POSITIVE TRANSFER AS A FUNCTION OF THE DEGREE OF 
INTER-LIST STIMULUS SIMILARITY AND INITIAL LIST 
LEARNING

by

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Abstract

The present study was designed to test the hypothesis that positive transfer is a function of the degree of inter-list stimulus similarity, and the degree of learning of an initial list. More specifically, the following hypotheses, derived from E. J. Gibson's theory of verbal learning, were tested:

1. Positive transfer is a function of inter-list stimulus similarity. A decrease of inter-list stimulus similarity will result in a decrease in the amount of positive transfer.

2. Less positive transfer will occur to a second list if practice of an initial list is continued after discrimination has been established among the stimulus items.

The effect of the interaction between inter-list stimulus similarity and the degree of initial list learning was also assessed. Since the status of Gibson's theory did not enable the deduction of a hypothesis, the null hypothesis was tested.

Sixty subjects learned an initial list of eleven stimulus forms paired with nonsense syllables of zero associative value. The subjects were required to learn each syllable so that they could spell it when the appropriate form was presented. Learning was by the method of right associates, and material was presented at the rate of two seconds per item, with a six second interval between trials. Thirty of the subjects learned this list to a criterion of one perfect recitation, and the other thirty subjects learned it to a criterion of five consecutive perfect recitations. When the criterion had been reached, the subjects were given a ten minute interval in which to rate a series of thirty jokes. The subjects were then assigned to three groups. Each group consisted of ten subjects who had learned the initial list to a criterion of one perfect recitation, and ten who had learned it to five consecutive perfect recitations. As a transfer task, each group received a different list of paired associates, whose stimulus members were of either medium, low or zero similarity to those of the initial list. Each group learned this task to a criterion of one perfect recitation.
The main findings and conclusions of the study were as follows:

1. Positive transfer is a function of the degree of inter-list stimulus similarity. Significantly less transfer occurs to a list of zero similarity than to a list of medium similarity or to one of low similarity. There is no significant difference between the amount of transfer to a list of medium similarity and the amount of transfer to one of low similarity. This indicates that the relationship between positive transfer and inter-list stimulus similarity is indirect, whereas Gibson's theory indicates that the relationship should be linear.

2. Increasing the degree of initial list learning from one perfect recitation to five consecutive perfect recitations does not significantly decrease the amount of positive transfer. This was considered to be an inadequate test of Gibson's hypothesis, because the criterion of one perfect recitation did not allow discrimination to be established among the items.

3. There is no interaction between inter-list stimulus similarity and the degree of initial list learning.
ACKNOWLEDGEMENT

The writer wishes to express her appreciation and thanks to her advisor, Dr. D. T. Kenny, for his encouragement and helpful suggestions. She wishes also to thank Mr. A. F. Shirran for his assistance in obtaining subjects for this study.
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1. Schematic Plan of a Three-Item List of Paired Associates, Showing Right Excitatory Tendencies and Generalized Excitatory Tendencies

2. Stimulus Forms, Response Syllables, and Percentages of Generalization to Original Presentation of Standard Forms

3. Number of Syllables Correct on First Recall Trial of List II as a Function of Inter-List Stimulus Similarity

4. Number of Trials to One Perfect Recitation of List II as a Function of Inter-List Stimulus Similarity.
CHAPTER I

STATEMENT OF THE PROBLEM

Transfer of training phenomena have, as well as practical significance, major implications for learning theory. E. J. Gibson's (4) theory of verbal learning is one of the important theories which has been proposed to explain and predict transfer phenomena. This theory attempts to explain transfer phenomena by applying principles and concepts from conditioning theory.

Gibson begins her analysis of paired associate learning by defining an excitatory tendency as "the tendency for a particular stimulus to evoke a particular response in a capacity greater than zero" (4 p. 205). Gibson distinguishes two kinds of excitatory tendencies: right excitatory tendencies, and generalized excitatory tendencies. Right excitatory tendencies, set up between the stimulus and response members of a pair, lead to correct responses. Generalized excitatory tendencies, set up between stimuli and responses other than members of a pair, are the result of generalization, or a lack of discrimination, between two stimulus items in a list. The strength of any generalized excitatory tendency is a function of the degree of generalization between the stimulus members involved. Since all stimuli within a list will not necessarily generalize to the same degree, generalizing tendencies may vary in strength. Figure I, a schematic plan of a list of paired associates, indicates the two kinds of tendencies. The effect of generalized excitatory tendencies will be determined by the relationship between the response members of the generalizing stimuli.
Figure 1. Schematic plan of a three-item list of paired associates, showing right excitatory tendencies (—→), and generalized excitatory tendencies (-----). (After Gibson, 4, p. 198.)
If a right excitatory tendency and a generalized one are evoked by the same stimulus, the resultant of the two tendencies will be stronger than either tendency alone. If the responses to two generalizing stimuli are the same, the right excitatory tendency and the generalized excitatory tendency will coincide. Thus, if \( S_a \) and \( S_b \) generalize and \( R_a \) and \( R_b \) are the same, \( S_a \rightarrow R_a \) and \( S_a \rightarrow R_b \) will coincide. The resultant of these two tendencies will be stronger than either \( S_a \rightarrow R_a \) or \( S_a \rightarrow R_b \) alone. Since the strength of \( S_a \rightarrow R_b \) is a function of the degree of the generalization between \( S_a \) and \( S_b \), learning will be easier in proportion to the degree of generalization between \( S_a \) and \( S_b \).

If the responses to two generalizing stimuli are different, the right excitatory tendency will be blocked by the generalized excitatory tendency, in proportion to the strength of the latter. Thus, if \( S_a \) and \( S_b \) generalize and \( R_a \) and \( R_b \) are different, \( S_a \rightarrow R_a \) will be blocked by \( S_a \rightarrow R_b \), in proportion to the strength of \( S_a \rightarrow R_b \). The greater the degree of generalization between \( S_a \) and \( S_b \), the stronger will be \( S_a \rightarrow R_b \), and the greater the blocking. Generalizing tendencies must be weakened in order that the correct response can occur. These can be weakened only by reinforcing correct responses. Gibson defines reinforcement as "a process which occurs during verbal learning when a subject sees a response as he had anticipated it, and thinks 'That's right' " (4, p. 205). The amount of reinforcement required to weaken any generalizing tendency will be a function of the strength of that particular generalizing tendency.

