

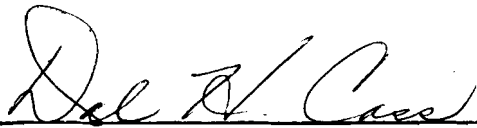
DISCRIMINATION AND CONTIGUITY PROCEDURES
IN VERBAL CONDITIONING

A Thesis
Presented to
the Department of Psychology
The Kansas State Teachers College of Emporia

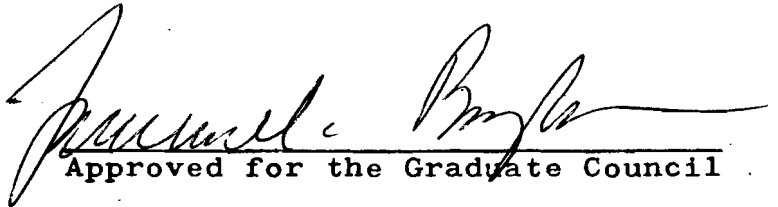
In Partial Fulfillment
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CHAPTER I.

THE PROBLEM AND DEFINITIONS OF TERMS USED

I. THE PROBLEM

Statement of the problem. The purpose of this study was to compare the two procedures which have been proposed as the necessary and sufficient condition to establish a neutral stimulus as a secondary reinforcer. For the first procedure, a stimulus was introduced before a response which was associated with a reinforcement. For the second procedure, a stimulus came between a right response and a reinforcer. It was also the purpose of the study to test the assumption that a neutral stimulus can acquire reinforcing value by being paired with a secondary reinforcer. In addition, the role of awareness in verbal conditioning was assessed and analyzed.

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Importance of the study. In his excellent review of the theories and the status of verbal conditioning, Kanfer stated that in studies using animals, a distinction is usually made between the experiments in which some cue is presented before a reinforcement-associated response and those in which selected responses are followed only by reinforcers. But this is not the case in

studies with human subjects.¹ It must also be noted that the basic question of secondary reinforcement is yet unsettled: "What are the necessary and sufficient conditions for the establishment of a secondary reinforcer?"² Thirdly, a survey of the literature showed that the Hull's assumption that a neutral stimulus can acquire a reinforcing value by being paired with a secondary reinforcer,³ had not been experimentally tested with human subjects. In addition, studies of verbal conditioning can contribute a great deal to our understanding of human interactions with the physical and social environments. Unfortunately, the studies on this topic have declined.⁴ Also, the role of awareness in verbal conditioning has been the major controversy among workers in the field.⁵ It was hoped that this study

¹Frederick H. Kanfer, "Verbal Conditioning: A Review of Current Status," Theodore R. Dixon, and David L. Horton (eds.), Verbal Behavior and General Behavior Theory (New York: Prentice-Hall, Inc., 1968), p. 262.

²Edward L. Wike, Secondary Reinforcement: Selected Experiments (New York: Harper and Row, Publishers, 1966), p. 25.

³Clark L. Hull, Principles of Behavior (New York: Appleton-Century-Crofts, 1943), p. 94.

⁴D. D. Cahoon, and W. W. Wenrich, "Verbal Reinforcement: Where Do We Go from Here?" The Psychological Record, XV (1965), 141.

⁵Kanfer, op. cit., p. 269.

would contribute to human understanding in two ways; first by adding to our understanding of secondary reinforcement, second by increasing our knowledge of verbal and social conditioning situations in which secondary reinforcers may be extensively involved.

Hypotheses. The null hypothesis will be used for each of the following factors:

1. There will be no difference between the discrimination, contiguity, and control groups in establishing secondary reinforcement in verbal conditioning.
2. Pairing of a neutral stimulus with a secondary reinforcer will not allow the former to acquire a reinforcing potential in verbal conditioning.
3. Awareness will not be a major factor in determining the subject's performance in verbal conditioning.

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II. DEFINITIONS OF TERMS USED

The following terms are defined to enable the reader better comprehension while reading the study.

Reinforcement.

. . . Any circumstance or event that increases the probability that a response will recur in a situation like that in which the reinforcing

condition originally occurred. . . .⁶

Secondary reinforcement. ". . . Any reinforcing or rewarding event or state that derives its effectiveness from a previous process of learning or conditioning. . . ." ⁷

Discriminative stimulus.

