DIFFERENTIAL STABILITY, EXTINCTION AND DECREMENT IN EXPECTANCY AS A FUNCTION OF MASSING AND SPACING

by

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TABLE OF CONTENTS

INTRODUCTION

A major purpose of psychological research is the enhancement of prediction of behavior. One research strategy is the deduction of hypotheses from a particular theory--a procedure which then allows the findings to be meaningfully related to other research from the same theoretical context.

The theory which is the context for the hypotheses of the present study is Rotter's Social Learning Theory (Rotter, 1954). One of the major constructs in Social Learning Theory is expectancy, which is defined by Rotter as "a probability or contingency held by the subject that any specific reinforcement or group of reinforcements will occur in any given situation or situations." (Rotter, 1954, p. 165)

The understanding and prediction of behavior through the use of the expectancy construct will likely be enhanced by careful examination of variables which affect expectancy changes. Since situational variables have come to occupy an increasingly more prominent role, the purpose of the present study will be to examine one such situational variable--namely, the massing and spacing of practice or experiences as it affects the expectancy that an individual holds for future reinforcement. In other words what we are concerned with is what change, if any, is there in the stated expectancy for reinforcement due to the massing or spacing of trials or experiences on a particular experimental task. The specific changes of interest here are the difference in stability and rate of extinction of expectancy as a function of massing and spacing of trials.

The basic formula of behavior according to the Social Learning Theory is:

$$B.P._{x,s_1,Ra} = f(E_{x,Ra,s_1} \ \& \ R.V._a) \quad \text{(Rotter, 1954, p. 108)}$$

where B.P. stands for behavior potential, E for expectancy, and R.V. for the value of the reinforcement. This formula reads, "the potential for behavior x to occur in situation 1 in relation to reinforcement a is a function of the expectancy of the occurrence of reinforcement a following behavior x in situation 1 and the value of reinforcement." (Rotter, 1954, p. 108)

Expectancy (E), which is a major construct in the above formula, is determined by two variables: (1) the generalized expectancy (GE), which is the summation of all expectancies held for a group of related behaviors, and (2) the specific expectancy (E') or the expectancy for reinforcement created through the past history of reinforcement for situations perceived to be the same as the present situation. The basic formula for expectancy is:

$$E_{s_1} = f(E'_{s_1} \& \frac{GE}{N_{s_1}} \quad \text{(Rotter, 1954, p. 166)}$$

This formula reads "an expectancy (E_{s_1}) is a function of the expectancy for a given reinforcement to occur as a result of previous experiences in the same situation (E'_{s_1}) and expectancies generalized from other situations (GE) divided by some function of the number of reinforcements in the specific situation (N_{s_1})" (Rotter, 1954, pp. 166-167). This means, therefore, that when an individual is presented with a novel situation his expectancy at first should be a function largely of the generalized expectancy and later, when he has had more experience in the situation, his expectancy for a given reinforcement in this situation will become more dependent on the specific expectancy built up as a function of reinforcement he has received in this specific situation.

Important in the prediction of behavior from this point of view is taking into account the situation in which the behavior occurs. Many psychological theories today emphasize the importance of situational variables but experimental studies are concerned mostly with the needs, motives, etc. that determine behavior. The predictions involved in these studies assume that the determinants of behavior are within the individual and often do not take into account the environmental or situational variables that are constantly impinging upon the subject. To fruitfully predict behavior, the behavior can not be taken out of context; both internal and external determinants must be taken into account and studied. In an expansion of Adaptation Level Theory from a psychophysical context to a personality-social context Helson states,

> Personality traits are manifested only in response to prevailing stimulus-background conditions and group behavior is also a function of the field conditions confronting the individuals composing the group coupled with whatever influence personal factors (residuals) may have in social context. (Helson, 1959, p. 602)

It can be seen in the two formulae above taken from Social Learning Theory that the psychological situation is a determinant of major proportions. The formulae state that the specific behavior which occurs is influenced to a large extent by expectancies that the individual holds in the specific psychological situation. "What the situation provides is cues which are related through previous experiences to expectancies for behavior-reinforcement sequences." (Rotter, 1955, p. 255)

Much experimental work on situational variables has been done in the area of psychological testing. As examples, it has been noted that changes in standard instructions of the Rorschach (Henry & Rotter, 1956), personality differences in administrators (Ferguson & Buss, 1960), and written versus oral methods of examination (Bernstein, 1956) have definite effects on the types of responses given by subjects to various psychological tests. Phares and Rotter (1956) likewise studied the effect of the place of administration on test responses and found significant differences in the type of response obtained depending on the environmental situation the subjects were in at the time of testing. Gross (1959) found that verbal and non-verbal positive reinforcements to responses significantly affected response categories most given on the Rorschach.

Studies have also been done on the effect of situational variables in other areas than psychological tests. Rosenbaum and Blake (1955) found that merely over-hearing a positive or negative response by another person to a request to participate in an experiment had a significant effect on the response of the subject when he was later subjected to the same request.

Well-known studies in the area of group behavior have obtained results that indicate the psychological situation of an individual in a group will affect his responses to various experimental tasks. Asch (1955) found that when a subject finds himself in a minority of one in a group situation errors in his judgment will increase because he will tend to change his responses to conform with the responses of others in the group. But if the subject has only one other person in the group that agrees with him (minority of two) the errors in judgment decrease considerably from the previous situation. Sherif (1958) found that a subject can be greatly influenced by another individual's response if the latter person carried some prestige with the subject.

Several recent studies have been done in the context of Social Learning Theory on the effect of situational variables on behavior. Phares (1957) found that subjects who were under the impression that reinforcements in an experimental task were due to chance had fewer changes and changes of a lesser magnitude in expectancy for future reinforcement than subjects who were under the impression that reinforcements were due to skill. In the skill situation, the subjects' expectancies went up with success and down with failure, but in the chance situation expectancies remained more stable regardless of success or failure because the subjects felt that former performance had little relevance to future performance.

Good (1957) in studying the effect of "no previous experience" in a situation as compared to some experience, found that upon giving a positive reinforcement, subjects with no previous experience or only one trial of experience in a specific situation showed a positive increment in expectancy significantly greater than individuals with more experience. No significant difference was found in subjects having five and fifteen previous trials in the specific situation or in subjects having massed or spaced practice. From these results it appears that after relatively few trials in a situation the specific expectancy (E') developed tends to stabilize the expectancy for a given reinforcement.

Rychak (1958) found approximately the same results as Good in that the number of past experiences in an experimental task seems to stabilize the subject's generalized expectancy (GE) as an increasing function, but found that this stability did not last when shifting from one task to another. These results may be interpreted the same as the previous experiment in that after only a few trials in the task the specific expectancy (E') developed to such an extent as to stabilize expectancy for future reinforcement. Possibly the reason for the stability not lasting from one task to another was that in each new task the measure was being taken while the generalized expectancy was still the main variable of expectancy and the measure of stability on the previous task was on the specific expectancy.

Phares (1961) found expectancy statements on a psychomotor skills task were affected by the situational variable of massing and spacing trials. It was hypothesized that subjects with an initial low expectancy, when given an opportunity to think or ruminate about it during an inter-trial interval, would return to the situation with a lower expectancy than they had left with because the initial low expectancy and the expectancy based on the immediately preceding trials would interact to produce this lower expectancy. In addition, these subjects should have a lower final expectancy after all the trials than a group under massed trial conditions. Results showed significantly larger decrements in stated expectancies on the trial immediately following the interval for subjects whose trials were spaced over a five day period (having trials on the first, third, and fifth days). Their average expectancy scores and final expectancy, however, did not differ significantly from the massed-trial group. Subjects, whose trials were spaced over a twelve day period with fewer trials on each day than the previous group, showed small decrements after inter-trial intervals. However, their final expectancy was significantly lower than either of the other two groups and there were larger numbers of unusual shifts in expectancy for these subjects.

The same author reported two later studies (Phares, 1962, in press) showing similar decrements in expectancy after an inter-trial interval. In the first study an attempt was made to create a more "true to life social situation" in the experimental laboratory to see if the same results would occur. In the second study overt behavioral choices were used as expectancy indicants rather than verbal ratings of confidence. Also in this second study one group of subjects under spaced trials were given "warm-up trials" to discover whether the expectancy decrements were simply due to subjects' expectations that after a lay-off they needed a little while to warm up. There was no difference between spaced trial groups with and without warm-up. Again this seems to indicate that the decrement in expectancy is due to an inter-action between the generalized expectancy and the specific expectancy in the situation.

Several studies on the incubation effect of anxiety (Bindra & Cameron, 1953; Diven, 1937; Golin, 1961) have reported that in an anxiety producing task, the anxiety significantly increases in subjects following an inter-trial interval. If anxiety and high expectancy for punishment can be equated, these results are in congruence with the results reported by Phares. Essentially all six studies seem to point to the same conclusions: during a period of time away from a specific situation the expectancy for positive reinforcement drops and the anxiety connected with or the expectancy for a negative reinforcement arises.

In light of, (1) the general evidence that situational variables have definite effects on behavior and particularly on the expectancies of subjects for future reinforcement and (2) the specific evidence accumulating on the importance of the massing-spacing variable, the purpose of the present study was to study the effects of massing and spacing experiences or trials on the stability and rate of extinction of expectancy.

STATEMENT OF THE PROBLEM

The present study was designed to investigate the role of massed versus spaced trials in the development and change of expectancies for the occurrence of a given reinforcement in a particular situation. Basically, an attempt will be made to answer three questions.

First, does initial level of expectancy affect the amount of decrement in expectancy which takes place during an inter-trial interval? Thus, if the rationale presented in the previous section is correct in that a "rumination" effect occurs during an inter-trial interval we would expect that spaced subjects who begin the trials with a high generalized expectancy would show less decrement than spaced subjects who begin with a low generalized expectancy.

The inter-trial interval would serve to enhance the operation of GE factors and thus bring the expectancy for success on the trial following the interval more in line with the initial GE.