When a list of paired associates is presented for learning, there is an initial increase in the tendency for stimulus members to generalize with each other. Generalization reaches a peak early in learning. As
practice is continued, generalization progressively decreases until all the stimuli are discriminated from one another. Thereafter, these stimuli will tend to generalize less with new stimulus items, the decrease in generalization being proportional to the amount of differential reinforcement given.

So far this discussion has been concerned only with generalization between the members of one list. But Gibson states that if stimulus members generalize with each other when presented in the form of one list, they will do so, with the same relative degree of generalization, when presented in the form of two lists (4, p. 207).

Gibson states that positive transfer will occur when the stimuli of two lists generalize, if the nature of the discrimination established in the first list is beneficial to the second list. Thus, if each stimulus member of one list has a generalizing member with the same response in the second list, learning will be facilitated. The greater the degree of generalization between the stimulus members of the two lists, the greater will be the positive transfer.

One of the conditions affecting generalization is similarity, which Gibson defines as, "a condition existing between stimulus members which causes them to generalize" (4, p. 208). Therefore, the greater the similarity between two stimuli, the greater will be their tendency to generalize with each other. It would be predicted that if the stimulus members of two lists are similar, and if similar members have the same response, then the greater the similarity between the stimulus members of the two lists, the greater will be the positive transfer.

The present study is an attempt to test this hypothesis. Three groups
of subjects learned the same initial list of paired associates. Then each group was given a different transfer task. One group learned a second list of paired associates whose stimulus members were of medium similarity to those of the initial list. The second group learned one whose stimulus members were of a low degree of similarity. The third group learned a list whose stimulus members were of zero similarity. It was predicted that there would be less positive transfer to a list of low or zero similarity than to one of medium similarity, and less to a list of zero than to one of low inter-list similarity.

Secondly, this study tests, with respect to positive transfer, the hypothesis that if practice of a list is continued after the stimulus members of the list have been discriminated from each other, they will generalize less with new stimuli. According to Gibson, less positive transfer should occur to a second list if practice of an initial list is continued after discrimination has been established among the stimulus items.

Although Gibson has not operationally defined when discrimination will be established, it appears to be at the point when right responses will be evoked by all the stimulus members of the list. Therefore, for the purpose of this study, when a subject has learned the list to one perfect recitation the point of discrimination has been reached. Consequently, when a subject has learned a list to five consecutive perfect recitations, the point of discrimination has been passed. Two groups of subjects learned the same initial list of paired associates. One group learned the list to one perfect recitation, the other learned it to five consecutive perfect recitations. The same transfer task was then given to both groups, who learned this list to one perfect recitation. It was predicted that less
positive transfer would occur when the list was learned to a criterion of five consecutive perfect recitations than if it were learned to one perfect recitation.

This experimental design also makes it possible to assess the significance of interaction between inter-list stimulus similarity and the degree of learning of the initial list. Since no prediction could be made from Gibson's theory, a null hypothesis was tested.
CHAPTER II

REVIEW OF RELATED RESEARCH

Inter-List Similarity Studies

The first experimental treatment of the hypothesis that positive transfer is a function of inter-list stimulus similarity was reported by Yum (11) in a series of three studies. In the first study, subjects were required to learn a list of hyphenated nonsense syllable stimuli (e.g. REB-QIM) paired with four-letter word responses (e.g. WOLF). As a transfer task, a second list, in which stimulus similarity was varied by changing one or more letters of the hyphenated syllables and varying the position of the changed letters, was presented. The degree of stimulus similarity, defined as the number of letters changed, did not significantly alter the amount of positive transfer. However, the locus or position of change proved significant. Changing the first or the middle letters of either syllable reduced transfer significantly, but changing the last letter of either syllable did not. Furthermore, changing the first letter of either syllable resulted in significantly less transfer than changing the middle letter of either syllable. In the second experiment of the series, two groups of subjects learned a list of paired associates with meaningful word stimulus and response members. As a transfer task, one group received a list with stimulus members quite similar in meaning to those of the initial list and the other group received one with stimulus members moderately similar (similarity of meaning had previously been determined by judges' ratings). There was significantly more transfer when similarity was greatest. In the third study, four groups of subjects learned a list consisting
of visual stimulus patterns paired with meaningful word responses. As a transfer task, each group received one of four lists, the stimulus members of each list judged to be of a different degree of similarity to those of the initial list. The results indicated that positive transfer was a function of inter-list stimulus similarity.

In his study, McKinney (9) used four geometric figures as stimuli, to which subjects responded with various letters of the alphabet. The amount of transfer, when stimulus figures were altered 10%, 20% or 30%, was tested. For example, one of the figures was a four centimetre line perpendicular to an eight centimetre line at its center, producing a figure which looked like a cross with one arm missing. A 10% alteration of this figure would be one with 10% taken off any arm, or $3 \frac{1}{3}$% taken off each arm simultaneously. Alterations of 20% and 30% were made in a similar manner. Percentage of transfer was found to decrease as a function of the degree of alteration, if the locus of alteration remained constant. However, the percentage of transfer was not proportional to the percentage of alteration. More transfer was obtained when the stimuli were altered symmetrically (i. e., when all the arms of the figure were reduced simultaneously) than when the stimuli were altered asymmetrically (i. e., when only one or two arms of the figure were reduced). McKinney's explanation was that the meaning or quality of a stimulus is changed when it is altered asymmetrically: since a stimulus is a function not only of its mass or quantity, but also of the manner in which that quantity is distributed.

