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Experiments in Conditioning Operant Verbal Behavior

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To the Graduate Council:

I am submitting herewith a dissertation written by Edwin O. Timmons entitled "Experiments in Conditioning Operant Verbal Behavior." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Psychology.

W. O. Jenkins, Major Professor

We have read this dissertation and recommend its acceptance:

Gerald R. Pascal, Raymond R. Shrader, James M. Porter, Merritt H. Moore, William E. Cole

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Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

August 28, 1958

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EXPERIMENTS IN CONDITIONING OPERANT VERBAL BEHAVIOR

A THESIS

Submitted to
The Graduate Council
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for the degree of
Doctor of Philosophy

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by

Edwin O. Timmons

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CHAPTER I

INTRODUCTION TO THE PROBLEM

In general, the writer's interests lie in the application of the principles of learning theory to the prediction and modification of gross human behavior. It is difficult to overemphasize the role of speech in the formation, shaping, and modification of an individual's behavior, and in the past few years a steadily growing body of investigators have been experimenting directly on speech, treating it as merely another behavior of the human organism rather than as an uncontrollable, supra-human phenomenon. Those who experiment in the area called verbal behavior generally follow Skinner's (45) operant conditioning procedures which entail using the free speech of the S as the dependent variable and the verbal and nonverbal behavior of the E as the independent variable or reinforcer. By using his own behavior as cues for action, the E attempts to systematically modify the operant verbal performance of the S.

A newcomer might ask if this procedure were not only restating what everybody already knows--that people

control and manipulate each other by word, gesture, or smile. The difference is, of course, that in the hands of scientists parameters and variables can be systematically derived under carefully controlled conditions and the resultant body of knowledge used to help better understand the complexities of human behavior.

The three experiments in this paper are intended to be the framework of an extended investigational program to systematically test out the variables and parameters of verbal behavior which seem most important to the examiner. These first studies began at the most primary level--the inducing of a verbal response and the weakening of an established verbal habit--and explored several parameters known to effect learning in general. To discover the comparative effects of amount of instructions, kind of reinforcement, and schedule of reinforcement, Ss were treated under all eight combinations of these parameters. Four methods of weakening established verbal behavior were utilized and compared in their effects; these were extinction, counter-conditioning, "punishment," and a combination of "punishment" plus counter-conditioning. A more complex study concerned assessing the concomitant change in a nonverbal behavior which was subtly related to a class of words which E reinforced without the S being able to verbalize

what was happening. The details of these experiments will be spelled out in later chapters.

Such programs as that described above are not uncommon. Krasner (30) has placed the size of the rapidly growing body of verbal conditioning literature at 31 articles in October, 1957 (2, 3, 8, 9, 10, 12, 13, 16, 17, 18, 19, 20, 26, 28, 29, 30, 31, 32, 35, 36, 37, 41, 42, 43, 44, 46, 49, 51, 56, 60, 61). Though the judgment of other reviewers might add or delete from Krasner's list, the figure is felt to be quite representative.

Each of the three major parts of the thesis were combined with its relevant references for the sake of clarity and were considered separately.

Inducing Verbal Behavior

Amount of Instructions

Few direct references concerning the amount of instructions given to the Ss were found. In two studies designed to test Thorndike's "immediate and mechanical" effect of reinforcement, Wallach and Henle (57) made a strong case for the importance of specific instructions to S. They concluded that reward, per se, has no automatic effect upon repetition of responses and that only when the situation is made sensible to the S will results

ensue similar to those on which the Law of Effect was based. Although Postman and Adams (39) decided that reinforcement is "automatic," they also emphasized the importance of specific instructions. Most of the other investigators did not discuss instructions as such, but by their design restricted the S to a few possible responses and thus made the purpose of the experiment implicit without verbal instructions. This is not to say that learning does not take place is the Ss are not in some way made aware of the purpose of the experiment. Verplanck (56) and his students cued selected responses during normal conversations with friends and obtained behavior change. McNair (35) purposely disguised his experiment as one investigating "anxiety level" and obtained learning.

Kinds of Reinforcement

Paramount among types of reinforcing stimuli is the use of affirmatory verbal responses by an experimenter to increase the frequency of a response; this was first made popular by Thorndike (52). His method of following a desired response with "Right" and an undesired response with "Wrong" has been used and modified by all the investigators in the field. Reinforcing

stimuli used by investigators in verbal conditioning can be divided into three general classes: verbal responses such as "Mmm hmm" and "Good"; nonverbal responses such as smiling, nodding the head, or leaning forward in the chair; and the occurrence of an impersonal such as a light, bell, or buzzer. By far the most popular reinforcing stimulus reported in the literature was the spoken "Good," which comprised 17 of the 46 reinforcers listed. "Mmm hmm" was used in 11 studies to rank as second most popular.

An interesting pair of experiments by Buss and Buss (5) and Buss, et al. (6) concerned the relative strength of "Right" and "Wrong" as cues to learning. They maintained that "Wrong" for an incorrect response is quite superior to "Right" for a correct response. Their conclusion that "Right" was practically useless as a reinforcing stimulus versus Thorndike's conclusion that "Wrong" has negligible effect on learning poses a study in itself.

Schedule of reinforcement

Only four studies reported an interest in differing schedules of reinforcement. It was difficult to decide what schedule was used in many of the experiments, and the logical assumption was that most had used a 100

per cent schedule. The review article of Jenkins and Stanley (23) on the effects of infrequent schedules showed that resistance to extinction was greatly enhanced by aperiodic and partial reinforcement. This appears to be one of the most fertile investigational areas in verbal conditioning.

Weakening Verbal Behavior

The purpose of this portion of the study was to assess the comparative efficacy of several means of getting rid of conditioned verbal behavior. Cohen, *et al.* (8) used two of the four methods compared in this thesis: omitting the reinforcing stimulus, and reinforcing a competing response. Klein (28) utilized three of the four: non-reinforcement, counter-conditioning, and negative reinforcement. Both these studies found results which essentially agree with the findings of the present experiment: non-reinforcement produced the slowest rate of weakening, while the other two methods produced faster rates of weakening. Six other studies used non-reinforcement or extinction as part of the experimental design and obtained weakening of the learned response (18, 29, 35, 36, 42, 46).

The Effect of an Unconscious Verbal Habit on a Related Nonverbal Behavior

This appears to be a virgin field, for few references were located describing even near similar phenomena. One study by Stevenson and Iscoe (47), in which a transfer of a learned relative-size discrimination was shown, stated that the ability to transpose the discrimination was positively related to the ability to verbalize the relationship. This trend was reversed by the findings of the present study which are more in line with Tanner's (50). Tanner found that learned "anxiety" to a conditioned verbal stimulus was more manifest in the Ss who were unable to verbalize the relationship between a stimulus word and a shock.

Unconscious Learning

Originally the thesis was not to be concerned with the problem of unconscious learning, but the unconscious nature of the learning in Phase III necessitated consideration of the phenomenon. Arguments for and against unconscious learning can be traced back to Leibnetz's (4) "petite perception-monad" formulation of the early 1700's, through Freud's (14) works of the early 1920's, and Thorndike and Rock's (53) 1935 paper on learning without awareness. Many others have become involved in the controversy (1, 10, 21, 22, 33, 37, 39,

43, 49, 50, 52). Varying degrees of positive results are offered by these investigators, with the differences usually being explicable in terms of the different experimental designs utilized by the differing groups. The phenomenon as it affects the modern verbal conditioning group has been summed up by Krasner (30) who reports that over 50 per cent of the experiments reviewed reported no S who became aware of the learning process to which he was being subjected. Further, only 5 per cent of the total S population was reported to have become aware of the experimental plans. The conclusion drawn is that the effect is undeniably real but that it varies according to the experimental situation, amount of structuring the S is given, and the definition of "learning" and "unconscious" subscribed to by the investigator.

The Operant Sample

An ancillary but important part of this research program was the gathering of a sample of operant verbal and drawing behavior of the undergraduate population at The University of Tennessee. Such direct sampling of the operant behavior differs from most other operant samples in that it was obtained directly from the S pool with the purpose of isolating a large number of

manipulatable variables that would lend themselves to wide range of operant conditioning situations. At this early date in verbal conditioning experimentation the responses available to be used as dependent variables are not yet assessed. Other lists were of little direct value except for information pertaining to collection of the data.

This cursory look at the literature of verbal conditioning argues that the tendency toward experimentation using conditioning techniques on verbal behavior will continue to grow and thus facilitate practical use of more and more of the laws of learning.

CHAPTER II

GENERAL PROCEDURE AND METHODOLOGY

The experiments in this study were separated into three groups--conditioning verbal behavior or Phase I, weakening verbal behavior or Phase II, and changing nonverbal behavior by verbal conditioning or Phase III. This chapter gives the over-all plan of experimentation for all three phases in a general way, but for a complete description and presentation of each experiment the reader is referred to Chapter IV for Phase I, Chapter V for Phase II, and Chapter VI for Phase III.

Phase I, discussed in detail in Chapter IV, was an experiment comparing the efficacy of eight sets of conditions in inducing a selected class of verbal behavior. The experimental task was selected through a pilot study of the operant verbal behavior of University of Tennessee undergraduates. As explained in Chapter III, it was found that words having "S" as the initial letter occurred approximately 15 per cent of the time. This frequency is high enough that one is assured of the occurrence of several "S-words" within a reasonably small

sample, and yet is low enough to allow the effects of learning to emerge.

The eight conditions used in Phase I were obtained by choosing three parameters which had proven to be important factors in learning and by varying each of them in two positions. The parameters chosen were amount of instructions, schedules of reinforcement, and types of reinforcing agents.

Amount of instructions was separated into "full" and "scant". In "scant" instructions the S was merely asked to say words--just any words--slowly enough for E to write them down and to keep going until asked to stop. "Full" instructions added to the above two bits of information: that words beginning with a certain letter were correct, and that the S should try to get as many right as possible.

Two schedules of reinforcement were used: 100 per cent, in which reinforcement was given for each correct response, and a 50 per cent fixed-ratio schedule in which every second correct response was reinforced.

Reinforcing agents were the E's saying "Right" or the sounding of a buzzer affixed to the desk out of sight of the S.

When all the combinations of these variables were laid out, eight conditions resulted, shown in Table XV, Chapter IV. They ranged from apparently simple conditions in which the S was told beforehand in some detail what he was expected to do, and then told that his correct responses were "Right" every time he made one of them, to the much more difficult condition in which the S was merely told to say words and was given a sounding of a buzzer on every second correct response. Between the condition giving many cues for performing the selected task and the quite unstructured Condition 8, the other six conditions are made up of intermediate numbers of cues for performing the task and, consequently, should be on some continuum of difficulty between Conditions 1 and 8.

Subjects were drawn from a large undergraduate psychology class at The University of Tennessee and were mostly sophomores with a sprinkling of other students. Males and females were used and were assigned to conditions systematically until three Ss had performed in each of the eight conditions, giving a total N of 24.

Each S was seated in a small, private office; was engaged in a short chit-chat session to promote feeling at ease in the situation; and was read the instructions

pertinent to the experimental condition in which he was placed by the E. He gave out single words until he reached a criterion of six consecutive S-words or, if the criterion were not met, a maximum of 100 words. A pilot study of the operant verbal behavior of the target population showed that six consecutive S-words were significantly above chance. The results of each S were recorded, and the eight conditions were compared as to their effectiveness in inducing learning of this verbal response.

Phase II, explained in full in Chapter V, was concerned with weakening established verbal behavior. Four methods were compared: (1) Extinction, in which the reinforcement was omitted from the correct response during the treatment or weakening phase, (2) "Punishment," in which reinforcement for the selected response was replaced by a signal that the response had become incorrect, (3) Counter-conditioning, in which the formerly correct group of words was no longer reinforced and the formerly incorrect words were rewarded, and (4) "Punishment" plus Counter-conditioning, in which all the previously correct responses were signalled to be wrong and all the formerly incorrect ones to be right.

Again, students in a University of Tennessee undergraduate psychology class were used as Ss and were assigned

to the four conditions systematically. Five Ss were used in each condition, making a total N of 20. None of these Ss had been used in Phase I. Each S was conditioned individually to a criterion of six successive correct responses under "full" instructions, with E saying "Right" to correct responses (again, S-words) on a 50 per cent fixed-ratio schedule. Thus all Ss were conditioned under the same procedure and were all performing at the same rate when the weakening treatment was begun.

As soon as the S had given the sixth consecutive S-word, the treatment phase was commenced with no signal from E and no break in the procedure. One hundred response-words were recorded for each S during the weakening or treatment phase and the results are compared in Chapter V.

Chapter VI reports the work done on Phase III, which was designed to test the possible effect of conditioned verbal behavior on subtly related nonverbal behavior. Teaching, preaching, debate, and especially psychotherapy are all based to a large degree on changing the verbal behavior of individuals with the tacit belief--or hope-- that the Ss' nonverbal behavior will undergo a concomitant change in the same direction.

Another extensive pilot study was necessitated to find suitable classes of both verbal and nonverbal

responses for experimentation in a laboratory setting. The sample of operant verbal behavior was searched for a category of words referring to an easily discriminable object or class of objects that occurred at a frequency suitable for manipulation. Words referring to buildings or building materials were given by every S and at a rate of about 11 per cent of the time.

It was then decided to assess the frequency with which the target population would draw a house or building of any sort when given a pencil, paper, no instructions, and told to "Draw something." The first control group of 61 Ss drew one picture each, and inspection showed that the pictures containing buildings comprised about 13 per cent of the drawings. The comparability of the levels of verbal and nonverbal behavior was striking. A later study in which each S was asked to draw three pictures yielded only 2 of 30 Ss drawing a building on the first picture, and 10 of 30 Ss producing a structure on any of their three drawings. In other words, houses were sometimes drawn by the "operant-level" group, but at a low enough frequency to allow the effects of the treatment to appear in a test period.

The plan of Phase III was to condition 10 Ss to say more words relating to buildings than are said under

operant conditions. If possible, it was desired that the Ss not become "aware" of the class of words chosen by E so that if the number of buildings drawn increased appreciably, the results could not be explained away on the basis of an S's having "had houses on his mind" consciously. To achieve these ends, a number of combinations of instructions, reinforcement schedules, and reinforcing agents were tried.

It was found that an aperiodic schedule tailored to the individual S's performance produced by far the fewest verbalizations of the limits of the response class chosen. In the final experimental group the percentage of reinforcements of building-words varied from a high of 87 per cent to a low of 64 per cent for the 10 Ss. The average schedule was three out of four building-words being reinforced with an affirmative phrase, either "OK . . . Yeah . . . Right . . . Unh-huh . . . Fine." The conditioning phase was carried on mostly by "feel," with frequent reinforcements given during the early part of the session and reinforcement being omitted when it seemed that the S was discovering the selected class of words. The smallest number of words elicited was 24 for a S who gave a great many responses in the house category very soon in the session; consequently, as near half of these

24 were house-words, he was stopped. The maximum number of words elicited from any S was 100. When any S was felt to be emitting the selected class at a higher than operant rate, he was stopped, handed a pencil and paper, and asked to "Draw something." When he finished, he was asked to draw another, then a third picture. Then the S was asked what he thought the session was all about; the answers were recorded. If this did not bring about a verbalization of the problem, he was asked what the E had been trying to attain. Then his reasons for drawing what he did were asked. The percentage of drawings of buildings in the control and treatment groups were compared to assess the effect of the conditioning treatment.