Secondly, are expectancies based on massed trials more stable than those based on spaced trials? That is, will a reinforcement markedly different in magnitude from those received on prior trials be greater in its effect on massed or spaced subjects? It appears likely that since generalized expectancy presumably plays a greater role for spaced subjects, their expectancies would be less stable. In other words, a markedly deviant reinforcement will likely have less effect on massed subjects since E' will have come to play a predominate role.

Thirdly, does massing or spacing of trials affect the rate of extinction of expectancies? Again, as in the preceding paragraph, to the extent that massing gives greater weight to the role of E', it seems reasonable to expect that massed subjects will extinguish less readily than spaced subjects.

Stated in null form the major hypotheses of this study are:

(1) There is no significant difference in the decrement in expectancy following inter-trial intervals for spaced subjects with an initial high expectancy for success and spaced subjects with an initial low expectancy for success.

(2) There is no significant difference in stability of expectancy for subjects high in initial expectancy under spaced conditions versus massed conditions.

(3) There is no significant difference in stability of expectancy for subjects low in initial expectancy under spaced conditions versus massed conditions.

(4) There is no significant difference in the rate of extinction of

expectancies for subjects high in initial expectancy under spaced conditions versus massed conditions.

(5) There is no significant difference in the rate of extinction of expectancies for subjects low in initial expectancy under spaced conditions versus massed conditions.

METHOD

Subjects

In testing the hypotheses forty subjects were used. The subjects were drawn from summer school general studies courses and fall semester general psychology classes at Kansas State University. The summer school students were paid volunteers. Students from the general psychology classes were required to participate in an experiment during the semester as part of their course requirements.

The forty subjects were divided randomly into four equal groups: two groups with initial low expectancy; one under massed conditions and the other under spaced conditions, and two groups with initial high expectancy; one under massed conditions and one under spaced conditions. An equal number of men and women were used for each group.

Procedure

The experimental task was a symbol substitution task, a modification of the Rotter-Jensen Group Level of Aspiration Test (Jensen & Rotter, 1947). Thirteen trials were used, plus a ten-second pre-test warm-up trial for all subjects under spaced conditions. For each trial the key for the symbol substitutions was re-arranged to eliminate the possibility of memorization of the key and thus improvement in performance on subsequent trials. The task was administered individually to each subject in an experimental cubicle in the Psychology Department.

In an effort to enhance involvement in the task, the instructions were worded to lead the subject to believe that the task was a measure of his general intelligence level. Each subject was informed that twenty-five correct substitutions constituted a successful score on any given test trial.

Instructions for all groups were identical, with two exceptions. All subjects were lead to believe they were among the last of a large number of subjects run for this experiment. They were told that from the subjects run previously a precise table of scores had been compiled that enabled precise prediction of future scores. From this table the experimenter could, supposedly, predict accurately the score a particular subject would get later from merely counting the number of correct substitutions that the subject had made in ten seconds. At this time all subjects were given the pre-test warm-up trial. Subjects in the high expectancy massed and spaced groups were informed that they should be getting a score of twenty-five (criterion for a successful trial) by the fifth trial. Subjects in the low expectancy massed and spaced groups were told that they quite definitely would not be getting a successful score by the fifth trial.

Since subjects in the low expectancy groups were told that they probably would not be doing well on the task during the first few trials, they were instructed that not only the absolute score but also the improvement shown from trial to trial would be counted in their final score. However, since the high expectancy groups were informed that they would be reaching a successful score by the fifth trial, they were instructed that only the absolute score was counted in their final score and nothing was mentioned about improvement on the task.

Expectancy scores were obtained from each subject before each of the thirteen test trials by asking them to indicate how confident they were that they would make a score of twenty-five on that particular trial. They were to rate themselves on an eleven point scale, going from 0, meaning very unsure, to 10, meaning very sure that a score of twenty-five would be achieved. Figure 1 represents the entire rating scale used by the subjects.

Very Unsure		Fairly Unsure		Moderately	Sure		Fairly Sure		Very Sure	
0	1	2	3	4	5	6	7	8	9	10

Fig. 1. Rating scale used by subjects to indicate their expectancy.

A reproduction of the experimental instructions will help clarify the procedure. The following instructions were given to the high expectancy groups under the massed and spaced conditions.

> This is a test of the speed with which you can substitute letters for symbols. It is called a symbol substitution test. It is included in most intelligence tests and how well you do on this test is known to be indicative of your general intelligence level.
>
> You will be given a series of trials on this test. It is important that you do well on any given trial for your absolute score is one indicator of your general intelligence. Look at these boxes. Notice that each has a symbol in the upper part and a letter in the lower part. Every symbol has a different letter. Now look here where the upper boxes have symbols but the squares beneath have no letters. You are to put in each of these squares the letter that should go there. I have here a booklet of sheets similar to that one. The idea is to make the proper substitutions as fast as you can without skipping any. You will be given 50 seconds on each trial. A score of 25 is what you should shoot at. Twenty-five constitutes a successful trial.
>
> We have run quite a large number of subjects on this test and need only a few more to complete the study. From the

subjects run thus far we have been able to set up a precise table of scores of what we can expect students to get. For example, I will give you a 10 sec. trial for a warm-up. By counting the number of substitutions you make in 10 seconds, I can predict accurately the number of substitutions you will make later on--say, by the 5th trial. Let's try the 10 sec. trial just to get you acquainted with the task and see how you compare with the scores of the other subjects . . . In 10 sec. you got ____ right. Fine. The tables indicate quite definitely that you should be getting a score of 25, regularly, by the 5th trial. Remember, a score of 25 should be your aim.

Another thing. Before each trial I would like to get an indication of how confident you are of making a score of 25 or better. You can indicate this on a scale going from 0 to 10. This card shows graphically what I mean. For example, if you feel very confident that you will reach a score of 25, you might rate yourself with a 9 or maybe a 10. If you feel only moderately sure you will succeed you might rate yourself with a 5 or 6. If you feel pretty sure you won't reach 25 you might rate yourself 0 or 1. Use any number between 0 and 10 to indicate how you feel you will do. Be as realistic as possible and avoid wishful thinking or underestimating just to protect yourself.

Don't forget, if this is to be a valid indicator of your ability do as well as you can on each trial. Okay. Let's start.

Below are the instructions for the low expectancy groups under the massed and spaced conditions.

This is a test of the speed with which you can substitute letters for symbols. It is called a symbol substitution test. It is included in most intelligence tests and how well you do on this test is known to be indicative of your general intelligence level.

You will be given a series of trials on this test. It is important that you do well on any given trial, and that you show some kind of improvement. Your improvement indicates your learning ability which is obviously an index of general intelligence. Look at these boxes. Notice that each has a symbol in the upper part and a letter in the lower part. Every symbol has a different letter. Now look here where the upper boxes have symbols but the squares beneath have no letters. You are to put in each of these squares the letters that should go there. I have here a booklet of sheets similar to that one. The idea is to make the proper substitutions as fast as you can without skipping any. You will be given 50 seconds for each trial. A score of 25 is what you should shoot at. Twenty-five constitutes a successful trial.

We have run quite a large number of subjects on this test and need only a few more to complete the study. To be frank, we have found that a large majority of students find this task very difficult. From the subjects run thus far we have been able to set up a precise table of scores of what we can expect students to get. For example, I will give you a 10 second trial for a warm-up. By counting the number of substitutions you make in 10 seconds I can predict accurately the number of substitutions you will make later on--say, by the 5th trial. Let's try a 10 second trial just to get you acquainted with the task and see how you compare with the scores of the other subjects. . . . In 10 seconds you got ____ right. Fine. Unfortunately, the tables indicate quite definitely that you will not be getting a score of 25 regularly by the 5th trial. But remember, a score of 25 should be your aim.

Another thing, before each trial I would like to get an indication of how confident you are of making a score of 25 or better. You can indicate this on a scale going from 0 to 10. This card shows graphically what I mean. For example, if you feel very confident you will reach a score of 25, you might rate yourself a 9 or maybe a 10. If you feel only moderately sure you will succeed you might rate yourself with a 5 or a 6. If you feel pretty sure you won't reach 25 you might rate yourself 0 or 1. Use any number between 0 and 10 to indicate how you feel you will do. Be as realistic as possible and avoid wishful thinking or underestimating just to protect yourself.

Don't forget, if this is to be a valid indicator of your ability, do as well as you can on each trial. Both absolute score and improvement are counted. Okay. Let's start.

The high- and low-expectancy groups under the massed trial conditions were given all trials in one session. The two groups under the spaced trial conditions were given the first five test-trials during the first session and forty-eight hours later were given the remaining trials. Upon returning to the situation the subjects under the spaced trial condition were again given the same instructions to refresh their memories. Again a ten-second warm-up trial was administered but this time a prediction of how well the subject should be doing was not given. It was administered as a warm-up trial only with no feed-back.

The reinforcement schedule, or the number of correct substitutions the subject was permitted to make on each trial, was the same for all subjects. Although subjects were told they would have a time limit of fifty-seconds for each trial they were actually given only the amount of time it took them, individually, to complete the pre-determined number of substitutions for a given trial. Subjects did not seem to be aware that the time was being manipulated. The reinforcement schedule is shown in Table 1.

Table 1

Reinforcement Schedule

Trials	1	2	3	4	5	6	7	8	9	10	11	12	13
Success/failure	-	-	+	-	+	+	!	-	-	-	-	-	+
Number of correct substitutions made	23	21	26	22	25	25	17	20	19	21	20	21	__

On the seventh trial (the second trial after the inter-trial interval for the spaced condition) all subjects were given a relatively large failure compared to the previous trials. The seventh trial, rather than the sixth trial, was used as the failure trial because, after the inter-trial interval, it was assumed that subjects under the spaced condition would have a decrement in their stated expectancies. In an earlier study (Phares, 1961) it was observed that upon giving a positive reinforcement on the trial immediately after an inter-trial interval, the subjects' expectancies for the next trial increased approximately to the level of the expectancies of subjects under massed conditions for that trial. To obtain a measure of stability the expectancy statements of subjects in the high expectancy groups would have to be approximately the same immediately before the failure trial, as would the expectancy statements of all subjects in the low expectancy groups. Therefore all subjects were given a positive reinforcement on the sixth trial, with the assumption that, on the next trial, the expectancy statements for the subjects under spaced condition would be approximately equal to those of the subjects under the massed condition for their particular group (high expectancy and low expectancy). A comparison between expectancy statements for the seventh trial (just prior to the failure) and expectancy statements for the eighth trial (just after the failure) was used as the measure of stability of expectancy. The more stable the expectancy the smaller should be the difference in expectancy statements between these two trials.