Hamilton (6) studied both positive transfer and retroactive facilitation as a function of inter-list stimulus similarity. The stimulus figures used in this study were those standardized by Gibson (5). These materials
consisted of thirteen forms (the standard list), and three sets of variations of the standard list. In the first list the figures were of medium similarity; in the second, of low similarity; and in the third, of zero similarity. The thirteen figures of the standard list were paired with nonsense syllables, and presented for learning to five groups of subjects. When a criterion of $8/13$ correct responses had been reached, learning was discontinued. A four-minute rest period, during which the subjects read *Life* or *The New Yorker*, or talked to the experimenter, followed for four of the groups. A second task was introduced: the first group relearned the standard list, the second received the medium similarity list, the third received the low similarity list, and the fourth received the zero similarity list. Each group learned the second list to a criterion of $8/13$ correct responses in approximately sixteen minutes. The fifth group had a twenty minute rest period, during which they read *Life* or *The New Yorker*, or talked to the experimenter. Then all groups relearned the standard list to a criterion of one perfect recitation. A gradient of positive transfer as a function of inter-list stimulus similarity was obtained, but only the difference between the group receiving the medium similarity list and the zero similarity list was significant. The same gradient was obtained using retroaction measures, and again only the difference between the group receiving the medium similarity list and the group receiving the zero similarity list was significant.

Bugelski and Gadwallader (2) also used Gibson's (5) standardized stimulus figures in their study of transfer and retroaction effects. The thirteen figures of the standard list were paired with meaningful words, and presented for learning to four groups of subjects. The materials were
presented on cards, and an item was dropped from the pack when it had been correctly anticipated on two successive trials. When all the items had been learned to this criterion, all the groups were given a two minute rest period. A second task was then introduced: the first group received the medium similarity list, the second group received the low similarity list, and the third received the zero similarity list. The criterion of learning for this list was the same as for the initial list. The fourth group read *The New Yorker* for eight minutes. After a two minute rest period all groups were tested for recall of the standard list. Positive transfer increased as a function of inter-list stimulus similarity, but the only significant difference was that between the group receiving the medium similarity list and the one receiving the zero similarity list. Retroactive facilitation increased as a function of inter-list stimulus similarity.

**Studies of the Degree of Initial Task Learning**

Atwater (1) used a verbal learning situation to study positive transfer as a function of the degree of initial task learning. Four groups of subjects learned a list of ten paired associates, consisting of three-letter words as stimulus and response members. The degrees of learning for the four groups were: no learning, six correct responses, one perfect recitation plus five trials, and one perfect recitation plus fifteen trials. The four groups were given the same transfer task, that of learning the responses of the initial list to new stimuli. All groups learned
this list to a criterion of one perfect recitation plus five trials. Positive transfer was a function of the degree of initial task learning, and all differences in the amount of transfer among the four degrees of learning were significant.

In his study, Mandler (7) used a switchboard apparatus which had six switches arranged in a hexagon. Five groups of subjects responded to each of four letters of the alphabet by operating the correct sequence of three switches on this switchboard. The groups were given 0, 10, 30, 50, or 100 errorless trials. After the criterion had been reached, there was a three minute rest period. The same transfer task, learning the responses of the initial task to new stimuli, was then given to all groups. All groups learned this task to a criterion of two successive, errorless repetitions or twenty trials, whichever occurred last. Positive transfer was a function of the degree of initial task learning, but only the difference between the group which had no learning and the one given 100 errorless trials was significant.

In an attempt to determine the generality of Mandler's (7) findings for motor behavior, Mandler and Heinemann (8) have conducted a comparable study using verbal materials. In this study the procedure was the same as for Mandler's (7) study, except that the materials used were single integer numbers as stimuli, paired with three-place consonant nonsense syllables. Positive transfer increased as a function of the degree of initial task learning. There was no significant difference in the amount of positive transfer with 0, 10, or 30 errorless trials, but with 50 errorless trials there was a significant increase of positive transfer. With
100 errorless trials there was significantly more transfer than with 50 trials. A much greater increment in the number of trials was required to produce a significant increase in the amount of positive transfer when motor learning was involved than when verbal materials were used. College students were the subjects for both studies, and the differences between the results of the two studies were explained in terms of the subjects used. College students are more adept at recombining units of verbal behavior than those of motor tasks.

Studies Investigating Inter-Task Stimulus Similarity and Degree of Initial Task Learning and Interaction Between Them

The only available study of positive transfer as a function of both inter-task stimulus similarity and the degree of initial task learning is that of Duncan (3). He used an apparatus consisting of six slots arranged radially on a panel. While holding a lever steady with his left hand, each subject responded to each of six colored light stimuli by moving, with his right hand, a driver into the correct slot. The subjects were given 10, 40, 80 or 180 trials of this task. Then the subjects were given one of three transfer tasks, each of a different degree of stimulus similarity. In the most similar task, four light-slot combinations remained the same as for the first task; in a less similar task, only two light-slot combinations remained the same; in the least similar task, all the lights were paired with different slots. Transfer was positive for all groups, and was a function of both the degree of inter-task stimulus similarity and the degree of initial task learning. He
found no interaction between inter-task stimulus similarity and the degree of initial task learning.

Summary of Related Research

Available data lend support to the hypothesis that positive transfer is a function of inter-task stimulus similarity. The hypothesis that positive transfer decreases with a high degree of learning of the initial task is not supported. Positive transfer has been found to increase with high degrees of initial task learning. No available study indicates interaction between inter-task stimulus similarity and the degree of initial task learning.
CHAPTER III

EXPERIMENTAL MATERIALS, SUBJECTS AND PROCEDURE

Experimental Materials

The stimulus materials used in this study are those which were standardized by E. J. Gibson (5) for use in her study of retroactive inhibition as a function of the degree of generalization between tasks. Gibson drew thirteen standard forms and a number of variations of each of them. These forms were given to a group of ten judges, who were asked to select, for each standard form, the variation which was most similar to the standard, one which was less similar, and one which was dissimilar. This procedure gave four sets of forms: thirteen standard forms, thirteen variations of medium similarity, thirteen variations of low similarity, and thirteen dissimilar variations.

A list composed of the thirteen standard forms, each paired with a different nonsense syllable, was given to a group of subjects to learn by the paired associates method. Twenty-four hours later, the subjects were given one of several recall lists. Each of these lists was composed of four standard forms, three variations of medium similarity, three variations of low similarity, and three variations of no similarity, so that, in each list, each standard form was represented by the standard form or by a variation. Gibson calculated an objective measure of generalization for each standard form and variation by determining the percentage of subjects who responded to each form by giving the response with which the standard form was paired in the first list. In only two
instances was there disagreement between the objective and subjective ratings. The judges had rated one variation as being of low similarity and another as being of zero similarity. Objective measures showed a reversal of these ratings.