In summary, Phase I tested various combinations of cues for learning the task of saying words that begin with the letter S, while Phase II compared four methods of weakening the habit of saying S-words. Predictions were made in both cases according to the established laws of conditioning. In the first, it was predicted that the more specific the cues given for the task, the more rapid the learning would be. The second-phase prediction was that the behavior would drop out more rapidly as more and more cues were changed. Phase III entailed conditioning 10 Ss

to say words pertaining to buildings at greater than operant frequency. The type and schedule of reinforcement were made vague to keep Ss from being able to discover that building-words were the desired category. After conditioning, the experimental Ss were asked to draw something. The number of buildings drawn by the experimental group was compared to the operant rate of building-drawings. Chapter III, the study of operant verbal and drawing behavior of the target population, provided variables used in the three experimental phases as well as basic data on the pre-treatment behavior of college undergraduates.

CHAPTER III

OPERANT VERBAL AND DRAWING BEHAVIOR

Most of the studies in verbal behavior of human subjects have been concerned with controlled associations and have chiefly used standardized lists such as those of Kent-Rosanoff (27) or Thorndike and Lorge (55). The experiments using such lists were primarily concerned with content factors operating to produce certain associational connections. Another type of research is typified by the pioneer work of Cattell in which the factors responsible for word and phrase recognition were studied (7).

Experiments in strengthening and weakening verbal behavior within the framework of conditioning require more than standard lists of stimulus words. McGeogh and Irion, in stressing the need for standardized baselines for learning experiments comment that ". . . more of the variables which enter into the learning of special skills, academic habits, and modes of adjustment to everyday life should be incorporated into standardized experimental situations for purposes of laboratory investigations." (34)

This chapter reports an empirical investigation of the operant verbal and drawing behavior of the college

undergraduate--the indispensible organism to psychologists in an academic environment--and is a contribution to this "spade work" program as well as being the foundation from which the experiments in this study take off.

The pre-experimental or operant level of responding in a wide range of behavioral media will ultimately have to be assessed to yield a source of variables to manipulate which occur at approximately the "right" frequency in the college undergraduate.

The immediate purpose of this basic data collection was to provide a beginning point for the experiments contained in this study; however, it is also believed that these results may be of assistance to others who wish to experiment in the field of verbal behavior.

A survey of the literature showed that no word list was directly equivalent to the one being derived for this study. Similar lists were constructed by a group of investigators at Iowa under Johnson (25), in which responses of superior freshmen were used in compiling a word frequency list. However, the aim of the studies carried out by Johnson's group was to establish the factors of word responses which differentiate between schizophrenics and normals, and data from both groups were combined for the list published. Another group typified by Thorndike

and Lorge (55) analyzed magazines and juvenile books, transcribed telephone conversations, and in general were striving for generality of use by breaking up sentences into component words. The list offered here is different in that the target population was directly sampled, and there were no situational limits such as were imposed by the nature of business being transacted by the telephone conversations. Here the behavior was cued only by asking the Ss to give words and sentences.

The information about single words assessed from the data is as follows: (1) a list giving the per cent and number of times that each part of speech occurred, (2) a list showing the per cent and number of times that each letter occurred as an initial letter, and (3) lists presenting all words given arranged by frequency and initial letter. These were the major sources of manipulative variables. For sentences is offered a table giving the average length of each S's sentences and the number of self-reference sentences. Though no use was made of the information gathered about sentences, the data are included for the record and for others interested in this field. Operant drawing behavior of the target population is presented in Part B of this chapter.

Part A: Verbal Behavior

Experimental Procedure

The Ss were drawn from an undergraduate class of Introductory Psychology at The University of Tennessee which was composed primarily of sophomores and included a small proportion of freshmen and juniors. Since students from practically all departments of the University generally take this course, the sample is believed to be quite representative. Ss were selected from an alphabetized role, with every twelfth student being chosen until 12 names were obtained from the list of 160.

To determine whether a sample of orally omitted words was different from a written sample, the 12 Ss were divided before testing into two groups with an equal number of males and females in each; one group wrote all responses and the other gave them orally. To check for order effects, these groups of six Ss each were further divided in half; three were asked to give words first and sentences second, and the remaining three were told to give sentences first and then words.

Each S was seated at the same desk and was read the instructions that pertained to his group. Those giving their responses orally were told: "Please say words (sentences)--just any words (sentences)--slowly enough for me to write them down. Keep going until asked to stop."

E recorded all responses on prepared record sheets. Ss who were assigned to the "written" group were told: "Please write words (sentences)--just any words (sentences)--in the spaces prepared for them on these sheets of paper. Keep going until you finish all the spaces."

Each S was required to give both 100 words and 25 sentences; after he finished the first part of his task, he was told that he was then to give words or sentences, according to which he had not previously given.

Results

The data sheets were collected and analyzed for the characteristics previously listed. First, the 1200-word sample of individual words was considered.

Table I shows the median and mean number of times each part of speech was given in 100 words by each of the groups. The table was divided into four subgroups to compare written versus oral data and to check possible effects of the order in which the Ss were asked to perform. Means and medians are given for the four order-effect subgroups, as well as for the combined oral and combined written subgroups. The raw data can be seen in Table I of the Appendix.

TABLE I

MEAN AND MEDIAN NUMBER OF TIMES EACH PART OF SPEECH OCCURRED IN THE FOUR SUB-GROUPS TO ALLOW COMPARISON OF ORDER EFFECTS IN COLLECTING DATA. MEANS AND MEDIANS OF THE COMBINED WRITTEN AND ORAL GROUPS

	Means				Medians				Combined Oral		Combined Written	
	Oral		Written		Oral		Written					
	[a]SWO	WSO	SWW	WSW	SWO	WSO	SWW	WSW	$\bar{X}$	Mdn	$\bar{X}$	Mdn
Nouns	79.0	78.7	67.7	77.0	82	79	66	72	79.0	80.5	72.3	69.0
(Plu. N)	13.7	12.0	7.7	10.0	13	12	8	7	12.8	12.5	9.0	7.5
Verbs	4.7	6.7	13.0	10.7	3	4	11	7	5.7	3.5	12.0	9.0
Adj	14.7	11.3	5.3	7.0	15	13	6	6	13.0	14.5	6.2	6.0
Vbls	1.7	3.3	3.0	1.0	1	3	0	1	2.5	3.0	2.0	0.5
Adv	0.0	0.0	8.3	3.7	0	0	2	5	0.0	0.0	6.0	3.5
Conj	0.0	0.0	1.3	0.3	0	0	0	0	0.0	0.0	0.8	0.0
Prep	0.0	0.0	1.0	0.0	0	0	0	0	0.0	0.0	0.5	0.0
Intj	0.0	0.0	0.0	0.3	0	0	0	0	0.0	0.0	0.2	0.0
Pro N	0.0	0.0	0.3	0.0	0	0	0	0	0.0	0.0	0.2	0.0

[a]In 1st and 2nd positions "S" means "Sentences" and "W" means "Words." For 3rd position "W" means "Written" and "O" means "Oral," i.e., SWO tells that sentences, then individual words were emitted orally by the S.

It is immediately apparent that there are no appreciable differences among the four subgroups, except for a preponderance of adverbs in the group that wrote responses. This disparity is due almost entirely to one S in the written group who was substituted for a member of the target group who failed to appear. It was discovered after he performed that he was atypical in that he was a graduating engineering student who regarded psychology with some trepidation and hostility. Other slight differences were that the number of verbs was higher for the group writing their responses, while the group giving oral responses gave more adjectives. The differences, however, are meager compared to the similarities, for an overwhelming majority of words in every subgroup were nouns. Nouns comprised 75.6 per cent of all words given and the range of occurrence was from a low of 53 per cent to a high of 97 per cent of the individual samples. Plural nouns, which were used by Greenspoon in his well-known study (16), made up an average of 10.9 per cent of all the words emitted with the range being from 1 per cent to 22 per cent. Verbs (8.8 per cent) and adjectives (9.6 per cent) were the only other parts of speech mentioned with great enough frequency to be notable.

It was concluded, then, that neither the oral-vs.-written factor nor the order in which sentences and words were collected had any large, striking effect on the type words given. Consequently, the samples were combined. The data for the total sample are presented in Table II, showing for each part of speech the total times occurring, median, mean, per cent of occurrence, and the range from least to most times any S gave the part of speech.

The question of sex differences was investigated and the results are also displayed in Table II. In the important noun group, females gave 78 per cent nouns to the males' 71 per cent. Females also gave more plural nouns by a ratio of 13 per cent to 9 per cent, while males offered more verbs by a 3 per cent margin. All these differences came nowhere near reaching statistical significance. The only startling divergence of the sex groups was found in the number of adverbs each emitted; but the disparity was traced to the atypical engineering student mentioned before, whose 100 words contained 23 adverbs as compared to a total of 13 by the other 11 Ss combined.

The full sample of 1200 words was next examined to assess the frequency, percentage of occurrence, and rank of each letter as the initial letter of a word.

TABLE II

COMBINED SAMPLE BROKEN DOWN INTO PARTS OF SPEECH. ACTUAL NUMBER OF EACH PART OF SPEECH, MEDIAN, PER CENT OF OCCURRENCE, AND RANGE FOR SAMPLE OF 1200 WORDS. MEAN AND PER CENT OF OCCURRENCE OF EACH PART OF SPEECH BY SEX

	Total Sample (1200 Words, 12 Subjects)				Sex Differences			
					Females		Males	
	Number	Mdn	Perc't[a]	Range	Mdn	Perc't	Mdn	Perc't
Nouns	907	75.5	75.6	53-97	81.5	79.67	67.5	71.5
(Plu N)	(130)	(8.5)	(10.9)	(4-22)	(10.0)	(12.67)	(8.0)	(9.0)
Verbs	105	5.5	8.8	1-26	3.0	7.5	8.0	10.0
Adj	115	6.0	9.6	0-28	5.0	8.67	10.0	15.00
Vbls	27	1.5	2.3	0-9	3.5	3.67	0.5	8.67
Adv	36	0.0	3.0	0-23	0.0	0.33	2.5	15.20
Conj	5	0.0	0.4	0-4	0.0	0.0	0.0	0.83
Prep	3	0.0	0.2	0-3	0.0	0.0	0.0	0.5
Intj	1	0.0	0.08	0-1	0.0	0.0	0.0	0.17
Pro N	1	0.0	0.08	0-1	0.0	0.17	0.0	0.0

[a]Percentages are the same as the means of the combined sample.

Table III shows the number of times out of 1200 that each letter was used to start a word. The percentage of the time that each initial letter occurred is listed next, and the ranking of the alphabet follows, with the rank "1" being given the most frequently occurring initial letter. A rough check on the rankings was made by counting the pages devoted to each letter by Webster's New Collegiate Dictionary (15). The rank order was different in places as Table III shows, but there was general agreement between the number of words available and the words given by the Ss. If an E wishes to select initial letters as a variable to manipulate in an operant conditioning framework, the column giving the range should be of interest, for it provides an estimate of how frequently the extreme Ss in the sample emitted words beginning with a given initial letter.

For those interested in a S by S breakdown of initial letters, Table II in the Appendix contains these data. Further, Table III in the Appendix is a list of words occurring more than once arranged in order of frequency and by initial letter. From this list the frequency of any letter, group of letters, or content factors can be drawn for future experiments. As would be expected, no appreciable differences between the sexes emerged when the frequency of use of initial letters was studied.

TABLE III

THE FREQUENCY AND PER CENT OF OCCURRENCE OF EACH LETTER AS THE INITIAL LETTER OUT OF 100 RESPONSES BY EACH OF 12 Ss SHOWING RANGE OF OCCURRENCE, RANK ORDER OF FREQUENCY BOTH EMPIRICALLY AND FROM COLLEGIATE DICTIONARY

Ltr	Times Occur'd	Perc't	Range	Rank Emp	Rank Dict	Ltr	Times Occur'd	Perc't	Range	Rank Emp	Rank Dict
A	50	4.1	0-12	11	4	N	30	2.5	0-6	17	20
B	102	8.5	5-16	3	7	O	15	1.2	0-5	18	17
C	126	10.5	6-14	2	1	P	98	8.2	3-12	4	2
D	54	4.5	0-10	9	8	Q	6	0.5	0-2	21.5	6
E	39	3.25	0-6	15	13	R	61	5.1	2-11	7	9
F	59	5.0	1-11	8	10	S	175	14.6	10-18	1	3
G	45	3.75	2-5	13	15	T	71	6.0	3-11	5	5
H	47	4.0	0-9	12	12	U	6	0.5	0-2	21.5	16
I	31	2.6	0-11	16	11	V	5	0.4	0-2	23	20
J	10	0.8	0-1	19	21	W	65	5.4	3-8	6	16
K	4	0.3	0-1	24	22	X	0	0.0	0-0	25.5	26
L	42	3.5	0-7	14	14	Y	7	0.6	0-3	20	24.5
M	52	4.3	2-7	10	6	Z	0	0.0	0-0	25.5	24.5

One of the prime reasons for the collection of operant verbal data was to select variables for use in the three experimental sections of the dissertation. The letter S as an initial letter was chosen as being most satisfactory as a learning task to be used in the first two experiments because it occurred at a relatively high frequency and with quite high consistency in all Ss. A criterion of learning to say more S-words was derived by finding the longest consecutive run of words beginning with S given by any S in the operant sample, and by then discovering what longer series of S-words was sufficiently above the operant runs for one to feel statistically sure that chance would not produce such a number of S-words in a row. The number of words beginning with S for each S is broken down into blocks of 25 trials in Table IV to show the consistency of occurrence of the selected words. Also included are the longest consecutive runs of initial S's; the longest was a series of four, one a series of three, and the rest two or one. Computation showed that six consecutive words beginning with S is a significant, yet attainable, criterion. Therefore, this criterion was used throughout the study.