It was decided that the criterion for extinction of expectancy would be a stated expectancy of three (fairly unsure) or lower for two trials in succession. In order to generate extinction, negative reinforcements (failure trials) were given for all trials after the seventh trial until the subject had reached the criterion for extinction. If a subject had reached the criterion before the thirteenth trial he was then given positive reinforcements for the remainder of the trials. Likewise, all subjects were given a positive reinforcement on the thirteenth trial in order to leave them with a success experience.

RESULTS

Figure 2 represents the mean stated expectancies on trials one through eight for the four experimental groups. Trials nine through thirteen are not represented in the figure because some subjects had extinguished by the ninth trial and were given positive reinforcements for the remaining trials on the test. Therefore, a continuation of the graph with these subjects either included or excluded would give an inaccurate picture of the expectancy statements after trial nine.

Since there was no reason to assume that the expectancy statements were normally distributed, it was decided that non-parametric statistics should be

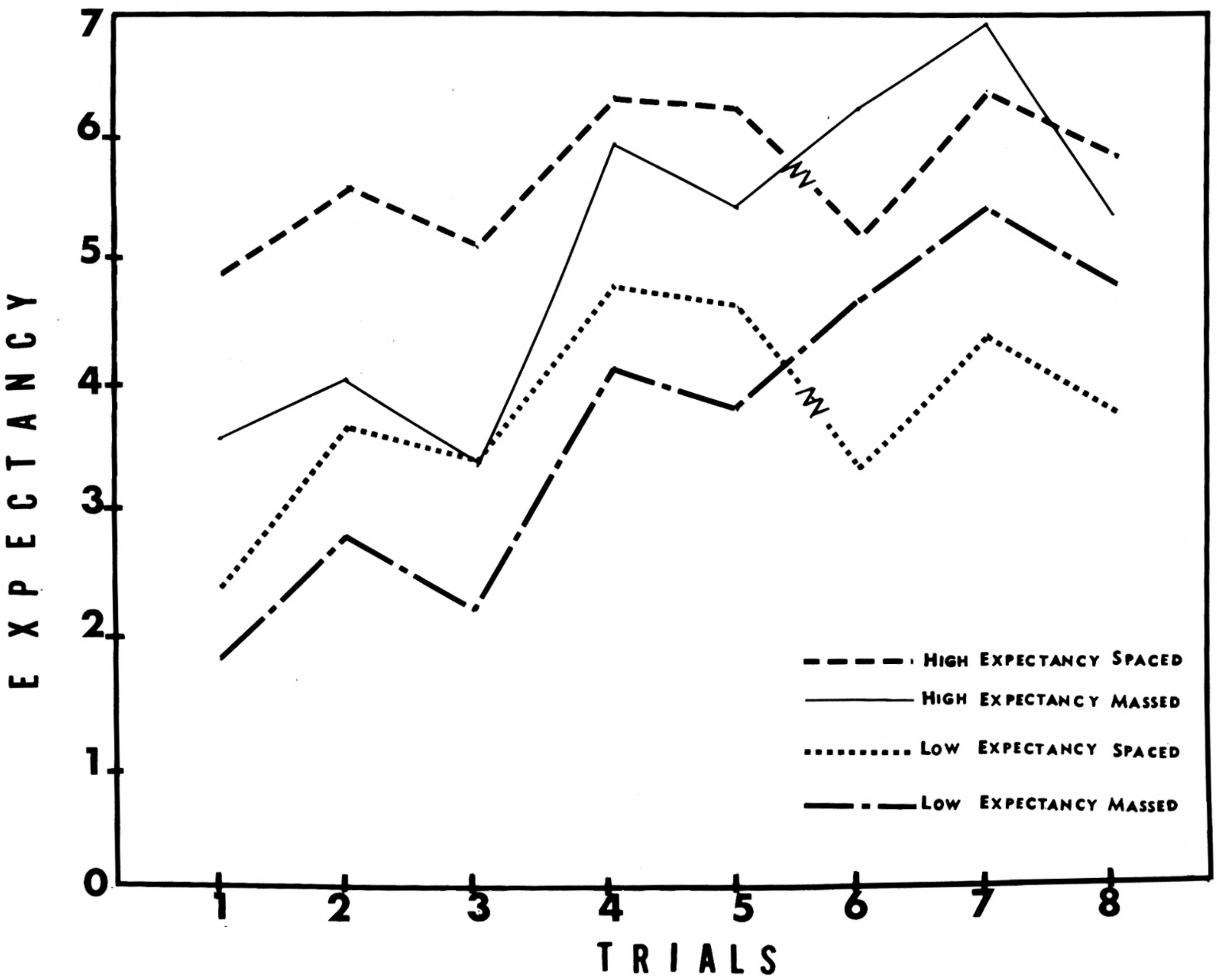

Fig. 2. Mean stated expectancy scores for each experimental group for trials one through eight.

used to test the hypotheses. The Kruskal-Wallis one-way analysis of variance test was used to test the main hypothesis.[1] This test assumes that the variable under study has a continuous distribution and requires at least an ordinal measurement of the variable. This technique tests the null hypothesis that the samples come from the same population or from identical populations with respect to averages (Siegel, 1956, pp.184-185).

Since the instructions were of utmost importance in determining whether we actually had high expectancy and low expectancy groups it seemed advisable to first test to determine whether the instructions had been effective. Since all subjects in the high expectancy groups, regardless of massing or spacing, received identical instructions, and all subjects in the low expectancy groups, both massed and spaced, received identical instructions, it was decided to treat all high expectancy subjects as one group and all low expectancy as another group for this test. The Kruskal-Wallis test rejected the null hypothesis that these subjects were from the same population at the .05 level of significance ($H = 4.92$, $df = 1$).

In observing Figure 2 one will note that the high expectancy group under massed conditions started with a considerably lower expectancy than the high expectancy group under spaced conditions. One could hardly treat these two groups as one group in the above analysis if the points at which they started were significantly different. Again using the Kruskal-Wallis test, no significant difference was found between these two groups for stated expectancy on trial one ($H = 1.32$, $df = 1$, $.30 > p > .20$).

In testing the hypothesis that there was no significant difference between massed and spaced conditions in stability of expectancy difference

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[1]In all analyses corrections were made for tied scores.

scores between trial seven and trial eight were used. In other words, the stated expectancy for each subject on trial eight was subtracted from the expectancy stated on trial seven. These difference scores were used for ranking purposes on the Kruskal-Wallis test. The analysis revealed that there was no significant difference between massed and spaced conditions for either the high or the low expectancy groups ($H = 1.25$, $df = 3$, $.80 > p > .70$). Support was thus not obtained regarding the prediction that groups under spaced conditions would be less stable in expectancy by showing a greater decrement after a large failure than would groups under massed conditions.

Turning now to the extinction hypothesis, Table 2 shows the trials on which each subject reached the criterion for extinction. It can be noted from Table 2 that many of the subjects had not extinguished by the end of the testing session. Therefore, instead of using the trial number in ranking the data for the analysis the following system was used. Subjects who had extinguished by trial nine received a score of 0, by trial ten a score of 1, by trial eleven a score of 2, by trial twelve a score of 3, by trial thirteen a score of 4, and subjects who did not extinguish by completion of the testing received a score of 5.

Using the Kruskal-Wallis test, it was impossible to reject the null hypothesis of no significant difference in the rate of extinction of expectancies between massing and spacing for either the high or the low expectancy groups ($H = 4.40$, $df = 3$, $.20 > p > .10$).

The high expectancy groups, however, reached a near significant level of difference in rate of extinction, ($H = 2.75$, $df = 1$, $.05 > p > .10$), but in the direction opposite to that predicted. In other words, the group under massed conditions seemed to extinguish more rapidly than the group under spaced conditions. Seven out of the ten subjects under the spaced conditions did not reach the criterion for extinction by the completion of the test. No significant difference was found in the rate of extinction for the low expectancy groups (H = .129, df = 1, .80 > p > .70).

Table 2

Trial on Which Extinction Occurred for Each Subject

Subject	Trial: High Expectancy Massed	High Expectancy Spaced	Low Expectancy Massed	Low Expectancy Spaced
1	12	no	9	9
2	11	no	no	no
3	11	no	11	9
4	no[1]	no	no	9
5	no	no	no	9
6	9	no	11	no
7	9	13	no	12
8	12	10	10	9
9	12	no	9	no
10	no	10	9	no

[1]<u>No</u> indicates the subject did not extinguish by the completion of testing.

Regarding the prediction that subjects with an initial low expectancy would show a greater decrement in expectancy following an inter-trial interval than subjects with an initial high expectancy, the following procedure was used. First, expectancy scores for each group under spaced conditions were tested separately to determine whether the decrement between trials five and six was significant for both groups. The Wilcoxon matched-pairs signed-rank test was used (Siegel, 1956, pp. 75-83). It was found that for both groups the decrement was significant (high expectancy group, p = .025; low expectancy group, p = .005).

Since potentially the high expectancy group had a greater distance that they could decrease (because they had a higher expectancy on the fifth trial than the low expectancy group) it was decided that proportion scores would be used in testing the difference between the two groups in amount of decrement. The proportion score was obtained by dividing the difference in stated expectancy between trials five and six for each subject by the stated expectancy for trial five for that subject. The Kruskal-Wallis test was used in testing this difference. No significant difference was found between the two groups in the amount of decrement ($H = .67$, $df = 1$, $.50 > p > .30$).

