

THE INFLUENCE OF A PERIOD OF 'INCIDENTAL' LEARNING
UPON SUBSEQUENT LEARNING WITH INTENTION

by

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THE INFLUENCE OF A PERIOD OF 'INCIDENTAL' LEARNING UPON SUBSEQUENT LEARNING WITH INTENTION

INTRODUCTION

Purpose of the Study

Both without and within the formal educational institution a great part of the average person's living experiences are directed in channels other than conscious attempts to gain information. Many of such experiences make use of information which was not consciously or intentionally learned.¹ For example, many items of information may be learned through the reading of novels but it cannot be said that it is always the reader's intention to learn this information. Similarly it may be said that individuals do not always consciously set about learning all of their emotional and attitudinal responses. That such learning² does result incidentally in other than

1. Learning may be defined here as the formation of an association, the formation of patterns of association, or the reconstruction of patterns of associations.

2. Learning which takes place during activities

conscious learning activities has been shown experimentally, as will be demonstrated in the historical section of this study. Moreover, a given period of such 'incidental' learning has been demonstrated experimentally to be less effective than an equal period of learning in which the intent to learn was present.¹ Since it is easily conceivable that a given situation may be first met under conditions that do not call for intended learning and later under conditions that demand conscious learning activity, it becomes important to know what influence such an initial period exerts upon subsequent intentional learning.

It is the purpose of this study to seek the answer to the question of the influence of a period of 'incidental' learning upon subsequent intentional learning in a series of experimental situations where the materials to be learned consist of meaningless syllables, simple words, complex words, and simple puzzles. The materials to be learned were selected so as to fall into two classifications: (1) memoritor or rote

characterized by the absence of the intention to learn is known as 'incidental' learning. The term 'incidental' was first used in connection with memory to designate that information which was remembered without intention on the part of the individual. Its adaption to describe a learning phenomenon is perhaps poor, 'unintentional' learning being a more truly descriptive phrase.

1. See page 3.

type learning, and (2) learning by problem solving.

Historical Development

A large amount of material has been published in regard to 'incidental' learning of which a minimum sampling serves adequately in the presentation of this study.

Wallace (12) presented a questionnaire to students ranging from the fourth grade to the second year of normal school who had attended a pre-holiday assembly program. The returns from the questionnaire showed that the individuals were able to recall a great deal of information of detailed character such as sections of recited poems, details of dress, details of lighting effects, names of unfamiliar people, and decorative effects although the individuals had not been instructed to gain such information.

Peterson (7) instructed a group of students in one of his psychology classes to copy on a sheet of paper a list of meaningless syllables as he wrote them on the blackboard. The list was then read over orally to be sure that each student had all of the syllables listed. Instructions were then given to fold the paper and write on the outside all of the syllables remembered. All of the students were

able to recall some of the syllables. A second list of syllables were then presented in the same manner with the exception that the students were instructed to learn as many as they could. The result was that each student learned a greater number during the second trial. The two lists of syllables were presented to another group of students the following hour in reversed order, i. e., the list which previously was presented first was now presented last. Peterson concluded that while learning did take place when the intent to learn was not present much more was learned when the intent to learn was present.

Thorndike and Rock (9) made a study of intellectual and motor associational tendencies to determine whether or not such tendencies could be strengthened without awareness or intent to strengthen on the part of the learner. In one experiment words were read to the subjects who had been previously instructed to respond with any word that came to mind. Responses that were sequential in nature, such as "truly" as a response to the stimulus word "yours", were rewarded. Responses, such as opposites, that aided in the establishment of meaning were called wrong. Such a wrong response might be the word "mine" as a response to the stimulus word "yours". In the second or motor learning experiment the subjects were placed before a large block,

the top of which was screened from view and the bottom of which was visible by a mirror arrangement. The subjects were instructed to put the first finger of their non-writing hand on a tack placed in the center of the underside of the block. The subjects were then told that they were to place a stylus held in the other hand on the corresponding position on the upperside of the block. The subject was rewarded by the word "Right" when he placed the stylus within a given quadrant of the area about the center spot. Placing the stylus too near or too far from the center or in any other quadrant was followed by the word "Wrong".

In both experiments the subjects gradually learned to respond in a manner that resulted in rewards. The experimenters concluded from this that learning had taken place without awareness by the learner of what was being learned or without intention to learn. Thorndike has used the term 'unconscious' to designate the learning that takes place under these conditions.

It should be noted that the concepts of 'incidental' and 'unconscious' learning differ to the extent that in the former one of the major characteristics is the absence of intent to learn while in the latter intention to learn is present but not directed toward that material upon which the measures of learning are based.

Irwin, Kauffman, Prior and Weaver (3) in a repetition of Thorndike and Rock's (9) experiment with intellectual association tendencies found that when intention to learn is introduced into that learning situation the rate of improvement is not significantly different than when apparently no awareness or intention to learn is present. They conclude that the burden of proof rests upon the experimenter as to whether or not awareness and intention to learn are absent.

The historical material presented so far has served to introduce two concepts, namely, 'incidental' and 'unconscious' learning. The work of Wallace (12) demonstrated 'incidental' learning in an actual life situation. The work of Peterson (7) demonstrated the experimental evidence of 'incidental' learning. The study of Thorndike and Rock (9) pictures the 'unconscious' learning concept while the repetition by Irwin, Kauffman, Prior and Weaver (3) pointed out the essential weakness of that concept.

A third, and closely comparable concept is that of 'latent' learning. Blodgett (1) investigated the effects of delayed introduction of reward upon maze performance in rats. In one experimental group the reward was not introduced until the end of the third trial. In a second experimental group the reward was introduced at the end of

the seventh trial. During these trials without reward the error curves fluctuated up and down daily in a manner that would be expected by chance. However, at the end of the second trial after introduction of the reward, the error curves had dropped almost to a level of the error curve for a control group that had been run an equal period of time but which had been given food at the end of every run. Blodgett concluded that the superior performance of the experimental groups was due to a 'latent' learning developed during the 'non-learning' period, i. e., before the introduction of the reward. The significant aspect of the 'latent' learning concept is that the daily performance during the 'latent' learning period does not show that any learning has taken place. The 'latent' learning manifests itself only after incentives for learning have been introduced.

In drawing comparisons between the concepts of 'latent' learning and 'incidental' and 'unconscious' learning it is assumed that the introduction of incentives to learn in the case of animals is a comparable procedure with introducing instructions to learn for humans, i. e., that both procedures result in the intention to learn. Since animals cannot be directly instructed, the incentives serve as indirect means of instruction.

A second phase of the historical development revolves around previous experiments that demonstrate the influence of an initial period of learning in the absence of intention to learn upon subsequent intentional learning.¹

Twitmyer (11) in a study of visual guidance upon human maze learning divided a group of psychology laboratory students into two groups. One group, the experimental group, administered a maze-learning situation to the second, or control, group in the usual manner. Later the two groups were reversed, i. e., the control group now administered the maze to the experimental group under the same conditions, namely, blindfolded, etc. A comparison of the performance records of the two groups, after careful elimination of individuals in the experimental group who expressed or demonstrated intent to learn during the period in which they were administrators, lead Twitmyer to conclude that not only was visual guidance "highly effective in increasing the efficiency for the early stages of acquisition in a blindfold, cul de sac maze" but that such increase

1. In a search through the periodical literature bearing relation to this problem the writer was able to find but one study that offered any evidence on this point. This one experiment was not conducted with the purpose of studying this question but nevertheless it was so organized as to result in a demonstration of the influence upon subsequent intentional learning by an initial period of 'incidental' learning.

in efficiency "may be found even under conditions of 'undirected intention' on the part of those subjected to visual guidance".

This experiment bears significance for the present problem in that it demonstrates that a period of 'incidental' learning has a beneficial influence upon subsequent intentional learning. It should be noted that the length of the 'incidental' learning period in this experiment was just as long as the total learning period for the control group, hence the total period during which the experimental group learned, incidentally and intentionally, was necessarily longer.