A stimulus which, when followed by a response, results in reinforcement. An S^D acquires control over an operant response by means of differential reinforcement, in which responses made in its presence are reinforced and those made in its absence are not reinforced.⁸

It will be abbreviated as S^D. For a specific description of discrimination procedure in this study, see pp. 25-26.

Contiguity procedure. A procedure which uses ". . . the general principle that togetherness in time is a necessary condition under which psychological phenomena become dynamically connected. . . ." ⁹ Differing from the discrimination procedure, a neutral stimulus is given after a response, but before a verbal rein-

⁶Horace B. English, and Ava C. English, A Comprehensive Dictionary of Psychological and Psycho-analytical Terms (New York: David McKay Company, Inc., 1958), p. 452.

⁷Ibid., p. 454.

⁸Wike, op. cit., p. 25.

⁹English, op. cit., p. 118.

forcer. For specific procedure in this study, see p. 26.

Awareness. When the subjects (Ss) are able to verbalize a response-reinforcement contingency on a postexperimental inquiry, they are said to be aware.

III. ASSUMPTIONS

It was assumed that the verbal reinforcer, the word "Good!" had approximately the same reinforcing value for all the Ss involved. It was also assumed that the level of intensity of the verbalization of the word "Good!" was kept constant throughout the experiment. The third assumption was that the intensity of the clicking of the playing cards was kept fairly constant throughout the experiment. The fourth assumption was that the Ss were honest in answering the postexperimental questionnaire.

IV. LIMITATIONS OF THE STUDY

This study was limited to the extent that the Ss were the students in Psychology classes who were promised extra credit for participating in the experiment so that they were moderately motivated to cooperate with the experimenter. Therefore, the results may not be

generalizable to situations where the interactions between the experimenter and the S are different.

CHAPTER II

RELATED RESEARCH

I. REVIEW OF RESEARCH

This review, at first, is an attempt to survey the recent studies concerning the two basic theories of the establishment of secondary reinforcers. The latter half of the review will be devoted to the recent studies in the area of modification of verbal behavior within an operant conditioning paradigm, where the reinforcer is some form of social approval introduced by another person. Special emphasis will be placed on the factor of awareness which is the recent controversy among the researchers.

In an excellent book in the area of secondary reinforcement, Wike stated that "a fundamental question regarding secondary reinforcement is: 'What are the necessary and sufficient conditions for establishing a stimulus as a secondary reinforcer?'"¹ One of the simplest hypotheses regarding this question is that of contiguity. It proposes that a neutral stimulus will acquire a secondary reinforcing value by simply being

¹Wike, loc. cit.

paired with a reinforcer. This was Pavlov's position and provided the basis of explaining higher-order conditioning.² But Pavlov himself acknowledged the fact that "it was found impossible . . . to press the secondary conditioned stimulus . . . to help us in the establishment of a new conditioned stimulus of the third order."³ On the other hand, Hull argued that the difficulty of obtaining third-order conditioning reported by Pavlov and his co-workers was due to the procedures they used, and seemed to have believed that the process of higher-order conditioning could go on indefinitely.⁴ In a summary after the discussion, Hull stated:

A receptor impulse will acquire the power of acting as a reinforcing agent if it occurs consistently and repeatedly within 20 seconds or so of a functionally potent reinforcing state of affairs, regardless of whether the latter is primary or secondary.⁵

If contiguity were the only necessary and sufficient condition for the establishment of a secondary reinforcer from a neutral stimulus, then this carries the implication that when an organism receives rein-

²I. P. Pavlov, Conditioned Reflexes, trans. G. V. Anrep (new edition; New York: Dover Publications, Inc., 1960), p. 26.

³Ibid., p. 34.

⁴Hull, *op. cit.*, p. 97. ⁵Ibid., pp. 94-95.

forcement, all of the contiguous stimuli in the environment would acquire some potential as reinforcers. Some writers accepted the hypothesis of Hull and regarded contiguity as the necessary and sufficient condition for establishing a secondary reinforcer.⁶ Skinner seemed to have followed the same line of thinking when he said: "If we have frequently presented a dish of food to a hungry organism, the empty dish will elicit salivation."⁷

Keller and Schoenfeld, however, were more explicit in stating the situation. They agreed with Hull and Skinner that the concept of secondary reinforcement is very important and that the establishment of a secondary reinforcer depends on being paired with another reinforcer.⁸ But they further specified the condition in which a secondary reinforcer (S^R) is established. They stated: "In order to act as an S^R for any response, a

⁶K. W. Spence, "The Role of Secondary Reinforcement in Delayed Reward Learning," Psychological Review, LIV (1947), 1-8.; and J. R. Wittenborn, et. al., "A Contingent Reinforcer," Psychological Review, LXX, No. 5, (1970), 418-431.

