CONCEPT CONDITIONING IN THE HUMAN ORGANISM: RETENTION

By

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And lastly to our cooperative undergraduate psychology students, without whom few graduate degrees in psychology would be awarded, a place of honor for furthering our science.

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CHAPTER I

THE PROBLEM

The purpose of the following thesis was to replicate an experiment by Aldrich (1962) recently reported at the Oklahoma State University and to extend the investigation into the area of retention. Within the paradigm of operant conditioning, using verbal behavior as an investigating tool, the experiment was conducted in the fall of 1963 at the Oklahoma State University. In addition to the replication of the Aldrich experiment, the investigation of the retention phenomenon was another step to a more thorough understanding of learning and attitude change. If the retention phenomenon is a factor in preconscious conditioning, other variables would deserve further study using the conceptual framework of Aldrich and the experiment reported herein.

The Aldrich Experiment

Since Aldrich's experiment was the starting point of the present experiment, a short review of his experiment will provide a basic outline of what has been done.

Aldrich (1962) selected thirty experimental subjects from a group of 170 undergraduates in the introductory psychology classes at the Oklahoma State University. In a forced choice situation subjects were chosen who responded equally with concrete and abstract choices on a survey instrument. The subjects were assigned at random to one of

three groups A, B or C as shown below. In the training session the task was to respond to successive homonyms. It was possible to respond with a forced choice of either a concrete or abstract meaning to the homonyms. In the experimental group A the subjects were reinforced by E saying "mmm-hmm" or "that's good" if they responded with an abstract choice, in experimental group C they were reinforced if they responded with a concrete choice, and in control group B no reinforcement was given. Following the training session each subject was tested by a set of 25 homonyms and the forced choice responses scored either concrete or abstract. An open-end questionnaire was used at the end of the testing period to ascertain awareness. Subjects who answered yes to any one of four questions were replaced. The results indicate a significant difference between the experimental and control group beyond the .01 level of confidence. The results demonstrated that a frame-of-reference could be instrumentally conditioned.

Concepts and Organization

The conceptual framework and the design of the experiment came from several sources. The writer is indebted to these sources which were the reasons for certain techniques, such as: the use of the operant conditioning technique, the investigation of preconscious conditioning using verbal behavior, the concept of retention, use of homonyms, idea of perception and attitude as related to verbal behavior, and latitude of acceptance.

Operant conditioning

Operant conditioning was used by Aldrich (1962) in his experiment. The same technique was used in the writer's present experiment.

Operant conditioning is the "learning procedure in which the experimenter alters the strength of an emitted response by reinforcing it whenever it is emitted" (Solley & Murphy, 1960), or, it is the strengthening of an operant response by presenting a reinforcing stimulus, if, and only if, the response occurs. It is synonomous with instrumental conditioning and reward learning (Hilgard, 1962).

A review of 46 such experiments by Krasner (1958) shows 34 or 74% of the experiments were successful, which indicates that the laws of operant conditioning are valid in human behavior.

Homonyms

A homonym is a language term for two or more words that have the same sound but different meanings. The words may or may not be spelled alike. Homonyms are fairly common in the English language.

In the training session the task for each subject was the structuring of the stimulus as a percept having either a concrete or abstract meaning. In the post training test the same procedure was followed except no responses were reinforced.

Perception and attitudes

Perception is the process of becoming aware of objects, qualities or relations by the way of sense organs. While sensory content is always present, in perception what is perceived is influenced by set and prior experience, so that perception is more than passive registration of stimuli impinging on the sense organs (Hilgard, 1962). This concept influenced this particular experiment. As Mowrer (1960) has commented:

> As we have now seen, the whole history of Behaviorism has been in the direction of liberalization (cf. Miller, 1959a), so much so, in fact, that Kendler, in his review, hardly refers to it at all, preferring instead to speak of 'neo-behaviorism' and 'S-R functionalism.' These latter movements

> readily accommodate concepts, such as fear and hope, which pristine Behaviorism would not countenance. Moreover, as also intimated by Kendler, these movements are now even beginning to acknowledge 'perception (or at least orienting acts).' In other words, the relevance of cognitive as well as affective processes is being recognized in systematic theory; and the solution to the problem of response selection and initiation hinges, quite specifically it seems, upon the reality of imagery (or memory), which is a cognitive phenomenon, pure and simple.

There are several ways of acquiring or introducing changes in perception. Attitudes, which are learned, influence the way a person appraises events (Sherif & Hovland, 1961; Newcomb, 1959). Attitude in a broader sense is an "...orientation toward or away from some object, concept or situation; a readiness to respond in a predetermined manner, to the object or concept or situation" (Hilgard, 1962). These are part of the internal structure and are acquired independently about objects and persons. Simultaneously beliefs are acquired about the communicator. Instigation of a communication is necessary to change attitudes (Newcomb, 1959). Perceptual qualities can be intrinsic in one sense but they are subject to influences which modify the state of the organism. Therefore, Helson (1951) felt that reinforcement must be effective in perception before it can operate in learning. Reinforcement probably is effective in changing perceptions.

The present experiment is an investigation into an area which is very similar to attitude. It is an investigation of an attitude like phenomenon. Some psychologists feel there is an intimate relation between perception and attitude. To this date there has been little research in these two related areas. Hovland, Janis and Kelley (1953) state that one approach to investigation of perception and attitude is the study of language and verbal behavior as it is related to the

frame-of-reference. The author has used verbal behavior as an investigating tool in the present experiment.

Preconscious level or awareness

The preconscious level is that level before imminent knowledge of one's own thoughts, feelings, and existances (Solley and Murphy, 1960). It can also be referred to as "awareness." The existance of "awareness" on the part of the Ss about the purpose of the experiment may well be the aspect of these studies that raises the most interesting questions. The subjects change their behavior as a function of responding to stimuli controlled by others (Krasner, 1958). Since both Aldrich and the author's experiment used only subjects who were assumed to be unaware of the contingency factors based on the four questions asked after the post training test, the issue of awareness while not investigated per se, was a factor in the experiment.

Latitude of acceptance

The author, as did Aldrich, selected subjects who habitually perceived the stimuli on the survey instrument about one half of the time as being concrete or abstract and responded thusly. In theory this placed the subjects near the middle of a concept continuum and would indicate they would have the widest latitude of acceptance.

Latitude of acceptance as used by Sherif (1956) refers to attitudes. However, it is analogous to the present situation in that subjects at the midpoint of the concrete-abstract response continuum can be conditioned to move in the continuum toward either making more or fewer abstract or concrete responses. Statistically subjects in the middle range of the concept continuum are desirable since there is a chance of a subject who responds 100% concretely being placed in a

concrete reinforcement experimental group where there would be no opportunity for change, except toward abstract.

This technique of selecting subjects reduces ceiling effects and thus improves the design of the experiment.