One further bit of information was needed from the verbal behavior sample. As Phase III entailed conditioning Ss to say words pertaining to buildings or building

TABLE IV

NUMBER OF WORDS OUT OF 100 WORDS BEGINNING WITH "S" EMITTED BY EACH S SHOWN IN BLOCKS OF 25 TRIALS. LONGEST CONSECUTIVE RUN OF "S"-WORDS FOR EACH S. MEDIANS FOR EACH BREAKDOWN

S	Blocks of 25 Words				Total	Longest Consecutive Run
	1st	2nd	3rd	4th		
1	5	1	5	3	14	3
2	4	3	3	5	15	2
3	3	1	5	4	13	1
4	5	3	4	3	15	2
5	4	2	4	4	14	2
6	3	1	3	2	9	2
7	1	4	4	6	15	2
8	5	2	6	5	18	2
9	3	1	6	7	17	1
10	4	4	2	4	14	1
11	3	7	3	3	16	4
12	5	2	3	4	14	2
Median	4	2	4	4	15	2

materials, it was necessary to assess the frequency with which these words normally occur. Table V lists the number of times that reference was made to buildings in general, any specific building, materials for building (wood, saw, wire, etc.), or any major component of a building (door, room, furnace, etc.). All the above were grouped together and termed "building-words." Listing was made for each S by 4 blocks of 25 trials with the "oral" and "written" groups given separately. The "oral" group gave more house-words by a factor of 2 1/3 to 1. As oral responding was selected as the method to be used in the specific experimental situation, the "oral" group's percentage of occurrence of 11 per cent was deemed quite satisfactory. The data assessed from the sample of sentences, though not used in the succeeding experiments, are reported in Table VI.

Part B: Operant Drawing Behavior

In searching for a nonverbal task to use as the dependent variable in the Phase III experiments E found that drawing was admirably suited in that a wide range of concepts (although nonverbal in nature) were easy to recognize, collect, and categorize. These factors were necessary if a concomitant change in nonverbal performance

TABLE V

NUMBER OF TIMES EACH S REFERRED TO BUILDINGS OR BUILDING MATERIALS. DIVISIONS BY BLOCKS OF 25 TRIALS AND BY "ORAL" AND "WRITTEN" GROUPS

S	Blocks of 25 Words 1st	2nd	3rd	4th	Sum	
				Oral		
1	2	2	0	7	11	
2	0	4	15	6	23	
3	3	1	1	4	9	
4	2	0	2	4	8	
5	3	1	1	4	9	
6	1	3	0	3	7	
					67	11 per cent
				Written		
7	0	1	0	2	3	
8	0	1	0	0	1	
9	0	0	0	0	0	
10	4	1	2	0	7	
11	3	4	2	0	9	
12	3	5	2	0	10	
					30	5 per cent

TABLE VI

THE MEDIAN NUMBER OF WORDS PER SENTENCE, THE RANGE FOR EACH S, AND THE NUMBER OF SELF-REFERENCE SENTENCES GIVEN BY EACH S. 12 Ss; 25 SENTENCES PER S

Subject	Median Length	Range	No. Self References
1	14	6-36	19
2	8	4-17	13
3	6	3-11	12
4	11	4-22	14
5	6	3-12	18
6	9	3-14	19
7	11	5-24	5
8	7	3-11	0
9	7	3-12	5
10	8	4-11	1
11	12	4-20	23
12	14	4-25	20

brought on by verbal conditioning was to be demonstrated. What a person says and draws are both public information and therefore amenable to experimental manipulation. The S's thoughts, feelings, or sensations are only accessible through being made public via speech or other media.

Drawing behavior, then, proved to be a most suitable dependent variable for the experiments at hand. However, before a change could be shown, it was necessary to find out what the target population would draw before receiving treatment, in this case related verbal conditioning.

Experimental Procedure

Ss were again drawn from the undergraduate psychology courses--which were fortunately quite large. Three separate samples were obtained. The 13 Ss in the first sample were tested individually in E's office and were selected from the alphabetized role by beginning with the sixth name and choosing every twelfth student as in the previous study. The S was seated, presented with an 8 x 11 sheet of blank paper and a pencil, and told to draw something. Questions were answered with "Just draw something; anything you wish." When the S indicated that he had finished, he was told to write a

brief description of what he had drawn; this was placed in the lower right-hand corner of the sheet. The titles of the individual drawings are in Table IV of the Appendix.

Checks were run on the typicality of the sample by randomly selecting two Introductory Psychology conference sections of 24 students each and obtaining drawing from each group separately. The following instructions were given:

> You have been given a plain sheet of paper. I want each of you to draw something on your paper with the sheet held longways, like this (E drew a rectangle with base longer than altitude on the board). It is very important that you look at no one else's drawing. This is not a test of any kind, but background for a series of future experiments. Remember, draw anything you wish without reference to anyone else's paper--just draw something.

When it was evident that about half the class had finished, E added: "When you finish, write a brief description of what you have drawn in the lower right-hand corner (indicated on board) of your paper."

The titles of the drawings of both groups are included in Table IV of the Appendix.

As reference to buildings or building materials had been selected as the variable to be manipulated, all drawings that contained buildings of any sort were placed in one category. The rest of the pictures arranged

themselves naturally into categories, which turned out to be landscapes, people, means of transportation, inanimate objects or animals, and geometric figures.

Results

Table VII shows the number of drawings that fell into each of the categories for each of the three samples. It will be noted that the consistency is striking among the groups; consequently, the three were combined to produce one large sample of 61 Ss. Eight drawings, 13 per cent of the total, fell into the building classification. This figure provided the first estimate of the pre-treatment frequency of "building-drawing." Pictures placed in the building category were not required to have a building as the primary theme. The inclusion of any building-like structure, even as part of the background, caused a drawing to be thrown into the "building" group.

During the time in which E was trying to learn as much as possible about the operant drawing habits of the target population, the advisability of collecting another sample of drawings was perceived. When Ss were asked why they drew what they had drawn, a large portion volunteered that they had offered their favorite doodle. It seemed

TABLE VII

OPERANT DRAWING SAMPLE I: ONE DRAWING PER S.
NUMBER OF DRAWINGS FALLING IN EACH OF
6 CATEGORIES DIVIDED BY SUB-SAMPLES

Categories	Sample 1 (individual)	Sample 2 (group)	Sample 3 (group)	Sum
Buildings	2	4	2	8
Landscapes	1	3	3	7
Transportation	1	6	3	10
People	3	4	8	15
Objects and Animals	3	5	6	14
Geometrical Figures	3	2	2	7
N =	13	24	24	61

possible that the favorite doodle--being a tremendously overlearned response--might override a large portion of the effect of the relatively short conditioning process. If that were the case, an average of eight near-subliminal reinforcements would be pitted in many cases against a habit which could have been performed literally thousands of times over a period of many years. Consequently, it was felt that if the S were asked to give three drawings, he might give the overlearned response first, and then be free to emit other responses--preferably the one incurred by the treatment--for at least one of the remaining drawings. In short, this was an attempt to check for a stacked deck against E.

As group and individual samples of drawing behavior had been shown to have no basic differences, ease of collection dictated gathering the new sample from groups. To add generality to the second sample--and also because the psychology class was finally depleted--sophomore English classes were used. Three groups of 10 Ss each were given three sheets of paper and were read the instructions previously used for gathering data from a group with the addition that three drawings were required. The drawings were sorted into the same six categories and the results are shown in Table VIII. The

TABLE VIII

OPERANT DRAWING SAMPLE II: THREE DRAWINGS PER S. NUMBER OF DRAWINGS FALLING INTO EACH OF 6 CATEGORIES. TABLE DIVIDED BY SUB-SAMPLES AND 1ST, 2ND, AND 3RD TRIALS

Categories	Sub-Sample I			Sub-Sample II			Sub-Sample III		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Buildings	0	1	2	1	1	2	1	2	1
Landscapes	4	2	1	1	0	1	3	2	2
Transportation	3	1	3	3	3	1	1	2	0
People	2	3	1	2	0	1	1	2	0
Objects and Animals	0	2	1	1	6	5	1	1	5
Geometrical Figures	1	1	2	2	0	0	3	1	2

titles of each picture are given for individual Ss in Table V of the Appendix.

This second sample produced an even lower percentage of buildings on the first drawings. Only 6.7 per cent or 2 of 30 of the first drawn pictures contained buildings. Only 10 of 30, or 33 per cent, of the Ss produced a picture containing a building on any of their three offerings.

By the above method was gained a rather complete view of what a S from the target population could be expected to draw without being given cues as to subject matter from E. These data were used as a comparison with the post-treatment drawing of the Ss used in Phase III of this thesis.

Summary

The experimental portions of this dissertation entailed attempts to change verbal and nonverbal habits of undergraduates at The University of Tennessee. Before change could be shown, it was necessary to assess the operant, or pre-treatment, level of responding in areas of performance that had been tentatively chosen for manipulation. Samples of verbal and drawing behavior

were elicited from a systematically selected portion of the target population. Words referring to buildings or building materials and drawings with buildings in them were selected as variables.

CHAPTER IV

INDUCING VERBAL CONDITIONING

The parameters affecting learning have been empirically studied in the laboratory by a large number of psychologists over a period of many years. Emphases have been laid on one or several parameters by investigators according to basic theoretical biases. However, most of the more systematic comparisons of parameters of learning have been done on sub-human species and have primary relevance to basic learning theory or further experimentation on the laboratory species used in the studies. How well the principles evolved by these studies transfer to verbal learning in human Ss is left a matter of speculation.

The importance of verbal behavior to humans is undeniably immense, for words are the vital tools of thinking and of communicating with other human beings. Therefore, the experiment reported here attempted to deal directly with the factors affecting the learning of verbal responses in human Ss. At the same time an effort was made to maintain a simplicity of design that

allowed for avoiding the overwhelming complexity that normal speech situations entail.

An operant conditioning design was set up in which human Ss were subjected to one of eight combinations of three factors known to affect verbal learning. The verbal task selected was quite simple--saying words beginning with the letter S. Chapter III tells in detail how the task was chosen. The selection of factors to be compared was influenced by the E's theoretical bias toward the importance of the number of cues to the S to perform in a certain manner. For this reason the parameters of amount of instructions, kind of reinforcement, and schedule of reinforcement were chosen from a large number of possible parameters. The prediction inherent in the theory is that increased cues to perform in a particular way will cause a direct increase in learning. Obversely, when cues are not offered or are vague, learning will be less rapid.

Experimental Design

Ss were drawn from a large undergraduate psychology class at The University of Tennessee and were mostly sophomores with a sprinkling of other students. Males and females were used and were assigned to conditions systematically until three Ss had performed in

each of the eight conditions, giving a total N of 24. The eight experimental conditions were obtained by using two variations on the parameters of amount of instructions, type of reinforcement, and reinforcement schedule. Table IX presents a systematic breakdown of the conditions for easy referral.

All Ss in each of the four conditions calling for "full" instructions were read the following while they were allowed to read the same material from a printed card: "Please say words--just any words--slowly enough for me to write them down. Words beginning with a certain letter are correct. Try to get as many right as possible. Keep going until asked to stop." Ss in the other four conditions which entailed "scant" instructions read the following while it was being read to them: "Please say words--just any words--slowly enough for me to write them down. Keep going until asked to stop." All questions were answered only by re-reading the instructions to the S.

The two reinforcing agents were (1) the ringing of a door buzzer attached to the side of E's desk out of sight of the S, and (2) E's saying "Right" in as near as possible a consistently conversational manner.

TABLE IX

MAKEUP OF THE 8 CONDITIONS TO BE COMPARED FOR ABILITY TO PRODUCE LEARNING. VARIANTS MARKED "+" RECEIVE THE MAXIMAL CUES IN EACH OF THE PARAMETERS AND THOSE MARKED "-" RECEIVE MINIMAL CUES (N = 3 per condition)

Condition	Amount of Instructions	Kind of Reinforcement	Reinforcement Schedule	Sum of Plus Signs
1	Full (+)	Right (+)	100% (+)	3
2	Full (+)	Right (+)	50% (-)	2
3	Full (+)	Bell (-)	100% (+)	2
4	Full (+)	Bell (-)	50% (-)	1
5	Scant (-)	Right (+)	100% (+)	2
6	Scant (-)	Right (+)	50% (-)	1
7	Scant (-)	Bell (-)	100% (+)	1
8	Scant (-)	Bell (-)	50% (-)	0

The schedule of reinforcement was either 100 per cent, under which every S-word was reinforced by the buzzer or "Right," or 50 per cent fixed-ratio reinforcement which required that every other S-word received "Right" or the buzzer.

Each S was seated in a small, private office; was engaged in a short period of irrelevant talk to engender ease in the experimental situation; and was read the instructions pertaining to the experimental condition in which he was placed by E. The S then gave single words until he reached a criterion of six consecutive S-words or, if the criterion was not met, a maximum of 100 words. The responses of each S were recorded on prepared record sheets. A pilot study of the operant verbal behavior of the target population--which is reported in Chapter III--showed that six consecutive S-words were significantly above the number that could be expected to occur consecutively by chance.

After the treatment period was completed, each S was asked for his impression of what the session was all about; this information was entered on the back of the S's record sheet. As the individual S left E's office, he was asked to refrain from discussing the experiment with any of his classmates. This admonition

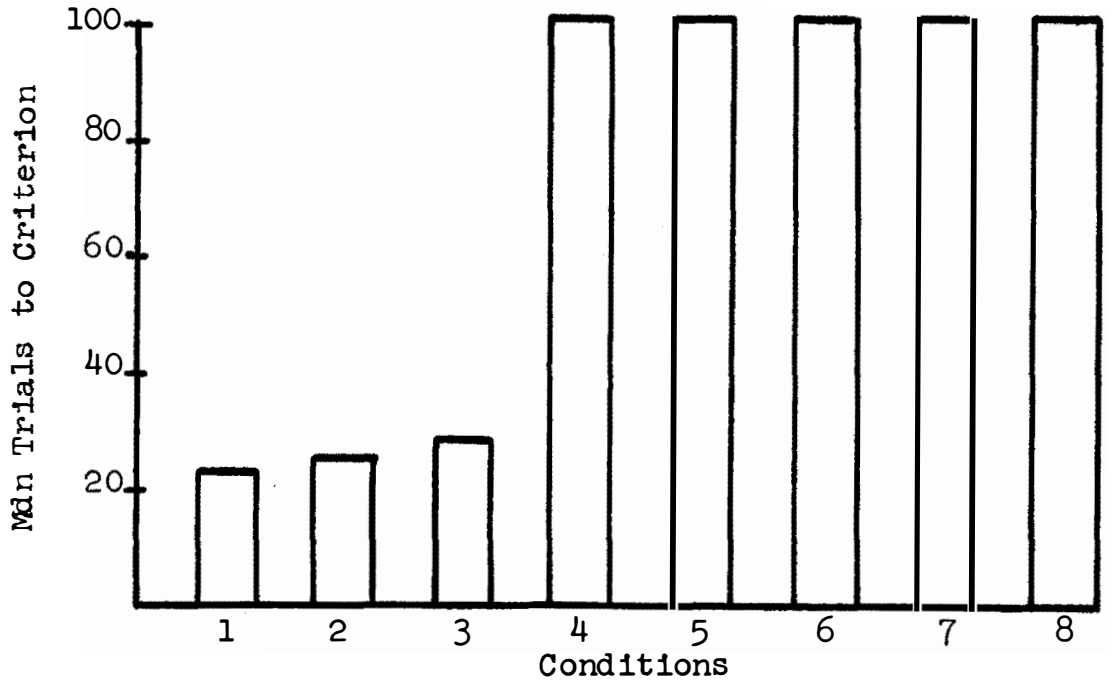
was strengthened by E's mentioning that the procedure changed subtly from S to S even though the general appearance of the experiment remained the same.