⁷B. F. Skinner, Science and Human Behavior (New York: Free Press, 1953), p. 76.

⁸Fred S. Keller, and William N. Schoenfeld, Principles of Psychology (New York: Appleton-Century-Crofts, Inc., 1950), p. 232.

stimulus must have status as an S^D for some response."⁹

Keller and Schoenfeld cited two studies in support of their theory. In the first experiment by Schoenfeld, Antonitis, and Bersh, two groups of rats were trained to press a bar for food. For the experimental group, a light was turned on for one second after the rats started to eat the pellet. Care was taken not to let the light precede the consummatory response. They were interested in making the light an S^F , instead of an S^D . The control group received the pellet but not the light stimulus. The results revealed that the two groups did not differ in performance. The second experiment by Dinsmoor reported that an S^D , established during training and used discriminatively for one group and reinforcingly for another group, did not produce any difference in their reinforcing potential.¹⁰ But as Wike noted, the first experiment lacked another group to show if the light was established as an S^D

⁹Ibid., p. 236.

¹⁰Ibid., pp. 236-238, citing W. N. Schoenfeld, J. J. Antonitis, and P. J. Bersh, "A Preliminary Study of Training Conditions Necessary for Secondary Reinforcement," Journal of Experimental Psychology, XL (1950), 40-45; and J. A. Dinsmoor, "A Quantitative Comparison of the Discriminative and Reinforcing Functions of a Stimulus," Journal of Experimental Psychology, XL (1950), 458-472.

that it would have acquired a secondary reinforcing value, and the second experiment did not support the hypothesis that the stimulus had to be an S^D to have a reinforcing potential.¹¹ Moreover, Long even questioned the validity of the study by stating that in the group where the S^D was used discriminatively, ". . . all but the first of a series of rapid responses would have been elicited by the stimulus."¹²

A more recent study was done by McGuigan and Crockett. These investigators trained two groups of rats, one with contiguity and the other with discrimination training. When the two groups were tested after the training for ten test trials in a Y-maze, it was found that only the animals in the discrimination group showed any evidence of secondary reinforcement. They concluded that the study confirmed the discriminative-stimulus hypothesis of secondary reinforcement.¹³ A

¹¹Wike, op. cit., p. 463.

¹²John B. Long, "Discriminative Stimuli, Secondary Reinforcers and Secondary Motivators" (paper read at the Rocky Mountain Psychological Association Convension, Denver, 1968).

¹³F. J. McGuigan, and F. Crockett, "Evidence that the Secondary Reinforcing Stimulus must be Discriminated," *Journal of Experimental Psychology*, LV (1958), 184-187.

similar conclusion was reached by others.¹⁴ Although the discriminative-stimulus hypothesis of the establishment of a secondary reinforcer seems to be well accepted by workers in the field,¹⁵ there are recent studies which suggest that the theory needs some modification.

As stated elsewhere, the first group of studies refute the discriminative-stimulus hypothesis by demonstrating that the omission of discrimination training, contiguity alone, can establish a secondary reinforcement potential for a stimulus.¹⁶ Reynolds and his co-workers, replicating the McGuigan and Crockett study mentioned earlier, found evidence contrary to the previous finding. They concluded that secondary reinforcement value was established for previously neutral stimulus using either of the training procedures.¹⁷ Bersh, who studied the temporal parameter of stimulus and rein-

¹⁴Stanley S. Pliskoff, T. Daryl Hawkins, and James E. Wright, "Some Observations on the Discriminative Stimulus Hypothesis and Rewarding Electrical Stimulation of the Brain," The Psychological Record, XIV (1964), 179-184.

¹⁵Robert C. Bolles, Theory of Motivation (New York: Harper and Row, Publishers, 1967), p. 386.

¹⁶Long, op. cit.; and Wike, op. cit., p. 464.

¹⁷W. F. Reynolds, J. E. Anderson, and N. F. Bersh, "Secondary Reinforcement Effects as a Function of Method of Testing," Journal of Experimental Psychology, LXVI (1963), 53-56.

forcement, found, as Bolles stated in support of discriminative-stimulus hypothesis,¹⁸ that the optimum interval for establishing secondary reinforcement was from 0.5 to one second. However, this study also showed that there was learning at zero second interval, which was greater than that at ten second interval.¹⁹ This indicates that when the stimulus was concomitant with the reinforcement, when only contiguity was possible, learning occurred. This study, like the study by Reynolds et. al., offered evidence that a stimulus did not have to be an S^D in order to acquire a secondary reinforcing potential.