Retention

Subjects in the writer's experiment were tested for the retention of a conditioned response at a period of 0, 24 and 48 hours delay in testing "...retention is the difference in proficiency of a performance during...retest from that during acquisition; the subsequent measure is made after a lapse of time...." (Brogden, 1951). Hovland (1951) refers to it as "...changes in performance at various time intervals...." When retention decreases with the passage of time, it is forgetting and when it improves, it is reminiscence.

Review of the Literature

History

Verbal conditioning and verbal behavior were used as the independent and dependent variables. A review of the literature and other related experiments is in order. The number of studies, the extensive history of verbal conditioning, and the present interest in the area indicates it is one of importance.

Thorndike. Thorndike did not refer to his experiments and studies as those of verbal conditioning. However, as early as 1934 Thorndike and Rock were conducting experiments in verbal behavior using a conditioning or reinforcement technique of stating "Right" or "Wrong" to the correct response (Thorndike, 1935).

Skinner. In 1948 Skinner suggested that verbal behavior should be studied in order to give further or other insights into both verbal behavior and behavior in general (Greenspoon, 1962).

> It was primarily through the efforts of B. F. Skinner (1948) that verbal behavior came to be studied and examined in a way that may provide the clinician with some aids in working with the verbal behavior of patients. Members of the response class may occur with some ascertainable frequency prior to the introduction of any specific set or sets of operations by the experimenter. If such conditions prevail, then it should be possible to work with behavior in much the same way that experimenters have worked with the behavior of rats, pigeons, etc. It should also be possible to investigate the same kinds of variables that have been investigated with the non-verbal behavior of humans and infrahumans. (Greenspoon, 1962)

Greenspoon. As we have seen in 1948 Skinner suggested the study of verbal behavior. Skinner also suggested the use of the operant conditioning technique. Early in the 1950's Greenspoon did his doctoral dissertation in the area of verbal conditioning.

> The initial research in the area that has come to be designated verbal conditioning was conducted by Greenspoon (1951, 1954, 1955). This research was designed to create an experimental situation to study verbal behavior that paralleled the operant conditioning conditions with infrahumans. (Greenspoon, 1962)

Literature. Since there are available in the literature excellent reviews in the work in this area, it is felt to be redundant to attempt to review all of the pertinent literature. The reader is referred to reviews by Krasner, 1955; Salzinger, 1959; and Greenspoon, 1962. These three articles have 318 citations. Although there are some duplications, it will give the reader an insight into the amount of literature available and the relative importance of the field.

Awareness

Occurrences of learning with awareness. In the area of verbal behavior the awareness of the contingency factor and the effects of

awareness has been a point in question. As early as 1934 Thorndike and Rock (Thorndike, 1935) felt that learning could take place without awareness and, further, that little if any early learning could be ascribed to awareness. On the other hand, they felt that unconscious learning was relatively undependable and slow but that it was not mystical or fortuitous (Thorndike, 1935). Thorndike and Rock in their experiments regarded the initial rise of the learning curve as an indication of learning without awareness. "When a subject gradually increased his tendency, it is evident that the tendency is strengthened without his being aware of it" (Thorndike, 1935). These experimenters further felt that only about one in thirty of their subjects showed any awareness of what was happening or could verbalize how he was learning. Thorndike (1935) felt one did not have to be able to verbalize the response reinforcement contingency to learn and stated: "If then any form of expectation of any satisfying after-effect is attached to any connection, it may strengthen the connection as truly as a real after-effect would."

These views, as reported by Postman (1962), were not shared by other investigators. Irwin, et al, repeated Thorndike's experiment with the exception that during the experiment the subject was shown the right and wrong response combination. The experimenters still got a gradual slope in the learning curve. This demonstrated that perhaps no valid inferences could be drawn about awareness from the slope of the learning curve.

The Irwin experiment was repeated by Postman and Jarrett in 1952. By using the subject's verbalization of the contingency factor as the criterion of awareness, they found essentially the same results as

reported by Thorndike and Rock (Postman, 1962).

The results of an experiment by Spence and Holland (1962) demonstrates that the meaning of a stimulus can be registered without awareness and can significantly influence subsequent recall. Awareness is not a reliable indicator of amount of information being registered by the subject. If anything, awareness is an indicator that more structurally determined responses are to be expected. The absence of awareness is an indicator that more meaning determined responses are to be expected as shown by the correlation between degree of awareness and the preference for structure over meaning in recall. The experiment was done with a subliminal presentation of cheese-related stimuli. Upon retest the subliminal group showed a significant preference for recall of cheese related words.

Chatterjee and Erickson (1960) have shown through a careful investigation of subject's awareness that the conditioning of the autonomic nervous system response (of GSR) was no more specific than Ss verbalizations about objects. Experiments by Baker (1937) and Miller (1939) had demonstrated that learning and discrimination could take place on a subliminal level and that psychological thresholds are lower than conscious judgments.

Attitude change without awareness by classical conditioning. Two recent studies in the area of attitude change indicate that it is possible for attitude change to take place without awareness (Hildum & Brown, 1956; and Staats & Staats, 1958).

Adams (1957) felt that after reviewing the literature the only type behavior which can be easily reproduced without awareness is that of the classical type.

Staats and Staats (1958) used classical conditioning to demonstrate attitude change without awareness. If attitudes are considered to be responses, the learning process should be the same as for other responses. The experiment was to test the hypothesis that attitudes already elicited by socially significant verbal stimuli can be changed by classical conditioning. Socially significant words have two responses, an evaluative response (attitude component) and the distinctive meaning of the word. By presenting the to-be-conditioned stimulus, in this case a national state or a man's name, prior to the unconditioned stimulus word, such as "pretty", the pairing of the two words results in an association between the to-be-conditioned stimulus and the evaluative meaning of the unconditioned stimulus. "The study showed significant changes in the direction predicted...." (Staats and Staats, 1958). In each experiment there was significant evidence that meaning responses had been conditioned to names without the subjects awareness.

Attitude change without awareness by operant conditioning. The Hildum and Brown study (1956) was an operant conditioning type study very similar to those by: Greenspoon (1955), Taffel (1955), Verplanck (1955).

The experimenters used a questionnaire of 15 items with four possible responses to each, and reinforced a previously selected response to the topic "general education" in an interview situation. The responses ranged from "strongly agree" to "strongly disagree." The statements were so worded that agreement with some statements represented an unfavorable attitude. Consequently the interviewer reinforced an "attitude" rather than a specific response category.

The interview was conducted over the telephone and the interviewer reinforced selective responses by either "mmm-hmm" or "good." Interviewees stated their answers were not influenced by the interviewer. A repeat of the experiment got similar results. The authors concluded that the attitudes of the subjects were changed without the subject's awareness.