Since both comparable massed groups showed an increment from trial 5 to trial 6, we again have demonstrated a clear massing-spacing effect--an effect noted in two previous studies (Phares, 1961; Phares, 1962). However, failure to obtain differential decrements in the spaced groups provides little support for the "rumination" hypothesis as an explanation for massing-spacing effects.

DISCUSSION

The results of this study did not confirm the major predictions regarding stability and extinction of expectancies. Nor was the hypothesis of differential decrements in the two spaced groups confirmed. However, the now typical massing-spacing effect was noted. In reviewing the study several methodological errors may be pointed out which perhaps indicate that these results may stem from a less than adequate test of the hypotheses under consideration.

The assumption underlying the prediction that groups under a spaced trial condition will develop a less stable expectancy than groups under a massed trial condition is that during the inter-trial interval for the spaced condition the interaction between the generalized expectancy established by the instructions (GE) and the expectancy based on the trials before the interval will operate to lower the expectancy for success upon returning to the situation. The results definitely indicate that this decrement in expectancy did occur following the interval for the groups under the spaced condition. However, all subjects were then given a success experience on the sixth trial. This was the trial immediately following the interval for the spaced subjects and served to raise the expectancy level of these subjects to approximately the level of the subjects under the massed condition. This procedure was followed in order that a comparison could be made between the low expectancy massed and spaced groups on the next stated expectancy (seventh trial). Therefore, before the measure of stability was obtained on the seventh trial all subjects had previously received six trials or experiences in this specific situation.

It has been pointed out previously in Chapter One that Good (1957) found no significant difference in increments in expectancy following a positive reinforcement for subjects who had had five versus fifteen trials. Rychlak (1958) subsequently found a similar result. Thus it appears that specific expectancies (E') develop rapidly in a task such as the one used in this study. Therefore, stabilization of expectancies occurs rather rapidly; probably before the seventh trial. In fact, the success experience on trial six may have served to convince spaced subjects that the situation had not changed since their pre-interval experiences. In effect, the sixth trial may have served to introduce an artificial stability into the situation.

In order to measure differential stability of expectancy as a function of massing versus spacing of trials the measure of stability should probably be obtained before E' becomes the primary determinant of expectancy. If generalized expectancy no longer has an effect by the seventh trial, the massing or spacing effect will also diminish or cease to exist because the effect of spaced trials is presumably due to the interaction of the specific expectancy with generalized expectancy based on the instructions. Thus, for example, if the inter-trial interval for the spaced trial condition came after the second or third trial and the measure of stability was obtained by the fourth or fifth trial, then the generalized expectancy would still have an impact. In testing the stability of expectancy between massed and spaced conditions in this manner one could then determine if the massing or spacing actually had an effect on the stability of expectancy. Other evidence (Phares, 1962) also indicates that massing-spacing effects diminish with the increasing strength of E'.

The instructions in the present study led the subjects to believe that the task was a measure of their intelligence. While the instructions were effective in producing significantly different levels of expectancy, they were not probably ideal. All subjects used in this experiment were college students and probably had already formed an expectancy of how they would operate on a task purporting to measure intelligence. Therefore, the instructions may have contradicted reality in some cases. If the task had been described as a measure of psychomotor skill, manual dexterity, or some other skill on which the general college student had not already formed an expectancy for success, the instructions might have been more effective than they perhaps were.

A second major prediction in this study was that subjects under the spaced trial condition would extinguish more rapidly than subjects under the massed trial condition, for both the high and low expectancy groups. Again the measurement of extinction came after the specific expectancy (E') for this situation had likely formed, thus probably preventing any significant difference between the massed and spaced conditions. The criterion for extinction in this study was a stated expectancy of three or lower on two successive trials after the measure for stability. Therefore the subjects could reach this criterion only on or after the ninth trial. Thus, the same comments apply here as in the case of the stability hypothesis.

To adequately test the hypothesis about extinction two adjustments need to be made in the methodology used in this study. First, the measurement of extinction should be introduced on an earlier trial, before E' becomes the main determinant of expectancy statements. Second, the instructions need to be worded so the GE is effective for a longer period of time or over more trials.

As stated previously, the results are consistent with the postulated rumination effect occurring during the inter-trial interval. It appears that after the fifth trial the GE from the instructions is still operating enough to significantly lower the expectancy for success for both the high and low expectancy groups during an inter-trial interval. However, upon re-entering the situation, and having one more experience in the situation the E' seems to stabilize the expectancy of these subjects.

However, the results did not confirm the prediction that subjects with an initial low expectancy will show a significantly greater decrement in expectancy than subjects with an initial high expectancy during the inter-trial interval. This failure seems, in retrospect, to be in the methodology. Both spaced groups showed a decrement in expectancy such that they started the sixth trial at approximately the level at which they began on the first trial. Presumably, if expectancy is raised during the trials before the interval, the interaction of GE and E' will serve to lower expectancy to about what it had been on trial one. Therefore, the rumination hypothesis seems to have validity, not in that a low expectancy will facilitate a greater decrement in expectancy, but in that if the initial expectancy is lower than the expectancy preceding the inter-trial interval, the rumination during the interval will lower the expectancy to approximately where it had been at the beginning of the trial sequence. Thus, these results are not contradictory to the rumination hypothesis. It does not seem to be necessary to say that subjects with an initial high expectancy will show a smaller decrement in expectancy than subjects with an initial low expectancy. The rumination effect is present in both groups, simply because the initial expectancy is lower than the expectancy immediately preceding the inter-trial interval.

A better test of the hypothesis in question would be a situation where groups begin with very low expectancies, say level 2, and very high expectancy expectancies, say level 8. Then, following a trial sequence characterized predominantly by success, an interval would be introduced. If the rumination hypothesis is a useful one, it would predict that the low expectancy group would show a significantly greater decrement in expectancy, proportionally, following the interval than the high expectancy group.

Furthermore, in testing this hypothesis it would be desirable to create GE (or initial expectancy) by pre-arranged experience on similar tasks rather than by instructions.

It would be of interest to investigate the effect on expectancy after an inter-trial interval when the initial expectancy is higher than the expectancy immediately preceding the interval. From the rumination hypothesis it would probably be predicted that the expectancy after the interval would show an increment from the expectancy immediately preceding the interval because of interaction between the initial expectancy and the expectancy based on the trials before the interval. Future research might well investigate this point.

Additionally, it would be of interest to investigate the rumination hypothesis by utilizing subjects whose differential GE is assessed by personality measures such as the Incomplete Sentences Blank, TAT, etc. That is, rather than utilize subjects whose initial expectancy is based either on experimental instructions or experience, subjects would be pre-selected on the basis of test scores which presumably are based on life histories of predominant success or failure.

SUMMARY

This study was designed to investigate the differential effect of massed versus spaced-trial conditions on the stability and extinction of expectancies for reinforcement. In addition, the differential effect of high and low initial expectancies on subsequent decrements in expectancy following inter-trial intervals was explored.

The hypotheses of this study were based on a "rumination" assumption which states that subjects, when given an opportunity to ruminate or think about an initial low expectancy during an inter-trial interval, will, upon returning to that situation, show a decrement in expectancy for success in the situation because of an interaction effect between the initial low expectancy and the expectancy based on trials preceding the interval. The specific predictions of this study were: (1) the expectancies of subjects under spaced conditions, for both high and low initial expectancy groups, would be less stable following an inter-trial interval than subjects under massed trial conditions; (2) subjects under spaced conditions would show a more rapid rate of extinction following the inter-trial interval than would subjects under massed conditions; and (3) the decrement in expectancy following an inter-trial interval would be greater for the low initial expectancy group than for

the high initial expectancy group.

The experimental task was a symbol substitution task consisting of thirteen trials plus a ten-second pre-test warm-up trial for all subjects and an additional warm-up trial after the inter-trial interval for subjects under the spaced conditions.

Forty subjects were used; ten subjects in each of four groups: high-expectancy spaced, high-expectancy massed, low-expectancy spaced, and low-expectancy massed. An attempt was made to create initial high and low expectancies in subjects through instructions. Groups under massed conditions were given all trials in one session. The groups under spaced conditions were given five trials during the first session and, forty-eight hours later, were given the remainder of the trials.

All subjects were given a relatively large negative reinforcement on the seventh trial. The measure of stability was the decrement in expectancy from the seventh to the eighth trial; the larger the decrement the less stable the expectancy. Trials eight through twelve were negatively reinforced in order to obtain a measure of the rate of extinction.

The results indicated that both high and low expectancy groups under spaced conditions showed significant decrements in expectancy after the inter-trial interval as contrasted with the massed groups. The high and low spaced groups did not, however, differ themselves in amount of decrement. There was no difference in stability of expectancy or rate of extinction between the spaced and massed conditions.

Failure to substantiate the extinction and stability hypotheses appeared to be a function of the fact that measures were instituted subsequent to the formation of specific expectancies based on experiences in the situation. The lack of difference in decrements between high and low spaced groups was traced to initial expectancy levels. That is the high and low groups were not initially enough disparate to provide an adequate test of the hypothesis and the obtained results were, in fact, predictable from the "rumination" hypothesis given the existing levels of initial expectancy.

Future research on the massing-spacing variable was suggested as well as improvements in the present methodology.

ACKNOWLEDGMENT

With deep appreciation the author wishes to acknowledge the assistance given by Dr. E. Jerry Phares who served as faculty advisor so helpfully and patiently in this investigation and to Dr. Holly C. Fryer, Department of Statistics, for his invaluable advice concerning the statistical analysis used.

