is controlled in this study in the sense that during the no-solution trials the average number of correct responses for each group is approximately the same. This does not mean that S's responses are controlled in the sense that E manipulates S's performance. Rather, it was shown in pre-testing, and again in the present testing,
TABLE VIII

CHI SQUARE AND SIGNIFICANCE POINTS OF THE DIFFERENCES BETWEEN THE GROUPS IN NUMBER OF SUBJECTS ATTEMPTING TO MEMORIZE THE DISCRETE RESPONSES

<table>
<thead>
<tr>
<th>Group</th>
<th>ENC. x² P</th>
<th>DISC. x² P</th>
<th>INCON. x² P</th>
<th>CONTROL x² P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>5.12 .013</td>
<td>3.02 .043</td>
<td>.32 .294</td>
<td></td>
</tr>
<tr>
<td>Group II</td>
<td>.27 .310</td>
<td>.27 .310</td>
<td>2.32 .045</td>
<td></td>
</tr>
<tr>
<td>Group III</td>
<td></td>
<td>1.41 .121</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group IV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

One tailed test of significance.

that the three experimental groups and the control group perform at about the same level on this particular problem during the no-solution trials. In other words, all S's are exposed to approximately the same amount of experience with right and wrong responses while an expectancy for improvement and an overall expectancy for success are being established. Data relevant to this are presented in Table IX.

As shown in Table IX, an F test of the differences between the groups in average number of correct responses for the no-solution trials and for the solution trials shows that none of the differences approach significance.
TABLE IX

AVERAGE NUMBER OF CORRECT RESPONSES FOR EACH GROUP
DURING THE NO-SOLUTION AND SOLUTION TRIALS

<table>
<thead>
<tr>
<th>Group</th>
<th>No-solution</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Av. no.</td>
<td>σ</td>
</tr>
<tr>
<td></td>
<td>correct</td>
<td></td>
</tr>
<tr>
<td>Group I - Encouraged</td>
<td>8.03</td>
<td>4.175</td>
</tr>
<tr>
<td>Group II - Discouraged</td>
<td>9.17</td>
<td>3.967</td>
</tr>
<tr>
<td>Group III - Inconsistent</td>
<td>8.13</td>
<td>4.059</td>
</tr>
<tr>
<td>Group IV - Control</td>
<td>7.03</td>
<td>3.341</td>
</tr>
</tbody>
</table>

F = 0.0375* 0.2810*

*The value of F in each of these cases would have to exceed 2.69 in order to be significant at the 5% level.

Likewise, none of the standard deviations are significantly different (see Appendix G, p. 80).

It would seem that there should be a difference between the groups in number of correct responses during the solution trials, since there was a significant difference between the groups in number of S's solving the problem logically. This lack of difference would in part be accounted for by the fact that there was no significant difference between the groups in number solving the problem using either a logical method or rote memory. In other words, although significantly less S's in the discouraged group met the criterion of logically conceptualizing the
pattern, some S's in this group did successfully complete their performance by memorizing the series of discrete responses. Thus the average number of correct responses is increased for the discouraged group by these memorized solutions, although the number solving the problem logically remains the same.

An analysis of the number of trials required to reach a solution reveals that approximately the same number of S's in the discouraged group solve the problem in the first twenty trials as do S's in the encouraged group (see Appendix F, p. 88). However, on the last 30 trials thirteen S's in the encouraged group solve the problem as compared to seven in the discouraged group. This suggests that the detrimental effect of verbal discouragement does not occur immediately but becomes more apparent after the initial attempts at solution. That is, when a problem demands organizing responses or conceptualizing and testing new ideas to reach a solution, it appears that unless the discouraged S's initial attempts at solution are successful, he is much less likely to solve the problem than a subject in the encouraged group. If he does solve it, his solution will more probably be a lower level conceptualization—i.e., rote memorization.

Tests for homogeneity of variance for all relevant comparisons were run, and none of them approached significance.
Discussion of the results

In the present study the question has been raised as to whether or not an individual's performance in a problem solving situation may be in part a function of his perception of his experiences in that situation, independent of the actual number of right and wrong responses he makes. Conceptualized in expectancy terms, can it be demonstrated that problem solving behavior is a function of the individual's expectancy for success in solving a problem when his expectancy for making a correct or an incorrect response is controlled? The results are discussed below.

Hypothesis I: Is there an expectancy established for successful performance which results in a significant difference between the groups in the number of subjects solving the problem?

The significant difference between the encouraged group and the discouraged group in number of logical solutions (Table II) suggests that there were high and low expectancies established for success in solving the problem, as a function of the verbal comments made. The differences between the other groups are not as great, as would be expected, since the reinforcements are less different; however, they are in the predicted direction. The occurrence of these differences in performance provides a basis for concluding that there is an expectancy established, as was predicted, as a function of the verbal reinforcement.
The insignificant differences between the number of S's in the encouraged group and the number in the control group solving the problem logically as compared to the greater differences between the control and the discouraged groups suggest that the encouraging statements were not as effective in determining performance as the discouraging statements. These findings are in line with observations made by E while the S's were performing in that the discouraging statements created a very negative attitude toward the problem situation and led to comments which indicated that S's in the discouraged group had developed a low expectancy for eventual solution of the problem.