Conclusion. Postman (1962), after reviewing several studies which showed learning with and without awareness, stated:

> There is now ample empirical evidence to support the conclusion that the after-effects can significantly modify behavior even when the subject is unable to verbalize the principle according to which the after-effects are administered. These results support Thorndike's contention that the influence of after-effects may be automatic....

The burden of proof now rests with those who insist we cannot learn unless we are aware of what we are learning. Thus, from the evidence cited, learning without awareness does take place.

Theory. One explanation of why learning without awareness takes place is the hypothesis of partial clues of Weiner and Schiller (1960). The findings of past experiments are all consistent with the hypothesis of perception of parital clues.

> Our results do not lead us to propose there is no behavior without awareness, nor do we propose that the only stimuli of which we are aware affect behavior. To assume that a new or different process underlies variations in behavior under what appear to be variations in conditions, or to infer new processes based upon acceptance of negative propositions may lead to a proliferation of constructs which will still further confuse and confound our limited understanding of behavior (Weiner & Schiller, 1960).

Reinforcers

A common generalized reinforcer or condition of reinforcement is that of approval. Several such reinforcements can be used. Experi-

menters are generally agreed that "that's good" and "mmm-hmm" are more effective than the others. Hall in 1960 demonstrated in a Taffel-like experiment using sentences and pronouns that "that's good" produced conditioning under all circumstances of the experiment and "mmm-hmm" produced conditioning or was reinforcing only under condition where the subject was ego involved in the task at hand. Hall further commented about the importance of the set produced by the instructions and the importance of good design of the experiment.

Most studies have been conducted on "normal" people. A late experiment by Horowitz (1963) found, using mentally retarded children with IQ's of 36-78, the best reinforcer was candy and a smile, as compared to candy, voice, or smile alone, or any other combination thereof.

The Hildum and Brown (1956) study found that verbal stimuli of "good" was more effective in changing opinion than "mmm-hmm."

Skinner (1957) showed that differential reinforcement shapes operant behavior, and that when a prior stimulus enters into a contingency relationship, reinforcement is responsible for its resulting control. The effectiveness of reinforcement depends upon the schedule in which it is used. Kanfer (1958) showed a fixed ratio schedule is superior to any other.

Since the present experiment replicated a previous one, a 100% reinforcement schedule was used and a positive reinforcement of "mmm-hmm" or "that's good" was the reinforcer.

Summary

Since verbal behavior has been found to be a good experimental

vehicle, and the conceptual and attitudinal process is a verbal one or closely related thereto, it has been shown that further investigation is necessary to ascertain the effects of time on the retention of conceptual conditioning at a preconscious level. The laboratory-controlled experimentation is desirable for pilot studies and preliminary investigation for a psychologist (Sherif & Sherif, 1956). Greenspoon (1962) is of the opinion that verbal behavior represents an excellent meeting ground for both experimental and applied psychology.

> The greater proportion of almost...all experiments in perceptual learning and verbal conditioning have focused their attention upon the single stimulus, that is the percept, and have given little or no attention to the nonspecific stimuli which form the frame-of-reference in the learning. Thorndike and Rock used specific words; Philbrick and Postman reinforced the pairing of specific words with specific numbers; Verplanck successfully conditioned the specific word content of conversation; Weide, as well as Matarazzo, Saslow and Pareis used specific relevant words; Solley and Murphy used an animal and doll....Further, Krasner in his review of verbal conditioning noted that up to that date (1958) all studies used a specific, content task to be conditioned and found no investigations which used a minimal, marginal or ambiguous stimulus in verbal conditioning of a perceptual task. (Scofield & Aldrich, 1963)

It is within the foregoing framework that the present experiment was conducted.

Hypothesis

The present experiment was designed to investigate the hypothesis that a concept can be conditioned at a preconscious level, or without awareness, by an operant conditioning technique. The concept once conditioned will be retained. Therefore, it is hypothesized that there will be a significant difference between the control and experimental

groups as measured by a criterion test when testing is delayed by 0, 24 and 48 hours.

CHAPTER II

PROCEDURE

Chapter I was concerned with the reason for the experiment and the hypothesis. The following will explain the method of investigating the problem.

Overview

The experimentation used an operant conditioning process, and a verbal reinforcement technique. The experimental population was selected on the basis of a pretest. Each subject was randomly assigned by a table of random numbers to one of nine reinforcement groups. The two major experimental groups were a concrete reinforcement group and an abstract reinforcement group. There was a no reinforcement control group for each. Further, these four major groups were subdivided into three testing time subgroups: immediately after training (0 hours), 24 hours after training, and 48 hours after training.

During the training period each subject was presented an ambiguous stimulus in the form of a set of homonyms and was reinforced on the basis of his category or group placement after he had made a forced choice response of one of the synonyms. The control groups (no reinforcement during training), underwent the training trials but receieved no reinforcement for their responses.

The experiment was analyzed using analysis of variance.

Instruments

The pretest, a preliminary survey instrument (Appendix A) was constructed by the experimenter. The training list stimulus words (Appendix B) and forced choice responses (Appendix C) are from Aldrich (1962). The test stimulus words (Appendix D) and the test forced choice list (Appendix E) are also from Aldrich (1962).

Pretest or survey instrument

The preliminary survey instrument was constructed from a list of words chosen by a random process from Thorndike and Lorge (1944) each of which had a code count of AA and M in at least three categories. Also included were 15 sample items from Aldrich (1962).

Synonyms, concrete or abstract in meaning, were chosen from Roget's Thesaurus (1941) and Webster's New Collegiate Dictionary (1956). The presentation of the order of either the concrete or the abstract synonym, first, was randomized by a toss of a coin. The survey was presented and analyzed. Twenty-three items identified by an asterisk (*) were used to select the population of subjects. Items which fell between 40% and 60% on the item analysis were retained and used as the selective instrument (Nunnally, 1959). A reliability coefficient of 0.71 was computed using Hoyt's version of the Kuder-Richardson (K-R 20) formula (Guilford, 1950, p. 496).[1] For the purpose of this experiment, subjects who scored 11 and 12 on the survey fell at 48% and 52% and were assumed to have no preference of being either abstract or concrete in their mode of response as measured by the instrument (See

---

[1] $\bar{X} = 49.20\%$, $S^2 = 142.85$, $s_{\bar{x}}^2 = 4.76$ and $r_{tt} = 0.71$, $n = 30$

Appendix I).

Training and criterion test

The training and criterion test instruments were taken from Aldrich (1962) (Appendix B, C, D, & E). A reliability coefficient was computed for the post-test instrument by the Hoyt version of the K-R 20 formula of $r_{tt} = 0.64$.[2] The population in this case was the control (no reinforcement) groups. The reliability coefficients of both the survey and criterion tests are significant (Steel & Torrie, 1960).