Procedures and Methods

In this study three experiments were conducted in which the material to be learned was of a memoritor or rote type. In a second set of experiments the material to be learned consisted of two simple problems. The procedures for each experiment will be presented separately.

Memoritor or Rote Learning Experiment

The first experiment involved the learning of a set of twenty meaningless syllables.¹

1. Selected from a list made up by J. A. Glaze (2).

KYH	JIC	KYB	LAF
QIH	ZIQ	GYQ	ZYS
JEX	MEQ	GUQ	GOQ
ZIF	ZYG	MEF	XUM
KYV	JID	XUW	JYZ

The syllables were printed on 7" x 11" white face cards. Each letter was one inch high and one inch wide. An eighth of an inch was left between each. They were presented to the groups by being placed on a small easel and removed one by one by the experimenter. As one was removed the next became exposed. Each syllable was exposed for two seconds, a metronome being used as a timing device.

To the experimental group, a group of sixty-one students in an elementary psychology class, the following directions were given:

"Here is a group of twenty meaningless syllables, commonly called nonsense syllables, that are going to be used in some experimental work by one of the graduate students. Since meaningless syllables are supposed to have no meaning, I am going to present them to this class to determine their association value, that is, whether or not they do have meaning.

"What I want you to do is to raise your hand whenever one of these syllables reminds you of some meaningful word. An observer is posted in the back of the room to note how many hands are raised for each syllable.

"In order to make sure that each syllable has proper consideration they will be presented five times in just the same way

that they will be used later on in the experimental work."

After the fifth presentation the group was instructed as follows:

"Write on the sheet of paper which has been given you all of the syllables that you have just seen and can recall."

The group was not limited in time during the recall period. A minute or two after the subjects had ceased writing the remaining instructions were administered.

"I shall present these syllables to you in the same manner five more times.. This time you are to try to learn as many of them as you can. As soon as they have been presented for the fifth time write as many as you can recall on the same piece of paper as you have just used. First, however, fold your papers now so that the syllables that you have just written will not be in view when you write those that you will learn this time.

"The scores you make this time are to be compared with scores made by another group of students so learn as many as you can."

In order to have paper at the disposal of the subjects for the testing without leading them to suspect that they would be asked to recall the group of syllables they were given a short free-association test just prior to the experiment. This served to have the paper present without leading to suspicion of its eventual use. At the end of the procedure before the papers were collected the subjects were told that if they had tried to learn the

syllables during the initial period they were to write a note to that effect on their papers. None did so.

A control group was given the same free-association test to render the experimental conditions comparable. This group was composed of forty-three university students in an elementary psychology class that met two hours later than the students in the experimental group. The control group received the following directions:

"Now, I am going to present to you a series of meaningless syllables that I want you to learn. There are twenty of them all and they will be shown to you five different times. When the fifth presentation is completed I want you to write down on a separate sheet of paper all of the syllables that you have seen and can recall. Pay close attention and learn as many as you can."

After a short, unlimited recall period instructions for a second learning period were presented:

"Fold your papers so that the list that you have just written is not visible.

"I will present these syllables five more times. Try to learn as many more as you can. Remember, your scores will be compared with the scores made by another group of students so learn as many more as you can.

"When the fifth presentation is completed write all the syllables you have learned on the same sheet of paper but not where you can see those you have already written."

Seventy-two hours after the immediate recall periods the groups were instructed to record the syllables they

remembered and to indicate if they had expected to be called upon for such action. In neither group was any such expectation indicated.

Simple, Meaningful Word Experiment

In the second experiment the material to be learned consisted of a list of twenty-eight words that had been previously selected and rated for pleasantness, unpleasantness, and neutrality. They were selected for this study because of the way they lent themselves to the experimental procedure. The words used were:

kiss	wound	white	love
afraid	insult	despise	proud
fight	carrot	happy	give
divorce	glass	habit	work
pencil	name	pray	child
swim	marry	woman	worry
money	flower	pond	family

The subjects in this experiment were the members of four psychology laboratory groups. Since some of the subjects had participated in the experiment with meaningless syllables it was thought best to have the experiment performed by the laboratory instructors to avoid suspicion of similarity with the previous experiment by the subjects who had been involved.

The two experimental groups, Groups I and A, were composed of thirty-nine and thirteen students respectively. Each individual was given three slips of paper and then read the following directions:

"I have here a list of twenty-eight words that have been rated as to whether they are pleasant, neutral, or unpleasant. I shall read them to you and as I do I want you to indicate how you would rate them. We want to find out if the ratings given these words by other people are the same as the ratings by university students. We also want to find out whether you will rate them the same three successive times. Use just one slip for each time.

"I shall read these words at the rate of one every two seconds. You will have to work quickly. If a word seems pleasant to you, put down a capital "P". If it is unpleasant, put down a capital "U". If it is neutral, that is, neither pleasant nor unpleasant, put down a capital "N".

After the list of words had been read three times one of the experimental groups, Group I, was given five slips of paper while the other group, Group A, was given ten slips. To Group I the instructor read as follows:

"I shall read this list five more times. I want you to learn all of the words that you can. After each time that I read the list you are to write as many of the words as you can remember. Each time you are to use a different slip of paper. Do not look at any previous list you have written nor at anyone else's paper. You will not be graded on this at all, but try as hard as you can."

Group A received instructions identical with the ex-

ception of the substitution of the word "ten" for "five" in the first sentence.

The period of recall was not limited, a halt being called only after all subjects had stopped writing. At the completion of the experiment both of the experimental groups were instructed to:

"Please write on your first slip whether or not you tried to learn any of the words when they were read to you the first three times. It is important that I know whether you tried or not."

The instructions to the control groups, Groups 2 and B, varied from the second set of instructions to the experimental groups only in the first sentence, "I have here a list of twenty-eight words which I shall read to you five (or ten) times", being substituted in place of "I shall read this list five (or ten) more times."

Complex, Meaningful Word Experiment

A third experiment made use of complicated yet meaningful words. The following list of technical, psychological words selected from a psychological dictionary were used:

antirrheoscope	intercalation	sonometer
bradylogia	manoptoscope	trisomic
dextrosinistral	noesis	xenophobia
goniometer	orthoporia	zoopsia
kyperkinesis	parapraxis	prosencephalon

The students comprising the groups to whom these words were presented were upper division students enrolled in a teaching methods course. The experimental group procedure is given below as presented to the twenty-nine individuals in that group.

To each individual a sheet of paper was given that had been previously folded to give four pages. Each page was numbered. On the first page number heads were placed for three columns. The instructions read were:

"You are to be given a short experimental test. This test has no bearing upon your grade in this course. However, please give your complete cooperation and pay attention only to your own work.

"First, I shall read to you a list of fifteen technical, psychological words. You are to try to classify these words as to whether they refer to some physical characteristic of living organisms, to some behavior characteristic, or to some piece of laboratory apparatus. Designate a physical characteristic by a capital "P", a behavior characteristic by a capital "B", and a piece of laboratory apparatus by a capital "A".

On the blackboard the three words "physical", "behavior", and "apparatus" were written and beside each the appropriate capital letter. The instructions continued:

"This list of words will be read to you three times. Put down the capital letter that you choose in a vertical column under the appropriate column heading on the first page. The capitals for the first reading will go under number 'one', the second reading under number 'two', the third under 'three'.

"Do not write on any other page during this part of the test.

"If you are unable to decide how to classify the word, put down a dash. Your time to decide is very limited so your decisions will have to be hurried.

"Are there any questions as to what you are to do?"

The list was read three times. The speed of reading was determined by the length of each word, that is, the reader pronounced the word and then repeated it silently three times as quickly as possible before pronouncing the next word. At the end of the third reading further directions were given:

"On page two write all of the words that you have just heard that you can recall. Please do not look at any paper other than your own."