The absence of a significant difference between the encouraged group and the discouraged group in number solving the problem when the criterion allows for either a logical or memorized solution suggests that in some instances the depressed expectancy for success resulting from the verbal discouragement manifests itself either in (1) regression to a lower level approach to solving the problem; or (2) failure to solve the problem. It seems quite likely that S may have a higher expectancy for success when using a lower level, overlearned approach (such as rote memorization) than when using a higher level approach to solving a problem. The verbal discouragement serves then to eliminate more quickly this higher level response as an available
response, even though it may have a higher choice value in this situation. The higher expectancy for success using a low level approach to solving the problem would tend to offset the effect of the verbal discouragement, in the sense that S would be more confident because of the previous higher expectancy for success using the more familiar method. On the other hand, S may be unable to function under similar discouraging conditions when a higher level of conceptualization is demanded because of the lower expectancy for success which has been further depressed by verbal discouragement.

Hypothesis II: Is there an inverse relationship between the time required for making a response and the expectancy for positive reinforcement to occur?

The inverse relationship does occur in every instance as predicted (Table V), but only during the first thirty trials (no-solution period). In four of the six group comparisons the difference between the groups is significant beyond the .01 point (Table VI). The fact that this inverse relationship between decision time and expectancy for positive reinforcement does not occur during the non-reinforced trials, as was predicted, suggests that the decision time for each response is primarily a function of an expectancy for immediate verbal reinforcement on each successive trial. Apparently this expectancy drops out once the actual verbal reinforcement is discontinued.
That is, after S has been encouraged several times he readily makes a response, expecting to receive more verbal encouragement, whereas after several instances of discouragement S avoids making a response because of his low expectancy for positive reinforcement. It would seem that this expectancy for verbal reinforcement is an immediate, trial-by-trial expectancy, as compared to the overall expectancy for eventually solving the problem, also established by the verbal comments, but apparently not as relevant in determining decision time. The overall expectancy, then, continues through the non-reinforced trials and leads to differential performances by the variously reinforced groups.

A low expectancy for positive reinforcement not only affects decision time but also has a detrimental effect which seems to be present only for those S's who do not immediately solve the problem. This interpretation is suggested by the fact that the six S's in the discouraged group who solve the problem within the first 20 solution trials constitute 60% of those in the discouraged group who ever solve the problem. Nearly as many S's (5 S's) in the encouraged group solve it in the first 20 trials, but they represent only 29% of the S's in that group who solve the problem; so that 71% of the encouraged group who solve the problem solve it in the last 30 trials, as compared to the 40% of the discouraged group. It appears that for those
S's who are able to benefit immediately from the hint given there is little interference effect from the earlier negative reinforcement. However, for those S's for whom the problem is not easily solvable, so that sustained concentration is demanded of them, the earlier negative reinforcement provides considerable interference.

There are several general findings worth reporting in view of the general exploratory nature of this study:

The use of memorization by significantly more S's in the groups with the lowest expectancy for success (Table VIII) suggests that under conditions of negative reinforcement (or partial negative reinforcement) the individual is, in many instances, handicapped in thinking through a novel problem which demands some sort of new conceptualization or organization of available responses. With an expectancy for failure established, S may in many instances resort to a familiar, more readily available mode of response which in this instance was memorization. Similar types of behavior were reported earlier where anxiety was introduced into a difficult problem solving situation (1, 4).

In addition, the comments made by S during the experiment, as well as his responses to questions in an interview following his performance, seem to be worth examining.

Although S was asked not to talk while the experiment
was in progress, the S's in the discouraged group made many comments, expressing considerable hostility toward E and toward the problem to be solved. Typical comments were: "I can't understand this fool thing; I don't believe there is a pattern; I don't see any connection; we're getting no place; I wish I could walk out of here; hell, there's no pattern; whatta you mean, try harder?"

S's in the inconsistent group made about half as many comments as the discouraged group, likewise expressing hostility toward E and toward the problem itself. Very few comments were made by S's in the encouraged and control groups.

In the interview at the end of the experiment the S's were asked how they felt about the problem. (A verbatim report of answers to this question is given in Appendix E.) The encouraged group as a whole reacted in terms of feeling confused and a little frustrated by the problem. None of them expressed hostility toward E, and only one S felt annoyed with the problem he was trying to solve.

The discouraged group reported more feelings of frustration and anger toward the whole situation. Nearly half of this group expressed considerable disgust with themselves for being unable to solve the problem; three expressed annoyance toward E, and five expressed hostility toward the problem itself.