When the lists were arranged in agreement with the objective ratings, the result was four lists of thirteen figures each: the standard list, with an average of 84.5% generalization to their original presentation; the medium similarity list, with an average of 41.1% generalization to the original presentation of the standard forms; the low similarity list, with an average of 9.7% generalization to the original presentation of the standard forms; and the zero similarity list, which generalized 0% with the original presentation of the standard forms.

In the present study only eleven of the thirteen forms are used. Variations of two of the standard forms in both the low and the zero similarity lists yielded measures of zero generalization. Otherwise, Gibson's four lists were used without further alteration. To each of the eleven standard forms a nonsense syllable of zero associative value, drawn from Glaze's (10) calibrated lists of nonsense syllables, was assigned. The same nonsense syllable was assigned to a form and all its variations.

To reduce response generalization, two conditions were imposed upon the selection of the syllables: no two syllables may begin with the same letter, and no two syllables may end with the same letter. Figure 2 shows the eleven forms with their respective variations, nonsense syllable names, and the percentages of generalization as determined by Gibson.

Twenty-four random orders of the standard forms were used in the
original learning and recall situations. Each list was constructed by
drawing, with India ink on a sheet of drawing paper, the thirteen stand-
ard forms, one below the other. Each stimulus figure was \( \frac{3}{4}'' \times \frac{3}{4}'' \). The
respective nonsense syllable names were typed in capital letters to the
right of each stimulus form. The recall orders were constructed in the
same way, except that blank spaces were substituted for response names.
Since subjects were to learn the standard list by the method of right
associates, the material was mounted on a memory drum so that a learning
order was always followed by a recall order. A blank space was left be-
 tween each order so that no material was visible when the memory drum was
stopped between trials. The memory drum was regulated to allow an ex-
posure time of two seconds per item. Material for the transfer task was
prepared and mounted in the same manner.

A series of thirty jokes, which the subjects were instructed to rate
on a five-point humour rating scale, was prepared for use as an interpo-
lated activity during the ten minutes after the completion of the learning
of the standard list. This activity was introduced to enable the experi-
menter to arrange the materials for the transfer task, and to reduce the
subject's fatigue. This material will be found in Appendix A.

Subjects

The sixty subjects were volunteers from a class in Introductory Psy-
chology and from a class in Psychological Testing at the University of
British Columbia. Subjects, if they were unable to learn the initial
list in the allotted time of one hour, were eliminated.
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<td>Forms</td>
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<td>LAJ</td>
<td>93%</td>
<td>80%</td>
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Average Generalization: 85.7% 44.2% 11.0% 0%

Figure 2. Stimulus forms, response syllables, and percentages of generalization to original presentation of standard forms.
Procedure

Table I outlines the six experimental conditions used in this study. Ten subjects were randomly assigned to each of the six conditions. Learning was by the method of right associates.

At the beginning of the experimental period, the subject was seated in front of the memory drum and given the following instructions:

"You will be shown a group of forms. Each form is paired with a nonsense syllable. The pairs will appear in this slot, one pair at a time. After the list has been shown to you, you will be shown the forms by themselves, one at a time, to see if you remember the nonsense syllable name. If you do remember the name, spell out the letters. For example, a form might be something like a triangle, and its name, Y-U-M. Then you will be shown all the pairs again, then another test to see if you remember the names, and so on, until you know all the names. Even if you have spelled the name out on one trial, you must continue to say it on all successive trials. Do not learn the pairs in any particular order because the order will be changed every time. The point is to associate a particular nonsense syllable with the form with which it always appears. Are there any questions?"

The standard list (List I) was then given to each subject. Each item was exposed for two seconds; there was a six second interval between trials. When the criterion, either one perfect recitation or five consecutive perfect recitations, had been reached, the subject was told:

"Good. Now I would like you to come over here, and sit down at the table. I have a series of jokes for you to rate. Read these instructions, and then begin rating the jokes, according to the instructions."

Ten minutes was allowed for this activity. During this time, the experimenter arranged the materials for the transfer task. Then the subject was told:

"You may leave that now, and finish it later. I have another list of forms paired with nonsense syllables for you to learn. The procedure will be exactly the same as for the first list."
**TABLE I**

EXPERIMENTAL CONDITIONS

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<thead>
<tr>
<th>Condition</th>
<th>Number of Perfect Recitations of Standard List I</th>
<th>Degree of Generalization of List II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>One</td>
<td>Medium</td>
</tr>
<tr>
<td>B</td>
<td>One</td>
<td>Low</td>
</tr>
<tr>
<td>C</td>
<td>One</td>
<td>Zero</td>
</tr>
<tr>
<td>D</td>
<td>Five consecutive</td>
<td>Medium</td>
</tr>
<tr>
<td>E</td>
<td>Five consecutive</td>
<td>Low</td>
</tr>
<tr>
<td>F</td>
<td>Five consecutive</td>
<td>Zero</td>
</tr>
</tbody>
</table>
The transfer task was then introduced. The subject received List II, which was either the medium, low or zero similarity list, depending upon the condition to which the subject had been assigned. The procedure was exactly the same as for the learning of the first list, except that each subject learned this task to a criterion of one perfect recitation. This completed the experiment proper, and the subject was not required to return to the interpolated activity.
CHAPTER IV

THE DATA AND THEIR TREATMENT

Before one can determine the effect of the experimental variables on positive transfer, it is necessary to determine what effect, if any, initial differences among the six groups had upon the results. Since all the various groups learned the same initial list, List I, to at least one perfect recitation, the learning equality of the groups before the experimental variables were introduced can be determined. Comparison of the number of trials required by each group to reach this criterion was made, using the analysis of variance technique. The means and standard deviations of these measures are given in Appendix B, Table I. The analysis of variance is given in Table II. The F value of 1.22 was not significant at the 5% level, which indicates that the six groups were members of a common population. Therefore, any differences obtained among the six groups on the transfer-task (List II) should be attributable to the experimental variables introduced beyond the point of one perfect recitation of List I.