The group was given a length of time for the recall that was terminated one minute after the last individual was observed to have stopped writing. The directions for

the second part were then presented:

"Now, fold your papers so that pages three and four are on the outside and pages one and two on the inside. Leave page three facing you.

"I will read this list of words three more times. Listen carefully and try to learn as many of them as you can. After the third reading write down all of the words that you have heard and can recall. Do not write until the list has been completely read for the third time, and do not look at any of the words you have just finished writing."

After three more repetitions with a subsequent recall period, the group was given a third presentation.

The instructions were:

"Turn your papers over so that page four is uppermost.

"I will read this list just three more times. Learn as many more of the words as you can. At the end of the third reading write down all that you are able to recall on page four. Please watch only your own work."

At the conclusion of the last recall period the subjects were told to designate on page one whether or not they had suspected that they would be asked to recall the words after the first readings and whether or not they had tried to learn any of the words during that period.

The control group of thirty-three was told at the outset that the object was to learn as many of the words as possible. The instructions for the second and third recalls

were identical with those for the experimental groups with the exception of the page numberings.

Problem-Solving Experiment

The problem-solving experiments consisted of two simple problem-solving situations. The problems as such were masked by being written into a short story and mimeographed for purposes of presentation. The exact form of presentation as used is given below:

Name _____

From the farm house to the town stretched thirty miles of country road. John had found much pleasure in making the drive on those days in which he traveled to town to stock up on provisions for the week, but now a different situation was at hand.

With hands aching and paining intensely whenever his hurried movements caused him to hit some hard object, he fought vainly to start the motor of the car upon which a life now depended. Twice now the motor had gasped and begun to show signs of life but both times it had died causing John's quickened heart to lag once more. After what seemed interminably long time the motor broke out into a roar.

Setting the hand throttle so that the motor would idle, John ran into the house and gathered up into his arms the bundle that was his son. Carefully he carried the boy to the car and laid him on the back seat, making sure that the blankets were so arranged as not to unwrap easily. Throwing himself into the driver's seat he began the slow but hurried journey.

"If only I could make it in an hour,"

he thought, "the doctor would have a chance. No matter what, I must get there in an hour!" At the halfway point, where the rough, winding road straightened out into a broad, smooth highway, John figured back and found that he had traveled the first half of the distance at only fifteen miles per hour. "How fast", he began to wonder, "must I go to maintain the thirty mile an hour average that will bring me to the doctor in time?"

Name

So engrossed were they in their new game that the children scarcely looked up as the stranger entered the room. Somewhat surprised, the new-comer asked the teacher what was so entrancing as to overcome the children's natural curiosity. Laughingly, the teacher told him about the puzzle the children had discovered and how it absorbed so much of their playing time.

Moving closer to the tables the new-comer began to observe the children and their actions as they busily went about the solution of the puzzle or sat thinking of the next move. Each child had before him a board about four inches wide and eight inches long. Separated at intervals of about two inches were three wooden pegs. The children were manipulating four small discs of different sizes, placing one first on one peg and then on another.

"The game", explained the teacher, "begins by placing the four discs on the extreme left peg in reversed pyramidal order, that is, the smallest on the bottom, the next largest on top of it, then the next largest on top of that, with the largest on top of all. The object of the game is to transfer all of the discs to the extreme right peg and have them arranged in the opposite order, that is, they are to be pyramided with the largest now on the bottom and the smallest now on the top. They may move only one disc at a time and

may never skip or jump the middle peg. If they abide by the rules of the game they can complete the transfer of the discs in as few as eight moves.

"Would you like to try it?" asked the teacher.

"Some other time!" was the hasty reply.

These problems, which shall be referred to hereafter as the "30 M.P.H." problem and the "3 peg" problem, respectively, were presented first to matched groups of sophomores and of juniors of the University high school of Eugene. The sophomores were given the "30 M.P.H." problem and the juniors the "3 peg" problem. To make sure that the results of the experiments were not a function of the nature of the problem in either case the problems were also presented to matched groups of sophomores and of juniors at the Salem high school of Salem. At Salem the sophomores were given the "3 peg" problem and the juniors the "30 M.P.H." problem.

The University high school groups were matched on the basis of I Q ratings received on one of the forms of the Stanford Revision of the Simon-Binet Scale. The Salem high school groups were matched on the basis of the I Q ratings received on a form of the Otis Self-Administering Mental Ability Test. The actual matchings are presented in Table I.

TABLE I

Means and SD's of Groups Matched on the Basis of IQ Scores

School and Class	Experimental Group		Control Group	
	Mean _{IQ}	SD _{IQ}	Mean _{IQ}	SD _{IQ}
University Soph.	112.05	10.27	113.14	10.67
University Jr.	117.64	10.44	117.18	10.59
Salem Sophomores	113.83	8.20	110.67	8.45
Salem Juniors	103.79	6.49	105.43	6.68

The instructions were read from a typewritten sheet. The experimental group instructions are reported below:

"You are going to be given a special kind of test this period. Each person in this group is matched with some person in another group taking this test at the same time. The work that you do will be compared with the work of the people in the other group.

"I shall pass out to each of you a mimeographed sheet of paper which you are to leave face down until instructions are given."

The sheets were then distributed.

"On these sheets will be found a short selection in story form. On the back of the sheet you are to outline this story in the best way that you can. Be

sure to include all of the points involved in the story.

"You will be given a limited amount of time. Work quickly but not hurriedly. When you are through check back over your work. Do not stop working until the signal to stop is given.

"Are there any questions as to what you are to do?

"Turn over your papers. Place your name on the line provided and begin outlining."

A period of ten minutes was allowed for the outlining activity. At the end of that period the groups were stopped and given further directions.

"The second part of this test is to solve the problem which is to be found in the story you have just outlined.

"All of the conditions or rules for solving the problem are to be found in the story. You are to try to solve the problem without violating any of the rules.

"When you have reached a solution do two things: first, put down the time that is written on the blackboard just in under your name; second, raise your hand so that I may come and check your answer.

"Are there any questions as to what you are to do?

"You may begin."

As the individuals raised their hands, indicating an attempted solution, the experimenter checked the solution. Any answer which expressed recognition of how the problem was solved was accepted.¹ If the answer did

1. The solutions to the problems will be found in the appendix with a few representative, acceptable answers made by the subjects.

not express such recognition the subject was told that his answer was wrong and that he must try again. However, if the answer was acceptable the subject was asked two questions:

"Have you ever seen this problem before?"

"Did you try to solve the problem while you were outlining the story?"

The control group procedure differed only in the instructions given after the papers were passed out. This part of the procedure is presented below:

"On each sheet is a short written selection in which there is a problem set forth. You are to read through the selection, find the problem, and then solve it. All of the rules or conditions of the problem are in the selection.

"When the signal to start is given turn over your paper and write your name at the top in the space provided. Then read the selection through once. As soon as you have finished reading through once look up at the blackboard and write down the time that is written there just below your name. Then immediately begin on the problem."

From this point on the procedures for the two groups are identical with the exception that it was necessary to ask only if the subjects had ever seen the problem before.

As suggested in the reported procedure the time was kept by an individual at the blackboard. The time was changed every minute.

DATA AND RESULTS

Meaningless Syllable Experiment

Figure 1 shows the positions of the experimental and control groups in respect to the number of syllables recalled at the first, second and third testings.