In the inconsistent group the S's again expressed
feelings of frustration with the problem, although there seemed to be more feeling of "interest" in the problem and in finding its solution. While none of the S's in the inconsistent group expressed hostility toward E, and only one felt annoyed with the problem itself, over a third of the S's expressed anger toward themselves for their inadequacy in solving the problem.

S's in the control group described general feelings of confusion, and some indifference to the problem. About a fourth of them expressed disgust with themselves for their inability to solve the problem, while none of them expressed annoyance with E or with the problem.

The fact that so many S's expressed hostility toward themselves and their inability to solve the problem following E's discouraging comments suggests that one of the major effects of verbal reproof is to make the individual feel quite inadequate for the task he is performing, regardless of his success in performing it. In addition, these reactions would seem to provide further evidence that the verbal comments made to the S's were effective.

The S's in the experimental groups were asked in the interview if they could remember anything about what was said to them while they were trying to solve the problem. The majority of S's in the encouraged group remembered that positive comments were made to them; only one S in this group mistakenly remembered that "negative" comments were
made. In the discouraged group, five S's recalled positive statements having been made, rather than negative, while in the inconsistent group fourteen S's remembered the statements as positive, rather than as both positive and negative. (N = 30 in each group) These figures would seem to indicate that there is a relationship between the positiveness of an experience and the remembering of that experience. Further, the reaction of the inconsistent group suggests a slight tendency on S's part to distort what actually occurred to what he might have liked to occur.

An analysis of the behavior of the discouraged group on the basis of those solving and not solving the problem shows that 90% of the S's solving the problem remember that the reinforcement was negative, while only 60% of those not solving the problem remember the nature of the verbal reinforcement. Approximately the same relationship occurs for the inconsistent group. These results point up again the relationship between the positiveness of an experience and the remembering of it; in this instance failure and avoidance seem to be associated.

The importance of a competitive element for providing motivation, even in individual performance, is brought out when S is questioned as to what he specifically remembers about the comments that were made to him. The comment most frequently remembered by S's in the encouraged group was: "everybody has quite a bit of trouble figuring this
out"; S's in the discouraged group remembered this comment most frequently: "you seem to be having more trouble than most people have". During the experiment frequent comments were: "if the others can get it, so can I"; or "did the others take this long?"

During the interview S was asked for a statement of his expectancy as to whether he had expected to solve the problem. The results are presented in Table X.

**TABLE X**

**STATED EXPECTANCY FOR SOLVING OR NOT SOLVING THE PROBLEM**

<table>
<thead>
<tr>
<th></th>
<th>Expects to solve problem</th>
<th>Actual no. solving problem</th>
<th>Expects not to solve problem</th>
<th>Actual no. not solving problem</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I</td>
<td>21</td>
<td>17</td>
<td>9</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>Group II</td>
<td>16</td>
<td>10</td>
<td>12</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>Group III</td>
<td>14</td>
<td>11</td>
<td>15</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>Group IV</td>
<td>17</td>
<td>16</td>
<td>13</td>
<td>14</td>
<td>0</td>
</tr>
</tbody>
</table>

As can be seen there is little relationship between the number of subjects in each group who state verbally an expectation for solving the problem and who solve the problem, or who state an expectation for not solving the problem and who do not solve it. Likewise, there is no significant difference between the groups in the number expecting to
solve the problem ($x^2 = 2.9306, P = .145$). Correlations between each S's stated expectancy for solving the problem and his actual performance show no relationship. The implication of this lack of relationship would seem to be that there is little correlation between S's verbally stated expectancy for solving the problem and his expectancy conceptualized as a function of the experimental conditions (that is, as established by the verbal reinforcement). However, the author feels that the method used here for getting a verbal statement of S's expectancy for solving the problem was not adequate, since he was not asked to state his expectancy until after completing the problem. It is quite possible that a more accurate statement of S's expectancy would have been obtained if he had been asked immediately after the series of verbally reinforced trials, so that his expectancy would be more nearly a function of the verbal reinforcements administered. This method would eliminate any effect of his having succeeded or failed in solving the problem.
CHAPTER VI
SUMMARY AND CONCLUSIONS

This study is designed to determine if a "situational" expectancy is established for eventual success or failure in a problem solving situation which in turn affects the individual's performance. Relevant expectancies are established through the use of differential verbal reinforcements for the three experimental groups. The verbal reinforcements include encouragement, discouragement, and a combination of the two. No comments are made to the control group.

A review of the literature relevant to the present study shows that little work has been done concerning the effect of such a situational expectancy for success or failure on performance. Consequently three other areas of research which would be considered relevant are discussed. First, definitions of the concept of expectancy and a general critique of these conceptualizations are reviewed. Also relevant are investigations of problem solving behavior under anxiety conditions, assuming that anxiety can be thought of as an expectancy for punishment or failure. Results in these studies show that in the majority of cases anxiety has little or no effect in an "easy" learning situation but that it has considerable effect when the problem
to be solved is a difficult one. Lastly, studies concerned with the effects of praise and reproof on learning are reviewed; the results show considerable inconsistency in the demonstrated effects of these two types of reinforcement.