Methods

Subjects and grouping

Subjects (Ss) for the experiment were 60 undergraduate volunteers from the introductory psychology classes at the Oklahoma State University. Ss were selected by a pretest and had scored between 48% and 52% on the pretest. The total pretest population (N) was 472 (See Appendix I). Experimental Ss included 20 males and 40 females of which 30 were Freshmen, 18 were Sophomores, 10 were Juniors, and 2 were Seniors.

There was an age range of 17-22 years. Fifty-nine of the Ss were Caucasian and one an Asian Indian. The Ss were aware that participation in an experiment was an extra credit activity as concerned their introductory psychology course grade. The Ss were assigned at random to the treatment groups using the randomization process of Steel and Torrie (1960).

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[2] $n = 30$, $u = 59.46$, $\sigma^2 = 138.73$, $\sigma^2_u = 4.62$, $r_{tt} = 0.64$

Technique

All subjects were trained and tested by the same experimenter under similar experimental conditions. The stimulus homonym was given by a tape recording. The assignment of the S to a reinforcement group determined whether or not the reinforcement was given for either an abstract or concrete response. The control groups received no reinforcement for any response during the training trials. Results of criterion tests were put on data sheets and analyzed as shown in Tables 1, 2, 3 and 4.

Experimental setting and task

The task instructions to the Ss were given by a tape recording, on a Wollensak recorder model 1500, recorded at speed setting 3 3/4 ft. per minute, "recording level 5" and "trebel" played back at "level 4" and "trebel."

The experimenter (E) conducted all of the experimental sessions and administered the reinforcement "mmm-hmm" and/or "that's good" in as conversational and objective manner as possible. The experimental room was one of the administrative offices of the Psychology Department and was relatively free from interference. The room was not soundproof. One could hear the exterior noise of the office staff, typewriters, etc. This did not seem to distract the Ss and none of them made any mention of it in their protocols.

The experimental sessions were scheduled individually as allowed by the Ss academic schedule. One half of the sessions were in the morning and one half were in the afternoon, Monday through Friday. Experimental sessions were conducted during the month of October, 1963.

Each experimental subject was given a training session and tested either immediately after the training session, 24 hours after the training session or 48 hours after the training session, depending upon the group to which he was assigned. The control group received no reinforcement during the training sessions.

Training session. The training session consisted of fifty aural stimuli homonyms presented verbally via a tape recorder (Appendix B). Each S responded to the stimulus by circling one of the response words on a hectographed forced choice list of response synonyms (Appendix C). The reinforcement schedule was 100% for either "concrete" or "abstract" response depending on the experimental group and was given immediately after the response was made by S. E sat next to S during experimental and test sessions.

The instructions given verbally by the tape recording are as follows for the training session:

> Good-day. The task you are asked to do is similar to the test paper situation you had of a few days ago. The change this time is that the cue word will be given verbally on this tape recorder. There are fifty situations. I will pronounce each cue word twice and will precede each word with its number, for example: one, cow; one, cow, then opposite the number one on your paper rapidly circle your first impression. Do not look for definitions or best response. There are no correct or most correct choices. Follow your first impression. Again there are no right, wrong, or best choices. We will move along quite rapidly, so listen carefully and circle your first impression.
>
> If you have any questions, you now will have on minute to ask them. (One minute break in recording was timed to allow questions and at the end of one minute the tape continued):
>
> If you are ready, we will begin.

Retention criterion testing. The test situation was similar except there were twenty-five homonyms given as stimulus words

(Appendix D) and twenty-five pairs of forced-choice words presented as shown in Appendix E.

The instructions for the test situation were again given by the tape recording and the stimulus words were also given by the tape recording. The instructions were the same as for the training situation with the exception: "There are twenty-five situations." was substituted for "There are fifty situations."

The criterion test was administered either immediately after the training session (0 hours), 24 hours after the training session, or 48 hours after the training session.

Check for awareness

In addition, to ascertain the level of awareness, four open end questions were given at the end of the test situation. Immediately after the twenty-fifth item the recorded instructions were:

> Now, on the reverse side of your paper please answer the following four questions which refer to the last twenty-five situations in which you were engaged:
>
> Question number one: What do you think the purpose of this experiment is? Question number one: What do you think the purpose of this experiment is?
>
> Question number two: Did the presence of the experimenter bother you in making your choices? (and repeated again as in 1.)
>
> Question number three: Did the presence of the experimenter influence your choice of words in any way? (and repeated as in 1 and 2.)
>
> Question number four: Do you think the experimenter's presence or behavior could influence your decision in choosing words? (and repeated as in 1, 2 and 3.

If any S indicated an affirmative answer, he or she was discarded from the experimental group. The Ss that were discarded were

replaced by other Ss in the same manner as the original group.

There was a brief concluding remark on the tape thanking each one for his time and trouble and stating that the purpose of the experiment and the results obtained would be explained to each participating psychology class.

The stimulus words were separated by a break of two seconds and there was a fifteen-second break between the open end questions. The whole procedure required fifteen minutes per subject from initial instruction to the last word on the taped conclusion. By careful scheduling the experimenter was able to run four subjects an hour.

Variables

Independent variables were the passage of time, and two experimental conditions of training (treatment, or reinforcement identified as concrete and abstract) and a no reinforcement during training or a control group. The measure of the dependent variable was the scores of the experimental group compared to the scores of the control group.

Design

The statistical analysis of the experiment and its design was after Edwards (1954) and results were analyzed by an analysis of variance. The concrete and abstract experimental groups were analyzed separately.

CHAPTER III

RESULTS

Preliminary survey test

Results of preliminary survey test are given by Figure 1. This shows the range of the subjects' scores from which the experimental and control groups were drawn and the distribution of the population. The items in the test were scored for abstract response.

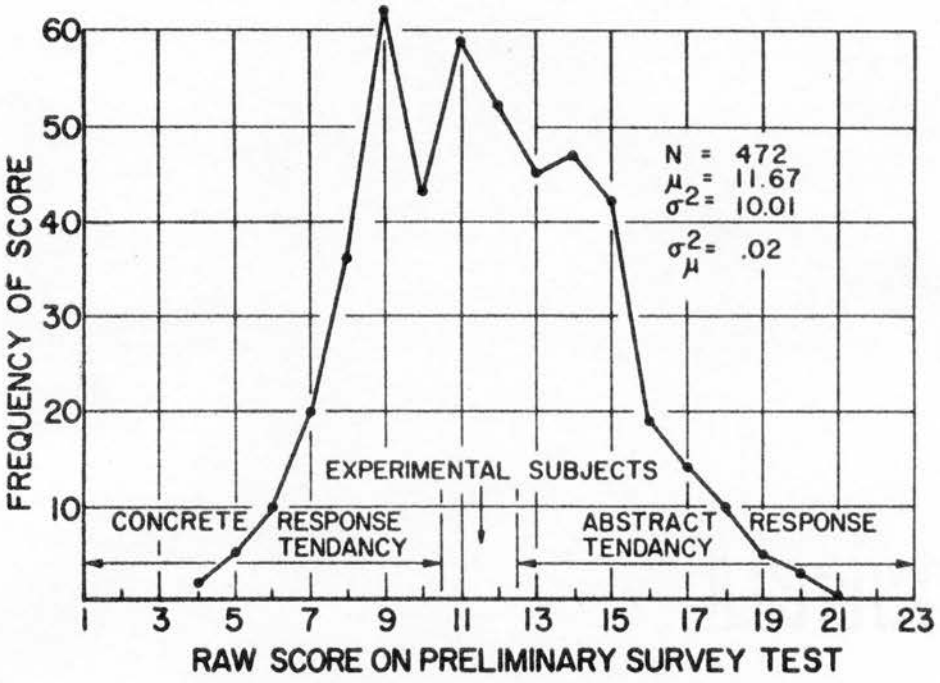

Figure 1. Preliminary survey population and the results of the preliminary survey test showing raw score plotted against frequency of score.