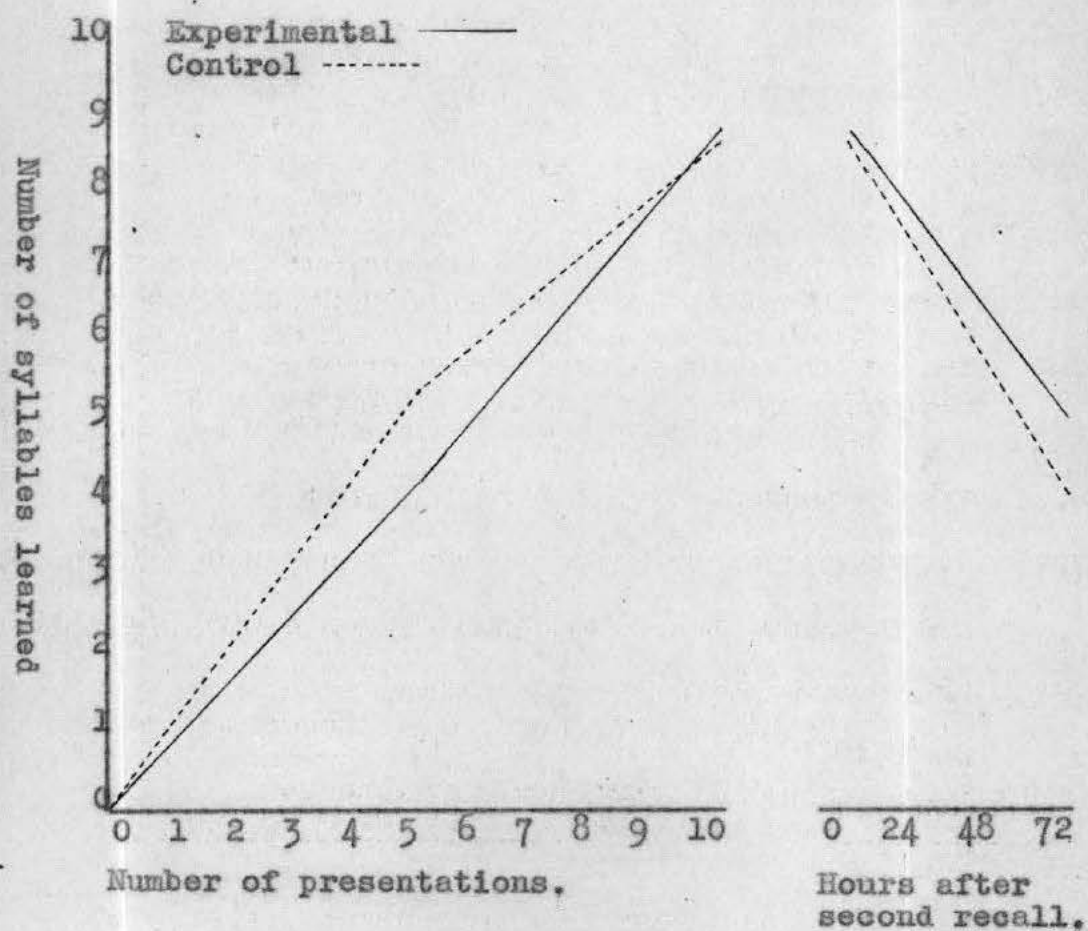


Figure 1. Graph of the Learning Curves of the Experimental and Control Groups.

Table II indicates the differences and the reliability of the differences at the three points of recall.

TABLE II
Reliability of Differences Between Means for Meaningless
Syllable Experiment

	Mean		σ_{dis}		σ_{Mean}		Dif _M	σ_{dif}	Dif _M / σ_{dif}
	Exp.	Con.	Exp.	Con.	Exp.	Con.			
Re-call 1	4.05	5.16	1.69	2.49	.216	.380	1.11	.437	2.54
Re-call 2	8.67	8.60	2.82	3.01	.361	.459	-0.07	.583	-0.12
Re-call 3	4.97	4.02	2.95	2.28	.378	.356	-0.95	.519	-1.83

A comparison of the curve of the experimental group with that of the control group on the recall shows that during the 'incidental' learning period the experimental group did not learn as much as did the control group. The significance of the difference between the two groups of this point is evidenced by a ratio of 2.54 between the mean-difference and SD of the difference. While it is fairly conclusive that individuals intent upon learning will learn more than individuals who are intent upon looking for associations, it is also of note that the latter did learn although they were not so instructed.

A comparison of the two groups for the second recall demonstrates three things. First, the experimental group increased their rate of learning over their rate during the first five trials. Second, the control group decreased its rate of learning during the second five trials. Third, the learning rate of the experimental group during the second five trials was enough greater as to result in more syllables recalled at the end than were recalled by the control group. The difference of the means at this point is, however, not significant.

Comparison for the third recall period, conducted seventy-two hours later, shows that the control retained only 46.74%, a difference of 9.58% in retention. The mean-difference is not significant.

Simple, Meaningful Word Experiment

The learning curves for the experimental and control groups, Groups 1 and 2 and Groups A and B are presented in Figures 2 and 3, respectively. The curves for both of the experimental groups are presented in two ways. The recall curve is the learning curve so placed as to coincide with the control group learning curve in sequential order of occurrence of recalls. The presentation curve is the learning curve so placed on the graph as to coincide with

the sequential order of occurrence of the presentations.

Such an arrangement is necessitated since in this experiment four presentations of the material were made to the experimental groups before the subjects were tested. In all of the other experiments the first recall period followed the first presentation.

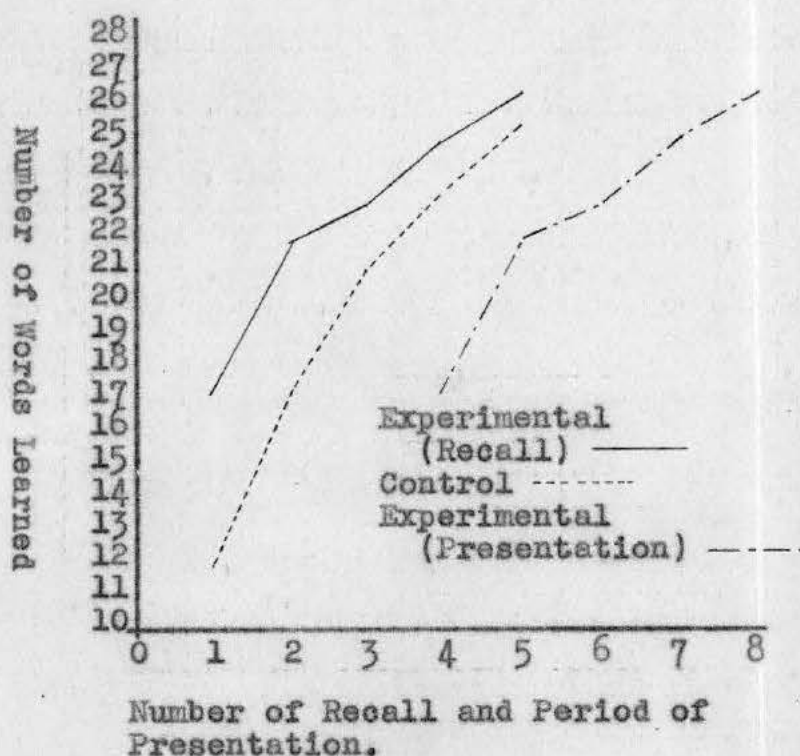


Figure 2. 'Recall' Learning Curve of Control Group 1 and 'Recall' and 'Presentation' Learning Curves of Experimental Group 2.