Secondly, the status of the discriminative-stimulus hypothesis itself was questioned by recent studies. Long tested three conditions for establishing a goal box as a secondary reinforcer: contiguity without discrimination training; discrimination training without contiguity; discrimination training with contiguity. The test showed that discrimination training without contiguity was the only condition that failed to establish the goal box as a secondary reinforcer. He concluded that conti-

¹⁸Bolles, op. cit., pp. 393-394.

¹⁹P. J. Bersh, "The Influence of Two Variables upon the Establishment of a Secondary Reinforcer of Operant Responses," Journal of Experimental Psychology, XLI (1951), 62-73.

guity of stimulus and reinforcement was necessary.²⁰
A later study by Coberly and Long confirmed the above finding.²¹

In spite of the contrary evidence which points out the weaknesses of the discriminative-stimulus hypothesis of secondary reinforcement, the above mentioned studies, except those of Long, and of Coberly and Long, suggest that a stimulus, after being conditioned as an S^D, can function as a secondary reinforcer. In Long's and in Coberly and Long's studies, when the stimulus was contiguous with the reinforcement, it acquired a secondary reinforcing value. In addition, if compared with the secondary reinforcers established through contiguity alone condition, discrimination training seemed to have added to the strength of secondary reinforcers in the studies reviewed by Wike.²² Although the first question over the necessary and sufficient conditions for the establishment of secondary reinforcers has not been answered, Wike's generalization seems most appro-

²⁰John B. Long, "Elicitation and Reinforcement as Separate Stimulus Functions," Psychological Reports, XIX (1966), 759-764.

²¹R. L. Coberly, and John B. Long, "Secondary Reinforcement as a Function of the Interstimulus Interval: A Confutation," Psychological Reports, XXV (1967), 929-933.

²²Wike, op. cit., p. 464.

priate at this point. Namely:

Generally, secondary reinforcers are discriminative stimuli, but stimuli which are simply associated with primary reinforcement frequently acquire learned reward value.²³

The review of the literature on secondary reinforcement revealed that little work has been done with human subjects. This is regrettable because our life is abundant with instances of secondary reinforcement. For the knowledge we have acquired with animal subjects to be applicable to our life, experiments with human subjects seem needed. There may be some modification to be made in the theories to account for differences between human and lower animals. It must also be noted that in the generalization quoted above, the reinforcement is specified as primary. This may be one area which may be modified with human subjects.

On the other hand, the field of verbal conditioning involves human subjects. Although Thorndike is credited for first formulating the hypothesis that verbal behavior was modifiable by verbal reinforcers, it was Greenspoon who actually demonstrated a modification of verbal behavior. He used four different reinforcers, verbal approval, disapproval, a light and a tone on

²³Ibid.

the frequency of occurrence of plural nouns.²⁴ Another representative paradigm was used by Taffel. He used three by five index cards on which different verbs in the past tense and six pronouns were printed. The Ss were to make a sentence using the verb with one of the pronouns. A significant preference for reinforced pronouns was found.²⁵ The significance and the implication of these studies were quickly grasped by other researchers and stirred the current interest in this field.²⁶ The majority of later researchers confirmed the above findings, while a few reported negative results.²⁷

Mandler and Kaplan, replicating the Greenspoon study, obtained negative results. They asked of their Ss questions to find out the Ss' reactions to the test-

²⁴Juanita H. Williams, "Conditioning of Verbalization: A Review," Psychological Bulletin, LXII, No. 6 (1964), 384, citing J. Greenspoon, "The Effect of Verbal and Nonverbal Stimuli on the Frequency of Members of Two Verbal Response Classes," (Unpublished doctoral dissertation, Indiana University, 1951)

²⁵C. Taffel, "Anxiety and the Conditioning of Verbal Behavior," Journal of Abnormal and Social Psychology, LI (1955), 496-501.

²⁶Williams, op. cit., p. 385.