The analysis of variance technique was used to assess the significance of differences in positive transfer as a function of the experimental variables. The number of syllables correct on the first recall trial of List II was used as a measure of transfer. The means and standard deviations are given in Appendix B, Table II. The analysis of variance is given in Table III. The F value of 34.05, obtained for the degree of inter-list stimulus similarity, was greater than the value of 5.01 required for significance at the 1% level. The F value of 0.32, obtained for the
TABLE II

ANALYSIS OF VARIANCE OF SCORES ON LEARNING OF LIST I TO A CRITERION OF ONE PERFECT RECITATION

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>Sums of Squares</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>5</td>
<td>583.73</td>
<td>116.74</td>
<td>1.22</td>
</tr>
<tr>
<td>Within Groups</td>
<td>54</td>
<td>5142.00</td>
<td>95.22</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td>5725.73</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE III

**ANALYSIS OF VARIANCE OF NUMBER OF SYLLABLES CORRECT ON FIRST RECALL TRIAL OF LIST II WITH THREE DEGREES OF SIMILARITY AND TWO DEGREES OF LIST I LEARNING**

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>Sums of Squares</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similarity</td>
<td>2</td>
<td>284.63</td>
<td>142.31</td>
<td>34.05*</td>
</tr>
<tr>
<td>Learning</td>
<td>1</td>
<td>1.35</td>
<td>1.35</td>
<td>0.32</td>
</tr>
<tr>
<td>Interaction</td>
<td>2</td>
<td>11.10</td>
<td>5.55</td>
<td>1.33</td>
</tr>
<tr>
<td>Error</td>
<td>54</td>
<td>225.50</td>
<td>4.18</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td>522.58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at the .01 level.
degree of learning of List I, was less than the value of 4.02 required for significance at the 5% level. The F value of 1.33, obtained for interaction between inter-list stimulus similarity and the degree of learning of List I, was less than the value of 3.17 required for significance at the 5% level. Thus, the degree of inter-list stimulus similarity was the only variable significantly influencing the amount of positive transfer.

Since the degree of learning of List I was not a significant variable influencing positive transfer, the data were regrouped according to the three degrees of inter-list stimulus similarity. T-tests were made between them to determine the location of significant differences. Table IV gives the means and standard deviations of the three levels of similarity and their statistical treatment. The differences between the low and the zero degrees of similarity, and between the medium and zero degrees of similarity, were significant at the 1% level. The difference between the medium and the low degrees of similarity was not significant at the 5% level. Figure 3 shows the number of syllables correct on the first recall trial of List II as a function of the degree of inter-list stimulus similarity. This graph indicates that positive transfer is a function of inter-list stimulus similarity.

A second measure of positive transfer, the number of trials to reach a criterion of one perfect recitation of List II, was also used. The means and standard deviations for this measure are given in Table III of Appendix B, and the analysis of variance in Table V. The F value of 6.97, obtained for the degree of inter-list stimulus similarity, was significant at the 1% level. The F value of 2.11, obtained for the degree of learning of List I, was not significant at the 5% level. The F value of 0.27, obtained for interaction between the degree of inter-list stimulus similarity and learn-
### TABLE IV

**COMPARISON OF FIRST RECALL TRIAL OF LIST II FOR THREE DEGREES OF SIMILARITY**

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Degree of Similarity</th>
<th>Differences Between Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Mean</td>
<td>8.20</td>
<td>7.70</td>
</tr>
<tr>
<td>S. D.</td>
<td>1.21</td>
<td>2.53</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Differences significant at the .01 level.
Figure 3. Number of syllables correct on first recall trial of List II as a function of inter-list stimulus similarity.
ing of List I, was not significant at the 5% level. These results agree with those obtained when the number of syllables correct on the first recall trial of List II was used as a measure of transfer: the degree of inter-list stimulus similarity was the only variable significantly influencing positive transfer.

The data were regrouped according to the three degrees of inter-list stimulus similarity, since the degree of learning of List I was not significant. T-tests were made between them to determine the location of significant differences. The means and standard deviations for this measure, and their statistical treatment, are given in Table VI. The differences between the low and the zero degrees of similarity, and between the medium and the zero degrees of similarity, were significant at the 1% level. The difference between the low and the medium degrees of similarity was not significant at the 5% level. These results agree with those obtained when the number of syllables correct on the first recall trial of List II was used as a measure of transfer. Figure 4 shows the number of trials required to reach a criterion of one perfect recitation of List II as a function of the degree of inter-list stimulus similarity. This graph shows a trend similar to Figure 3, indicating that positive transfer is a function of inter-list stimulus similarity.
TABLE V

ANALYSIS OF VARIANCE OF TRIALS TO REACH CRITERION OF ONE PERFECT RECITATION OF LIST II WITH THREE DEGREES OF SIMILARITY AND TWO DEGREES OF LIST I LEARNING

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>Sums of Squares</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Similarity</td>
<td>2</td>
<td>185.03</td>
<td>92.52</td>
<td>6.97*</td>
</tr>
<tr>
<td>Learning</td>
<td>1</td>
<td>28.01</td>
<td>28.01</td>
<td>2.11</td>
</tr>
<tr>
<td>Interaction</td>
<td>2</td>
<td>7.04</td>
<td>3.52</td>
<td>0.27</td>
</tr>
<tr>
<td>Error</td>
<td>54</td>
<td>716.10</td>
<td>13.26</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td>936.18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at the .01 level.
### TABLE VI

**COMPARISON OF TRIALS TO ONE PERFECT RECITATION OF LIST II**  
**FOR THREE DEGREES OF SIMILARITY**

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Degree of Similarity</th>
<th>Differences Between Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Mean</td>
<td>4.80</td>
<td>4.30</td>
</tr>
<tr>
<td>S. D.</td>
<td>2.64</td>
<td>3.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Differences significant at the .01 level.
Figure 4. Number of trials to one perfect recitation of List II as a function of inter-list stimulus similarity.
CHAPTER V
DISCUSSION OF RESULTS

The results support the initial hypothesis, derived from Gibson’s theory, that positive transfer is a function of inter-list stimulus similarity. Further analysis of the data indicates significantly less positive transfer to a list of zero inter-list stimulus similarity than to one of medium or low inter-list stimulus similarity. However, there is no significant difference between the amounts of positive transfer to a list of medium inter-list stimulus similarity and to one of low inter-list stimulus similarity.