The concept of expectancy utilized in the present study is derived from Rotter's social learning theory (44), in which he defines expectancy as the probability held by an individual that a certain behavior will lead to a certain amount of reinforcement. It is necessary in this particular situation to think in terms of the operation of three interacting expectancies. First, an expectancy for right or wrong responses (E1), which is controlled. Second, an expectancy for improvement in performance (E2), which is varied by manipulating the verbal reinforcement. And third, an overall expectancy for solution of the problem (E3), which is a combination of both E1 and E2. Since E1 is controlled here, E3 will vary directly as a function of E2, and both will be a product of the verbal reinforcement given.

The prediction is that significantly more S's who have developed a high expectancy for solving the problem (i.e., who have received verbal encouragement) will solve the problem with a logical, higher order solution than will S's whose expectancy for solving the problem is lower than the encouraged group (i.e., S's in the discouraged group, inconsistent group, and control group). It is also predicted
that significantly less S's in the verbally discouraged group will solve the problem than will S's in the inconsistent group and in the control group. In addition, it is suggested that S's with a low overall expectancy for successfully solving the problem will tend to use rote memorization rather than to work out a logical solution to the problem.

It is further hypothesized that there will be an inverse relationship between the time required for making a response and the overall expectancy for positive reinforcement to occur. That is, it is predicted that the average decision time required for a response will be significantly less for S's in the verbally encouraged group than for S's in the verbally discouraged group, inconsistent group, or control group. Also, the average decision time will be significantly greater for S's in the verbally discouraged group than for S's in the inconsistent group or in the control group.

The problem to be solved requires the conceptualization of a mathematical pattern according to which a series of lights is flashed. The three experimental groups are verbally reinforced during the first thirty trials of the experiment, regardless of the correctness or incorrectness of each of their responses. The problem is purposely too difficult to be solved during the thirty verbally reinforced trials, so following these S is given a hint about
the solution and is allowed fifty more trials, without verbal reinforcement, in which to solve the problem.

At the end of the experiment a brief interview is conducted with S in an attempt to ascertain his reaction to the verbal reinforcement and his resultant attitude toward solving the problem. He is also asked to state what his expectancy had been during his performance for successfully solving the problem.

Analysis of the results reveals that the differences in the number of S's in each group solving the problem when the criterion demands a logical, higher order solution all occur in the predicted direction (Hypothesis I). The difference between the encouraged group and the discouraged group is significant beyond the .05 point (P = .038), and three other differences approach significance. These are between the discouraged group and the control group (P = .062), between the encouraged group and the inconsistent group (P = .065), and between the inconsistent group and the control group (P = .10). The absence of a significant difference in the number of S's in the encouraged group and the control group solving the problem, as compared to the almost significant difference between the discouraged group and the control group, indicates that the discouraging statements were much more effective than the encouraging statements in determining performance. These findings agree with observations made during the experiment.
which show a much stronger reaction to the negative rein-
forcement than to the positive.

When the data are analyzed on the basis of the crite-
rior allowing for either a logical or memorized solution to
the problem, the differences between the groups in number
solving the problem are not significant. The depressed ex-
pectancy for success brought about by the verbal discour-
agement manifests itself in several instances in either re-
gression to a lower level approach to solving the problem,
or in failure to solve the problem.

Analysis of the differences in decision time shows
that in four of the six group comparisons the average de-
cision time is significantly larger for the S's with a low
expectancy for positive reinforcement to occur than for the
S's with a high expectancy for positive reinforcement to
occur. The two group comparisons which are not significant
are the encouraged group vs. the control group and the dis-
couraged group vs. the inconsistent group. This inverse
relationship occurs, however, only during the thirty trials
in which verbal reinforcement is given; during the subse-
quent non-reinforced trials there is little difference
between the groups in average decision time for each re-
sponse. This would suggest that the verbal reinforcement
operates to establish a high or low expectancy for verbal
reinforcement on each successive trial, and that once the
verbal reinforcement is discontinued, this expectancy drops
out and no longer affects decision time for making a response. On the other hand, the overall expectancy for solving the problem, also a function of the verbal reinforcement, does not drop out with the verbal reinforcement but continues through the non-reinforced trials and leads to differential performances by the groups.

General findings of the study are summarized below:

Significantly more S's in the groups with the lowest expectancy for success use memorization to solve the problem, suggesting that with a low expectancy for success S is more likely to resort to a familiar, readily available mode of response rather than to attempt to conceptualize a solution as required in a novel problem solving situation.