As it was expected that the conditions offering large numbers of cues would produce learning to the criterion prior to the S's one-hundredth response, it became necessary to impose the assumption that any S who reached the criterion of learning was able to give words beginning with S on all remaining trials. In other words, if a S in Condition 1 were to give six S-words during the first 25-word block of trials, it would be assumed that he had discovered the correct response class and would give 75 S-words as his last 75 responses. Such an assumption was necessary to produce groups of equal size that could be directly compared. It is fully realized that a number of factors such as fatigue, exhaustion of the S's supply of S-words, or monotony would probably cause many Ss to give some responses not in the selected category. The mitigating factor turned out to be that every S who reached the criterion of learning was able to verbalize that E wanted him to continue to give words beginning with the letter S.

A prediction of the relative efficacy of the eight conditions was made by assigning a plus sign to "full" instructions, "Right," and the 100 per cent schedule, and a minus sign to "scant" instructions, the bell, and the 50 per cent fixed-ratio schedule. The plus signs denote that the variants which they mark offer more cues than the variants marked with minuses. Table IX shows the sum of the plus signs for each condition which represents a rough prediction of the order in which they will produce learning. This prediction was based solely on the number of cues and not on the relative strength of each parameter, for the latter point was one of the experimental questions which the study was asked to answer. For example, Condition 1 received the maximal number of cues for each of the three parameters (three plus-values) and was thus predicted to be the condition which should produce the fastest learning. Condition 8 received minimal cues for each parameter (three minus-values) with the resultant prediction that it would produce the least and slowest learning. Conditions entailing intermediate numbers of cues fell between these extreme cases.

Results

The results are shown graphically in Figure 1 in two ways: the first graph represents the median number of



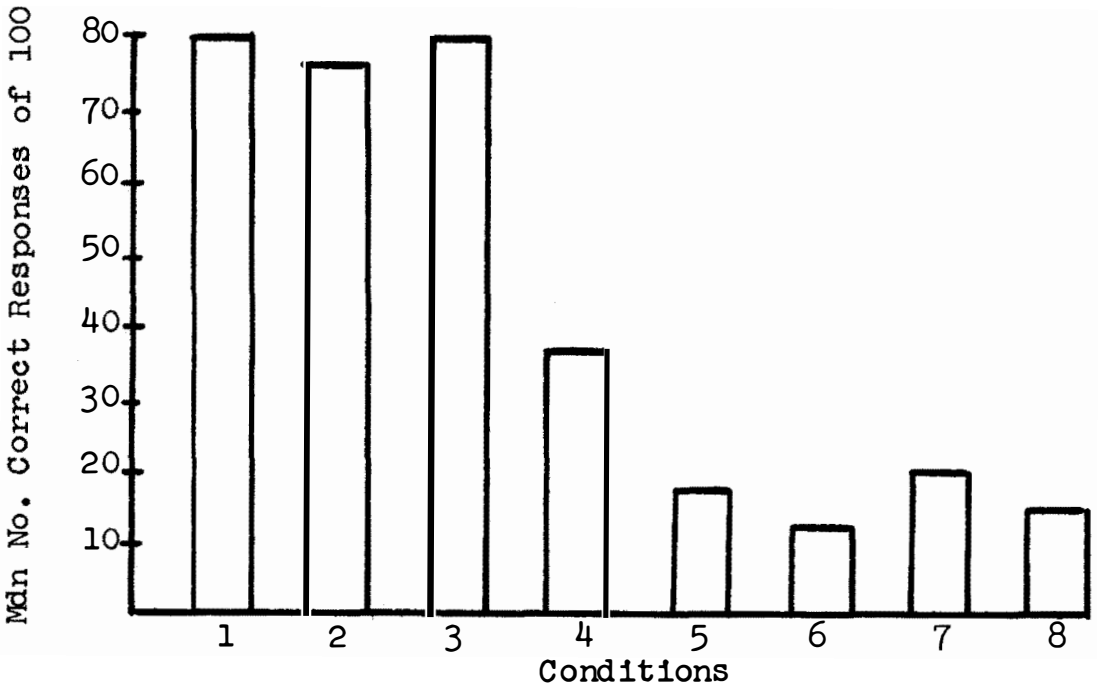


Figure 1

Median Trials Required for Ss to Reach the Criterion of Learning and Median Number of Correct Responses by Ss in Each Condition Given in the 100 Learning Trials

trials required for the Ss in each treatment group to learn to the criterion, while the second gives the mean number of responses of each group during the entire 100-word treatment period. Both histograms are quite regular and are in the predicted direction, with slower and less complete learning being associated with the conditions giving the Ss less cues for performing the selected task. Table X presents the mean and median number of trials to reach the criterion of learning and the mean and median number of S-words given by Ss in each of the eight conditions. Also included is a breakdown of the number of Ss in each condition who reached the criterion of learning.

It will be noted that the mean of Condition 7 breaks from the performance level predicted for it by the very regular progression of the data. The deviancy is easily traced to one S, number 7-1, as reference to the performance of individual Ss in Table VII of the Appendix will show. The other two Ss in Condition 7 are seen to have performed at the expected level, near that of Conditions 6 and 8. Still, such a marked deviation from expected performance demanded investigation. Three extra Ss were given the Condition 7 treatment and all performed at the expected level; none of the three reached the criterion of learning and the mean number

TABLE X

MEAN AND MEDIAN PERFORMANCE DATA OF THE 8 TREATMENT GROUPS: NUMBER OF Ss REACHING CRITERION, NUMBER OF TRIALS TO REACH CRITERION, AND NUMBER OF CORRECT RESPONSES OUT OF 100 TREATMENT TRIALS PER S

Condition	No. Reaching Criterion	Mean Trials to Criterion	Median Trials to Criterion	Mean No. Correct Resp.	Mdn. No. Correct Resp.
1	3	23	23	79.7	79
2	3	25	25	77.0	75
3	3	39.5	26	65.0	79
4	1	78.3	100	40.3	34
5	0	100	100	14.3	16
6	0	100	100	11.7	10
7[a]	1(0)	71.3(100)	100	32.7(14.0)	18
8	0	100	100	12.7	13

[a]Numbers in parentheses exclude S 7-1, shown to be deviant. Three extra Condition 7 Ss not included in either computation.

of responses in the selected category during the conditioning period was 12.9. None of the extra Ss were used in any of the computations. The deviant S turned out to be a quiet, studious sophomore majoring in premed who had earned an almost perfect scholastic record at the University. On questioning he offered that he liked puzzles and had presumed some problem must be envolved in the situation even though he had not been told of it, and that he had simply concentrated on E's actions to discover any hints that might emerge. The conclusion drawn from S number 7-1 is that individuals within any group show tremendous variability, while the conclusions drawn from the other five Ss treated in Condition 7 is that the phenomenon suggested by the smooth, regular graph is quite real. Except for the effect of this deviant which affects the means--though not the medians--the presence and regularity of the effect is striking. Data for individual Ss are given in Table VII of the Appendix.

In addition to bearing out the differential effect of the treatments, the individual data suggested that some improvement in performance over the blocks of 25 trials took place even when Ss failed to reach the criterion of learning and were unable to verbalize the

solution to the learning problem. Phase III of this thesis was concerned in large part with obtaining learning without the S's awareness; therefore, attention was focused on the four conditions which did not produce learning to the criterion or verbalization of the S-word concept. These conditions were 5, 6, 8, plus the two non-deviant Ss in 7.

Reaching a criterion set by an E is, of course, not the intrinsic meaning of learning, for learning has been defined as a systematic increase in the frequency of a reinforced response (45). Consequently, if the performance of the groups who did not learn to a criterion shows that a regular increase across trials took place, then learning has taken place. The Ss in the conditions which failed to produce learning to the criterion were combined and the mean number of responses that the combined group gave by blocks of 25 trials was plotted in Figure 2. It will be noted that the curve shows a small but regular increase in frequency over the first three blocks of trials and a slight decrease during the last 25 trials. Consistency of the phenomenon was shown by comparing the number of correct responses in the first 50 trials with the number given in the last 50 trials for each S. Of the 11 Ss, 9 gave an increased

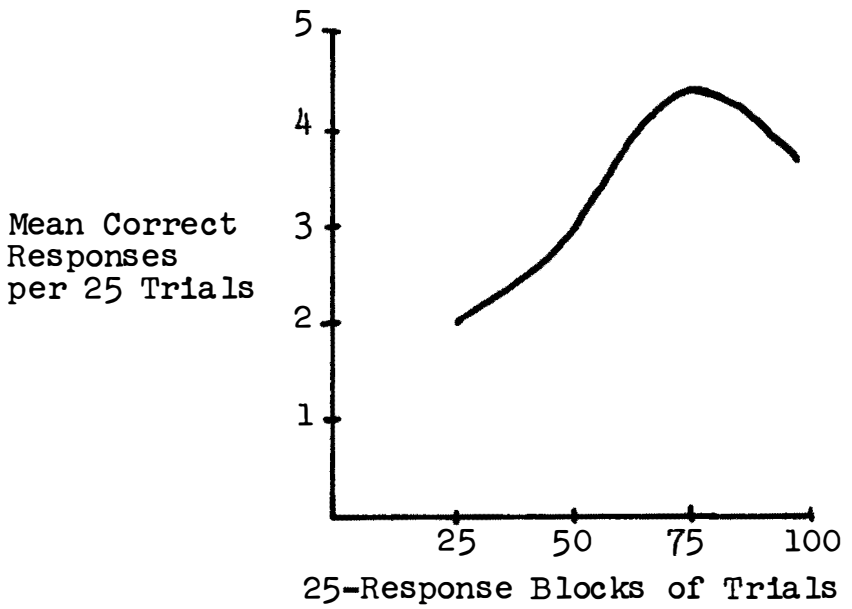


Figure 2

Mean Number Correct Responses per 25 Trials for Ss in Conditions 5 through 8 Who Failed to Reach the Criterion of Learning

number of responses as treatment proceeded. Application of the binomial expansion showed that such extreme distributions can be expected to occur by chance 3.3 times in 100. The dropping-off phenomenon which occurred in the last 25 responses was present in almost every individual learning curve, but no clear-cut answer is offered to explain it.

Amount of instructions is clearly seen as being the most powerful of the three parameters in bringing about verbal conditioning. Conditions 1 through 4 entailed "full" instructions while 5 through 8 received the instructions called "scant." Thus 12 Ss were exposed to each of these variants. The number of Ss who reached the criterion of learning in the "full" instruction group was 10 of 12, while only 1 of the 12 Ss who received "scant" instructions reached the criterion. The application of Chi Square to these data yields a probability near .001, which argues that chance alone can be expected to yield such a division one time in a thousand trials. A further comparison of the four "full" vs. the four "scant" conditions on the basis of the number of S-words given in 100 trials was accomplished by dividing the mean and median number of S-words given by each group on both the grand mean and the grand median of the entire sample.

The four conditions receiving "full" instructions all exceeded the grand mean and median, and the four receiving "scant" instructions fell below these figures. Thus, a 4-0 0-4 split was obtained; Fisher's Exact Test (24) shows that such results can be expected 14 times in 1000. When a comparable analysis was performed on the individual Ss, 11 of the 12 "full" Ss exceeded the grand median and only 1 of the 12 "scant" Ss. These results yielded a P value of far less than .001.

The other two parameters showed relatively little ability to pull the conditions apart and no significant trends were discovered. As the parameter of amount of instructions produced such a drastic separation of the conditions, it became necessary to run separate comparisons as to the differential effects of schedules of reinforcement and type of reinforcement in each of the two divisions caused by the "full" and "scant" instructions. The comparisons entailed combining--and thereby holding constant--one of the remaining parameters (i.e. Conditions 1 and 3 received both "full" instructions and 100 per cent reinforcement) to allow the effect of the remaining variable--in this case "Right" vs. the bell--to be evaluated. The statistical comparisons all fell far short of accepted levels of significance, most of them being, in fact, near chance.

The answer to the question "What happened?" emerges quite clearly when one steps back from the data and notices that the first three conditions form an homogeneous group, Condition 4 fails at an intermediate level, and Conditions 5 through 8 form another homogeneous group. Conditions 1 through 3 have in common the powerful "full" instructions and one other variant giving maximal cues for learning. Condition 4 received "full" instructions but was given the minimal variants of the other two parameters. Practically no learning occurred in the last four conditions, evidently because they have in common the minimal variant of the amount of instructions parameter. The results seem to say that without maximal instructions, variations in the other two learning factors is unlikely.

Discussion

The results showed clearly that Ss learn faster when many concise cues are offered concerning how they are expected to perform. In almost every case the conditions receiving more positive cues had higher percentages of Ss reaching the criterion, reaching the criterion more quickly, and giving more of the selected class of words than conditions receiving more vague cues.

Amount of instructions was the most potent determinant of learning of the three used in the experiment. The cues added in the "full" instructions were in words and therefore did not have to be interpreted by the Ss. The variation in this parameter directly told one-half the Ss that the initial letter of the words he was to say held the key to "correctness" and that he should strive to continue saying "correct" words. By comparison, the group with "scant" instructions was only told to say words, and if they were to solve the problem situation, they first were required to formulate on their own the problem to be solved. When "Right" is said to a S following a response he has made, it is quite clear to him that his response is satisfactory, for such situations have occurred many times in the experience of virtually all persons. A buzzer, on the other hand, in the past history of the S might have meant any number of things: someone at the door, time for class to be over, a warning that five seconds remain before the next round of boxing begins, and so on. The S is required to discover a meaning as he performs which he then must put into words--or thoughts--so that they can be used as cues for continued action. Somewhat similarly, a 50 per cent fixed-ratio

schedule might mean to a S that a second factor along with the correct initial letter concept must be discovered before he has succeeded. Such reasoning was frequently verbalized during the experiment. A S receiving a signal of some sort by which he may check his performance one hundred per cent of the time has no such problem.

The data bore out the efficacy of fuller, more precise instructions to an overwhelming degree, but the differential effects of the other two parameters seemed somewhat watered down by the striking differences attributable to amount of instructions. The general tendencies were visible in the data, but none of them were near statistical significance.

The present experiment was designed primarily to develop a method of experimenting with verbal responses of Ss from an undergraduate population. Consequently, only rather primitive estimates of comparative strengths of a few parameters of learning were touched on. The need is quite obvious for an extensive, coordinated program to empirically derive strength-values of the factors known to effect learning. For instance the three parameters used in this study have almost limitless degrees of variation rather than the two almost arbitrarily chosen variants used. Kind of reinforcement

could be varied from an almost imperceptable change in stimulation to intense changes in every receptive modality of the S--sound, light, heat, smell, etc. In the present study the extremely powerful and interesting effects of aperiodic reinforcement were not even touched on. The experimental method used here proved to be satisfactory and relatively sound and points directly to further experimentation in the field of verbal learning.