²⁷Leonard Krasner, "Studies of the Conditioning of Verbal Behavior," Psychological Bulletin, LV, No. 3 (1958), 148-170.

ing situation. They found that those who identified the experimenter's reinforcer as positive, showed an increase in their rate of reinforced responses, while those who thought that the reinforcers were negative, showed a decrease in their rate of reinforcement-associated responses.²⁸ In an extensive review covering the studies of awareness factor in verbal conditioning, Adams concluded that the empirical evidence to support learning without awareness was doubtful.²⁹ More recently, Dulaney partially replicated Greenspoon's study. He verbally reinforced the plural nouns in the S's continuous verbalization. The postexperimental questions were asked of each of the Ss, and they were divided into three groups; those who had some idea of the reinforcement, those who stated that the experimenter was studying the subject's verbal associations, and those who did not verbalize any knowledge of reinforcement or associations. Analysis of the data revealed that the first group showed the greatest amount of conditioning;

²⁸G. Mandler, and W. K. Kaplan, "Subjective Evaluation and Reinforcing Effect of a Verbal Stimulus," Science, CXXIV (1956), 582-583.

²⁹J. Adams, "Laboratory Studies of Behavior Without Awareness," Psychological Bulletin, LIV (1957), 383-405.

the second group showed a moderate amount of conditioning; and the third group showed no sign of conditioning. These results led him to conclude that conditioning without awareness was not found. He felt that what is called verbal conditioning may turn out to be human problem solving.³⁰ The above view by Dulaney, and others, is termed the cognitive view of verbal conditioning and regards awareness as prerequisite for conditioning in human Ss. According to this view, learning occurs only when the Ss are either totally or partially aware of the correct response-reinforcement contingencies.³¹

There are, however, others who advocate noncognitive or nonmediational theory of verbal conditioning. This view states that human learning, like animal learning, can occur without awareness. It is possible that the person may become aware of the contingencies, but awareness is the result of, and not a precondition for, the change in verbal performance. They treat awareness

³⁰D. E. Dulaney, Jr., "Hypotheses and Habits in Verbal 'Operant Conditioning'," Journal of Abnormal and Social Psychology, LXIII (1961), 251-263.

³¹Albert Bandura, Principles of Behavior Modification (New York: Holt, Rinehart and Winston, Inc., 1969), p. 566.

as a dependent variable like any other variable in an experiment which can be manipulated as such.³²

The first line of evidence gives strong indication that learning without awareness can occur in human learning. Thomas used college students as Ss and assigned them to a modified Taffel task. They were instructed to write anything which occurred to their mind after each trial in order to assess awareness. There was a detailed postexperimental questionnaire. The analyses of the results revealed that for the aware subjects, there was a significant performance gain on the test trials before they became aware of the contingencies. It was also found that unaware subjects also performed significantly higher after an increase in their programmed reinforcement. They concluded that verbal learning could occur without awareness.³³ Silver and Modigliani assigned an identical task to two groups under two conditions. The first condition encouraged

³²Leonard Krasner, "Verbal Conditioning and Awareness," Kurt Salzinger, and Suzanne Salzinger (eds.), Research in Verbal Behavior and Some Neurophysiological Implications (New York: Academic Press, 1967), p. 60.

³³T. D. Kennedy, "Verbal Conditioning Without Awareness: The Use of Programmed Reinforcement and Recurring Assessment of Awareness." Journal of Experimental Psychology, LXXXIV, No. 3 (1970), 484-494.

hypothesis testing and the second condition was arranged so that forming a hypothesis was unlikely. The results revealed that learning without awareness occurred in both groups.³⁴

Secondly, there is some evidence accumulating concerning the manipulation of the awareness factor and the conditions affecting the verbalizations of response-reinforcement contingencies. Binder and Salop trained two groups of subjects, one using verbal reinforcement "Good!" and the other using a mild electric shock. The questioning revealed that the first group had more aware subjects than the second.³⁵ Kanfer and McBrearty found that the number of aware Ss and the rate of performance increased as a function of stimulus inequality between the right and the alternative stimuli.³⁶ But one of the most dramatic studies and which cautions every worker in this controversy, came from Rosenthal and his co-workers. The study used double-blind situation where

³⁴D. S. Silver, and V. Modigliani, "Awareness and Hypothesis Testing in Concept and Operant Learning," Journal of Experimental Psychology, LXXXIV, No. 2 (1970), 198-203.

³⁵A. D. Binder, and P. Salop, "Reinforcement and Personality Factors in Verbal Conditioning," Journal of Psychology, LII (1961), 379-402.