Treatment of groups

Results of treatment of groups are given in Appendix F, G, H, and I and Figures 2 and 3.

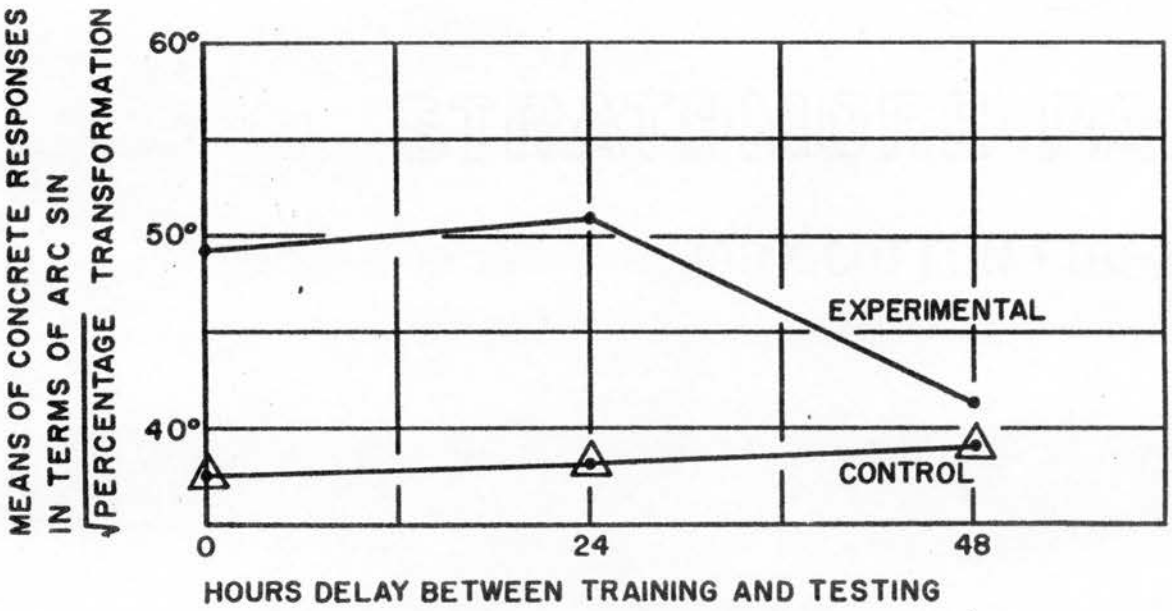

Figure 2. Plot of means of responses of experimental group reinforced during training for concrete responses as measured by the post training criterion test versus hours delay between training session and testing.

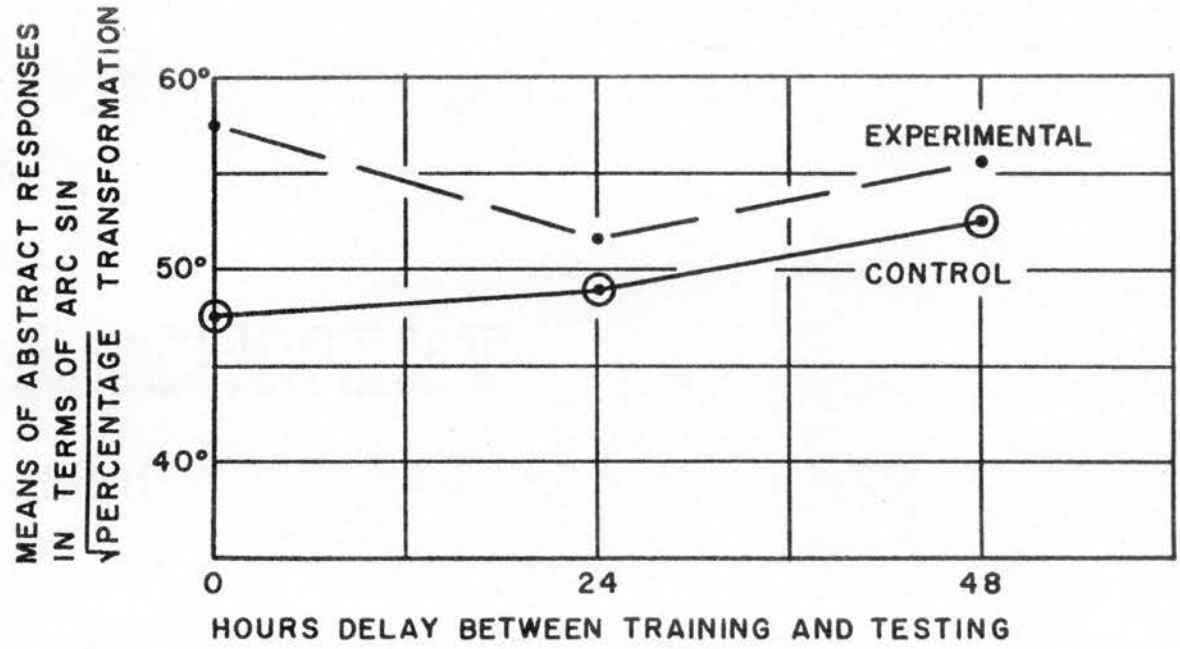

Figure 3. Plot of means of responses of experimental group reinforced during training for abstract responses as measured by the post training criterion test versus hours delay between training session and testing.

The appendices show the raw data by treatment group and subject in terms of raw score, percentage score and the arc sin $\sqrt{\text{percentage}}$ transformation of each score. Figures 2 and 3 show a plot of the means of the experimental group versus the control group in terms of the arc sin $\sqrt{\text{percentage}}$ transformation.

Statistical analysis

Scores of each subject was transformed to an arc sin $\sqrt{\text{percentage}}$ function after Steel and Torrie (1960). All analysis and comparisons are reported in terms of the arc sin $\sqrt{\text{percentage}}$ transformation.