Summary

The impact of varying the number of cues for responding verbally in a prescribed manner was investigated by comparing the rapidity and degree to which college undergraduates learned a simple verbal conditioning task. Variations of amount of instructions were either "full" or "scant"; in kind of reinforcement, E's saying "Right" or sounding a buzzer; and in reinforcement schedules, 100 per cent or 50 per cent fixed-ratio. All combinations of these parameters produced eight conditions; 3 Ss were placed in each. The prediction of more cues producing faster and more complete learning was borne out, and amount of instructions was by far the most potent factor of the three compared.

CHAPTER V

COMPARISON OF THE EFFICIENCY OF VARIOUS METHODS OF WEAKENING VERBAL BEHAVIOR

Statement of the Problem

This chapter is concerned with the relative efficiency of four methods of weakening verbal habits in human subjects: Extinction (Ex), "Punishment" (P), Counter-conditioning (CC), and "Punishment" plus Counter-Conditioning (P+CC). Table XI briefly describes the operations that make up each method. By no means are these four weakening methods presumed to be exhaustive; rather, they were selected from a multitude of possible factors for three general reasons: (1) they provide a good framework for a test of the theoretical tenet that cue-change is an important factor in changing behavior; (2) there is a strong resemblance between these methods and those used in a wide variety of everyday situations, such as child-rearing, teaching, psychotherapy, and the ministry; (3) extinction, punishment, and counter-conditioning are utilized frequently in experimental literature and a need was apparent to directly compare them experimentally.

TABLE XI

NAMES AND OPERATIONS COMPRISING THE FOUR TREATMENT CONDITIONS COMPARED FOR ABILITY TO GET RID OF CONDITIONED VERBAL BEHAVIOR; NUMBER OF CUES CHANGED FROM CONDITIONING TO TREATMENT PHASES AND PREDICTED ORDER OF EFFICACY

Treatment	Operations	Cues Changed	Predicted Order Effic	N
Extinction	Omit "Right" from formerly correct class	1	4	5
"Punishment"	Omit "Right" from formerly correct class; add "Wrong" to form. correct class	2	2.5	5
Counter-Conditioning	Omit "Right" from formerly correct class; add to formerly incorrect class	2	2.5	5
"Punishment" plus Counter-Conditioning	Omit "Right" from formerly correct class and add to formerly incorrect class; add "Wrong" to formerly correct class	4	1	5

An interesting definitional problem arose with the condition labeled "Punishment." For the purpose of this experiment, punishment consisted of E's saying "Wrong" in the weakening section of the experiment to a response that had been labeled "Right" in the conditioning phase. A very large body of literature exists concerning the effect of punishment on learning. McGeogh and Irion (34) concluded that Thorndike's 1932 formulation of the "law of effect" is most probably correct when it states that punishment, per se, is ". . .responsible for little, if any, unlearning." We are further told that Thorndike believed that a response gains more strength from occurring than it loses from being followed by the word "Wrong" used as a punishment.

Despite Thorndike's conclusion, the hypothesis advanced in this experiment was that the greater the degree of cue change from the conditioning to the treatment phase, the greater the corresponding efficiency of the weakening method. Inherent in this hypothesis is a prediction that the condition "Punishment," which involves two gross cue changes, will be a more efficient suppressive agent than straight extinction, which entails only one change.

Experimental Procedure

All Ss used in this experiment were undergraduates from an Introductory Psychology class at The University of Tennessee. They were asked to volunteer with no distinction being made between sexes, college, level, etc., for E previously had ascertained by means of the operant behavior sample reported in Chapter III that none of these factors had a significant effect on the type behavior being elicited. The first S to report was assigned to Treatment 1, the next to Treatment 2, and so on until each treatment group contained five Ss. Every S was seated in the same chair in the E's office and was engaged in a short period of light conversation to allow for overcoming nervousness and getting accustomed to E as a person. Recording sheets with four columns of 25 spaces were prepared for all Ss.

The following instructions were read aloud while the S read them from a printed card: "Please say words--just any words--slowly enough for me to write them down. Words beginning with a certain letter are correct. Try to get as many right as possible. Keep going until asked to stop." Questions were answered only by re-reading the pertinent portion of the instructions verbatim.

Saying words beginning with the letter S was chosen as the habit to be strengthened by conditioning. Chapter III tells the details of how this task was selected. During the conditioning phase Ss were reinforced by E's saying "Right" when they said words beginning with the letter S. Reinforcement was administered on a 50 per cent fixed-ratio schedule. Conditioning continued, with E recording all responses, until a criterion of six correct responses in a row was attained. This criterion was empirically evolved as reported in Chapter III. All 20 of the Ss were treated under the same conditions to the same criterion of learning.

As soon as each S gave his sixth consecutive word beginning with S, the weakening phase was begun immediately and with no discernible break in the procedure. For Ss in the Extinction treatment group, E simply stopped saying "Right" to any response given by the S. This constituted one cue change in that the reinforcement was omitted from the selected class of words. The "Punishment" treatment consisted of omitting the reinforcing "Right" from the S-words and adding "Wrong" to any S-word given after the treatment phase had begun. Two cues were thus changed for this group of Ss. Counter-conditioning treatment entailed leaving off "Right" from

S-words after the treatment period began and adding "Right" to all words beginning with any letter except S. Here again two gross cues were changed. The fourth condition, "Punishment" plus Counter-conditioning, required that all S-words in the treatment period be met with the word "Wrong" and all words not beginning with S be reinforced with "Right." In this case, each of the two categories of words had two changes made in its treatment--a total of four cue changes. Table XI presents the four treatments in tabular form for easy comparison.

One hundred treatment responses were recorded for each S on the record sheets. At the end of this phase Ss were asked to verbalize their impressions of the purpose of the experiment. This information was also recorded.

Results

The most lucid representation of the results is shown graphically in Figure 3. The 100 weakening phase responses were divided into 25 response blocks for each S and the mean number of responses for the five Ss in each treatment group computed and plotted on the graph. All four curves show a steady downward trend over the four blocks of trials with a close correspondence of Ex

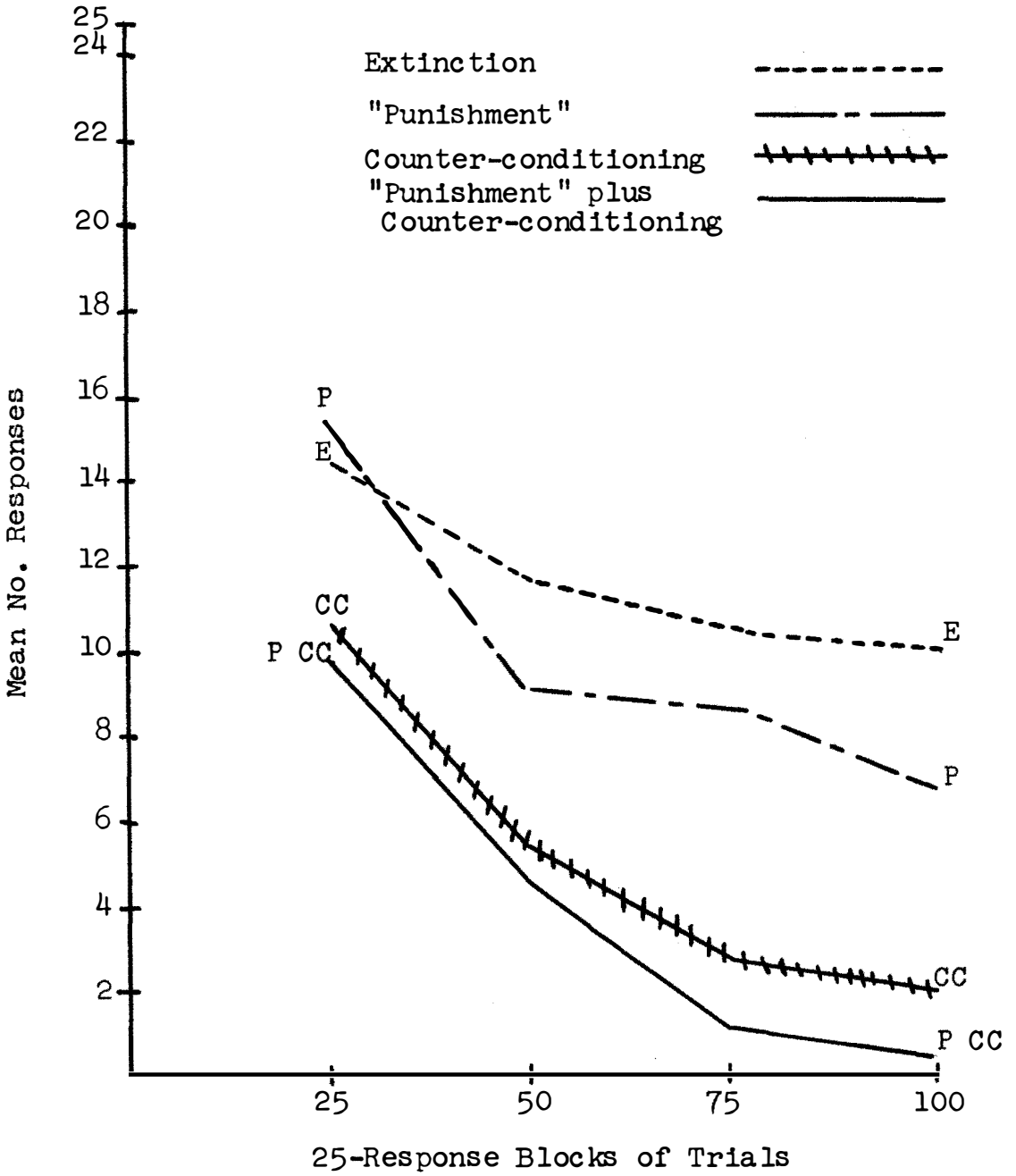


Figure 3

Mean Number of Responses For 5 Ss in Each Treatment Group Broken Down into Blocks of 25 Trials

and P groups at the higher levels of responding, while CC and P+CC form a comparable close group at the lower performance level. The treatment groups maintained the predicted order of efficacy at every comparison point except for P vs. Ex in the first block of 25 responses. P caused slightly less behavior loss at this point, but showed a pronounced superiority to Ex over the remaining three blocks of treatment responses.

As all 20 Ss were saying S-words at a 100 per cent rate while reaching the criterion of learning, it is possible to consider the beginning point of each line on the graph as being at the maximum level of 25 mean responses. This being the case, the majority of behavior loss came during the first 25 responses for every group.

Another way to examine the differential effects of the four treatments in getting rid of behavior was to compare the total number of formerly correct responses given during the 100 treatment trials under each method. Table XII gives the total number of responses by each S and the mean and median number of responses for each treatment. Kruskal-Wallace's Chi-H-Square (24) was applied to the data and yielded a probability of .09. That is to say, results as extreme as these in the predicted direction could be expected to occur nine times out of a

TABLE XII

TOTAL NUMBER OF FORMERLY CORRECT RESPONSES GIVEN BY 5 Ss PER CONDITION IN TREATMENT PHASES

	Experimental Conditions			
S	Ex	P	CC	P+ CC
1	78	32	39	47
2	21	9	15	12
3	14	15	14	11
4	28	45	19	1
5	100	100	17	8
Sum	241	201	104	79
Mean	48.2	40.2	20.8	15.8
Median	28	32	17	11

$X^2_H = 5.1$, 3 df
$P = .09$ (one-tailed)

Ex + P vs. CC + P+CC
$P = .04$

hundred by chance alone. Although these results do not reach the usual level of statistical significance, the reason stemmed from a few deviant scores which caused considerable dispersion in a sample of 20 Ss. The effect was clear-cut in spite of the lack of significance as judged by analysis of variance procedures. When the means of the total treatment responses shown in Table XII were compared, the P+CC treatment exceeded Ex in ability to get rid of the verbal habit by a factor of more than 3 :: 1; P+CC exceeded P in efficacy by a margin of 2.5 :: 1. Further comparisons showed that CC was more efficient than Ex by 2.3 :: 1 and got rid of more verbal behavior than P by almost 2 :: 1. The group differences were large and formed two distinct sets of pairs: Ex with P and CC with P+CC. The Mann-Whitney-Wilcoxen T test (24) states that the difference between these pairs is significant at the .04 level.

Table XIII shows a factor of regularity in the data that the disparity of the outlying cases obscures. The data of Table XII were pooled and divided along the grand mean. The number of Ss who fell above and below the grand mean in each treatment group had complete regularity in the predicted direction.

The striking consistency of the data is demonstrated in another manner in Table XIV. The mean

TABLE XIII

NUMBER OF Ss IN EACH CONDITION WHOSE NUMBER OF RESPONSES IN THE WEAKENING PHASE FELL ABOVE AND BELOW THE GRAND MEAN NUMBER OF RESPONSES

	Ex	P	CC	P+CC
Above Grand $\bar{X}$	4	3	2	1
Below Grand $\bar{X}$	1	2	3	4

TABLE XIV

MEAN NUMBER OF FORMERLY CORRECT RESPONSES GIVEN BY Ss IN EACH TREATMENT GROUP DURING WEAKENING PHASE; PRESENTED IN BLOCKS OF 25 TRIALS. N=5 EACH GROUP

Block of 25 Trials	Ex	P	CC	P+CC	Sum
1st	14.6	15.6	10.6	9.8	50.6
2nd	12.2	9.6	5.6	4.6	32.0
3rd	11.0	8.0	2.8	1.0	22.8
4th	10.4	7.0	1.8	0.4	19.6
Sum	48.2	40.2	20.8	15.8	

responses for each block of 25 treatment trials is given for all four treatment groups, which makes it possible to compare the number of responses of each treatment group at four points in the treatment period. When comparison is made only between adjacent columns (E vs. P, P vs. CC, and CC vs. P+CC), a test of the predicted order of efficacy is afforded. The 16 figures offer 12 comparisons of which 11 are in the predicted direction, that is with progressively fewer responses occurring from E through P+CC. Application of the Binomial Expansion (24) yielded a probability of .003, which attests that such consistency could be expected by chance alone three times in one thousand. If each mean is compared with all means in categories predicted to be smaller, 24 comparisons are provided. Again, only one reversal was seen (E vs. P, first 25-response block) and the Binomial Expansion gave a probability of .000001 that chance caused the consistency.

Analysis of the data from another viewpoint was necessary to see if the more rapid losing of behavior by the CC and P+CC groups was due to the differential effect of treatments or to an unfortunate chance factor of having a preponderance of fast learners--who would also tend to be fast learners of the new response--in these conditions. If any group proved to have a significant

excess of these fast learners, doubt could be shed on the reality of the effect, and a case could be made for the effect being due to a carryover from the conditioning stage. The number of responses in conditioning prior to the six successive correct responses set as a criterion of learning was tabulated and is given in Table XV. The Patnaik approximation to the classical F Test (24) showed that there was no significant systematic trend operative in these data.

The data for individual Ss are given in Table VI of the Appendix.