These results are illustrated graphically in Figures 3 and 4. At first glance, these two curves may be thought to indicate that the two transfer measures have given different results. When transfer is measured by the number of syllables correct on the first recall trial of the transfer task, there is less transfer to a list of low than to a list of medium inter-list stimulus similarity. When positive transfer is measured by the number of trials required to reach a criterion of one perfect recitation of the transfer task, there is more transfer to a list of low than to a list of medium inter-list stimulus similarity. Since the difference between positive transfer to a list of medium and to a list of low inter-list stimulus similarity was not significant, this conclusion is not valid.

If the relationship between positive transfer and inter-list stimulus similarity be linear, a certain degree of reduction in inter-list stimulus similarity should result in a proportional decrease in the amount of positive transfer. The average degrees of inter-list stimulus similarity in
the present study are 44.2% for medium similarity, 11.0% for low similarity, and 0% for zero similarity. The difference in inter-list stimulus similarity between the medium and low degrees of similarity is greater than that between the low and zero ones. The difference in positive transfer between the low and zero degrees of similarity is significant, whereas the difference between the medium and low degrees is not. This indicates that the relationship between positive transfer and inter-list stimulus similarity is not linear, as Gibson's theory would indicate.

The studies most closely related to the present one are those of Hamilton (6) and Bugelski and Cadwallader (2), because Gibson's standardized stimulus forms were used in both of these studies. They also found that positive transfer was a function of the degree of inter-list stimulus similarity. Hamilton and Bugelski and Cadwallader obtained significant differences in positive transfer only between the medium and the zero degrees of inter-list stimulus similarity, whereas in the present study significant differences were obtained also between the low and zero similarity degrees. This discrepancy might have resulted from their use of the two standard forms, which, in the present study, were discarded because their variations yielded the same degrees of generalization, 0%, in both the low and the zero similarity categories. This would tend to minimize the differences in transfer between the low and the zero degrees of similarity.

Yum (11) concluded from his three studies that positive transfer was a function of inter-list stimulus similarity. Using hyphenated nonsense syllables as stimuli, he found that the number of letters changed did not significantly affect positive transfer, but the position of changed letters did. Using meaningful words as stimuli, Yum obtained significant differ-
ences in positive transfer between lists of high and medium degrees of similarity. Using visual patterns as stimuli, he obtained decreasing positive transfer with decreasing degrees of inter-list stimulus similarity. He did not report if the decreases were significant.

McKinney (9) used geometric figures as stimuli, and measured positive transfer when the stimuli were altered 10%, 20% and 30%. Positive transfer decreased as a function of the degree of alteration, but a given degree of reduction of inter-list stimulus similarity did not result in a proportional decrease in the amount of positive transfer.

There is one serious criticism which could be made of the forms standardized by Gibson and used in the present study. Gibson's percentages of generalization, shown in Figure 2, lack uniformity within and between categories. The zero similarity category is the only one which does not overlap with other categories. In some cases, the percentage of generalization between the medium similarity category and the original presentation of the standard figures is higher than the percentage of generalization between the standard figures and their original presentation. This discrepancy is present also between some of the variations in the low similarity category and the medium similarity category. The inconsistencies result from assigning each variation to a category because of its relation to its standard form, without considering the range of generalization represented in that category. A category of generalization, so that it does not overlap with the next category, should contain forms of a certain range of generalization. Using such forms, it should be possible to specify more exactly the relationship between positive transfer and inter-list stimulus similarity.
The hypothesis that positive transfer will decrease if the practice of an initial list is continued after members have been discriminated from each other was not supported by the data of the present study. There was no significant difference in the amount of positive transfer when List I was learned to one perfect recitation (defined as discrimination) or to five consecutive perfect recitations (defined as practice continued after discrimination was established). However, the design cannot be considered an adequate test of the hypothesis. A criterion of one perfect recitation does not appear to have allowed discrimination to be established among the items, since twenty-two of the thirty subjects who continued to the higher criterion reverted to incorrect responses after learning the list to one perfect recitation.

It is possible that there was no significant difference in positive transfer because the two criteria of learning might represent two comparable qualitative points, one on the ascending and the other on the descending portions of the same curve. Positive transfer will continue to increase after one perfect recitation of List I because discrimination has not been established among the stimulus items. When five consecutive perfect recitations has been reached, surely practice has been carried past discrimination, so that positive transfer would be decreasing.

The results of other experiments, however, suggest a more probable explanation. Atwater (1), Mandler (7), Mandler and Heinemann (8) and Duncan (3) have shown that positive transfer is a function of the degree of learning of the initial task. Moreover, their data show that positive transfer continues to increase when practice of the initial task is carried to very high degrees, when learning obviously has been continued far beyond
discrimination. These results have been obtained in both motor learning and verbal learning situations. Hence, the non-significant differences obtained in the present study probably result from using criterion measures which are not sufficiently different to yield significant differences in positive transfer.

The hypothesis that positive transfer decreases if the initial list is learned to a high degree is derived from Gibson's postulate that once stimulus members have been discriminated from each other, they will tend to generalize less with new stimulus items. The decrease in generalization will be proportional to the amount of differential reinforcement given. Existing data indicate that this postulate may be invalid, or, at least, may require further qualification with respect to positive transfer.

The hypothesis that there would be no interaction between inter-list stimulus similarity and the degree of learning of the initial list was supported by the data of the present study and that of Duncan (3). The null hypothesis was tested because it was not possible to derive one from Gibson's theory. Consequently, the results are not a test of the adequacy of Gibson's theory.
CHAPTER VI

SUMMARY AND CONCLUSIONS

The present study was designed to test positive transfer as a function of two variables: the degree of inter-list stimulus similarity, and the degree of learning of an initial list. The following hypotheses, derived from E. J. Gibson's theory of verbal learning, were tested.