³⁶Frederick H. Kanfer, and J. F. McBrearty, "Verbal Conditioning: Discrimination and Awareness," Journal of Psychology, LII (1961), 115-124.

the experimenters were divided into two groups: half of them were instructed that they could expect high rate of awareness, while other half was not. The number of aware subjects in the first group was significantly higher than those in the second group.³⁷

Recently, there are some who advocate that there are two types of learning in verbal conditioning, problem solving and incidental learning.³⁸ But the controversy seems to be intensifying, each side trying to generalize the data obtained from small verbal response classes to all verbal conditioning. It is hoped that for the future, in addition to encouragement of further research, there will be an agreement on procedures and assessment of the factors which would enable us to compare data from both sides of the controversy.³⁹

³⁷Krasner, 1967, op. cit., citing Rosenthal, et. al., "The Effect of Experimenter Outcome-Bias and Subject Set on Awareness in Verbal Conditioning Experiments," Journal of Verbal Learning and Verbal Behavior, II (1963), 275-283.

³⁸Theodore R. Dixon, and Alan E. Moulton, "Effects of Questioning Unaware Problem Solvers in a 'Verbal Conditioning' Task," Journal of Experimental Psychology, LXXXIII, No. 3 (1970), 434.

³⁹Krasner, 1967, op. cit., p. 76.

II. RELATION OF THE STUDY TO THE PREVIOUS RESEARCH

The review of related research provided some areas of concern as well as some guidelines for this study. Controversy over the necessary and sufficient conditions for establishing a secondary reinforcer is not yet settled. Also, the experiments reviewed on secondary reinforcement lacked studies with human subjects. The difficulty of obtaining higher-order conditioning reported by Pavlov may be solved with human subjects. This study was an attempt to investigate these two topics.

The review of the research of verbal conditioning revealed complexity and difficulty in dealing with human learning. Despite this, verbal behavior is regularly and reliably altered by verbal reinforcement.⁴⁰ The workers in the field do not agree on the role of awareness and the controversy is gaining in intensity. The present study attempted to assess awareness and analyze its relationship to verbal conditioning. It was found, as some researchers indicated, that an assessment of awareness was more complex than merely giving postexperimental questions.

⁴⁰Krasner, 1958, op. cit., p. 166.

CHAPTER III

DESIGN OF THE STUDY

I. INTRODUCTION

This study was undertaken with hope of arriving at valid statistical differences between discrimination and contiguity as procedures for establishing secondary reinforcers. It was also hoped that the reinforcing value of a neutral stimulus after being paired with a verbal secondary reinforcer would be statistically greater than that stimulus when it had not been paired with a verbal secondary reinforcer. Thirdly, an attempt was made to assess awareness and analyze its role.

II. SUBJECTS

Fifty-nine students from the classes of Introduction to Psychology, Human Growth and Development, and Social Psychology were the Ss. Fourteen of them were discarded and replaced; eleven, lacking discrimination after 600 trials, and three, due to incomplete experimental sessions. Their grades ranged from freshman to senior, and they were divided into two groups, those above and below Introduction to Psychology level. All three conditions were matched for the number of students

on each level. The instructors had promised their students extra credit for participating in the study.

III. INSTRUMENTATION

Appendix A contains the instructions which were read aloud by the experimenter to each S at the beginning of the experiment. Two hundred playing cards were used, fifty cards of each suit. Face cards were not used. A standard data sheet was used to record the Ss' guess on each trial. At the top of the scoring sheets, the initials of the suits were printed in the order of Spades, Clubs, Hearts, and Diamonds. Appendix B contains the postexperimental questions which were asked of each S upon completion of the experiment. These questions were adapted from those of Levin.¹

IV. PROCEDURE

Each scheduled S came at an appointed time to the back room of Mobil Room 5. In order to establish rapport, the experimenter talked with the S for five minutes about the Psychology class the S was taking. Then the instructions were read. The Ss were instructed

¹Saul M. Levin, "The Effects of Awareness on Verbal Conditioning," Journal of Experimental Psychology, LXI, No. 1 (1961), 69.

that there were three phases in the experiment. The first to see their real ability of extra-sensory perception, the second to let them know when their guesses were right, and the third to see if the knowledge of results during the second phase would influence their performance in any way. The Ss were assigned to one of the following conditions.