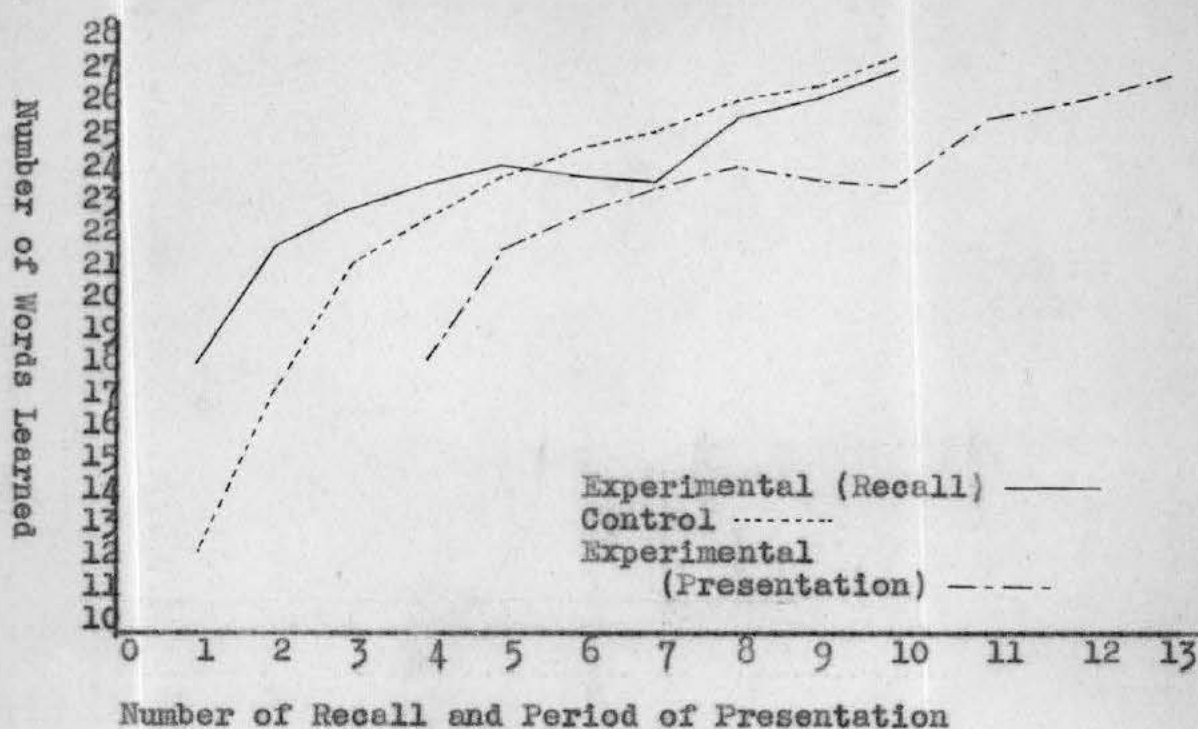


Figure 3. 'Recall' Learning Curve of Control Group A and 'Recall' and 'Presentation' Learning Curves of Experimental Group B.

Comparisons of the recall and presentation learning curves of the experimental group, Group 1, with the learning curves of the control group, Group 2, show four points: (1) The experimental group achieved higher scores on each recall. (2) During the fifth presentation the experimental group evidenced a greater rate of learning than did the control group for the same number of words. (3) The control group had learned more by the end of the fourth and fifth presentations than had the experimental group.

(4) The control group curve shows a steeper slope between the points of recall than does the experimental group recall curve.

The recall and presentation curves for Group A and the curve for Group B when compared show four things: (1) The experimental group achieved higher scores for the first five recall periods but then fell and remained below the control group for the subsequent five recalls. (2) The recall scores at the end of comparable periods of presentation show the control group to be always at a higher point of achievement. (3) The experimental group shows a superior learning rate only between the seventh and ninth recall periods, at other times the control group excelled. (4) The experimental group rate of learning during the fifth, sixth and seventh presentation periods was higher than the learning rate during the same periods by the control group.

Tables III and IV give the reliability of the mean-differences of the scores obtained at the end of the comparable periods of presentation for Groups 1 and 2 and Groups A and B, respectively.

TABLE III

Reliability of Mean-Differences of Groups 1 and 2 in
Terms of Sequential Order of Presentation

Pre- sent- ation	Group	Recall	M	σ_{dist}	σ_M	Dif_M	σ_{dif}	$\text{Dif}_M / \sigma_{\text{dif}}$
4	1	1	11.63	2.52	.404	11.44	.468	24.44
	2	4	23.07	1.23	.237			
5	1	2	17.07	2.03	.325	7.98	.682	11.70
	2	5	25.05	3.12	.600			

TABLE IV

Reliability of Mean-Differences of Groups A and B in
Terms of Sequential Order of Presentation

Pre- sent- ation	Group	Recall	M	σ_{dist}	σ_M	Dif _M	σ_{dif}	Dif _M / σ_{dif}
4	A	1	18.0	2.21	.614	4.6	.901	5.11
	B	4	22.6	2.95	.660			
5	A	2	21.5	2.17	.602	2.4	.871	2.76
	B	5	23.9	2.81	.629			
6	A	3	22.9	2.51	.697	1.8	.884	2.04
	B	6	24.7	2.43	.543			
7	A	4	23.5	2.00	.556	1.7	.848	2.00
	B	7	25.2	2.86	.640			
8	A	5	24.2	1.82	.504	1.9	.674	2.82
	B	8	26.1	2.00	.448			
9	A	6	23.9	2.83	.786	2.5	.896	2.79
	B	9	26.4	1.92	.430			
10	A	7	23.7	3.55	.986	3.7	1.028	3.60
	B	10	27.4	1.30	.292			

Tables V and VI give the reliability of the mean-differences of the scores obtained during comparable periods of recall for Groups 1 and 2 and Groups A and B, respectively.

TABLE V

Reliability of Mean-Differences of Experimental
Group 1 and Control Group 2 in Terms of the
Sequential Order of Recalls

Recall Group		M	σ_{dist}	σ_M	Diff _M	σ_{diff}	Diff _M / σ_{diff}
1	1	17.15	2.52	.404	5.52	.709	7.78
	2	11.63	3.03	.583			
2	1	21.48	2.03	.325	3.41	.623	5.47
	2	17.07	3.02	.581			
3	1	22.64	2.09	.335	1.94	.536	3.62
	2	20.70	2.18	.419			
4	1	24.51	1.92	.308	1.44	.388	3.71
	2	23.07	1.23	.237			
5	1	26.03	1.19	.190	0.98	.630	1.56
	2	25.05	3.12	.600			

TABLE VI
Reliability of Mean-Differences of Experimental
Group A and Control Group B in Terms of the
Sequential Order of Recalls

Recall	Group	M	σ_{dist}	σ_M	Diff _M	σ_{diff}	Diff _M / σ_{diff}
1	A	18.0	2.21	.614	5.7	.782	7.28
	B	12.3	2.17	.485			
2	A	21.5	2.17	.602	4.3	.912	4.67
	B	17.2	3.06	.685			
3	A	22.9	2.51	.697	1.7	1.024	1.66
	B	21.2	3.36	.752			
4	A	23.5	2.00	.556	0.9	.863	1.09
	B	22.6	2.95	.660			
5	A	24.2	1.82	.504	0.3	.806	0.37
	B	23.9	2.81	.629			
6	A	23.9	2.83	.786	-0.8	.995	-0.84
	B	24.7	2.43	.543			
7	A	23.7	3.55	.986	-1.5	1.175	-1.28
	B	25.2	2.86	.640			
8	A	25.5	1.84	.512	-0.5	.680	-0.75
	B	26.1	2.00	.448			
9	A	26.2	1.48	.412	-0.2	.595	-0.34
	B	26.4	1.92	.430			
10	A	26.8	1.27	.351	-0.6	.456	-1.25
	B	27.4	1.30	.292			

Complex, Meaningful Word Experiment

Since all of the subjects who had participated in the first part of the experiment were not present for the recall period the results are presented in Tables VII and VIII are based respectively upon all of the subjects involved in the first part and on only the subjects who completed the entire procedure.