Comments made during the experiment and in an interview after S's performance show that subjects in the discouraged group express considerable hostility toward E and toward the problem to be solved, as well as toward themselves for failing to solve the problem as quickly as they feel they should. This reaction is also characteristic of the inconsistent group, although it does not occur as frequently as in the discouraged group. There is little expression of hostility in either the encouraged group or the control group. These reactions would suggest that the verbal comments have an even more general effect than the demonstrated establishment of a high or low expectancy for success in this task. In addition, they act to establish
a positive or negative attitude toward the whole experimen-
tal situation, including the persons involved in it.

In questioning S about the verbal reinforcement he received, there is a tendency for him to recall positive statements having been made, even in instances where the reinforcement was negative, or both positive and negative. This would suggest some perceptual distortion of what actually occurred particularly on the part of S's who had been negatively reinforced.

An analysis of the subjects' stated expectancies for solving the problem reveals no significant differences between the groups in the number expecting to solve the problem, and no relationship between the stated expectancy for solving the problem and the actual solving of it. This lack of relationship can probably be accounted for in part by the timing of the question asking S for a statement of his expectancy for solving the problem. The question was asked after S had completed his performance and had experienced success or failure, rather than immediately after S had heard the thirty verbal comments, when eventual success was still uncertain.

In conclusion, it is felt that the data presented here demonstrate the establishment of a "situational" expectancy for success in solving a problem which influences an individual's performance in that problem solving situation. The data indicate an inverse relationship between an
expectancy for immediate positive or negative reinforcement to occur and the decision time required for making a response. In general, it can be concluded that the development of a low expectancy for success in a problem solving situation sometimes leads to inefficient behavior in that situation.


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APPENDIX A: STANDARD LIST OF VERBAL STATEMENTS FOR GROUP I-ENCOURAGED GROUP

For each correct response: "Good"

For incorrect response (comments are made in the order listed):

1. The first one is probably the hardest.
2. That's all right; it will take a little time.
3. You're doing fine.
4. Okay.
5. It's very confusing at first.
7. It seems awfully hard to solve, I know.
8. It just takes time to figure it out.
9. You're doing fine.
10. Okay.
11. You're doing as well as most people do.
12. Remember you can't expect to get it right away.
13. Don't get discouraged.
14. You'll get it; I'm sure.
15. I think you're getting closer.
16. You're doing fine.
17. Okay.
18. Don't worry; you'll get it.
19. I think you're getting the idea.
20. Remember it takes a while to figure it out.
21. It's not easy to solve, that's for sure.
22. You're doing all right, even if it seems slow.
23. Just keep at it.
24. It gets confusing.
25. I think you're getting there.
26. Don't give up; you're doing fine.
27. Just keep trying.
28. You're making progress.
29. You'll get it before long.
30. It's hard to figure out.
APPENDIX B: STANDARD LIST OF VERBAL STATEMENTS FOR
GROUP II - DISCOURAGED GROUP

For correct response: "It's about time you got one right";
or "you finally got one right".

(If a correct response is made in the first five trials, or
if there are two consecutive correct responses, where the
above would be inappropriate, S is told, "that was just
luck").

For incorrect response (comments are made in the order
listed):

1. You missed.
2. Wrong again.
3. No.
4. Try a little harder.
5. There's nothing very difficult about it.
6. You're not doing very well.
7. You don't seem to be trying.
8. You sure seem to be on the wrong track.
9. You're not getting anywhere.
10. I think you could try harder.
11. You seem to be having more trouble than most
people have.
12. No.
13. You just don't seem to be trying.
14. You should have gotten it by now.
15. Wrong again.
16. No, you were way off on that one.
17. It really isn't very hard.
18. You'll have to concentrate on it.
19. You just don't seem to get the idea.
20. You're pretty slow at solving it.
21. Missed again.
22. You're not getting any closer.
23. No.
24. I think you're confused.
25. That wasn't so good.
26. Wrong again.
27. You're way off now.
28. I guess you still don't have the idea.
29. That's no good.
30. You're not making any progress.
APPENDIX C: STANDARD LIST OF VERBAL STATEMENTS FOR
GROUP III - INCONSISTENT GROUP

For correct response: Alternately "good" and "it's about time you got one right" (or "well that was lucky" if more appropriate).