1. Positive transfer is a function of inter-list stimulus similarity. A decrease of inter-list stimulus similarity will result in a decrease in the amount of positive transfer.

2. Less positive transfer will occur to a second list if practice of an initial list is continued after discrimination has been established among the stimulus items.

The effect of the interaction between inter-list stimulus similarity and the degree of initial list learning was also assessed. Since the status of Gibson's theory did not enable the deduction of an experimental hypothesis, a null hypothesis was tested.

Sixty subjects learned an initial list of eleven stimulus forms, each paired with a nonsense syllable response of zero associative value. The subjects were required to learn each syllable so that they could spell it when the appropriate form was presented. The subjects were tested individually. Learning was by the method of right associates. A memory drum apparatus was used to present materials at the rate of two seconds per item, with a six second interval between trials. Thirty of the subjects learned this list to a criterion of one perfect recitation, and the other thirty learned the list to a criterion of five consecutive perfect reci-
tations. When the criterion had been reached, the subjects were given a 
ten minute interval in which to rate a series of thirty jokes. The subjects 
were then assigned to three groups. Each group consisted of ten subjects 
who had learned the initial list to a criterion of one perfect recitation, 
and ten subjects who had learned it to five consecutive perfect recita-
tions. As a transfer task, each group received a different list of paired 
associates, whose stimulus members were of either medium, low or zero 
similarity to those of the initial list. Each group learned this task to 
a criterion of one perfect recitation.

The main findings and conclusions of the study were as follows:

1. Positive transfer is a function of the degree of inter-list stimu-
lus similarity. Significantly less transfer occurs to a list of zero 
similarity than to a list of medium similarity or to one of low similarity. 
There is no significant difference between the amount of transfer to a list 
of medium similarity and the amount of transfer to one of low similarity. 
A reduction in inter-list stimulus similarity does not result in a propor-
tional decrease in the amount of positive transfer.

2. Increasing the degree of initial list learning from one perfect 
recitation to five consecutive perfect recitations does not significantly 
decrease the amount of positive transfer.

3. There is no interaction between inter-list stimulus similarity and 
the degree of initial list learning.

Other investigators have also obtained results indicating that positive 
transfer is a function of the degree of inter-list stimulus similarity. 
The results of the present study and that of McKinney suggest that the re-
relationship is indirect, whereas Gibson's theory indicates that the relation-
ship is linear. The present study of the degree of initial list learning was considered to be an inadequate test of Gibson's hypothesis, because the criterion of one perfect recitation did not allow discrimination to be established among the items. Contrary to Gibson's hypothesis, the results of other studies indicate increasing positive transfer with high degrees of initial task learning. Interaction between inter-list stimulus similarity and the degree of initial task learning has also been found by another investigator to be a non-significant factor in positive transfer.
REFERENCES


APPENDIX A

THE SET OF JOKES AND RATING SCALE
Remember there are no right or wrong ratings. Before making your ratings, be sure to follow the directions carefully.

Rate each one on the answer sheet. Do NOT make any marks on the Joke Schedule.

1. Friend: "Isn't there anything you would like to say, Sam, before they pull the rope?"
   Sam (with head in noose): "Jes' tell the judge maybe he done a good thing after all. This is gonna be a mighty good lesson to me."

2. A young starlet asked a studio still photographer for one of her pictures.
   Photographer: "Would you like it mounted?"
   Starlet: "Oh, that would be wonderful. I look so much better on a horse."

3. A young lady with a baby in her arms slipped up to the perfume counter and carefully surveyed the display which included "My Sin", "Tabu" and "Surrender." Quietly she asked the salesgirl, "Would you care to have a testimonial?"

4. Lady: "Colonel, do you remember the time you proposed to me and I refused you?"
   Colonel: "Madam, it is the one moment of my life that I remember with greatest pleasure."

5. Friend: "Did you make the debating team?"
   Bill: "N-n-n-no. They s-s-said I wasn't t-t-tall enough."

6. A doctor leaving the sick-bed of a wife, whose husband accompanied him, exclaimed doubtfully: "I do not like her looks."
   Husband: "I have not liked her looks for a long time."

7. After a visit to an old friend in the hospital, Irving took the patient's very lovely nurse aside and asked: "Give me the real lowdown nurse. Is he making progress?"
   Replied the nurse: "None at all. He's not my type."

8. Landlady (to student looking for room): "A professor of chemistry formerly occupied this room sir. He invented an explosive."
   Student: "I suppose those spots on the ceiling are the explosive?"
   Landlady: "No, they're the professor."
9. A gentleman had shown much ingenuity in evading a notorious borrower whom he had sent away many times with the request to call when he was "in." One day, however, the borrower eluded the servant at the door and cornered his victim. "Ah," said the host, seeing that there was no way out of it, "at last I am in." "No," returned the borrower in anticipation, "at last I am in and you are out."

10. A blackbird asked the stork how he enjoyed his vacation. The long-legged one answered: "I had a fine time. I rested, except for scaring hell out of a couple of chorus girls."

11. A friend noticed remnants of food on the beard of another. "I can tell you what you ate yesterday," he remarked. "Well, let's hear it," said the other. "Beans," said the first one. "You are wrong," responded the other, and added "I had beans the day before yesterday."

12. A child at the beach pleaded, "Please, Mommy, may I go in the water?"
Mother: "Oh, no, honey, - it's too deep."
Child: "But Daddy is out there in the water."
Mother: "Yes, but he's big and strong - and he's insured."

13. Quiz master to contestant: "What animal is second in intelligence to man?"
Contestant: "Woman."

14. A man ambled into a tennis tournament and sat down on a bench. He asked: "Whose game?"
A shy young thing sitting next to him looked up hopefully.
She replied: "I am."

15. A horse-dealer, in recommending a saddle horse to his client, said: "If you mount this horse at four o'clock in the morning, you will be in Seattle at seven-thirty in the morning."
Asked the client: "What will I do in Seattle at seven-thirty in the morning?"

16. A little boy was crying on the curb and an old man passing by asked the little fellow why he was crying. The little one said: "I can't do what the big boys do." So the old man sat down on the curb and cried too.