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APPENDIX

RAW DATA

Stated Expectancy on Each Trial for Each Subject

Low Expectancy Massed

Subjects	Trials 1	2	3	4	5	6	7	8	9	10	11	12	13
1	4	4	3	3	3	3	3	3	3	2	2	2	2
2	2	3	3	5	5	8	10	10	10	8	8	7	7
3	1	2	2	4	3	4	5	4	4	3	3	3	4
4	[illegible]	3	3	4	4	4	5	5	5	4	5	4	4
5	1	3	3	5	5	6	6	5	5	5	4	4	4
6	2	2	2	3	3	4	4	4	4	3	3	4	4
7	3	3	3	7	6	6	7	7	6	6	5	5	5
8	0	3	2	5	4	6	6	4	3	3	4	5	7
9	2	4	1	4	3	4	4	3	3	3	4	4	4
10	0	1	0	1	2	2	4	3	2	3	3	4	5

Low Expectancy Spaced

Subjects	Trials 1	2	3	4	5	6	7	8	9	10	11	12	13
1	2	3	3	3	3	3	4	3	3	2	2	2	3
2	1	3	3	7	7	4	7	7	6	5	5	5	5
3	2	3	2	3	3	3	4	3	3	3	2	2	3
4	3	4	3	5	4	3	4	3	3	3	3	3	4
5	1	3	3	4	3	2	2	2	3	2	3	3	4
6	4	5	4	6	5	4	5	4	5	4	4	3	6
7	2	2	4	4	5	2	3	2	4	4	3	3	5
8	1	4	3	5	4	3	4	3	3	3	3	4	4
9	3	4	4	5	6	4	5	5	4	4	4	5	4
10	5	6	5	5	6	5	6	5	5	4	5	4	5

High Expectancy Massed

Subjects	Trials 1	2	3	4	5	6	7	8	9	10	11	12	13
1	3	4	4	5	5	6	7	5	3	4	3	3	4
2	1	1	1	3	3	5	5	5	4	2	2	3	3
3	5	3	3	5	5	5	6	6	4	3	3	3	4
4	7	7	5	9	9	10	10	8	8	6	8	8	7
5	5	5	5	5	6	7	8	7	7	7	6	6	6
6	2	2	2	8	5	8	8	3	2	3	6	7	8
7	3	3	2	5	3	3	5	2	1	1	1	2	2
8	1	3	3	7	6	6	7	5	3	4	2	1	4
9	3	5	4	5	5	5	5	5	3	6	3	3	5
10	5	7	5	7	7	7	8	8	6	6	6	6	6

High Expectancy Spaced

Subjects	Trials 1	2	3	4	5	6	7	8	9	10	11	12	13
1	8	8	7	7	7	8	8	7	7	6	7	6	5
2	1	5	4	7	7	4	7	6	6	6	5	5	4
3	7	7	6	7	6	6	7	6	5	5	5	4	4
4	5	5	4	5	5	5	7	7	7	7	8	6	6
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7	7	6	6	7	7	5	5	4	4	3	4	3	3
8	3	3	3	4	4	3	5	4	3	3	3	3	4
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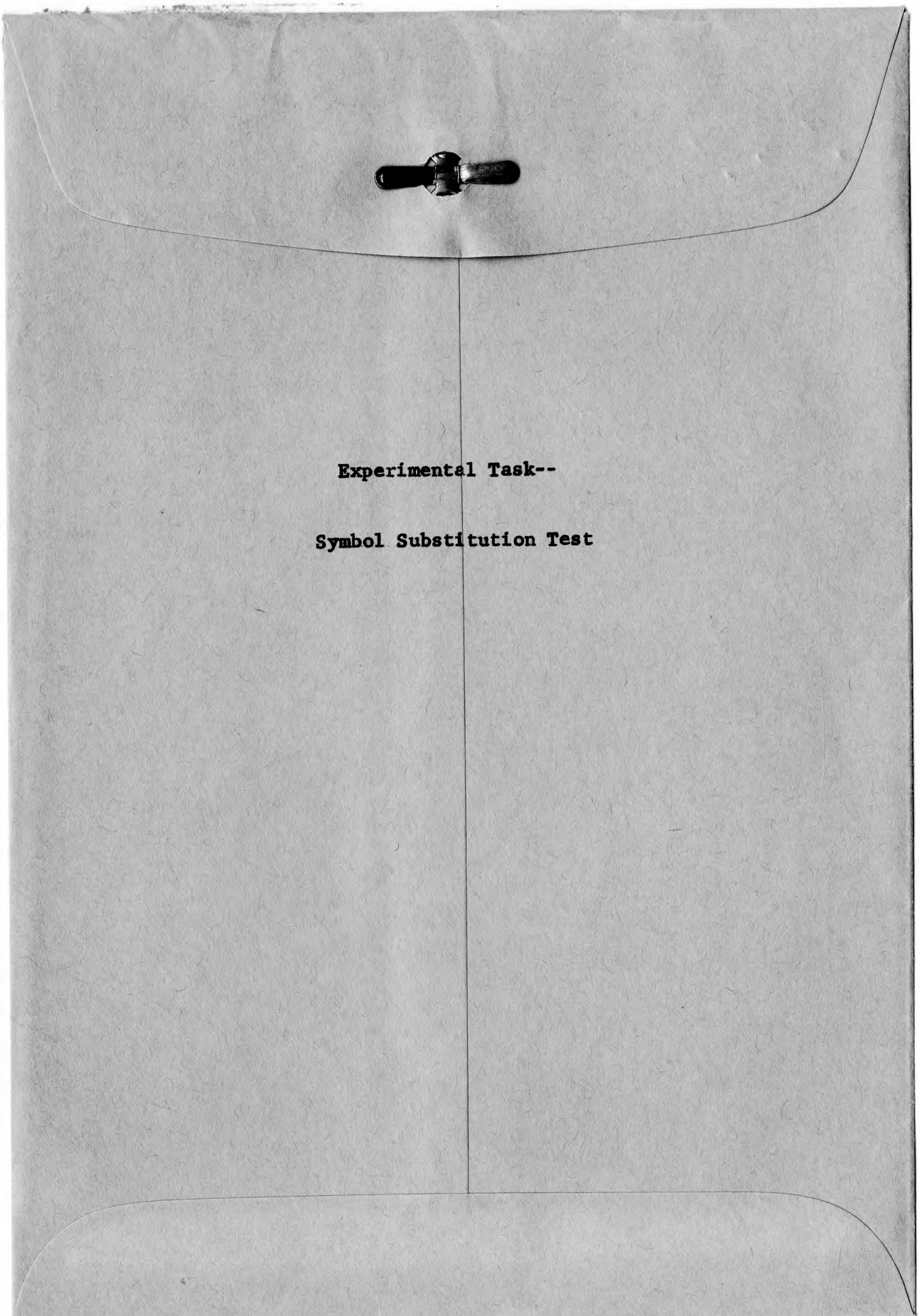
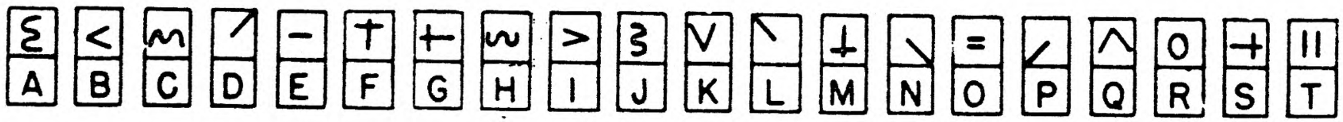