For incorrect response:

1. You missed.
2. Wrong again.
3. The first ones are probably the hardest.
4. It's very confusing at first.
5. You don't seem to be trying on it.
6. It will take time to figure it out.
7. You're doing fine.
8. There's nothing very difficult about it.
9. You don't seem to be trying.
10. It will take time to figure it out.
11. You seem to be completely on the wrong track.
12. Remember you can't expect to get it right away.
13. Don't get discouraged.
14. You just don't seem to be trying.
15. You should have gotten it by now.
16. You'll get it.
17. I think you're getting closer.
18. You're doing fine.
19. No, you were way off on that one.
20. It really isn't very hard.
21. Remember you can't expect to get it right away.
22. It's not easy to solve, that's for sure.
23. Remember you can't expect to get it right away.
24. You're doing all right, even if it seems slow.
25. You'll have to concentrate.
26. You just don't seem to get the idea.
27. You're pretty slow at solving it.
28. Just keep at it.
29. It gets confusing.
30. That's no good.
31. You're way off now.
32. It's hard to figure out.
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<thead>
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<th>Subject</th>
<th>Sex</th>
<th>Group</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Subject</th>
<th>Sex</th>
<th>Group</th>
</tr>
</thead>
</table>

## NO SOLUTION

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<th>Correct Number</th>
<th>Response</th>
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<td>3</td>
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<td>2</td>
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<td>5</td>
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<td>6</td>
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**TIME:**
APPENDIX E: STATEMENTS MADE DURING THE INTERVIEW IN ANSWERING "HOW DID YOU FEEL ABOUT THE PROBLEM?"

GROUP I - ENCOURAGED

S's who solved the problem:

S3 Confused at the very beginning.
S4 I had no feeling about it. Just not able to figure it out. Didn't feel discouraged.
S12 Puzzling. Every time I'd try it would be wrong.
S18 Didn't have any special feeling about it.
S42 I was a little worried that I wasn't getting anything right.
S45 If you mean did it frustrate me, no. I've run up against things tougher than this. Sometimes I get a little mad at myself for not being about to figure things out. I was mad here.
S46 I felt a little discouraged.
S48 I thought it was a lotta fun, like a crossword puzzle. Then I got confused.
S62 Completely confused; very much so.
S70 Completely confused. I had no idea what you expected. If you hadn't of told me I'd have given up.
S71 Good problem, but hard. Thought I was being pretty stupid there for awhile. Thought there was something the matter with me. It was a little discouraging at points.
S78 Thought I would be able to get it. Aggravated with myself.
S33 It was confusing. Possibly a little frustrating because--I guess it was because I don't have too much patience with something like that.
S106 Well, I felt I was wrong, but being stereotyped about it, even though I knew that 3, 4 & 5 weren't working. It bothered me to be wrong, but my thoughts were all a-jumble, and I just kept doing it without much thinking. I felt pretty discouraged.
S117 Little confusing. You'd think you had it then it would be wrong. Confused and puzzled.
S118 Frustrating. Felt good when I thought I had it figured out, and then when it was something different I felt like I might as well quit.
S119 I like to do things like this; it was sorts difficult. I wasn't too discouraged. Felt like if I kept on I can get it.
APPENDIX E (continued). STATEMENTS MADE DURING THE INTERVIEW IN ANSWERING "HOW DID YOU FEEL ABOUT THE PROBLEM?"

GROUP I - ENCOURAGED

S's who did not solve the problem:

S4 I didn't feel I was doing very well. When I would hit one it gave me encouragement.
S3 I felt sort of frustrated after I got lost, not right at first.
S9 Pretty complicated until the hint. Felt like I needed to try hard.
S23 Puzzled and very discouraged.
S29 It was confusing.
S43 For awhile I couldn't figure it out and was getting discouraged. Then began to catch on.
S52 Thought it was an interesting problem; made me think. It taxed your ability. It was a challenge more than anything.
S64 A challenge you might say. Sorta frustrating you might say. You just keep guessing and hope it will dawn on you.
S65 Seemed like it was strictly guesswork. Trying to figure it out but didn't work. Wondering how you were feeling about how well I was doing. Felt very discouraged about it because I knew it couldn't be guesswork.
S86 I feel like I was a little upset about it. I hate to take these things for that reason; if you don't come out all right you feel like an imbecile.
S97 Didn't have any idea what the pattern was. Felt confused.
S111 I just kept thinking I'd finally become aware of what was happening. Felt like I'd just keep going until I found it.
S120 Well I thought it was pointless. I felt that I was being experimented on. Probably felt apathetic more than anything else. I had no personal feeling for it--disinterested.

GROUP II - DISCOURAGED

S's who solved the problem:

S1 I was a little perturbed when I'd make a mistake.
S11 I was afraid that I couldn't work it out.
APPENDIX E (continued). STATEMENTS MADE DURING THE INTERVIEW IN ANSWERING "HOW DID YOU FEEL ABOUT THE PROBLEM?"

GROUP II - DISCOURAGED

S's who solved the problem (continued):

S13 Confused. I didn't know what was happening. A little discouraged too.
S20 Just didn't see how I was gonna do it. Just guessed at all of them. Just confused, and very discouraged.
S31 Mostly confused. I didn't know what I was doing. I began just memorizing some of the numbers. I was a little discouraged.
S32 Really didn't think you had a pattern. I was just trying to figure the problem out; had no other thoughts.
S33 Disgusted at first. Thought I could figure it out; then I couldn't see any pattern.
S51 Well I was--I seemed quite mixed up--didn't know--felt pretty tense about it. Then after I started memorizing it, it wasn't clear to me what to do.
S101 I was more or less angry at myself because it seemed so simple and yet I couldn't figure it out. I just wanted to give up completely before the hint; I just felt lost.
S104 I was definitely confused. I don't know exactly how to say. I wanted to go on and find it. After awhile I got a little discouraged if I didn't find it.