TABLE VII

Means of Achievement for All Subjects for
First Three Tests

Group	N	Recall 1	Recall 2	Recall 3
Exp.	33	.455	2.848	5.121
Con.	29	1.828	3.793	5.724

TABLE VIII
Means of Achievement for Subjects Available for
Delayed Recall

Group	N	Recall 1	Recall 2	Recall 3	Delayed Recall
Exp	23	.435	2.826	5.261	1.500
Con	18	1.667	3.667	5.278	3.167

The experimental group had achieved approximately one-fourth or 25% as much as had the control group by the end of the first presentation. By the end of the third presentation the experimental group showed approximately 90% of the control group achievement. These figures are based on all of the subjects as indicated in Table VII. Table VIII demonstrates that for the delayed recall the experimental group retained only about 50% of the amount retained by the control group although both groups were nearly equal.

Problem Solving Experiments

Table IX presents a composite of the results obtained from the experiments conducted at the University and

TABLE IX *

Reliability of Mean-Differences in Problem-Solving Time for All Groups

	N	M	σ_{dist}	r_{IT}	σ_M	Diff_M	r_{IT}	PE_{diff}	$\text{Diff}_M / \text{PE}_{\text{diff}}$
"30 M.P.H."	14	12.40	9.05	-.168	2.3848	17.24	+.532	1.3630	12.65
		29.64	4.55	+.207	1.1896				
Un. So.	21	27.81	19.57	-.193	4.1893	-.19	+.001	3.4620	.06
		27.62	15.77	-.505	2.9698				
"3 Pegs"	22	4.09	3.53	-.014	.7519	11.18	-.066	1.7104	4.41
		15.27	10.05	-.387	1.9758				
Un. Jr.	18	10.11	6.56	-.306	1.4720	5.22	-.048	1.8914	2.76
		15.33	9.90	-.122	2.3172				

TABLE X

Reliability of Mean-Difference of Total Time Spent by Salem Junior Groups

"30 MPH"	14	22.40	9.05	-.168	2.3848	7.24	+.532	1.3630	5.31
		29.64	4.55	+.207	1.1896				

* See footnote bottom page 38.

Salem high schools for each of the two problems used.¹

The results show four noticeable points: First, that in two cases the mean-differences are of statistical significance. Second, that in the case of the Salem junior groups the total time spent by the experimental group was 7.24 minutes less than the total time spent by the control group. Third, that significant differences are present only in the groups involving high school juniors. Fourth, that in three out of the four cases the tendency was for the mean-differences to be positive.

1. Lindquist's (5) method was used for determining the significance of a difference in means between matched groups.*The data presented in Table IX for the University high school junior and sophomore experimental groups is offered to the reader's consideration with no claims of validity by the author. When the instructions were given to these groups (both were handled together in the same room) the instructor did not read the exact instructions but used the written instructions merely as a guide. Accidentally this teacher, a home-room teacher who was used to help eliminate novelty from the experiment, mentioned that they would eventually be asked to solve the problem. The assistant experimenter, however, immediately instructed the group that they were for the present only to outline the story given them. Subsequent questioning of the subjects that none of the individuals tried to solve the problem during the outlining period. Whether the subjects answered truthfully or whether they answered as they did because they felt that that was what was expected cannot be determined and will be left to the reader's judgment. The results were presented because of the comparability with the results of the Salem high school experiments and because the author's opinion is that the results are probably valid.

Table X¹ is of importance in that it designates the presence of a significant difference between the total time, including the time used in outlining, spent by the experimental group within the experimental situation and the total time spent by the control group.

Discussion of Results

Before presenting the interpretation of the data and results the author believes that much confusion will be avoided if first the data from all the experiments are summarized and discussed by comparable periods or phases. The results may be satisfactorily grouped into three main periods: (1) the initial period, in which the experimental groups are given instructions other than instructions to learn; (2) the post period, the period following the introduction of instructions to learn; and (3) the delayed recall period.

Each phase or period will be introduced by a generalized statement of the significant aspect of that period. The evidence accruing to the substantiation or invalidation of the general statement will then be considered. Other important aspects of the period will be treated in a like manner.

1. See page 37 for Table X.

Initial Period

In all of the experiments the experimental groups learned during the initial period although no instructions to learn were given and none of the subjects reported either an expectation to recall the presented material or the exercise of an intention to learn.

In the meaningless syllable experiment the experimental group demonstrated on the first recall that they had learned a mean-average of 4.05 syllables while the control group had learned 5.16 syllables. It is assumed that the absence of reports by the subjects involved is sufficient evidence to establish that intention to learn was not present.

As pointed out under Figures 2 and 3, which illustrate the results of the simple, meaningful word experiment, the experimental groups achieved higher scores on the first recall test than did the control groups. In both cases the mean-differences were of decided reliability as evidenced by ratios of 7.78 and 7.28. To have achieved such reliably higher scores the experimental groups must have learned during the initial period in which they were instructed to rate words for pleasantness or unpleasantness. As in the previous experiment it is assumed that

the absence of reports of intent to learn is sufficient evidence to establish the point.

The experimental group subjects that were instructed to classify a group of psychological terms were able to recall on the average 0.455 of the terms immediately after presentation while the control groups were able to recall a mean-average of 1.828 of the terms after an equal period of presentation under instructions to learn. Again the lack of reports of intent to learn is assumed to be sufficient evidence of the absence of intent.

In the case of the experimental groups that were presented with simple problem-solving situations it must be inferred that learning took place during the initial period of outlining activity. In three of the four cases presented the mean-differences were positive, which is to say that after having been given instructions to look for and solve the problem, three of the experimental groups were able to complete the solutions in less time than the comparable control groups. In two of the cases the mean-differences were of distinct statistical significance while a third tended definitely toward significance. These results combined with absence of reports of attempts to solve the problem during the outlining period are offered as evidence of the validity of the inference that learning

took place during this initial period in which no intention to learn was present.

A second general statement to be considered under the initial period discussion is that the efficiency of 'incidental' as opposed to intentional learning as evidenced by 'incidental'-intentional learning ratios is always less where such ratios may be determined.

The experimental group in the meaningless syllable experiment showed a ratio of 1 : 1.25, i. e., the experimental group learned one syllable incidentally to every 1.25 syllables learned by the control group during the first presentation period. The meaningless syllables are regarded as being the simplest of the three types of rote learning material used. The criterion of simplicity arbitrarily adopted by the author is the actual complexity of the structure of the syllable or word.

In the more complex words used in the simple meaningful word experiments the ratio of the intentional learning to the 'incidental' learning is at least 1 : 3 in both cases. This ratio is arrived at in the following manner: since the first two trials with intention to learn place the control groups on approximately the same level as do the three trials without intention plus one trial with intention for the experimental groups, then one trial with

intention equals three trials without intention. At best this is an approximation since no recall was held for the experimental groups immediately after the 'incidental' learning period.

The experimental group in the complex, psychological terms experiment showed approximately one-fourth the achievement of the control group during the initial presentation. This low ratio was demonstrated with the most complex of the learning materials.

Because of the nature of the problem-solving situations it is impossible to determine exactly or to even infer validly the 'incidental'-intentional learning ratio. The exact reasons are two: (1) the criteria of learning was the acceptable solution of the problem and hence until the solution was achieved no measurement of the learning was possible; (2) in the case of the Salem junior groups the total time spent by the experimental group in both outlining and problem-solving was significantly less than the total time spent by the control group as evidenced by a ratio of 5.31 between the mean-difference and the PE of the difference.

The first reason shows that no precise determination of the 'incidental'-intentional learning ratio is possible because no measurement could be obtained at the end of any

definite time period. The second reason shows that inference of the ratio is impossible due to the inability to determine the rate of learning at any given point. For the other groups, if the learning rates were assumed to be the same, it might be said that the amount of time the experimental groups saved during the problem-solving with intention period represented the amount learned during the outlining period. Following this line of reasoning for the Salem junior experimental group it would have to be said that they had accomplished in ten minutes without intention what the control group had accomplished in 17.24 minutes with intention. What has obviously occurred is that the initial outlining period has been followed by a highly increased learning rate during the problem-solving period. The purpose of discussing this point here is merely to demonstrate that the attempt to infer an 'incidental'-intentional learning ratio for these groups is an unjustifiable procedure. The phenomenon of the increased learning rate in the post period will be discussed in the following section.