Experimental Task--
Symbol Substitution Test

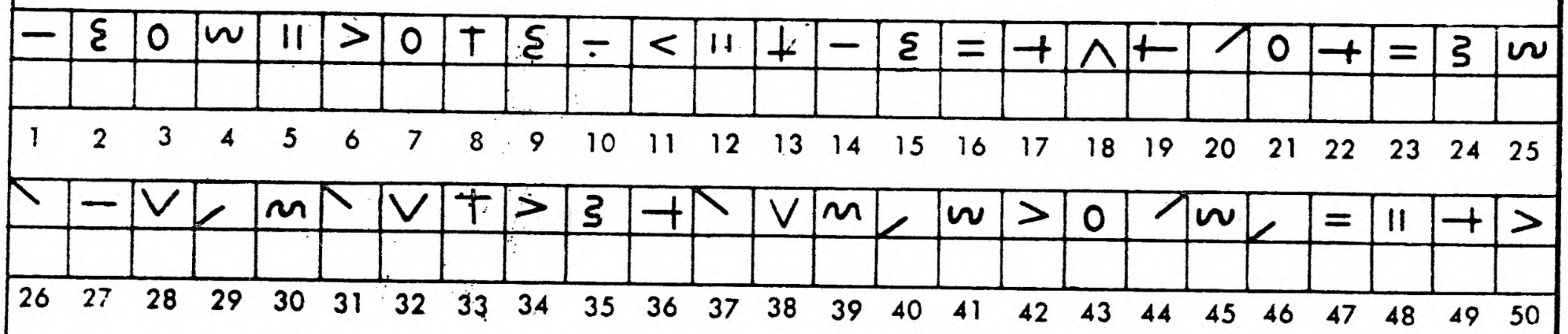
No. 1

Name CLASS SEX Date

Put The Right Letter Under Every Mark

KEY





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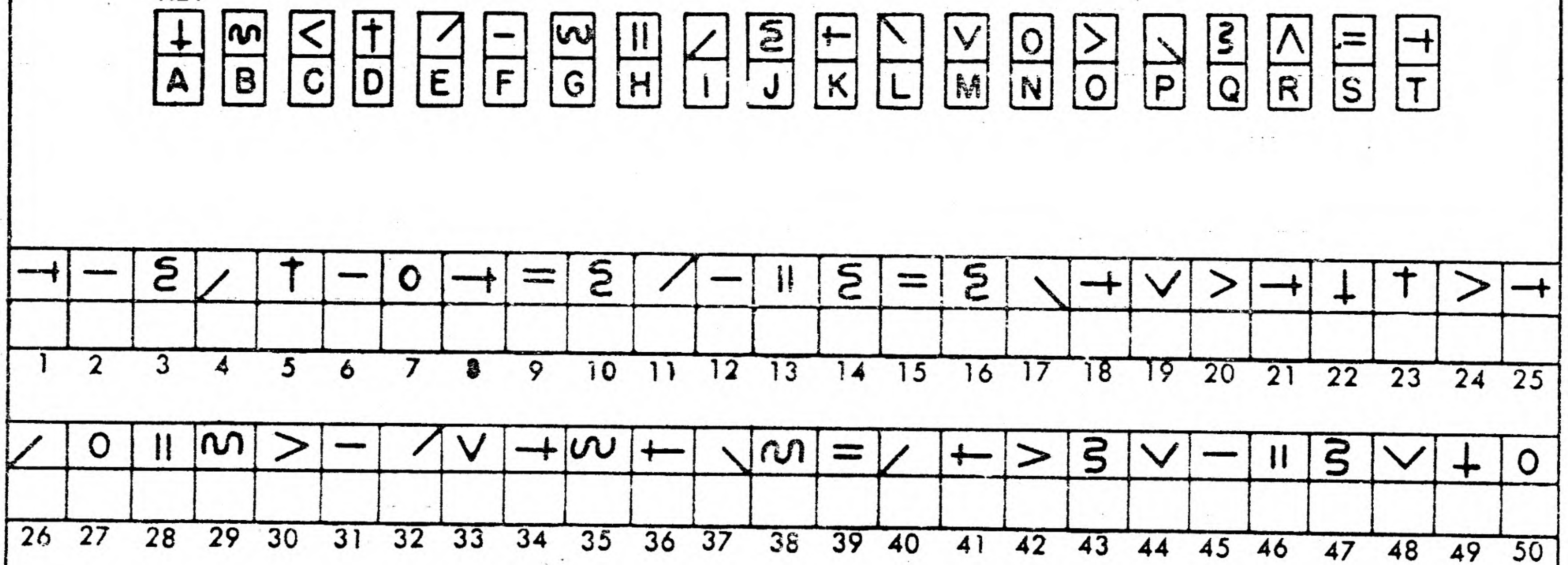

Estimate	Completed	Score

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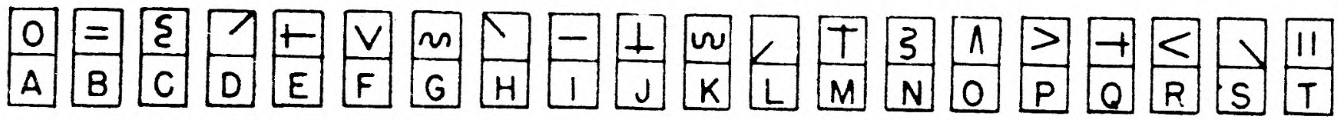

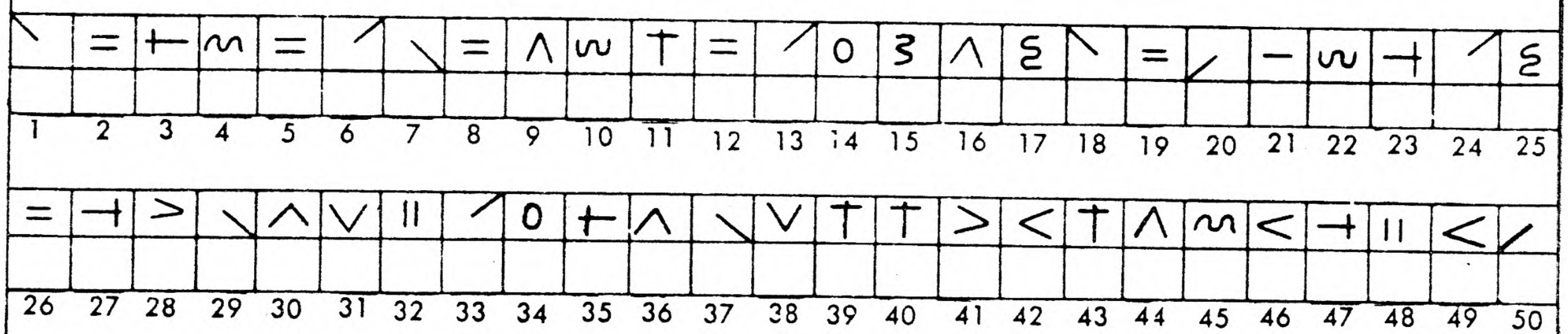

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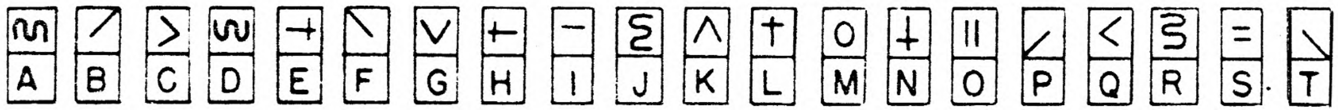

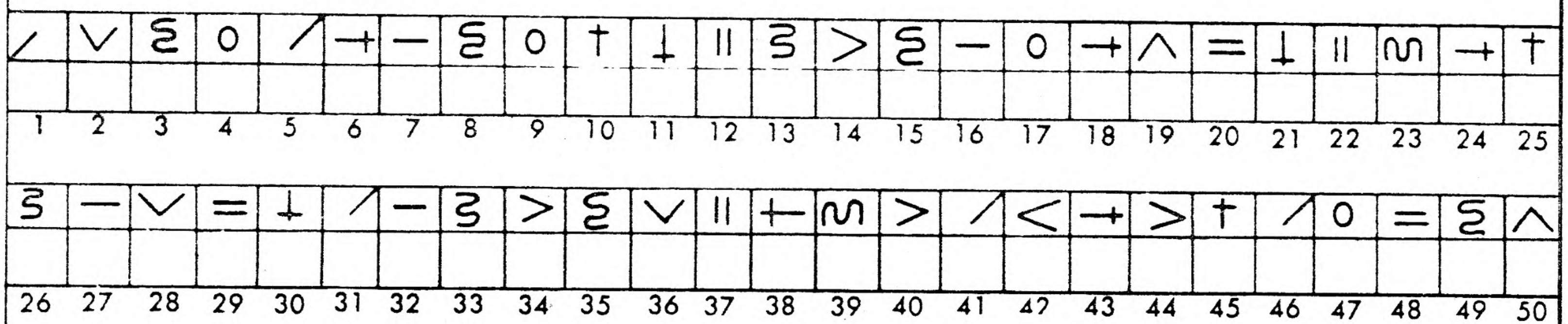

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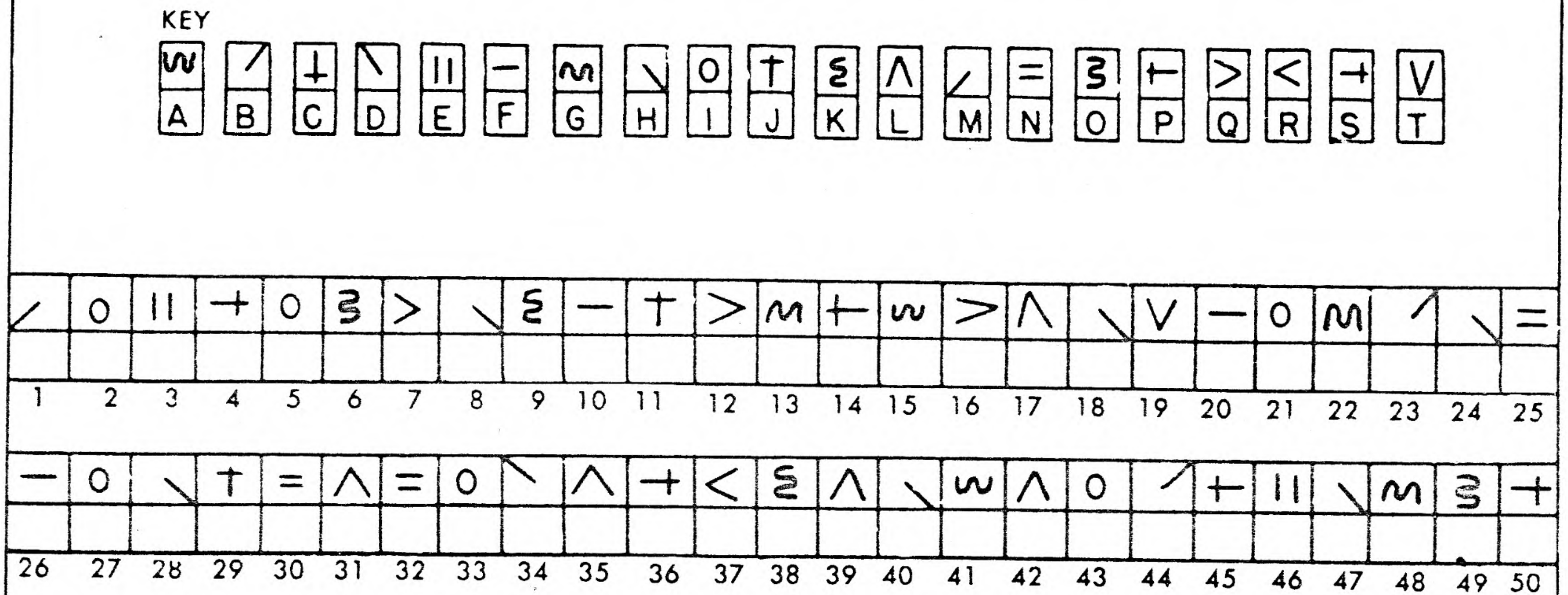