All the three groups had 100 trials for base-rate, and 200 trials for the testing phase where Spades and Diamonds were reinforced by a click. They differed only in respect to the training phase. For the Discrimination Condition, after the experimenter said "Guess!" the card was clicked against the table when a suit of a predetermined color was in his hand. Seven of the Ss were to learn that reinforcement would follow their response only if they guessed either of the two red suits; eight were to learn that reinforcement would follow their response only if they guessed either of the two black suits. When the experimenter said "Guess!" without the cue, Ss were verbally reinforced only when they guessed correctly. The criterion of discrimination to which the Ss of this group were trained was reached when the sum of correct responses for a click-associated color over the total sum of responses for that color exceeded 0.6 level. If S did not reach this criterion

after 600 trials, the S was replaced. This procedure was used to minimize the possibility that Ss would become aware of the real purpose of the study.

In the Contiguity Condition, seven of the Ss were reinforced verbally when they guessed either of the two red suits, and eight were reinforced verbally when they guessed either of the two black suits. Immediately after S guessed one of the rewarded suits, the experimenter clicked the card on the table and said, "Good!" immediately thereafter. For the other suits, correct guesses were verbally reinforced but were not followed by a click. Both the Discrimination and the Contiguity conditions were matched for the colors of the suits to be reinforced and the number of pairings between the neutral stimulus and the verbal reinforcer.

For the control group, only the right guesses were reinforced and no click was given during the training phase. This group and the Discrimination group were matched for trials. The postexperimental questions were asked of each subject orally in order to assess awareness during the training and the test phase.

V. ANALYSIS OF DATA

Deviation scores were used in the analysis. They were obtained for each S by subtracting the number of

times S guessed the reinforced suits (Spades and Diamonds) during the last fifty trials of the training phase from the number of times S guessed these suits in each of the four blocks (fifty trials each) during the test phase. The deviation scores for the unreinforced suits (Hearts and Clubs) were obtained in the same manner. The obtained scores were subjected to an extension of Type I mixed-plot analysis of variance.² The uncorrelated variables (i. e. , variables involving independent measurements) were: training conditions (C), and awareness (A). The correlated variables (i. e. , variables involving repeated measurements) were: reinforced versus unreinforced guesses during the test phase (R), and four blocks of fifty trials each (B).

²E. F. Lindquist, Design and Analysis of Experiments in Psychology and Education (Boston: Houghton Mifflin Company, 1956), pp. 267-273.

CHAPTER IV

RESULTS

Because the deviation scores for each S must add up to zero in each block of trials, the mean sums of squares of the following interactions had to be zero: Ss, A, C, B, A X C, A X B, B X C, and A X B X C. (See Table I.)

F-ratios of the interactions other than those stated above were computed and are reported on Table I. The mean deviation score for the reinforced suits (+1.08) was significantly larger ($F=14.91$; $df=1/273$; $p<.001$) than the mean deviation score for the unreinforced suits (-1.08). Thus, the null hypothesis about higher-order conditioned reinforcers in verbal conditioning must be rejected because the click served as a reinforcer. Hull's position in this regard was supported.

The mean deviation scores for the reinforced and the unreinforced suits differed significantly as a function of the training conditions ($F=3.39$; $df=2/273$; $p<.05$). As may be seen on Figure 1, the control group showed no difference in the mean deviation scores for the reinforced and the unreinforced suits ($t=0.14$; $df=273$). The discrimination and the contiguity groups however, guessed the reinforced suits significantly more

TABLE I
SUMMARY OF ANALYSIS OF VARIANCE

Source of Variation	Degrees of Freedom	Mean Sum of Squares	F	p
Awareness (A)	44	0		
Conditions (C)	2	0		
A X C	2	0		
error (b)	39	0		
Subjects	44	0		
<hr/>				
Blocks (B)	3	0		
A X B	3	0		
B X C	6	0		
A X B X C	6	0		
Reinforcement (R)	1	422.50	14.91	<.001
A X R	1	76.54	2.70	
B X R	3	65.91	2.33	
C X R	2	96.04	3.09	<.05
A X B X R	3	64.37	2.27	
A X C X R	2	38.65	1.36	
B X C X R	6	27.44	<1	
A X B X C X R	6	5.96	<1	
error (w)	273	28.26		
Total	359			