Post Period

The experimental evidence indicates that after the introduction of intent to learn in the large majority of

cases the learning rate of the experimental groups is increased to a degree greater than their learning rate during the initial period and greater than the learning rate of the control group during the corresponding period.

The experimental group in the meaningless syllable experiment came up from 4.05 syllables to 8.67 syllables while the control group increased from 5.16 to only 8.60 syllables. Figure 1 demonstrates the increase in rate of learning very nicely and accentuates this increase by showing the decrease in the learning rate of the control group.

From the results of the experiments using the simple, meaningful words it can not be determined if the learning rate of the experimental groups increased after introduction of instructions to learn since no recall was held immediately after the initial period of three trials. Comparison of the experimental presentation learning curves with the control group curves indicates that the experimental groups had greater rates during the fifth presentation periods than had the control groups. This, however, may be explained on the basis of the fact that the control groups were nearer the ceiling and therefore would be expected to have lesser learning rates.

The third experiment using the technical,

psychological terms produced results that also demonstrate the increase in the experimental group learning rate over its initial learning rate. Tables VII and VIII show that the experimental group learned approximately five times as much in the period immediately after being instructed to learn as was learned during the initial period. Reference to the same tables show that the experimental group learned about 2.4 words during this second presentation period while the control group learned about 2. The experimental group might be expected to have a superior rate, however, as they were at a lower level of achievement.

In three of the four cases in the problem-solving experiments there can be little doubt that the experimental group learning rates were increased over their rates during the initial period since during the initial period it is difficult to conceive of a solution being reached other than by chance as long as the outlining activity was continued and no intention to solve the problem was present. The Salem junior groups show that the post period learning rate was decidedly increased for the experimental subjects to a degree above the control group. The results for the University high juniors and the Salem sophomores indicate at least a tendency toward such a

marked increase. No detrimental or facilitating effect of any importance is shown by the data on the University high sophomores. The evidence seems to point that unlike the other groups this group failed to learn a thing during the outlining period.

A second noticeable phenomenon in the post period of the experimental groups is their tendency to equal the control groups in achievement after a short period of intentional learning even to the point of excelling the control group achievement.

Such a tendency is noted in the meaningless syllable experiment. The degree to which the experimental group excelled the control group is not, however, significant.¹

The learning curves of the groups involved in the simple, meaningful word experiment² at first glance would appear to contradict such a statement, especially the curves for Groups A and B. However, the fact that the curves for Groups 1 and A, the experimental groups, both possess plateaus is evidence indicating that other factors might have entered into the experimental situation and influenced the learning performance. In the case of Groups

1. See Table II, page 26.

2. See Figures 2 and 3, pages 28 and 29.

A and B, Group A had completed eight presentation periods and five recall periods and still had five more trials to go when the plateau effect began. This group did not resume its apparently normal learning rate until the twelfth presentation period. Probably the experimental groups were bored by the extra periods of presentation and this boredom influenced the performance.

Reference to Table VII relative to the results of the complex, meaningful word experiment established that the experimental group continued to cut down the lead of the control group. Had the learning rates been comparably maintained by the two groups the experimental group would have excelled the control group before the absolute ceiling was reached. Table VIII shows that for the subjects who were available for all the recall periods the members of the experimental group were practically at the same point of achievement by the third recall as were the control group subjects. The results given in Table VII are based on larger numbers of subjects and are probably more reliable.

The only experimental group in the problem-solving experiments that excelled a control group was the Salem junior experimental group. The superiority may be regarded as being of definite significance as evidenced by a ratio

of 5.31 between the mean-difference of the time totals and the PE of the difference.¹

Delayed Recall Period

The major characteristic of the delayed recall period is the absence of a direct tendency of the results to vary in a given manner. In the meaningful syllable experiment the results of the delayed recall period expressed a superior retention by the experimental group. The converse was the case in the technical, psychological word experiment. Reference to Tables II and VIII, respectively, establish the point.

Interpretation of Results

As in the discussion of the results immediately preceding this section the interpretation will be presented by periods.

The results have indicated that during the initial period the experimental group subjects learn although not so instructed. The lack of reports by the subjects has been assumed to be sufficient evidence to establish that intention to learn was not present. How, then, does learning take place when the subjects are not trying to learn?

1. See Table X, page 37.

Must a new law or new laws of learning be postulated to account for this phenomenon?

Thorndike and Rock (9) have offered the results of their experiments on learning without awareness of what was being learned as evidence indicating that the learning which takes place under the experimental conditions may be explained by the Law of Effect. The essence of the experiments was to have present during the performance of the subjects differential effects following the responses. Correct responses were "rewarded" with "Right"; incorrect responses were "punished" by "Wrong". Assumedly the subjects were without awareness of what was being learned. Supposedly the differential effects, i. e., "rewards" and "punishments", produced in the learners "satisfyingness" and "annoyingness" which resulted in learning.

Tolman (17) has interpreted 'latent' learning as demonstrating that the Law of Effect is in itself inadequate to account for the learning which took place under conditions of delayed introduction of reward in the maze performance of rats. The experimental evidence was that the performance of the rats before introduction of the reward in the form of food did not show that any learning had taken place during that period. However, after the food had been introduced the learning

rate increased to a degree that soon placed the rats of both groups on an equal level of achievement. While the control groups had had a relatively strong differential effect, i. e., reward, during the entire learning period the experimental groups had not, the final achievement of the experimental groups indicated that the learning had been just as effective as if the strong differential effect had been present throughout the entire learning period thus leading Tolman to the conclusion he made.

Where Thorndike and Rock had strong differential effects present during the initial period the 'latent' learning experiments had minor differential effects or none at all. In the present investigation the differential effects were at least stronger during the post period than during the initial period, providing the differential effects are regarded as being cues that aid in the formation of associations. In this aspect the present experiments are comparable to the 'latent' learning experiments. They agree with the 'unconscious' learning experiments of Thorndike and Rock in the sense that the learning which had taken place was measurable in the performance of the subjects.

Since in this investigation it cannot be proven that no differential effects were present and since learning

was demonstrated in the performance of the first recall, it cannot be said that these experiments completely support Tolman's contention relative to the invalidity of the Law of Effect.

The results do, to a degree, support Tolman in that the tendency of the experimental groups seemed to indicate that their learning is eventually just as effective as if strong differential effects were present throughout the entire learning period.

In regard to the question of how learning takes place in the absence of intention to learn the author is forced to conclude that the evidence of this investigation indicates that the learning may have taken place in the same manner as would be expected under the Law of Effect.

The variations in the 'incidental'-intentional learning ratio may be a resultant of both the amount of material presented and the difficulty of the material. To clear this point further investigations would have to be made with materials equated for difficulty and varied in amount.

The second major aspect of this study that requires interpretation is the increase in the experimental group learning rate following the introduction of instructions to learn. The tendency apparently is for the learning to

be increased to a degree great enough to allow the experimental group to "catch-up" with the control group and in cases to excel. The results resolve themselves into the question of what happens to the subjects during the post period in consequence of having been exposed to the initial period of learning without intention.

Two factors that might be of definite influence upon learning rates for rote type learning material immediately suggest themselves. These factors are (1) motivation, and (2) savings by "relearning".

If the motivation should be stronger for the experimental group during the post period than for the control group during the corresponding period then a greater learning rate would normally be expected. Analysis of the experiments indicates that motivational increase may have been effected in any or all of at least three different ways.

Sullivan (8) found that "in general, the time taken to learn a memory series is increased by the knowledge of failure in a previous performance". If the fact that the subjects were able to recall some of the material presented during the initial periods operated in such a way as to act as information of success it would be expected that the experimental groups would increase their learning rates.