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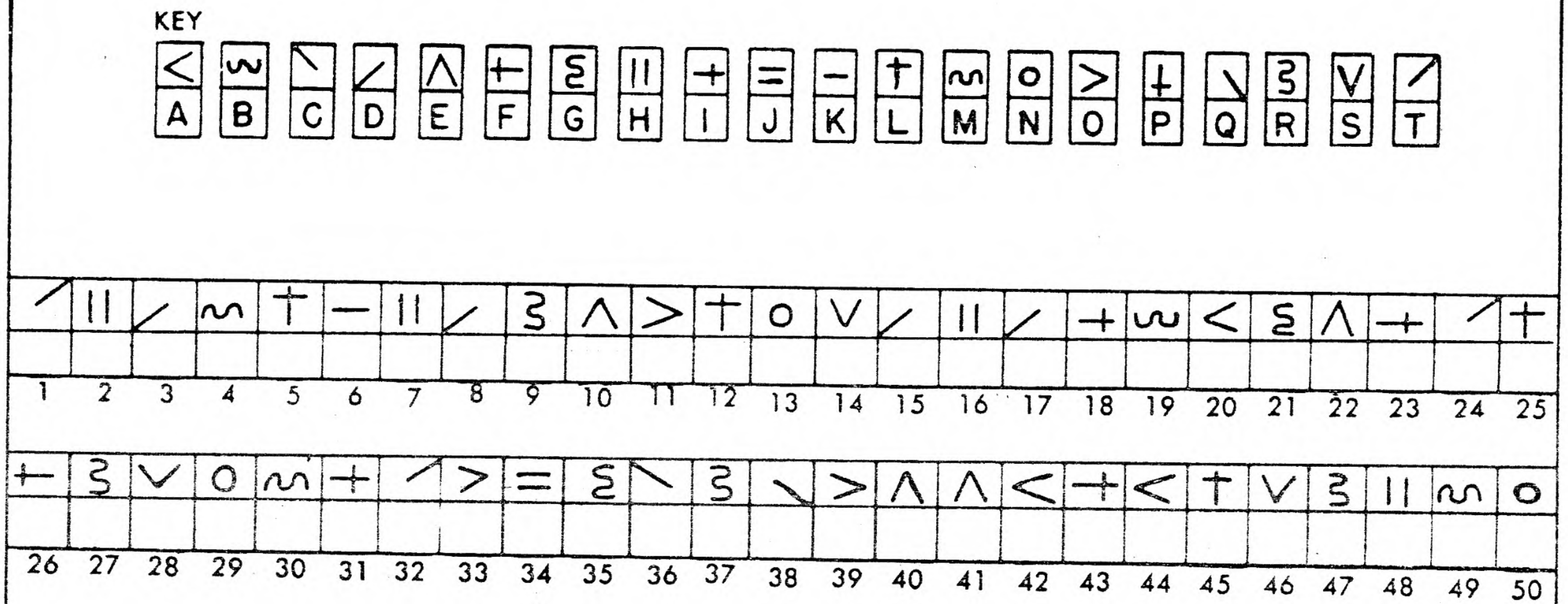

Estimate

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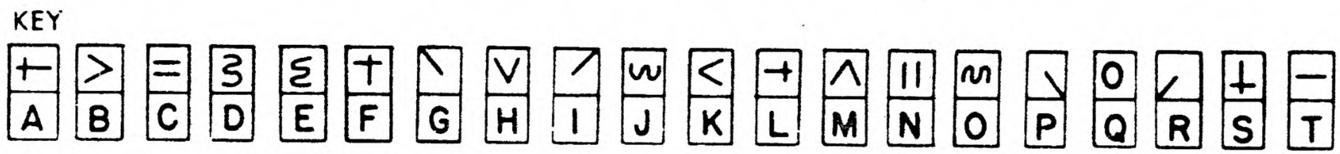

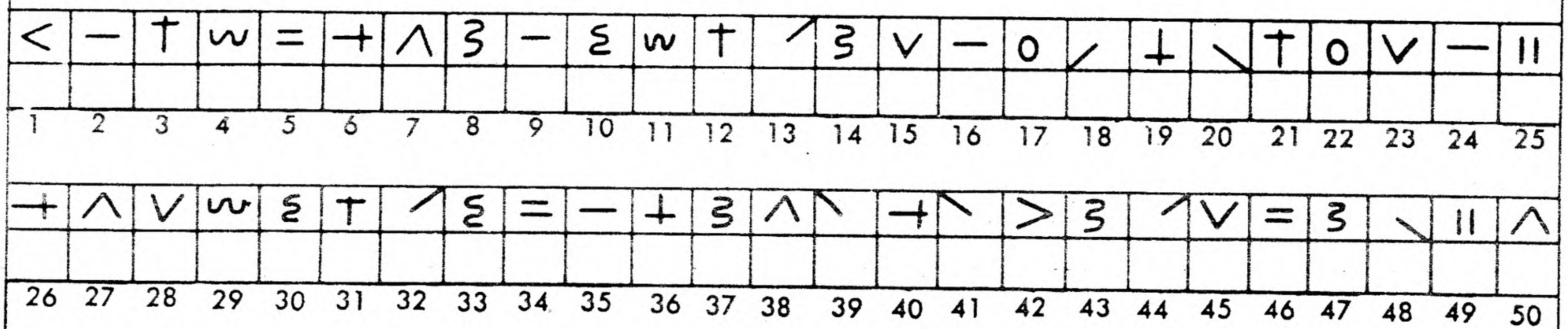

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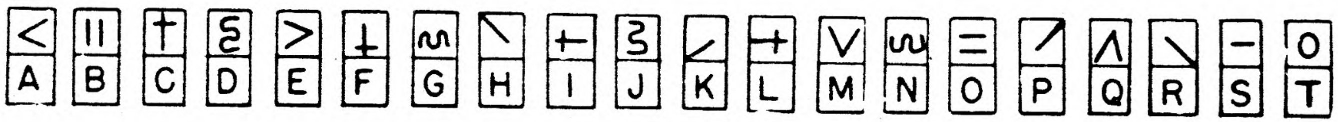

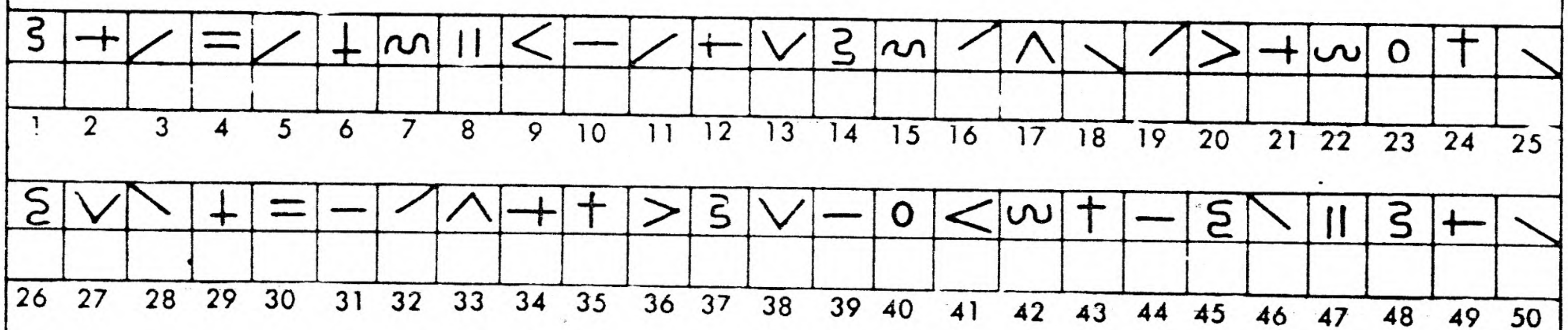

Estimate	Completed	Score

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Put The Right Letter Under Every Mark

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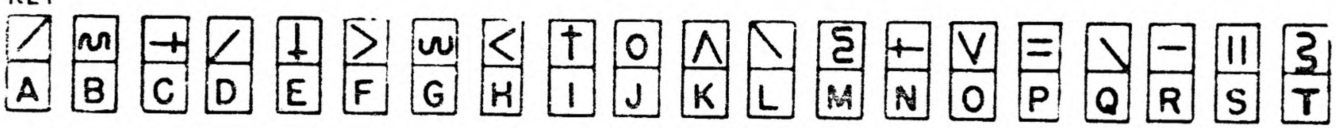