Analysis of variance. The results of the analysis of variance are contained in the Tables 1 and 2. These results show that the F-tests support the hypotheses. One would reject the null hypothesis and accept an alternate hypothesis that a S can be operantly conditioned to respond with either a concrete or abstract response to a homonym.

TABLE 1

ANALYSIS OF VARIANCE EXPERIMENTAL GROUP (CONCRETE) VS CONTROL GROUP (NO REINFORCEMENT DURING TRAINING) n = 30

Source of Variation	df	SS	MS	F
A (treatments)	1	607.860	607.860	11.14**
B (time)	2	96.466	48.233	0.88 ns
A X B (treatments X time)	2	172.625	86.312	1.58 ns
S (AB) (error)	24	1310.001	54.583	--
Total	29	2186.952	--	--

**$p < .01$ w 1 and 24 df.

TABLE 2

ANALYSIS OF VARIANCE EXPERIMENTAL GROUP (ABSTRACT) VS CONTROL GROUP (NO REINFORCEMENT DURING TRAINING) n = 30

Source of Variation	df	SS	MS	F
A (treatments)	1	273.370	273.370	5.589*
B (time)	2	39.759	19.879	0.41 ns
A X B (treatments X time)	2	59.957	29.978	0.61 ns
S (AB) (error)	24	1173.780	48.907	--
Total	29	1546.866	--	--

*p<.05 w 1 and 24 df.

Comparison of means. A comparison of means between experimental and control groups using the Tukey w procedure (Steel & Torrie, 1960), which gives an experimentwise error rate, shows that one would reject the null hypothesis at 0 hours delay in testing in both the experimental concrete and abstract reinforced groups. This finding supports Aldrich's findings.

TABLE 3

COMPARISON OF MEANS EXPERIMENTAL GROUP (ABSTRACT) VS CONTROL GROUP (NO REINFORCEMENT DURING TRAINING) USING TUKEY W PROCEDURE

Hrs. Delay in Testing	Experimental $\bar{X}$ - Control $\bar{X}$
0	57.60 - 47.58 = 10.02*
24	52.72 - 48.99 = 3.73 ns
48	55.84 - 51.46 = 4.38 ns

*p<.05 w 1 and 24 df. hsd: $w_{(.05)} = 9.65$, $w_{(.01)} = 13.08$

TABLE 4

COMPARISON OF MEANS EXPERIMENTAL GROUP (CONCRETE) VS CONTROL GROUP (NO REINFORCEMENT DURING TRAINING) USING TUKEY W PROCEDURE

Hrs. Delay in Testing	Experimental $\bar{X}$ - Control $\bar{X}$
0	49.43 - 37.52 = 11.91*
24	50.91 - 38.05 = 12.86*
48	41.39 - 39.15 = 2.24 ns
*$p < .05$ w 1 and 24 df.	hsd: $w_{(.05)} = 9.13$, $w_{(.01)} = 12.38$

At 24 hours delay in testing the concrete group is significantly different at $p < .05$ level and there is a slight increase in the difference which might be termed reminiscence. The curve then falls off rapidly and shows no significant difference at 48 hours delay in testing.

The abstract group conditioning as measured at 0 hours delay is significant. Conditioning, as measured by the criterion test at 24 and 48 hours, has occurred although it does not approach significance.

CHAPTER IV

DISCUSSION AND CONCLUSION

In the previous chapter the results support Aldrich's finding that a specific frame-of-reference can be conditioned by an operant reinforcement technique. The use of a more rigid experimental condition in that the **E** was only involved in the reinforcement phase and not in the stimulus presentation was different than that used by Aldrich, and the results demonstrate that a concept can be conditioned without awareness. Although significant results were not shown in each comparison of the means, the experimental hypothesis seems valid. In regard to a proper level of significance:

> Questions often arise about the choice of significance, but it cannot be expected that a general answer will be forthcoming. The development of a statistical notion of decision functions rather than classical significance tests emphasizes the point all the more. In the decision function approach one tries to decide how much data is needed to reach a decision which in some cases is most economical, but for the full treatment it is important to know the value of correct decisions and the costs associated with the incorrect one... (Mosteller & Bush, 1954)

Although the results are not statistically significant in all cases, the trend is in the hypothesized direction.

Use of homonyms

In Salzinger's 1959 review he noted that there was a dearth of experimentation with a discriminative stimulus in classical behavior studies. In the present study and Aldrich study the discriminative

stimulus is known. This may not have been the case in other studies. The fact that the stimulus was perceived as having two meanings and that one can shape the intervening variable make the present study and the Aldrich study unique.

Awareness

The use of subjects who were not aware of the contingency factors point up the fact that learning without awareness takes place. This area deserves further study.

Correspondence with other studies

Results of abstract responses. In the case of the abstract group the results parallel a Hovland, Lumsdaine and Sheffield study which suggested in connection with the "Why We Fight" films that the abstract message of the films had more impact on attitude after a sinking-in period (McGuire, 1960). It is suggested that perhaps the above applies in the present experiment. A delay of testing over a longer time period might have revealed an increase in retention of the abstract conceptual framework.

Concrete response results. The results of the present experiment seem to indicate that it might be easier to establish a concept of concreteness rather than one of abstractness since there is greater retention over a relatively short period of time. This idea supports a study by Heidbreder, Bensley and Ivy in 1948 and one by Grant in 1951. The results of these experiments showed it was easier to attain a concept of an object than of spacial forms or numbers (Hilgard, 1962).

Relation to theory

The results of the study can be interpreted in the light of

either a cognitive theory or the S-R position. The eventual use of the data should be considered only in light of the boundary conditions that were used in selecting the subjects and the test for awareness in the experimental design.

Areas of improvement and investigation

Reliability. While the reliability of our test instruments has been underestimated by the K-R 20 formula, a scaling of items and further item analysis will increase the reliability and will give a more valid measure of results.

Selection. There may be a question about the advisability of selecting Ss using a visual stimulus device and then doing the training using an aural stimulus device. Therefore, one should probably use the same system of stimulus presentation in all phases.

Reinforcement. There are two areas of reinforcement to be considered in the forced choice response situation, one of partial reinforcement and the other of the presentation of the forced choice responses.

It would be informative to investigate partial reinforcement since studies show that retention of response or the resistance to extinction is greater under partial reinforcement conditions.

The E noted that there was a tendency for the Ss to attend to the next forced choice response by movement of his pencil to the next line after the required one had been circled. This behavior may confound the association of reinforcement and response and cloud the analysis of the results. The use of a tachistoscope or booklet presentation of the forced choices would give more rigid control of the experiment.

Summary and conclusions

The present experiment has demonstrated the results of the Aldrich (1962) experiment can be replicated and that:

(1) concepts can be operantly conditioned without awareness on a preconscious level.

(2) use of a discriminative stimulus is possible in verbal behavior studies within the operant conditioning paradigm.