A preliminary experiment very closely approximating the present study was carried out earlier by E and several associates. The only major difference in experimental procedures was that Ss were asked to say numbers between 100 and 1000 rather than words. Numbers having the figure 5 in the second or third place were reinforced in the manner used in the present experiment. The results were quite similar, as reference to Table XVI will show. The study using numbers as a response had far fewer deviant Ss and yielded a probability value of less than .001 derived from analysis of variance procedures. The sensitivity of such procedures to deviant cases is demonstrated clearly here, for though the means of the

TABLE XV

NUMBER OF TRIALS REQUIRED BY EACH S TO REACH THE CRITERION OF 6 CONSECUTIVE CORRECT RESPONSES

S	E	P	CC	P + CC
1	25	71	42	12
2	16	37	63	21
3	20	32	33	12
4	10	38	26	40
5	45	14	16	44
Sum	116	192	180	129
$\bar{X}$	23.2	38.4	36.0	25.8
Mdn	20	37	33	21
Rn	35	57	47	32

$F_{range} = 0.4$, df = 16
(Value of 5.0 = .05)

TABLE XVI

MEAN AND MEDIAN NUMBER OF FORMERLY CORRECT RESPONSES IN WEAKENING PHASE WITH MEDIAN TRIALS TO CRITERION. FROM PRELIMINARY EXPERIMENT USING WORDS AS RESPONSE CLASS
(N = 6 per condition)

	Ex	P	CC	P+CC
Mean Responses	48	45.8	14	11.2
Median Responses	53	36	14.5	14
Mean Trials to Criterion	29	35	37	31

$X^2_H = 10.17$; df = 3
P = .018

COMPARABLE DATA FROM A PRELIMINARY EXPERIMENT USING NUMBERS AS A RESPONSE CLASS
(N = 8 per condition)

	Ex	P	CC	P+CC
Mean Responses	46.8	26.6	16.0	17.5
Median Responses	45	27	15	17.5
Mean Trials to Criterion	48.9	58.9	34.7	48.0

$X^2_H = 18.7$; df = 3
P = less than .001

groups in the present study pulled further apart than those of the earlier study using numbers, the latter data produced a P-value of only .09.

Another comparable experiment was executed by the members of an experimental design class using words as a response class and the same paradigm used here. A summary table of the results is included in Table XVI and the results are quite similar to both the other studies reported. Each summary table contains the number of trials to reach the criterion of learning; in neither case are significant trends discernible.

Discussion

The results showed clearly that the hypothesis advanced was borne out. The differential effect of the four weakening methods was significantly consistent and in the predicted direction. Amount of cue change appears to be responsible for the differences found, for a close relationship emerged between the amount of cue change from conditioning to weakening phases which was directly comparable to the efficiency of the weakening method.

Two similar studies done prior to the present experiment offer both replication and generality to the findings. One used numbers rather than words as a response class and the other was a class project involving

several experimenters, each with his own stimulus value as an E. In spite of these factors, the three sets of results were remarkably similar.

An interesting development in all three studies was the marked superiority of CC over P as a factor in causing behavior loss even though both entail two gross cue changes. The greater strength of CC is thought to be due to the positive nature of the change, whereas in P only a negative cue was added. This concept is compatible with Thorndike's evaluation of the comparative power of "Right" vs. "Wrong" as inducements to learning.

The similarity of conditions CC and P+CC was not expected. The conclusion can be drawn that the addition of punishment to counter-conditioning adds little to the effectiveness of counter-conditioning alone. Such an inference is borne out even more positively by the results of the two preliminary experiments.

Ramifications of these findings could possibly be extended to several fields. It would seem that the most efficient single method of getting rid of unwanted behavior would be to condition in the original stimulus situation another response--one interfering with the unwanted behavior--rather than trying to remove behavior by punishment or by failing to reinforce it. In psychotherapy, for instance, the therapist would decide on a

suitable counter-response and reinforce it when it occurred. (The problem of inducing the behavior remains an open experimental question.) Child rearing specialists may find it more efficient to allow an unwanted bit of behavior to go unrewarded and unpunished, while an exhibition of a similar, but more desirable, behavior is promptly rewarded. These uses, only suggested by the data, require more direct proving-out.

Summary

A comparison was made of the relative efficiency of four methods of weakening verbal behavior: Extinction, "Punishment," Counter-conditioning, and "Punishment" plus Counter-conditioning. It was hypothesized that methods involving greater amounts of cue change from conditioning to the weakening stage would have correspondingly greater effects. The data bore out this prediction.

Counter-conditioning--conditioning a similar but incompatible behavior--was the most powerful single weakening agent. Relatively little was added by combining "Punishment" with Counter-conditioning. Punishment alone was approximately one-half as effective as Counter-conditioning, and straight Extinction less effective than Counter-conditioning by a factor of three to one.

Possible uses of this data in psychotherapy and child training were proposed.

CHAPTER VI

THE EFFECT OF AN UNCONSCIOUSLY LEARNED VERBAL HABIT ON A RELATED NONVERBAL BEHAVIOR

Statement of the Problem

A great number of human enterprises are based on the empirical assumption that it is possible to change the behavior of a human being by changing his verbalizations. A minister addressing his congregation is in essence attempting to change nonverbal behavior through changing verbal habits, and the huge field of advertising is almost entirely built on this assumption. The same principle holds for teaching, child rearing, political campaigns, and newspaper editorials. In the midst of our own field is psychotherapy, which is conducted on a completely verbal level and is to effect widespread behavior change of a verbal and nonverbal nature.

The standardization of a laboratory procedure which could demonstrate the phenomenon of such concomitant behavior change and allow for purposeful and controlled manipulation of the variables would be of great potential value. An approach to the problem was

made utilizing the same general experimental procedures used in Phases I and II.

In essence, the purpose of the experiment was to verbally condition Ss to say words relating to a common concept and then to check the Ss' performance on a task subtly related to the verbal category. At the same time, every effort was made to make the relationship between the verbal and performance tasks vague enough so that most of the Ss would not be able to verbalize the purpose of the experiment.

Of necessity, the nonverbal task had to be clearly parallel to verbal behavior and yet completely nonvocal in nature. Impromptu freehand drawings proved to be the ideal choice, for a vast number of words can be easily connected with the subject matter of a picture other than the simple naming of the object represented.

The operant behavior sample reported in Chapter III furnished a suitable class of verbal responses to use in the experimental pattern. An investigation showed that words referring to buildings and building materials were given orally by every S at a consistent level and at an average rate of 11 per cent of all words given. In an operant conditioning schema, such a rate is very satisfactory, for one could expect to have a word of the

selected category occur for possible reinforcement about once in every 11 words.

A sample of the drawing behavior of the target group was collected, explained in detail in Chapter III. The combined results of six samples of college undergraduates totaling 91 Ss showed that approximately 10 per cent of the drawings elicited by the instructions "Draw something" were of buildings or contained buildings in them. The comparability between the number of building-words and drawings of buildings was quite striking, and thus quickly settled the choice of a category to use in the experiments.

Another useful feature of the category "buildings" was the rather loose bounds or limits of the concept. For instance, in the verbal conditioning phase, not only words directly relating to the category like house, Ayres Hall, or factory were reinforced, but also less direct references, such as wood, wire, cement, furnace and couch. Since many of the latter words can be given in several frames of reference, the amorphous quality of the selected category was enhanced.

Because no comparable data were available to E for use as guideposts, it frequently became necessary to resort to trial-and-error methods to discover procedural

details not yielded by the operant behavior sample. So that the reader can better follow the experimental procedure, the preliminary work will be described in the following section.

Preliminary Procedural Details

The primary purpose of the Phase I experiment was to compare the efficacy of various combinations of parameters on verbal learning. An important secondary purpose was an attempt to find for Phase III that combination of (1) amount of instructions, (2) kind of reinforcement, and (3) amount of reinforcement which would produce a reasonable amount of behavioral change with the fewest number of Ss being able to verbalize the principle being used. Unfortunately, no clear-cut indication could be drawn from the results of Phase I, and more direct investigation was entailed. One fortunate result of this new groundwork was that it allowed for the inclusion of an aperiodic schedule of reinforcement (APR) in the new comparisons. An APR schedule was not included as a variable in Phase I as the experimental design allowed for only two degrees of variation per parameter. However, APR, which is by definition irregular, seemed ideally suited as a factor to produce a non-verbalizable habit.

The parameters utilized in this secondary investigation were amount of instructions and reinforcement schedules. The comparison between sounding a buzzer and saying "Right," used in Phase I, was omitted since the buzzer proved to lack subtlety. Its value as a reinforcer was slight until the S realized that its sound meant that his response was correct, at which point it became no different in effect from "Right." Plans for Phase III also called for the use of less positive verbal reinforcers than the rather pointed and blatant "Right."

Three reinforcement schedules--100 per cent, 50 per cent fixed-ratio, and APR--were used with both "full" and "scant" instructions. The latter consisted of telling the S to say nouns until asked to stop, while the former added the information that certain words were correct and that he should try to get as many correct as possible. All possible combinations of these factors produced six categories. The comparisons are shown in Table XVII. Information afforded in this table is the number of Ss in each condition who verbalized the concept of "buildings" after treatment, and the number of Ss who drew a picture with a building in it. It is noteworthy that although all 12 Ss in the three conditions which received "full" instructions verbalized at least

TABLE XVII

PRELIMINARY WORK, PHASE III: ATTEMPTS TO FIND THE CORRECT COMBINATION OF AMOUNT OF INSTRUCTIONS AND REINFORCEMENT SCHEDULE TO PRODUCE INCREASED NUMBER OF BUILDINGS IN TEST (DRAWING) PHASE

Reinforcement Schedules

	S	100%		APR (70%)		50% Fixed-Ratio	
		Verb?	Bldg?	Verb?	Bldg?	Verb?	Bldg?
	1	Yes	No	Yes	No	Yes	No
"Full"	2	Yes	No	Yes	No	Yes	No
Instr.	3	Yes	Yes		Yes	Yes	Yes
	4	Part	No			Part	No
	5					Yes	Yes
	6					Yes	No
		(4/4)	(1/4)	(2/2)	(0/2)	(6/6)	(2/6)
	1	Yes	Yes	No	Yes	No	No
	2			Part	Yes	No	No
"Scant"	3			No	No	No	No
Instr.	4			No	Yes	No	No
	5			No	No	No	Yes
	6			Yes	Yes	No	No
		(1/1)	(1/1)	(2/6)	(4/6)	(0/5)	(1/5)

part of the concept, only three of them drew buildings. The three conditions receiving "scant" instructions showed a proportionately higher level of buildings in the drawings and a much lower level of verbalizations of the building concept. The six Ss in the "scant-APR" condition fitted the desired pattern much better than the other five conditions, for only two of six discovered the relationship and four of six produced pictures with buildings. Thus, the selection of instructions and schedule to be used in the experiment proper was empirically derived.

Early in the investigational program it was noted that a disappointingly large number of Ss would not condition. A colleague volunteered to act as a S in order to feed back to the E an impression of how the experimental situation "felt." To him it seemed that most undergraduates would feel that they were being somehow tested and therefore threatened. Consequently, a short statement was added to the preliminary conversational period to the effect that not the S but the E and his experimental procedure was being tested. This rather straightforward assurance that the S was not being evaluated evidently alleviated much of the tenseness and on guard attitude of many earlier Ss who usually later

admitted that they had been diligently searching for "gimmicks" that would make them "look better" to the E. The addition of this simple explanation is considered an extremely important part of the experimental design.

The reader is referred to Chapter III for further details of the preliminary work that went into the make-up of the experiment to demonstrate the effect of verbal conditioning on a related nonverbal behavior.

Experimental Procedure

The Ss were six male and four female volunteers from an undergraduate General Psychology course at The University of Tennessee. Each S in turn was seated in a small, private office and engaged in a short period of irrelevant talk, during which he was assured that he was not being evaluated, as explained above. When the S seemed reasonably at ease, he was read the following instructions: "Please say nouns--just any nouns--slowly enough for me to write them down. Keep going until asked to stop." Questions were answered only by re-reading the instructions verbatim.

All words were recorded on prepared record sheets by E. Words which referred to buildings of any sort, tools, building materials, furniture, or major components

of buildings were considered to be within the selected category called "building words." Reinforcement consisted of E giving a mild confirmatory response, such as "OK . . . All right . . . Unh hnh . . . Fine . . . Yeah." The average schedule of reinforcement was set at about 75 per cent. However, the conditioning phase was carried on mainly by "feel," with frequent reinforcement being given during the early part of conditioning and reinforcement being omitted when it seemed that the S was discovering the selected class of words.

No criterion of learning was set; rather, when E saw that the incidence of building-words had increased to a level higher than operant rate, the S was stopped, handed a sheet of $8\frac{1}{2}$ x 11 typing paper, and asked to "Draw something." All questions were answered with "Draw anything you wish; just draw something." If E felt that the S was not responding appreciably above operant level, he was stopped at 100 responses and asked to draw something. When the S finished his first drawing, he was asked to draw another, and then a third picture. The papers were collected, and the S was asked several questions, the answers to which were recorded on the back of his record sheets. The first question was "What do you think the session was all about?" If this rather

general enquiry failed to bring out a verbalization, he was asked, "What was I trying to do?" The final question for all Ss was, "Why did you draw what you did?"

This constituted the end of the experiment proper, and as the S was being escorted out, he was requested not to discuss the experiment with any of his classmates because the nature of the experiment required Ss who had no previous knowledge of what to expect. All ten of the Ss stated that they had received no prior briefing from classmates.

Results

Table XVIII gives the number of Ss whose pictures contained buildings on each of the three drawing trials. Six of the ten Experimental Group Ss produced a building on the first drawing, three on the second trial, and one on the last trial. S number 6 drew buildings on both the first and second trials, and S number 7 produced no buildings. Thus, nine of the ten Ss drew at least one building during the three post-treatment trials. One of the most striking results was that none of the 10 Ss verbalized the relationship between the verbal conditioning phase and his test drawings. The nearest to a verbalization was given by S number 1 who said, "You

TABLE XVIII

POST-TREATMENT PERFORMANCE OF EXPERIMENTAL GROUP Ss SHOWING SEX OF EACH S, TRIALS ON WHICH BUILDINGS APPEARED, APR SCHEDULE, AND TOTAL WORDS ELICITED IN CONDITIONING PHASE FOR EACH S

S	Sex	Building 1st	Building 2nd	Building 3rd	Concept Verbalized?	Reinforcement Schedule		Total Words in Condit'g
1	M	X			No	9/14	.64	47
2	F	X			No	13/15	.87	100
3	M	X			No	8/11	.73	100
4	M			X	No	7/9	.78	100
5	M		X		No	13/18	.72	57
6	F	X	X		No	18/28	.64	57
7	F				No	19/22	.86	61
8	M	X			No	8/12	.76	24
9	F		X		No	11/14	.80	100
10	M	X			No	7/9	.78	80
	Sum	6	3	1		$\bar{X}$ = 75.8%		$\bar{X}$ = 72.5
						Mdn = 76.0%		Mdn =70.5

asked me to name words. At first I had to struggle to find words to say. Then I found it was easy to name things I could see here in the office." The most frequently occurring answer to the question asking in essence "What went on" was that E was somehow interested in "free association" or "the way my chain of thoughts worked." One S mentioned naming several objects in the office or at the University during the post-test inquiry, but she was the S who drew no building. The reasons for drawing what they did were generally quite vague; for instance, "That's the first thing I thought of," or "I don't draw well, so I drew the first easy thing that came to mind."