That this may have been the case is possible since being able to recall material that was presented without instructions to learn might be thought of as a credible achievement and thus act as an informant of success. In final analysis this information of success directly influences the motivation of the subject.

The motivation may have also been influenced by the effect of having asked the subjects to recall material which they had not been instructed to learn. In all of the experiments the experimental groups evidenced some, and in cases a great deal, of indignation over such a requirement. It is conceivable that the result was a challenged attitude on the part of subjects leading to greater motivation.

Similar in effect upon the motivation might be the fact that in the experimental groups the situation was more or less novel and not consciously encountered in the everyday routine. Such novelty may have aided in centering the attention of the subjects on the material to be learned by having created an interested or challenged attitude.

Another major factor other than motivational variation that may have been of influence is the influence of "relearning". Since it has been demonstrated conclusive-

ly that learning did take place during the initial period, it is reasonable to think that associations were also formed in connection with the words that were not subject to immediate recall. If such were the case many of the words would be "relearned" or the existing associations strengthened. Savings in time through such "relearning" and strengthening of associations might account in part for the increased rate of learning.

In the case of the problem-solving situations both a challenged attitude and an interested attitude may have been operative. However, another factor is present which in part would account for the decrease in problem-solving time. This factor is that during the initial period of the experimental procedure the experimental group was led to do part of the things which would be necessary to the solution of the problem anyway, such as reading through the story and becoming familiar with certain parts. If this factor is operative to any degree it would become important to ascertain the length of time necessary to "see" the different parts of the problem in their problematic relationship under conditions of intentional problem-solving. It might be that the time saving of the experimental groups may be largely accounted for on this basis.

That the junior experimental groups should show more

significant time savings than the sophomore groups as evidence by the ratios of the mean-difference to the PE's of the differences may be a function of experience with problem-solving situations. Where the junior groups are accustomed to meeting more difficult problems and hence are probably more experienced, the initial period of outlining activity may be capable of exercising greater effect upon their subsequent intentional problem-solving. It is conceivable that in cases where problem-solving situations are rarely met and methods of attack unfamiliar that factors tending to increase rate of solution would be of less influence than in cases where such situations were common and methods of attack more familiar.

To explain the varied effects upon the period of delayed recall the findings of Lyon (5) may be used as a reference. Lyon found that "as to the relation of quickness of learning to retentiveness the most general statement that can be made is that those who learn quickly remember longest if the material is logical in character. Where the material is 'illogical' and is memorized by 'motor associations' so to speak the converse is true. Exceptions are most notable in the case of nonsense-syllables and words." Logical material refers to such matter as prose and poetry selections where the material

has meaning by virtue of its assemblage. Illogical material is material presented in a manner that has no inherent inter-associations that give it meaning such as disjointed lists of words or meaningless syllables. Regarded in its conformity to the above classifications the material used in the present study would fall under the illogical classification.

The results of the delayed recall performance of the experimental group in the meaningless-syllable experiment can be explained on the basis of the above findings. The meaningless syllables fit the criteria for "illogical" material and are noted by Lyon as an exception to the general rule. Hence, the experimental group might be expected to evidence greater retention because of its superior learning rate.

The inferior performance of the experimental group in the experiment using technical, psychological words can not be so easily accounted for. By the criteria of "illogical" the words should be so classified and by virtue of being a series of words they should fall under the noted exceptions. The expectation would be that the experimental group would show greater retention than the control group. Such not being the case, a different explanation becomes necessary. Since there is no apparent

reason that evolves from the experimental evidence of this investigation that the performance during retention periods should be other than a function of the rate of learning and the type of material, the final answer must await further investigation as to whether or not an initial period of 'incidental' learning produces its own peculiar effects upon recall performance.

SUMMARY AND CONCLUSIONS

An investigation was made concerning the influence of a period of 'incidental' learning upon subsequent learning with intention.

The method used was to present the material to be learned to an experimental group in such a way as to lead to the centering of the subjects' attention upon that material with intentions other than intentions to learn. After a given period of such presentation the subjects were instructed to learn during subsequent trials. The control group subjects were given instructions to learn from the outset. In all but one of the experiments the same number of presentations were given to both groups. In two of the experiments delayed recalls were held two or more days after the immediate recalls.

The materials to be learned consisted of two types: (1) rote or memoritor type material and (2) simple problems.

In general the results indicated three things: (1) that learning took place even though instructions to learn were not given and none of the subjects reported intent to learn; (2) that after introduction of the instructions to learn the experimental group subjects tended to learn at

a greater rate than the control group subjects; and (3) that the performance upon delayed recall tests was inconsistent, in one case the experimental group excelling and in the other case the control group excelling.

As a result of this investigation the following conclusions may be made relative to the experimental findings:

1) College students do learn material of a rote or memoritor type even though they are not instructed to learn and do not have intention to learn.

2) Members of the elementary psychology classes and principles of teaching class that were used in the experiments on rote or memoritor learning do benefit by a period of 'incidental' learning to the extent of a slightly increased learning rate during subsequent learning activity with intention to learn.

3) The increased learning rate during the intentional learning period may result in greater final achievement for the members of the experimental groups although the number of trials for both groups is equal.

4) The performance of the experimental groups upon a delayed recall is neither consistent with itself in occurrence nor consistent with a previous experimental report which indicated that the amount retained was a

function of the rate at which it was learned.

5) As a general rule University high school juniors and sophomores and Salem high school juniors and sophomores will solve a problem in less time if previously they have been given a period of ten minutes in which to outline a short story in which the problem occurs.

6) University and Salem high school juniors are more apt to benefit by such a period of outlining than are University and Salem high school sophomores.

7) Salem high school juniors may benefit from such a period of outlining to the extent of reducing materially the total time spent within the experimental situation.

APPENDIX¹Acceptable Solutions to the Problems Used in
the Problem-Solving Experiments

The "30 M.P.H." problem is briefly:

There are thirty miles to be traveled. The average speed must be thirty miles per hour. The first half of the distance is traveled at fifteen miles per hour. At what speed must the remaining distance be traveled to maintain the thirty mile per hour average speed over the whole distance?

The solution is achieved by recognizing (1) that the thirty miles must be traveled in no more nor no less than one hour, (2) that traveling half of the distance, a distance of fifteen miles, at a speed of fifteen miles per hour takes exactly one hour of time, and (3) that since the hour is consumed in traveling the first half of the distance no time is left in which to travel the remaining distance. The subjects were not asked to give any such analysis on their papers but only the "answer" as they saw

1. Since this investigation gives evidence that serves only to establish the presence of phenomena that result following a period of 'incidental' learning and does not give evidence except in a suggestive way of what the causes of the phenomena might be, the author feels that exact quotations of raw score results are of no practical consequence.

it. If the answer was not clear to the experimenter the subjects were asked to explain how they got the "answer". Given below are a few of the responses recorded that were considered acceptable without question.

"He couldn't reach there in an hour because his time was taken up."

"He has no time left."

"He can't get there. It already took him an hour to go 15 miles."

"He can't get there. Its 30 miles distance and he traveled the first half (15 miles) in an hour."

"There is no time left as he has already used the full hour required."

"Nothing flat."

Answers such as, "Can't make it", or "Couldn't do it", were accepted upon verbal qualification.

The "3 Peg" puzzle consisted of four different sized discs placed in reversed pyramidal order on the extreme left of three pegs. The object was to transfer all of the discs to the extreme right peg in such a manner as to have the discs stacked in upright pyramidal order. The rules insisted that each disc be placed on the center peg before being transferred to the extreme right peg.

Where most subjects failed was in assuming that all of the discs were to be placed on the center peg before any could be removed to the extreme right peg. The proper procedure is to take the top disc, place it on the center peg, remove it from the center peg and place it on the

extreme right. Each disc being moved separately this way gives a pyramided stack on the extreme right peg. The greatest majority of the subjects demonstrated their solutions by rough drawings. Those who did not explained the solution verbally.

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