(3) the study supports other investigations in the area of abstract and concrete conceptualization.

(4) a concept conditioned by the operant conditioning technique is retained at a significant level over a period of at least 24 hours in the case of a concrete concept, and in the case of an abstract concept although retention is not significant at 24 hours, at 48 hours the curve tends in an upward course toward a significant level.

One would conclude that the results of the experiment support the hypothesis in the case of the experimental group reinforced for concrete responses and that further experimentation is necessary to determine the influence of reinforcement for abstract responses.

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APPENDIX A

PRELIMINARY SURVEY INSTRUMENT

INSTRUCTIONS:

1. Please print your name and other information in the blanks as applicable.

Your Name_____Sch Address_____

Telephone FR 2-_____Ext._____ Circle one: Male Female

Circle one: Fr So Jr Sr Gd Circle one: Caucasian Negro Other

Instructor's Name_____ Your age_____

Class Schedule: Put a check mark in space where you have a class.

	8 AM	9 AM	10 AM	11 AM	12:00	1 PM	2 PM	3 PM	4 PM	5 PM
Monday										
Tuesday										
Wednesday										
Thursday										
Friday										
Saturday										

2. Rapidly read each word in the first column and circle one of the two choice words.

3. Do not look for definitions, meanings or best choice. There are no correct or incorrect choices.

4. Follow your first impression and work rapidly as comfortable.

5. Again, there are no right, wrong, or best choices, simply work as rapidly as possible circling your first choice.

6. Your remarks or comments:

APPENDIX A (Cont.)

1.	Her	Female - Person
2.	Did	Yesterday - Effect
*3.	Back	Football - Reverse
*4.	Very	Truth - Same
5.	Five	Dice - Number
6.	Both	Us - Equally
7.	Night	Dark - Moon
8.	Perhaps	Cards - Chance
*9.	Step	Foot - Advance
10.	Mister	Man - Respect
11.	When	Clock - Moment
12.	May	Let - Month
13.	Year	Sun - Time
*14.	Word	Idea - Book
*15.	Knight	Romance - Roundtable
16.	Came	Travel - Vehicle
17.	Seen	Experience - Eye
18.	Door	Entrance - Open
19.	Make	Build - Trademark
20.	Hair	Head - Slender
*21.	Silk	Stocking - Soft
22.	Up	Aircraft - Direction
23.	Book	Read - Ledger
24.	Voice	Ballot - Express
25.	Have	Possession - Control
*26.	Cook	Prepare - Food
27.	Half	Part - Athletics
28.	Father	Parent - Religion
29.	Land	Disembark - Earth
30.	Full	Cup - Complete
31.	Red	Color - Brick
*32.	School	College - Education
33.	Was	Place - Time
34.	Children	Small - Infant
35.	Another	Again - Person
36.	Cause	Reason - Person
37.	First	Preceeding - Sports
38.	Now	Here - Act
39.	Fire	Ember - Warmth
40.	Bed	Sleep - Furniture
41.	Name	Title - Speak
42.	Enough	Ample - Supplies
*43.	Company	Friendly - Business
44.	Dead	Devoid - Cemetery
*45.	Some	Unspecified - Persons
46.	Receive	Television - Accept
47.	Food	Meal - Hunger
48.	Wait	Remain - Servant
49.	During	Calendar - Time
*50.	From	Motive - Home

APPENDIX A (Cont.)

51.	Hard	Rock - Difficult
52.	Took	Seized - Robber
53.	Each	One - Person
54.	People	Common - Tribe
55.	Reason	Statement - Motive
56.	Us	Together - Group
57.	Country	Farm - Patriotic
58.	And	More - Arithmetic
59.	Horse	Sport - Polo
60.	Long	Train - Extent
61.	Give	Gift - Allow
62.	Of	From - Clock
63.	Demand	Money - Order
64.	Feel	Hand - Sense
65.	Get	Money - Acquire
66.	Might	Military - Power
67.	Day	Calendar - Light
68.	Bring	Lead - Hand
69.	Hour	Clock - Time
70.	Come	Approach - Sailing
71.	Begin	Start - Freshman
72.	Seem	Appear - Mind
73.	Against	Contrary - Vote
74.	Good	Property - Satisfactory
75.	Cry	Sorrow - Tear
76.	Start	Race - Move
*77.	Home	House - Affections
*78.	Between	Comparison - Space
79.	Next	Near - Neighbor
80.	Even	Smooth - Number
81.	Body	Physical - Corpse
82.	Out	Beyond - Country
*83.	Low	Note - Elevation
84.	Among	Crowd - Divide
85.	No	Vote - Opposing
86.	Who	Sound - People
87.	Mother	Love - Parent
88.	Before	Front - Nose
*89.	Plan	Method - Blueprint
90.	Around	Lie - Circle
91.	Girl	Sweetheart - Pretty
92.	I	Me - Aware
93.	House	Building - Legislature
94.	Second	Clock - After
*95.	Family	Warm - Household
*96.	Space	Room - Explore
*97.	Mouth	Oral - Tongue
98.	At	Direction - Arrow
99.	Less	Arithmetic - Smaller
*100.	Mean	Statistics - Personality

APPENDIX B

STIMULUS TRAINING LIST

1. AIR / HEIR
2. PAIR / PEAR
3. REIGN / RAIN
4. VANE / VAIN
5. MAZE / MAIZE
6. SHEER / SHEAR
7. BAWL / BALL
8. LOCK / LOCH
9. OR / ORE
10. OUR / HOUR
11. HIM / HYMN
12. SOUL / SOLE
13. BEAU / BOW
14. EARN / URN
15. DOWN
16. ADD / AD
17. BELLE / BELL
18. TIDE / TIED
19. SHOOT / CHUTE
20. MALE / MAIL
21. WAY / WEIGH
22. DONE / DUN
23. SEEM / SEAM
24. SURGE / SERGE
25. MISS
26. HALE / HAIL
27. SORE / SOAR
28. FELT
29. CORE / CORPS
30. AUNT / ANT
31. BLEW / BLUE
32. STEER
33. DO / DEW
34. TEEM / TEAM
35. SHOW
36. FLEW / FLUE
37. SOW / SEW
38. OH / OWE
39. TEA / TEE
40. BORE / BOAR
41. COLOR
42. RODE / ROAD
43. BARON / BAREN
44. BARE / BEAR
45. MADE / MAID
46. ALTER / ALTAR
47. NOTE
48. SALE / SAIL
49. FAIR / FARE
50. CARROT / KARAT