Table XVIII also offers the total number of words given by each S during the conditioning period. Four of the ten were allowed to continue to the maximum of 100 words because E had not felt that they reached a high enough frequency of building-words during the conditioning period. All four subsequently drew buildings, two on the first trial. The mean number of total words elicited in conditioning was 72.5, but the range was quite wide, from the 100 maximum down to 24 words by one S who began by naming objects in the office and was stopped when he had received eight reinforcements.

The percentage of words in the building category given by each S is also shown in Table XVIII. The denominator of the fraction is the total number of building-words given by the individual and the numerator the number which were reinforced. The second set of figures in this column presents the same relationship shown as the percentage of building-words reinforced for each S. S number 2 received the highest percentage of reinforcements (87 per cent) and S number 1 the lowest (64 per cent). The mean percentage of reinforcement was 75.8 per cent and the median 76 per cent. The cross-S variation was quite small.

To check on the possibility that the last response given might have an undue amount of influence on the subsequent drawings, five of the Ss were stopped immediately after they said a building-word and five were stopped after saying a word that did not fall into the building category. Although the S who drew no building was in the second group, the tendency is inconsequential when the magnitude of the over-all effect is noted.

Another built-in check entailed using one-half male and one-half female Ss on the assumption that one might think females more prone to produce houses in line with wifely ambitions. A miscalculation allowed six males and

four females to be treated, but the findings that the only S who drew no building was a female somewhat alleviated the idea that femaleness might be a strong factor in building-drawing. Again the tendency was small compared to the primary effect.

Statistical comparison of operant drawing behavior with post-treatment drawing behavior was done on two bases. First, only the initial drawing of the Experimental Group was considered so that several comparisons with the Control Group which drew only one picture could be made. For easy reference, both Operant Samples I and II are shown in summary form in Table XIX. Thirteen controls were tested individually in E's office. Of this group, 2 drew buildings and 11 did not. The Experimental Group produced six pictures with buildings and four of other subject matter on their first pictures. When Chi Square was applied to these data, a one-tailed probability of .04 was derived; thus, one could expect such results in the predicted direction four times out of a hundred by chance alone. As demonstrated in Chapter III, two samples of 24 Ss each who were tested in groups were shown comparable to those Ss tested singly, and the samples were combined. The combination yielded a sample of 61 Ss in

TABLE XIX

SUMMARY TABLES OF THE TWO OPERANT DRAWING SAMPLES BROKEN DOWN INTO SUB-GROUPS TO SHOW CONSISTENCY. SAMPLE I REQUIRED ONLY ONE DRAWING, WHILE SAMPLE II REQUIRED THREE DRAWINGS IN TURN FROM EACH S

Group	N	Drawings Containing Buildings	Per Cent Ss Drawing Buildings
Operant Sample I			
Individually Tested	13	2	15.4%
Group Test No. 1	24	4	16.7%
Group Test No. 2	24	2	8.3%
Total	61	8	13.1%

Operant Sample II					
Sub-Sample	N	No. Bldgs. of Each Drawing Trial			Sum of 3 Trials
		1st	2nd	3rd	
1	10	0	1	2	3
2	10	1	1	2	4
3	10	1	2	1	4
Total	30	2	4	5	11
Per Cent		6.7%	13.3%	16.7%	36.7%

Control Group I, 8 of whom drew pictures containing buildings while 53 drew pictures of other subject matter. The application of Chi Square to this combined sample against the Experimental Group yielded a P-value of .0008. Chance alone could be expected to produce such extreme results in the predicted direction eight times in ten thousand.

Operant Sample II, in which each S was required to draw three pictures rather than one, was made necessary when it was decided to require three post-treatment drawings from the Experimental Group Ss. This new sample totaled 30 Ss divided into three sub-samples of 10 Ss each. Several types of comparison were run to check on the consistency of the effect.

Table XVIII reveals that nine of the ten experimental Ss produced a picture of a building on at least one of his three drawings. From the summary of the results of Operant Sample II in Table XIX, one notes that 10 of the 30 Ss in the entire sample drew at least one building. The Chi Square comparison of the combined subsamples against the Experimental Group yielded a one-tailed probability of .003. Chance could be expected to produce such results three times in a thousand. If only the first drawing of Operant Sample II is compared to the first drawings of the Experimental Group, the probability

of chance being responsible for the predicted results is approximately nine in ten thousand, or a P-value of .0009. These data are displayed in Table XX.

To complete the comparisons, internal consistency was checked by placing each of the three sub-samples of 10 Ss in contrast to the 10 Experimental Group Ss. When only the first pictures were considered, the probabilities yielded by Chi Square were .008, .03, and .03 respectively for the three sub-samples. The comparison of the number of buildings in all three drawings of the operant sub-samples vs. the Experimental Group showed probabilities of .01, .01, and .03. Exceptional consistency of the data was pointed out by these internal comparisons. In each case where Chi Square was used, Shepard's correction for continuity was incorporated into the formula.

Discussion

Wherever statistical procedures were used, the normally accepted level of statistical significance was surpassed. The least significant comparison was that of the first-drawn pictures from the Control Group Ss who were tested individually vs. the Experimental Group. Even there the probability fell at the .04 level of

TABLE XX

COMPARISON OF PER CENT OF DRAWINGS CONTAINING BUILDINGS IN EXPERIMENTAL GROUP (POST-TREATMENT) VS. OPERANT SAMPLE I AND OPERANT SAMPLE II

	Experimental Group (N = 10)	Operant Sample I (N = 61)	Operant Sample II (N = 30)
Per Cent Bldgs on 1st Pict.	60%	13.1%	6.7%
Per Cent Bldgs on at Least 1 of the 3 Pict.	90%	---	36.7%

significance. When the small size of the individually produced operant sample was obviated by the addition of 48 comparable group-tested Ss, the results yielded extreme statistical significance. Probabilities as slight as those obtained are rare in experiments dealing with subtle behavioral change in adult human Ss, and certainly such definite statistical significance in conjunction with the clear-cut effect can be interpreted as arguing that "something real happened."

It hardly seems necessary to resort to statistical analysis to state that a very real effect has been demonstrated, for inspection of the data showed that prior to the conditioning treatment 11 per cent of the control group drew a building on the first picture and after treatment 60 per cent drew buildings in their first productions. When all three drawings were considered, prior to conditioning 36.7 per cent of the target population drew at least one building in three drawings, and after treatment 90 per cent drew at least one building. These huge effects are in the predicted direction. Table XX presents this information for easy comparison. The factor that made the results even more striking was that not one of the 10 Experimental Group Ss was able to express a relationship between the verbal and performance phases of the procedure.

The preliminary work toward finding the correct combination of instructions and schedule of reinforcement turned up an interesting point. The 24 Ss who were tested under six different combinations of (1) reinforcement schedules and (2) amounts of instruction seemed to show that as the relationship between verbal and performance phases was made more obvious, the nonverbal behavior became less related to the verbal conditioning phase. For instance, the 12 Ss whose instructions gave rather obvious cues to the nature of the task readily verbalized the building concept on request in 100 per cent of the cases. However, only 3 of the 12, or 25 per cent, drew a building when requested to draw something after conditioning. The group whose instructions consisted merely of "Say nouns" verbalized the connection in 3 of 12 cases, yet they produced 6 buildings in 12 pictures.

The results suggest, then, that vague instructions lead to greater transfer from verbal to nonverbal performance in the type of experimental situation described in this study. Further, an aperiodic schedule of reinforcement, which is by definition subtle, was by far the most effective schedule of reinforcement in carrying over the concept of buildings from the vocal to performance mode.

It is interesting to speculate on the similarity of these findings to the remarkable effect of "Subliminal Advertising" on patrons' buying habits in movie theaters. In both cases a vague, unverbalized verbal stimulus seems to cause a concomitant unverbalized performance which is disproportionately powerful.

Closer to our own field, perhaps the principle shown here is basic to understanding why "advice" is seldom effective in bringing about a change in behavior while the effect of a less directive reinforcement psychotherapy is much more pronounced and long lasting. It is also noteworthy that the permissive and accepting atmosphere considered basic to the success of the experiment is quite like the atmosphere in a therapy situation. At the very least, the principle shows promise of being important in both an applied and theoretical sense.

Summary

Six male and four female undergraduates from a General Psychology class served individually as Ss. Each was seated in a private office, made to feel at ease, and assured that he was not being tested in any way. Instructions were simply that the S was to say nouns slowly enough for E to write them down until asked to stop. The E had selected words relating to buildings of any kind,

materials used in buildings, and major parts and furnishings of buildings as the class of words to be increased in frequency by operant conditioning procedures. Reinforcement--mild affirmative words such as "Unh huh, Yeah, OK"--was administered on an aperiodic schedule of approximately 75 per cent. The schedule was regulated by E's "feel," for early in the conditioning phase almost all "building-words" were reinforced; and when the S seemed to be near discovering the selected concept, reinforcement was omitted. When a S was saying more than the operant number of building-words, or when a maximum of 100 words was obtained, the S was stopped, handed a sheet of typing paper, and told to "Draw something." When he finished, he was asked for another drawing, and then a third. Statistical comparisons were made between the productions of the Experimental Group and those of comparable control Ss who did not receive the conditioning treatment. In every comparison the Experimental Group produced more drawings containing buildings than the Control Group by a degree constituting extreme statistical significance. None of the Experimental Group Ss could verbalize the concept of "building" or the connection between his drawings and the experimental treatment. Several speculations were raised concerning the

demonstrated superiority of vague, non-specific conditions of learning over more direct conditions in fostering a transference of verbally learned materials to the realm of non-verbal performance.

CHAPTER VII

DISCUSSION AND IMPLICATIONS

As each chapter from III through VI contains a summary of the research problem it reports, a comprehensive summary here would be redundant. It will suffice to mention the principles felt to be most important and to point out their implications and the suggested directions for further research.

First, the writer's reasons for choosing operant verbal conditioning as the field in which to experiment could be explored. The goals of the science of psychology are the prediction and control of human behavior, and clearly the overwhelmingly powerful instrument of shaping and controlling human behavior is language--or verbal behavior. Unfortunately, none of the laws of learning were derived from human subjects using verbal behavior as the response variable. Many of the principles of learning have been applied to practical or experimental manipulation of language from time to time, but no one has launched a long-term research program to check out the many variables and parameters on a

coordinated basis. In some ways this thesis may be considered a beginning in this area, for it starts with a study of the operant verbal and drawing behavior of the target population to be used as subjects and proceeds to two of the most basic principles of conditioning--inducing and strengthening a chosen response and systematically weakening a response. The operant conditioning paradigm fits the peculiarities of human language quite well. Language is sufficiently variable and at the same time sufficiently stable to contain classes of responses that lend themselves to experimentation.

The operant verbal and drawing data reported in Chapter III were collected to isolate variables that are suitable for experimental manipulation; that is, they occur at a consistent level in most subjects, but not at so high a level that the effects of treatment will not show. Yet another product of the operant survey was the assessment of the strength of specific responses already in the repertory of the subjects. This is methodologically important because apparent learning phenomena may be due to existent habits that are called forth fortuitously by stimuli in the learning situation. For instance, some of Pavlov's findings in higher order conditioning may have been due to existing stimulus-response connections between the response measured and

some part of the laboratory procedure.

This study does not pretend to offer answers to questions, but rather offers questions to be answered by a concerted research program. In Phase I, for example, the writer incorporated only two reinforcement schedules, two amounts of instructions, and two types of reinforcement. Consider the latter parameter: a stimulus can only be said to be a reinforcer when it has been shown to strengthen the behavior it follows. A verbal "Right" and a buzzer were arbitrarily chosen because they have been used in previous experiments. However, it is possible that every sensory modality of human subjects can act as the receptor of reinforcing stimuli. The effect of olfactory and tactual cues, the results from various colors and illuminations, the effect of positional cues, and on and on--none of these have been tested as reinforcers even though theory would suggest that any discriminable cue could be a reinforcer. Going further, there are interminable degrees of intensity possible for each of these variables, and experience in the present study showed that "too much" and "too little" can be equally detrimental to the inducing of a habit.

Consider schedules: only 100 per cent and 50 per cent fixed-ratio were utilized in the experiment proper

with the addition of a bit of exploratory research into the effects of an aperiodic schedule. Skinner (44) at the present time is investigating the effects of schedules and has derived several interesting principles. The task is to check Skinner's results against subjects in verbal learning experiments, as well as incorporating the principles set forth in the literature on infrequent reinforcement schedules (23).

Experience in trying to arrive at the optimal amount and kind of instructions to bring about efficient learning has convinced the writer that this simple-appearing parameter is anything but simple. When in the present study a large number of subjects failed to condition, more information was added to the instructions with the naive belief that the wastage rate would go down. Of course, the instructions rapidly became so detailed and involved that practically no subjects conditioned. Thus, the parameter of instructions is a fertile field for study.

Phase II, the weakening experiment, offers as a basic principle that amount of cue change from conditioning to weakening phases is responsible for the amount of behavior loss. That various schedules applied in the learning phase have differential effects on the

amount and rapidity of behavior loss in the weakening stage is strongly stated by Jenkins and Stanley (23). These principles need to be put to empirical test in verbal conditioning schema as do the many different methods of weakening verbal behavior, different intensities of each method, and combinations of these methods.

The laboratory demonstration in Chapter VI of unverbalized nonverbal behavior change as a result of verbal conditioning--though done on a small scale--was, nevertheless, striking. Since experimentation is almost nonexistent in this area, an investigator might be tempted to outrun his data. Restraint is called for because the phenomenon appears so pregnant with practical applications and the possibility of "newsworthy" experiments. Before such uses can be asked of the method, the parameters must be derived and their effects studied both singly and with each other.

These are but brief suggestions for research projects that are directly indicated by the experiments reported here. It is strongly felt that experimentation in operant verbal conditioning, using more and more lifelike designs, will grow at a rapid pace.

CHAPTER VIII

SUMMARY

The project was comprised of a series of experiments utilizing the methodology of operant conditioning with verbal responses used as the manipulated behavior. The four sections of the study, though related, are independent experimental entities. A brief statement of the problems and results follows.

A Sample of the Operant Verbal and Drawing Behavior of Undergraduates at The University of Tennessee (Chapter III)

Each of 12 Ss gave 100 single words and 25 sentences in a small, private office--the setting used later for the experimental portions of the project. No treatment was given any of these Ss. The 1200-word sample of single words was analyzed for the following: (1) frequency of occurrence of each part of speech, (2) assessment of sex differences, order effects, and written vs. oral methods of collecting data, (3) frequency of occurrence of each letter as the initial

letter, (4) intensive study of the letter S as initial letter, and (5) frequency of words referring to buildings. The sample of 300 sentences yielded (1) length of sentences and (2) frequency of self-reference sentences. The drawing data produced (1) subject matter of drawings, (2) subject matter differences when drawings are collected in group or individual settings, and (3) special attention to the number of drawings containing buildings.