S's who did not solve the problem:

S37 Sorta resentful. Just wanted to get up and leave.
S15 Felt there was some sequence but I couldn't figure it out. Tried to memorize, but it didn't work.
S23 Felt that I'd eventually find the pattern. I wasn't discouraged. I took a great deal of time but thought I'd get it.
S27 A little scared that I wouldn't get it.
S36 Because I knew I wasn't doing what I was supposed to be doing; it bothered me. It upset me.
S47 I thought it was kinda silly. I was trying to pick up the pattern.
S55 I felt just plain dumb. I kept thinking how I used to hate math. Thought maybe if I'd learned it then coulda gotten this. Wasn't embarrassed about it; just at a loss.
S55 I was thinking I'll not take another test just after I get up. No special feeling; just doubt as to what would be next.
APPENDIX E (continued). STATEMENTS MADE DURING THE INTERVIEW IN ANSWERING "HOW DID YOU FEEL ABOUT THE PROBLEM?"

GROUP II - DISCOURAGED

S's who did not solve the problem: (Continued)

S73 Sorta puzzling. Didn't like the idea of missing the numbers.
S74 I was just messed up. Sitting there trying to figure what was going on. Mad at myself because couldn't find the pattern.
S79 Annoyed. I was very discouraged about it.
S82 I felt pretty discouraged about it. I was rather disgusted because of it not working out the way I thought it would.
S83 Felt dumb. I was completely discouraged. Didn't even want to punch a light, because I knew it would be wrong. Just didn't care.
S87 I wanted to figure it out. Felt like—well, I was trying to figure out a way to do it.
S93 Trying to do my best, but was confused. Felt like I kept wanting to try harder the more I missed. Felt like I was dumb. Trying so hard maybe more or less confusing.
S98 Felt I wasn't doing too good. Felt pretty discouraged about it.
S99 Confused. Since there was no point behind it there was no point in putting much effort into it. Would have been wasted effort. Frankly my mind wasn't on it.
S105 I was baffled. I got annoyed for awhile. I felt annoyed toward you; I felt maybe you thought I was dumb. I sorts developed a complex for awhile. I began to feel, well, thought maybe you thought I was dumb; I had a sort of inferior feeling.
S114 I didn't like it because you can't use number eight. It seems real confusing. I actually felt real lost because I didn't know what was happening. Actually I was trying to figure it out. It was sort of a challenge.
S115 I didn't have any feelings about solving it; I just guessed a number. I wasn't concentrating on the pattern. At times I'd try to memorize where you'd gone. To tell you the truth, I felt bad because I wasn't getting any of it. I mean it seems illiterate since everybody else was getting it. I felt embarrassed about it to tell you the truth.
GROUP III - INCONSISTENT

S's who solved the problem:

S5 Discouraged after so many failures.
S17 Little discouraged. Didn't matter a whole lot, but didn't feel I would get it.
S26 Felt like giving up.
S37 I was about to give up.
S56 I wasn't too worried about it. I felt pretty discouraged after I missed a couple of them.
S58 Bothered me because I couldn't figure it out. Knew it didn't amount to too much, it really wasn't important, but still thought I should have been able to do it.
S67 Irritated I guess.
S80 Felt silly because of the mistakes; I ought to do better. It was discouraging when I hit the wrong one.
S92 When I got the right one I'd feel jubilant; and then feel depressed when I missed it.
S94 Confused. When one that I thought was right didn't work I felt discouraged, but it didn't upset me.
S96 Confused. Thought, I just can't figure it out.

S's who did not solve the problem:

S72 Interested, but had a sense of failure all the time. I got very discouraged with it; felt like we ought to stop this nonsense.
S81 Aggravating. Because couldn't get on to it. Once or twice I just wanted to give up.
S84 Got mixed up when I missed. I always kept trying. When wrong I'd be completely frustrated. Wouldn't know what to do.
S85 Frustrated.
S89 Felt I was being very dumb. Hit a couple right ones felt good; hit some wrong ones and felt excited that I couldn't do it. When I missed them made me feel kinda upset.
S91 I felt lost. It upset me. I thought maybe I should be able to do it, and didn't know why I couldn't.
S108 Felt rather lost. Frustrated.
S109 I was confused. Just couldn't get it so I felt let down. I had a dumb feeling.
APPENDIX E (continued). STATEMENTS MADE DURING THE INTERVIEW IN ANSWERING "HOW DID YOU FEEL ABOUT THE PROBLEM?"