APPENDIX C

STIMULUS TEST LIST

1. MEDAL / MEDDLE
2. FLEE / FLEA
3. COARSE / COURSE
4. REAL / REEL
5. DIE / DYE
6. PALE / PAIL
7. SEA / SEE
8. PAIN / PANE
9. BEAT / BEET
10. BE / BEE
11. HERD / HEARD
12. TALE / TAIL
13. MANE / MAIN
14. MEET / MEAT
15. RIGHT / WRITE
16. ATE / EIGHT
17. STAIR / STARE
18. STEEL / STEAL
19. ROLL / ROLE
20. ARC / ARK
21. SCENT / CENT
22. DEER / DEAR
23. GREAT / GRATE
24. ALE / AIL
25. KNOT / NOT

APPENDIX D

FORCED CHOICE TRAINING RESPONSE LIST

1. BREATHE - SON
2. DUAL - FRUIT
3. KING - FALL
4. SELFISH - WEATHERCOCK
5. CEREAL - INTRICATE
6. TRANSPARENT - SHEEP
7. TENNIS - CRY
8. SCOTLAND - SECURE
9. RATHER - MINER
10. POSSESS - MIDNIGHT
11. HE - CHOIR
12. LEATHER - SPIRIT
13. TIE - DATE
14. VASE - DESERVE
15. UNDER - FEATHER
16. NEWSPAPER - SUM
17. TELEPHONE - BEAUTY
18. BOUND - OCEAN
19. HUNT - SKYDIVER
20. POSTMAN - MASCULINE
21. METRECAL - MANNER
22. BILL - FINISHED
23. APPEAR - THREAD
24. SUIT - THROB
25. ERROR - GIRL
26. STORM - HEALTHY
27. GLIDER - TENDER
28. HAT - EMOTION
29. MARINE - CENTER
30. PICNIC - KIN
31. SKY - GUSTY
32. DIRECT - CATTLE
33. MOISTURE - ACCOMPLISH
34. SWARM - PLAYER
35. ACTOR - DISPLAY
36. SOAR - CHIMNEY
37. BUTTON - SCATTER
38. SURPRISE - DEBT
39. FAIRWAY - BREW
40. SWINE - CALIBER
41. SHADE - CRAYON
42. CARRY - MAP
43. ARISTOCRATIC - DESERT
44. KODIAK - EMPTY
45. BUILT - SERVANT
46. SERMON - MODIFY
47. PAD - OBSERVE
48. BARGIN - YACHT
49. TICKET - EQUAL
50. DIAMOND - GROW

APPENDIX E

FORCED CHOICE TEST RESPONSE LIST

1. DECORATION - INTERFERE
2. ESCAPE - INSECT
3. ROUTE - CRUDE
4. FILM - TRUE
5. STAIN - PERISH
6. BUCKET - DIM
7. TIDE - LOOK
8. GLASS - HURT
9. VEGETABLE - WIN
10. EXIST - HONEY
11. AUDIBLE - FLOCK
12. WAG - FABLE
13. PRIMARY - LION
14. STEAK - ENCOUNTER
15. LETTER - JUSTICE
16. NUMBER - CONSUMED
17. STEPS - GAZE
18. METAL - ROB
19. ROTATE - PASTRY
20. BOAT - CURVED
21. ODOR - PENNY
22. PRECIOUS - FAUN
23. BARS - IMMENSE
24. SICK - BEER
25. SHOELACE - NEVER

APPENDIX F

ABSTRACT RESPONSE REINFORCED SUBJECTS UNDER CONDITIONS OF 0, 24 & 48 HRS. DELAY BETWEEN TRAINING AND TESTING

0 Hrs. Delay			24 Hrs. Delay			48 Hrs. Delay		
Subject	Score	Arc Sin Trns.	Subject	Score	Arc Sin Trns.	Subject	Score	Arc Sin Trns.
1	20 (80%)	63.44	6	16 (64%)	53.15	11	15 (60%)	50.77
2	17 (68%)	55.55	7	18 (72%)	58.05	12	15 (60%)	50.77
3	13 (52%)	46.15	8	13 (52%)	46.15	13	20 (80%)	63.44
4	16 (64%)	53.13	9	16 (64%)	53.13	14	20 (80%)	63.44
5	22 (88%)	69.73	10	16 (64%)	53.13	15	15 (60%)	50.77

APPENDIX G

ABSTRACT CONTROL (NO REINFORCEMENT DURING TRAINING) SUBJECTS UNDER CONDITIONS OF 0, 24 & 48 HRS. DELAY BETWEEN TRAINING AND TESTING

0 Hrs. Delay			24 Hrs. Delay			48 Hrs. Delay		
Subject	Score	Arc Sin Trns.	Subject	Score	Arc Sin Trns.	Subject	Score	Arc Sin Trns.
16	10 (40%)	39.23	21	18 (72%)	58.05	26	12 (48%)	43.85
17	13 (52%)	46.15	22	12 (48%)	43.85	27	14 (56%)	48.45
18	17 (68%)	55.55	23	15 (60%)	50.77	28	14 (56%)	48.45
19	12 (48%)	43.85	24	11 (44%)	41.55	29	20 (80%)	63.44
20	16 (64%)	53.13	25	15 (60%)	50.77	30	16 (64%)	53.13

APPENDIX H

CONCRETE RESPONSE REINFORCED SUBJECTS UNDER CONDITIONS OF 0, 24 & 48 HRS. DELAY BETWEEN TRAINING AND TESTING

0 Hrs. Delay			24 Hrs. Delay			48 Hrs. Delay		
Subject	Score	Arc Sin Trns.	Subject	Score	Arc Sin Trns.	Subject	Score	Arc Sin Trns.
31	14 (56%)	48.45	36	14 (56%)	48.45	41	07 (28%)	31.95
32	16 (64%)	53.13	37	19 (76%)	60.67	42	12 (48%)	43.85
33	13 (52%)	46.15	38	13 (52%)	46.15	43	15 (60%)	50.77
34	12 (48%)	43.85	39	13 (52%)	46.15	44	14 (56%)	48.45
35	17 (68%)	55.55	40	16 (64%)	53.13	45	07 (28%)	31.95

APPENDIX I

CONCRETE CONTROL (NO REINFORCEMENT DURING TRAINING) SUBJECTS UNDER CONDITIONS OF 0, 24, & 48 HRS. DELAY BETWEEN TRAINING AND TESTING

0 Hrs. Delay			24 Hrs. Delay			48 Hrs. Delay		
Subject	Score	Arc Sin Trns.	Subject	Score	Arc Sin Trns.	Subject	Score	Arc Sin Trns.
46	07 (28%)	31.95	51	12 (48%)	43.85	56	08 (32%)	34.45
47	12 (48%)	43.85	52	05 (20%)	26.56	57	11 (44%)	41.55
48	05 (20%)	26.56	53	12 (48%)	43.85	58	08 (32%)	34.45
49	08 (32%)	34.45	54	11 (44%)	48.45	59	09 (36%)	36.87
50	15 (60%)	50.77	55	08 (32%)	34.45	60	14 (56%)	48.45

VITA

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