Much of this information was used to isolate factors which might be used as dependent variables. Words beginning with the letter S were chosen as the dependent variable for two subsequent experiments and words pertaining to buildings as well as drawings with buildings in them were the factors focused on in the last experiment.

Inducing Verbal Conditioning (Chapter IV)

Eight experimental groups were formed by creating arbitrary "much" and "little" dimensions on each of three parameters of conditioning: (1) amount of instructions, (2) kind of reinforcement, and (3) schedule of reinforcement. The task was learning to say words beginning with the letter S. Amount of instructions, the first parameter,

proved to be the overwhelmingly powerful variable in inducing learning of the task. Groups receiving most cues for performing learned quicker, but all groups tended to show some improvement over operant level performance.

Comparison of Four Methods of Weakening Verbal Behavior (Chapter V)

By a common method 20 Ss were conditioned to say S-words to the same criterion of learning. Ss were then placed in one of four treatment groups: (1) Extinction; (2) "Punishment," or following formerly correct words with "Wrong"; (3) Counter-conditioning, or rewarding formerly incorrect responses with "Right"; and (4) a combination of "Punishment" and Counter-conditioning. Borne out was the hypothesis that increasing amounts of cue change from the conditioning phase to the weakening phase will cause an increasing rate of behavior loss.

The Effect of an Unconsciously Learned Verbal Habit on a Related Nonverbal Behavior (Chapter VI)

Ss were conditioned to say words relating to buildings on a 75 per cent APR schedule. The schedule was administered by "feel," for early in conditioning

nearly all "building-words" were reinforced; later, few of them were reinforced to prevent the Ss from discovering the selected category. Reinforcing stimuli were mild, affirmatory words such as "Unh-huh, OK, and Yeah." Ss were asked to "Draw something" after treatment and the number of buildings drawn by the Experimental Group was compared to the operant level of drawings. Results were extremely significant even though none of the 10 Ss could verbalize the selected category or a relationship between his saying words and what he drew.

It is obvious that the principles and methods of operant conditioning are well suited to experimentation with verbal behavior. On logical and seemingly on empirical grounds, operant verbal conditioning can become an important scientific tool for dealing with the prediction and control of the behavior of man.

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APPENDIX

TABLE I

NUMBER OF TIMES EACH PART OF SPEECH WAS GIVEN IN 100 WORDS BY EACH S. SUBDIVISIONS ARE: "ORAL" SEPARATED INTO "SENTENCES, THEN WORDS" (SWO), "WORDS, THEN SENTENCES" (WSO), ETC. SHOWN ARE SUMS AND RANGES OF EACH GROUP AND THE TOTAL SAMPLE. ROMAN NUMERALS ARE INDIVIDUAL Ss IN EACH GROUP

	Oral Group									
	SWO				Oral	WSO				
Subj #	I	II	III	Sum	Sum	I	II	III	Sum	Range
Nouns	58	97	82	237	473	79	95	62	236	58-97
(Plu N)	(8)	(20)	(13)	(41)	(77)	(20)	(12)	(4)	(36)	(4-20)
Verbs	10	1	3	14	34	4	2	14	20	1-14
Adj	28	1	15	44	78	13	0	21	34	0-28
Vbls	4	1	0	5	15	4	3	3	10	0-4
Adv	0	0	0	0	0	0	0	0	0	0-0
Conj	0	0	0	0	0	0	0	0	0	0-0
Prep	0	0	0	0	0	0	0	0	0	0-0
Intj	0	0	0	0	0	0	0	0	0	0-0
Pro N	0	0	0	0	0	0	0	0	0	0-0
	100	100	100	300	600	100	100	100	300	

TABLE I (cont.)

	Written Group									
	SWW				Written	WSW				
Subj #	I	II	III	Sum	Sum	I	II	III	Sum	Range
Nouns	83	53	66	203	434	96	63	72	231	53-96
(Plu N)	(8)	(9)	(6)	(23)	(53)	(22)	(1)	(7)	(30)	(1-22)
Verbs	2	11	26	39	71	1	24	7	32	1-26
Adj	4	6	6	16	37	1	6	14	21	1-14
Vbls	9	0	0	9	12	2	0	1	3	0-9
Adv	0	23	2	25	36	0	5	6	11	0-23
Conj	0	4	0	4	5	0	1	0	1	0-4
Prep	0	3	0	3	3	0	0	0	0	0-3
Intj	0	0	0	0	1	0	1	0	1	0-1
Pro N	1	0	0	1	1	0	0	0	0	0-1
	100	100	100	300	600	100	100	100	300	

TABLE II

NUMBER OF TIMES EACH S GAVE EACH LETTER AS AN INITIAL LETTER

Letter	Subjects 1	2	3	4	5	6	7	8	9	10	11	12
A	4	0	8	1	0	11	3	12	1	4	3	4
B	6	11	7	16	5	6	10	6	10	10	8	7
C	14	14	13	10	8	11	9	7	9	6	10	14
D	3	4	5	2	10	0	6	5	7	5	3	4
E	5	2	4	1	2	2	6	2	0	4	5	6
F	8	5	4	4	7	2	4	1	11	7	4	3
G	3	2	3	5	5	4	3	2	5	4	5	5
H	0	5	5	4	9	5	2	1	3	6	5	2
I	3	1	1	0	2	11	3	3	4	2	0	4
J	0	4	1	0	1	0	1	0	1	1	1	0
K	0	1	1	1	0	0	0	0	0	0	0	0
L	5	3	4	3	4	2	2	3	0	2	6	7
M	2	2	3	5	6	7	5	5	6	3	4	3
N	2	2	1	4	3	6	1	5	3	2	1	0
O	1	5	0	1	0	0	3	4	0	1	0	0
P	8	6	11	12	8	3	5	10	6	8	9	12
Q	2	0	1	0	0	0	0	1	0	1	1	0
R	7	5	4	4	5	11	5	2	5	6	3	4
S	17	15	14	15	14	10	16	10	17	15	18	15
T	4	7	4	3	4	3	7	11	10	8	7	3
U	2	1	2	0	0	0	0	1	0	0	0	0
V	0	1	1	1	0	0	0	0	0	0	2	0
W	3	4	3	7	7	6	8	5	6	5	4	7
X	0	0	0	0	0	0	0	0	0	0	0	0
Y	1	0	0	1	0	0	1	3	0	0	1	0
Z	0	0	0	0	0	0	0	0	0	0	0	0
	100	100	100	100	100	100	100	100	100	100	100	100

TABLE III

159 WORDS THAT OCCURRED MORE THAN ONCE ARRANGED IN ORDER OF FREQUENCY

10 book	4 coat	3 furnace
8 school	4 desk	3 home
7 car	4 football	3 hot
7 light	4 friends	3 ink
7 shoe	4 green	3 man
6 door	4 picture	3 notes
6 grass	4 play	3 night
6 house	4 red	3 orange
6 money	4 rooms	3 paint
6 pencil	4 shirts	3 pen
6 ring	4 tie	3 people
6 water	4 window	3 ping-pong
6 watch	4 yellow	3 psychology
5 automobile	3 ashtray	3 rain
5 chair	3 bell	3 sand
5 cigarette	3 bicycle	3 seat
5 dress	3 boat	3 sound
5 glasses	3 boy	3 street
5 paper	3 bracelet	3 swimming
5 tree	3 brick	3 tennis

TABLE III (cont.)

4	blue	3	bus	3	walking
4	bottle	3	business	3	wall
4	building	3	children	3	wind
4	chair	3	dirt	3	woman
4	cigar	3	eyes	3	work
4	classes	3	fly	2	airplane
2	apple	2	father	2	please
2	architecture	2	flag	2	preacher
2	bed	2	fraternities	2	professor
2	birth	2	girl	2	quarter
2	black	2	glove	2	radio
2	box	2	homework	2	sand
2	brown	2	horse	2	screen
2	brush	2	ice cream	2	ship
2	calendar	2	jewelry	2	silver
2	camera	2	job	2	sister
2	can	2	library	2	skirt
2	carbon	2	license	2	snow
2	cards	2	love	2	soap
2	cats	2	many	2	social
2	cheerleader	2	material	2	stamps
2	clothes	2	metal	2	star
2	coincidence	2	moon	2	stop

TABLE III (cont.)

2	crescent	2	mother	2	student
2	death	2	movies	2	study
2	dog	2	nails	2	stove
2	dormitory	2	nature	2	sweater
2	eat	2	numbers	2	table
2	economics	2	ocean	2	tire
2	education	2	office	2	train
2	entertainment	2	pin	2	uniform
2	evening	2	physics	2	weather
				2	word

TABLE IV

OPERANT DRAWING SAMPLE I: TITLES OF THE SINGLE DRAWINGS OBTAINED FROM THREE GROUPS OF Ss COMPRISING A TOTAL N OF 61

Ss Tested Individually (N=13)	Group Tested (N=24)	Group Tested (N=24)
House and surroundings	Country home	Flat-top house
House	House	Mountain home
Sailboat	House on hill	Box
Trees	Landscape (w/house)	Math diagram
Woman's head	Landscape	Cat and tree
Woman's head	Tree	Horse's head
Girl w/sandwich board	Golf course	Eiffel tower
Gate	Car	Rocking chair
Desk lamp	Car	Beaker, chem. lab.
Kitchen stove	Rocket ship	Mechanical drawing
Abstract	Airplane	Man's head
Box	Sail boat	Woman's head
Curved line	Sailing ship	Man's head
	Human figure	Monkey quartet
	Man's picture	Boat, water skier
	Party dress	Man running
	Girl at piano	Man's head
	Bridge	Hanging girl
	Vase of flowers	Tree stump, mountains
	Snail	Desert island
	Table, book	Tree and swing
	Bucket	Car
	Math function	Rocket ship
	Geomet. figure	Boat

TABLE V

OPERANT DRAWING SAMPLE II: TITLES OF EACH OF THREE DRAWINGS BY 30 Ss. PICTURES CONTAINING BUILDINGS UNDERLINED

S No.	1st Drawing	2nd Drawing	3rd Drawing
1	Road and hill	Palm tree	Sunset
2	Tree	Cat	House
3	Man's head	Man's head	Car
4	Tree	Castle	Airplane
5	Airplane	Rabbit	Elec. circuit
6	Sports car	Man's head	Speedboat
7	Hiway and bridge	Airplane	Freeform
8	Woman's head	Palm tree	Devil's head
9	Freeform	Freeform	Freeform
10	Boat and sunset	Man fishing	Street scene
11	Airplane	Oil well	Dog, tree, fence
12	Pot flowers	House	Lake scene(w/house)
13	Freeform	Chair	Dice
14	Geomet. Figure	Book	Tombstone
15	2 people & house	Stove	Flowers and vase
16	Boat	Clock	House
17	Tree	Airplane	Fence
18	Man's head	Boat	Football player
19	Boat	Sofa	Horn victrola
20	Man's head	Airplane	Car
21	Airplane	Man's head	Dog's head
22	Tree	Floor plan	Table
23	Girl's head	Tree	Flower pot
24	Fish	Man's head	Mountain scene
25	House	Car	Power shovel
26	Geomet. figure	Geomet. figure	Physics experiment
27	Geomet. figure	Building	Bed
28	Math function	Crankshaft	Geomet. figure
29	Tree	Boats	House
30	Tree	Cloud	Mountains

TABLE VI

DATA FOR INDIVIDUAL Ss IN PHASE II OR WEAKENING VERBAL BEHAVIOR CHAPTER.
TRIALS TO CRITERION, FORMERLY CORRECT RESPONSES BY 25'S.
FORMERLY CORRECT RESPONSES BY FIRST HALF - SECOND HALF

	S	Cond. on Trial No.	Formerly Correct Responses in Treatment Phase					
			1st	2nd	3rd	4th	First 50	Second 50
	JC1	25	20	21	15	22	41	37
	EH5	16	9	7	4	1	16	5
Ext	NH9	20	9	2	3	0	11	3
	GM14	10	10	6	8	4	16	12
	SW18	45	25	25	25	25	50	50
	JS2	71	13	12	5	2	25	7
	NW6	37	5	0	3	1	5	4
Pun	MW10	32	10	2	2	1	12	3
	BT15	38	25	9	5	6	34	11
	EF19	14	25	25	25	25	50	50
	JN12*	42	25	14	0	0	39	0
	JD7	63	5	4	4	2	9	6
CC	GO11	33	6	3	2	3	9	5
	SK16	26	10	4	5	0	14	5
	SG20	16	7	3	3	4	10	7
	BW4	12	25	22	0	0	47	0
	JD8	21	9	1	2	0	10	2
P CC	HD13	12	11	0	0	0	11	0
	CP17	40	1	0	0	0	1	0
	MB21	44	3	0	3	2	3	5

*S JE3 omitted from picture as he failed to condition

TABLE VII

INDIVIDUAL DATA FOR EACH OF 24 Ss SHOWING RESPONSE ON WHICH CRITERION RUN OF 6 CONSECUTIVE RESPONSES BEGAN, NUMBER OF CORRECT RESPONSES BY BLOCKS OF 25 AND 50 RESPONSES, AND TOTAL NUMBER OF CORRECT RESPONSES FOR EACH S

Condit	Subj.	Crit. Run Begun on -	Correct Responses 1st 25	2nd 25	3rd 25	4th 25	1st 50	2nd 50	Total Correct
1	JB 2	28	7	7*	-	-	14*	-	72
	BV 9	23	3	4*	-	-	7*	-	77
	HR 17	18	6*	-	-	-	6*	-	82
2	AL 1	35	10	11*	-	-	22*	-	65
	DM 10	25	6	5*	-	-	11*	-	75
	CZ 18	15	6*	-	-	-	6*	-	85
3	CC 3	80	1	5	2	6*	6	8*	20
	CW 11	12	10*	-	-	-	10*	-	88
	SC 19	26	4	6*	-	-	10*	-	74
4	CG 4	No	5	9	0	8	14	8	22
	DP 12	No	6	12	7	9	18	16	34
	DD 20	35	0	6*	-	-	6*	-	65
5	JF 5	No	5	2	8	5	7	13	20
	GA 13	No	0	4	7	5	4	12	16
	JB 21	No	1	1	3	2	2	5	7
6	WC 6	No	0	6	2	2	6	4	10
	ZE 14	No	4	3	5	3	7	8	15
	FB 22	No	1	1	4	4	2	8	10

TABLE VII (cont.)

Condit	Subj.	Crit. Run Begun on -	Correct Responses 1st 25	2nd 25	3rd 25	4th 25	1st 50	2nd 50	Total Correct
7	BW 7	24	2	5*	-	-	7*	-	76
	PR 15	No	3	5	6	4	8	10	18
	DN 23	No	4	3	2	1	7	3	10
8	RC 8	No	2	3	3	5	5	8	13
	RC 16	No	1	2	2	3	3	5	8
	JJ 24	No	2	4	5	6	6	11	17

*Number includes run of 6 correct responses