GROUP III - INCONSISTENT

S's who did not solve the problem: (continued)

S113 At first I felt as though I'd never get it. Determined to get it some way. A little disgusted. I could feel the temperature rise.
S116 Felt very uncertain. Kept wishing that the experiment was over. First I wished I'd hurry up and get it. Then secondly wished it was over. Sorta frustrated me.
S10 I felt discouraged. Felt maybe I didn't have the ability to see what was going on.
S22 Interested. Made me feel like I wanted to keep going till I got it.
S34 I was trying. Each time it seemed like I was catching on more, so I didn't get discouraged.
S40 Hunting for the right way. I figured there had to be an answer to it.
S50 Wanted to know how to do it but didn't seem to be able to figure it out. A little discouraged about it.
S54 Confused. Felt like I had to get it. If there's a problem put before me I have to get it. Something like this makes me nervous.
S57 I was a little bit puzzled.
S59 I felt it was kinda a hard problem to get. I felt kinda dumb. Should be getting it. Like to quit doing it, that's why I started looking out the window. I felt sort of frustrated.
S60 I felt like I was a little clutched up; trying too hard.

GROUP IV - CONTROL

S's who solved the problem:

S2 Confused and thought perhaps I wasn't going to get it.
S14 Frustrated I guess.
S16 Confused.
S19 No particular feelings about it.
S21 Felt as if I was just punching buttons without any purpose. Knew there must be some pattern, but felt like I was fuddling around hopelessly.
S24 Got a little discouraged.
S38 Thought it was difficult till I caught on.
APPENDIX E (continued). STATEMENTS MADE DURING THE INTERVIEW IN ANSWERING "HOW DID YOU FEEL ABOUT THE PROBLEM?"

GROUP IV - CONTROL

S's who solved the problem: (continued)

S40 I wanted to get it; was interested in it.
S41 I liked it; just baffled about what to do when it went beyond 10.
S61 Determined to solve it. When I missed one would get a little discouraged, but really even more determined to get it then.
S69 Just a little bit confused.
S76 Guess I got frustrated for awhile when you'd punch the right one.
S77 Was wondering in the back of my mind if I should have gotten it before the hint. More or less comparing myself to others. Before the hint, upset because couldn't get it; after the hint felt cheered up.
S102 Almost ready to give up; didn't see how I'd ever catch on. Came to the point where I didn't want to push any of them, because I knew it would be wrong.
S103 When I hit the wrong one it more or less got me. More or less discouraged before I got the hint.
S110 I didn't give up.

S's who did not solve the problem:

S25 Got a little tense sometimes.
S30 It was fun to try to figure it out.
S35 I felt lost most of the time.
S39 I was sorta mixed up; felt as if I should know this thing but couldn't get it.
S44 Indifferent. After the hint I was really confused.
S53 I felt frustrated, but not especially discouraged. Figured no point in getting discouraged; I had to do it.
S65 Felt really ignorant. Don't think I was even thinking. So discouraged, so much going on this week.
S68 I was feeling rather stupid. Wasn't too important to me.
S75 Disappointed that I couldn't catch on as quickly as I should have been able to.
S20 I felt kinda discouraged about it.
GROUP IV - CONTROL

S's who did not solve the problem (continued):

S95 I wasn't too bothered by it, just having a little fun with it to guess along with it. Kinds disgusted with myself after third or fourth time.
S100 Frustrated when it was the wrong one.
S107 Just a little before middle way through I was thinking maybe I'd hit it some way. Later I just didn't care. No need in trying to go ahead. Just gave up towards the last.
S122 I was just hoping I'd get the right patterns.
### APPENDIX F.

**DISTRIBUTION OF SUBJECTS ON THE BASIS OF NUMBER OF TRIALS REQUIRED TO REACH A LOGICAL SOLUTION**

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**DISTRIBUTION OF SUBJECTS ON THE BASIS OF NUMBER OF TRIALS REQUIRED TO SOLVE THE PROBLEM BY A LOGICAL METHOD OR BY ROTE MEMORY**

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APPENDIX G:

SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE STANDARD DEVIATIONS OF THE AVERAGE NUMBER OF CORRECT RESPONSES FOR THE FOUR GROUPS
(t test of significance)

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<td>.75</td>
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<tr>
<td>Group IV</td>
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</tbody>
</table>

*The value of t in each of these comparisons would have to exceed 2.00 to be significant at the 5% level.
I, Bonnie Wallis Tyler, was born in Ashland, Nebraska, March 11, 1925. I received my secondary school education in the Pawnee City, Nebraska, High School. My undergraduate training was obtained at DePauw University, from which I received the degree Bachelor of Arts in 1948. During 1948, 1949, and 1950, I was a Graduate Assistant at Ohio State University. I received the degree Master of Arts in 1949. I have specialized in the department of psychology while completing the requirements for the degree Doctor of Philosophy.