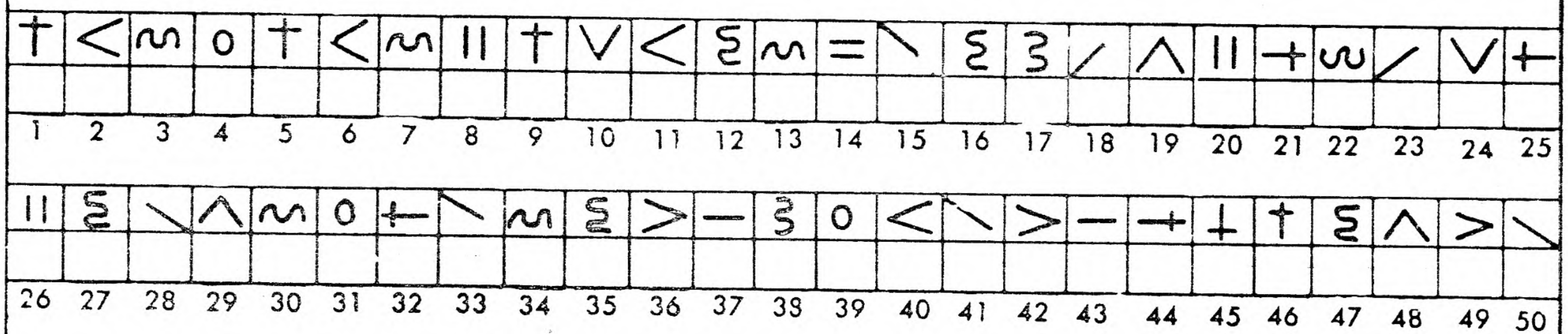

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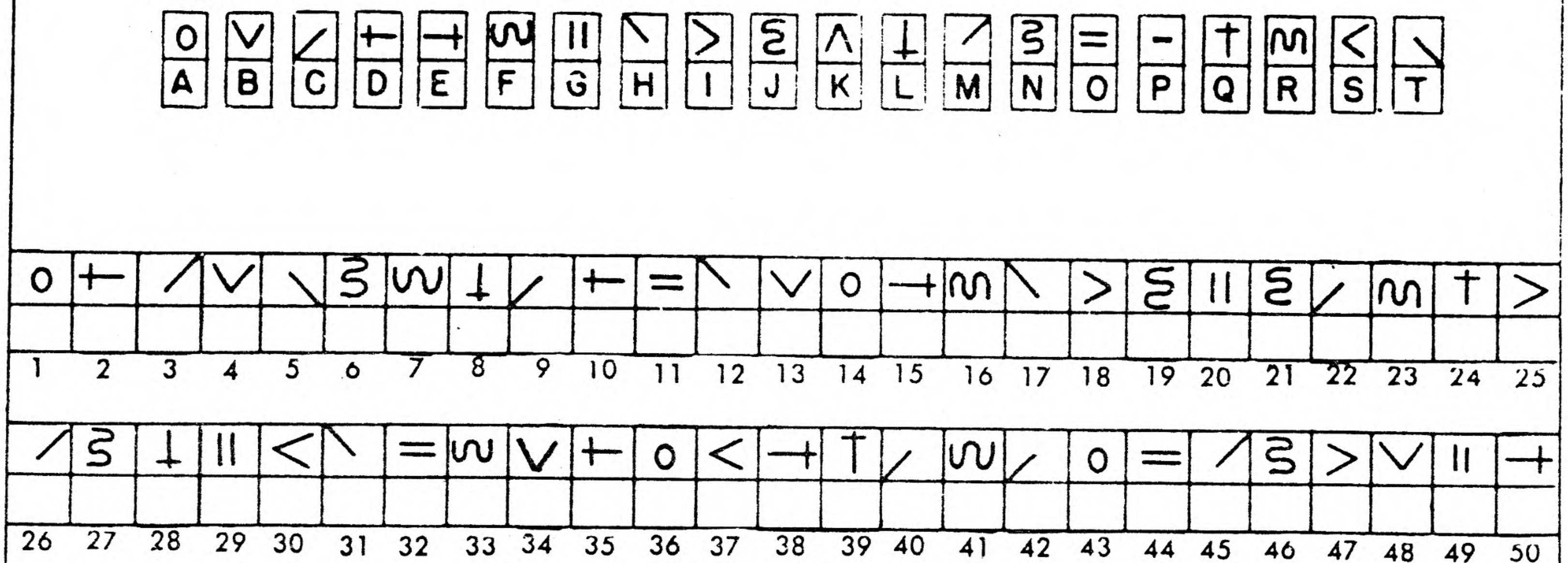

Estimate

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Put The Right Letter Under Every Mark

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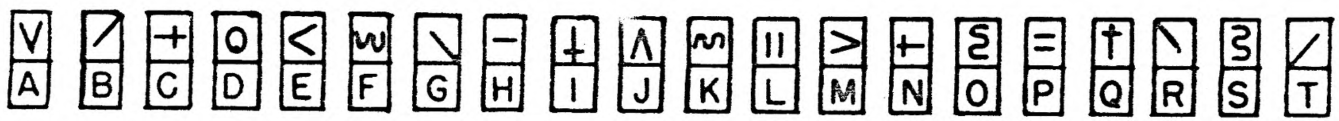

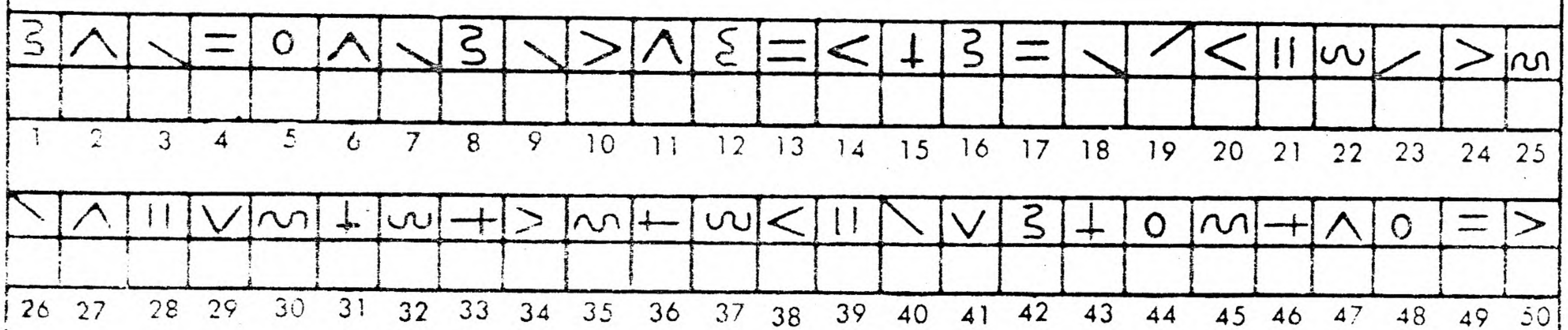

Estimate

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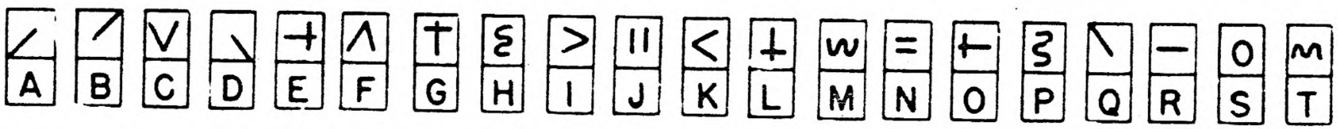
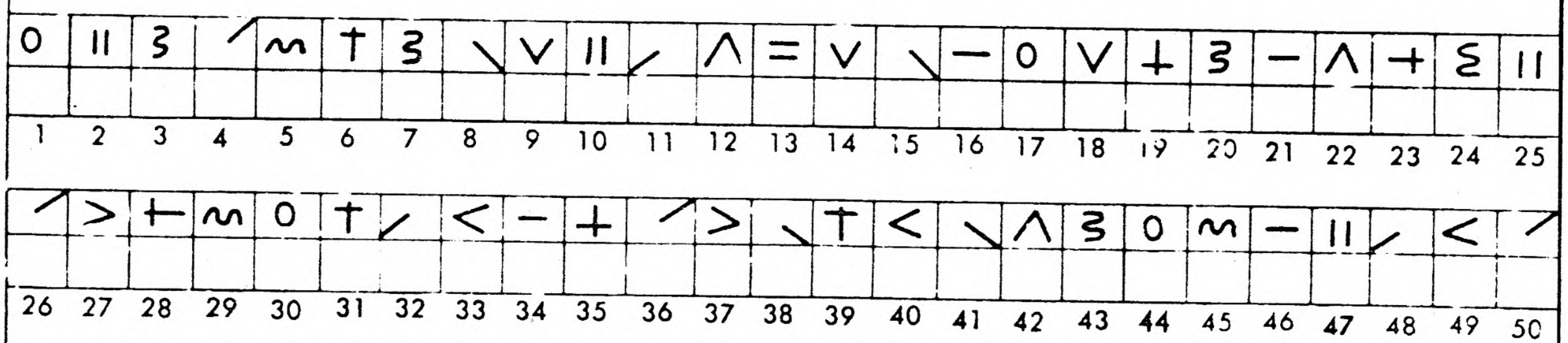
Put The Right Letter Under Every Mark

KEY





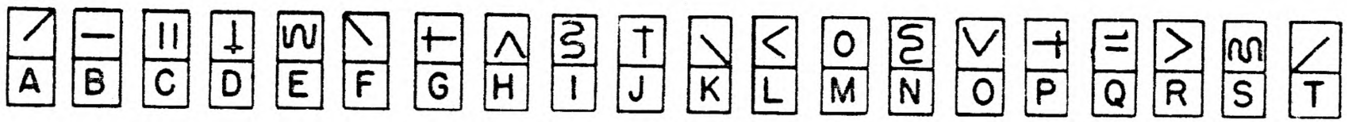
Estimate	Completed	Score

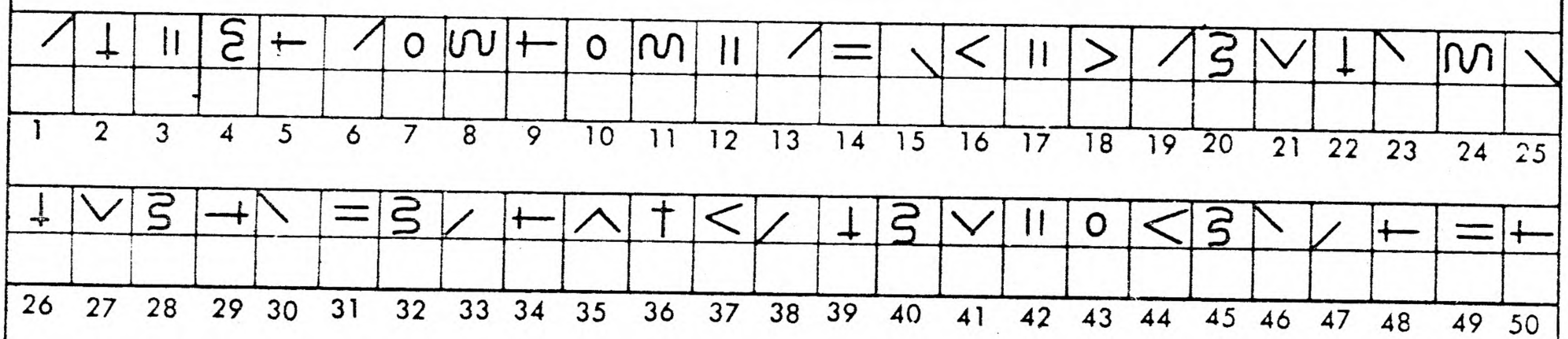
No. 13

Name

Put The Right Letter Under Every Mark

KEY





Estimate

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Score

DIFFERENTIAL STABILITY, EXTINCTION AND DECREMENTS IN EXPECTANCY AS A FUNCTION OF MASSING AND SPACING

by

PATRICIA JOANNE McHUGH

B. S., Kansas State University, 1960

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Psychology

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1962

This study was designed to investigate the differential effect of massed versus spaced-trial conditions on the stability and extinction of expectancies for reinforcement. In addition, the differential effect of high and low initial expectancies on subsequent decrements in expectancy following inter-trial intervals was explored.

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