17. Actress to room clerk: "Can you give me a room and bath?"
Clerk: "I can give you a room, but you'll have to take your own bath."
18. A girl asked another one what you could do to make her apartment prettier. The frank advice was: "Stay out of it."

19. Woman speaking to her psychiatrist: "I wish you'd see my husband. He blows smoke rings through his nose — it frightens me."
Psychiatrist: "I don't know that it's so terribly unusual for someone to blow smoke rings through his nose."
Woman: "But my husband doesn't smoke."

20. An elderly man patted his friend on the back one day at a bar and said: "You're a good egg, let's have a drink."
You see, my doctor is permitting me to drink sherry with an egg."

21. A baker said to a tavern keeper, one of whose fingers was festering: "I guess your finger got into your beer."
Tavern keeper: "You are wrong. One of your rolls got under my finger nail."

22. On being introduced to his blind-date, Robert was rather unpleasantly surprised, and drawing aside his friend, he reproachfully whispered to him: "Why have you fixed me up with this? She is ugly and old. She squints, has bad teeth and bleary eyes."
The so-called friend: "You can talk louder. She is deaf, too."

23. Co-Ed: "I'd like to see the captain of this ship."
Sailor: "He's forward, Miss."
Co-Ed: "That's all right. This is a pleasure trip."

24. A well-known university teacher who was wont to spice richly with jokes his rather dry specialty, was once congratulated upon the birth of his youngest son, who was bestowed upon him at a rather advanced age.
Said he to his well wishers: "Yes, it is remarkable what mortal hands can accomplish."

25. The chairman rapped for order while the restless crowd suffered a long-winded after dinner speaker. A man who sat very near the chairman was hit on the head by the gavel. He muttered: "Hit me again. I can still hear him."
26. A wealthy but elderly gentleman was showing his devotion to a young actress by giving her many lavish gifts. Being a respectable girl, she took the first opportunity to discourage his attentions by telling him that her heart was already given to another man. His polite answer was: "I never aspired as high as that."

27. In his distress, a needy man borrowed 25 dollars from a wealthy acquaintance. The same day, he was discovered by his creditor in a restaurant eating a dish of salmon with mayonnaise. The creditor reproached him in these words: "You borrow money from me and then order salmon with mayonnaise. Is that what you needed the money for?" Responded the debtor: "I don't understand you. When I have no money, I can't eat salmon with mayonnaise. When I have money, I mustn't eat it. Then, when shall I ever eat salmon with mayonnaise?"

28. The legend is told that in the days of ancient Rome an officer called to the wars locked his beautiful young wife in armor and gave the key to his best friend, using the admonition: "If I don't return in six months, use this key. To you my dear friend, I entrust it." He then galloped off to the wars. Ten miles away from his home, he saw a cloud of dust approaching and waited. His friend, on horseback, galloped saying, "You gave me the wrong key."

29. Friend: "Frank, I hate to tell you, but last night at the party, your sister promised to become my wife. Can you forgive me for taking her away?"
Frank: "Shucks, that's what the party was for."

30. A man who was addicted to drink supported himself in a small city by private teaching. His vice gradually became known and he lost most of his pupils in consequence. A friend of his took it upon himself to admonish him to reform. "Look here," said the friend, "you could have the best pupils in town if you would give up drinking. Why not do it?" The indignant reply was: "What are you talking about? I am teaching in order to be able to drink. Shall I give up drinking in order to get pupils?"
The purpose of this research is to study a new technique for the psychological scaling of jokes as to the degree of humour expressed in them.

You are given 30 jokes which represent widely different varieties. You may think some are funny, or you may think some are disagreeable, and perhaps, you may feel that some are neither funny or disagreeable. Whether you think a joke is funny or disagreeable, others are sure to agree with you. There are no right or wrong ratings for the jokes.

You are to read each joke and evaluate how funny or disagreeable it is to you. Please rate each joke on the following scale:

- **Very Funny**: If you think it is very funny, put three crosses after its number on the answer sheet - like this +++
- **Funny**: If you think it is funny on the whole, put two crosses after its number on the answer sheet - like this ++
- **Slightly Funny**: If you think it is slightly funny, put one cross after its number on the answer sheet - like this +
- **Neutral**: If you think it is not at all funny, i.e., neither amusing or disagreeable, put a zero after its number on the answer sheet - like this 0
- **Slightly Disagreeable**: If you think it is slightly disagreeable, put a minus sign after its number on the answer sheet - like this -
- **Disagreeable**: If you think it is disagreeable on the whole, put two minus signs after its number on the answer sheet - like this --
- **Very Disagreeable**: If you think it is very disagreeable, put three minus signs after its number on the answer sheet - like this ---

Be sure not to omit any joke.

**WORK FAST.** Do not stop to meditate, give your first reaction each time.
PSYCHOLOGICAL SCALING OF JOKES

For your convenience, remember to use the following code:

+++ Very Funny
++ Funny
+ Slightly Funny
0 Neutral
- Slightly Disagreeable
-- Disagreeable
--- Very Disagreeable

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Personal Details

It would be appreciated if you could fill in the following details.

31 Age__________
32 Sex__________
33 Year in University__________
APPENDIX B

MEANS AND STANDARD DEVIATIONS OF CRITERION MEASURES
FOR LIST I AND LIST II
### TABLE I

MEANS AND STANDARD DEVIATIONS ON LEARNING OF LIST I
TO A CRITERION OF ONE PERFECT RECITATION

<table>
<thead>
<tr>
<th>CONDITIONS</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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<td>25.70</td>
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TABLE II

MEANS AND STANDARD DEVIATIONS OF NUMBER OF SYLLABLES CORRECT ON FIRST RECALL TRIAL OF LIST II WITH THREE LEVELS OF SIMILARITY AND TWO DEGREES OF LIST I LEARNING

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TABLE III

MEANS AND STANDARD DEVIATIONS OF TRIALS TO REACH CRITERION OF ONE PERFECT RECITATION OF LIST II WITH THREE LEVELS OF SIMILARITY AND TWO DEGREES OF LIST I LEARNING

<table>
<thead>
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