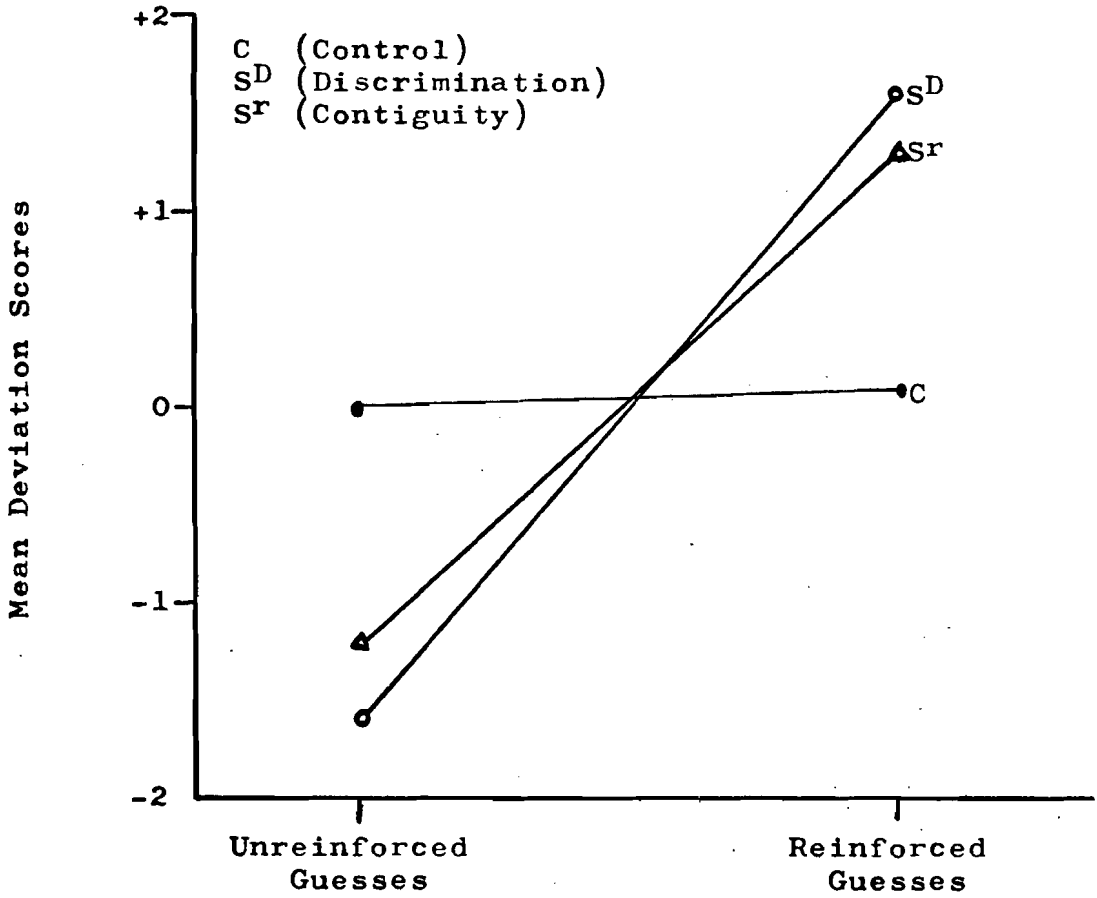


FIGURE 1

MEAN DEVIATION SCORES OF REINFORCED AND
UNREINFORCED SUITS FOR
THREE CONDITIONS

often than the unreinforced suits ($t=3.61, 2.94$; $df=273$; $p<.001$). Thus, the null hypothesis about the effects of conditions must be rejected. Also, as can be seen on Figure 1, S^r was established by both contiguity and discrimination trainings, contrary to both theories of secondary reinforcement. This part of the results of the study offers a support for the above mentioned generalization by Wike.

This null hypothesis about the effect of awareness must be accepted because the following interactions were not significant: A X R, A X B X R, A X C X R, A X B X C X R. (See Table I.) This may partially be attributed to the fact that the number of unaware Ss in the contiguity condition was small (three out of fifteen), and might not have provided a valid basis for analysis. Also, a sudden drop in the rate of reinforced responses among unaware subjects from Block II to III for the discrimination group seemed to indicate that the subjects might have been aware of the contingency but reported unaware for the postexperimental questions. As Kanfer pointed out, the validity of such verbal reports are questionable. All the remaining F-ratios were insignificant.

¹Kanfer, op.cit., p. 273.

CHAPTER V

SUMMARY AND CONCLUSIONS

I. SUMMARY

Fifty-nine college students (fourteen were replaced) from the Kansas State Teachers College were asked to participate in this study to determine if there was any difference between the two procedures, discrimination and contiguity, in establishing a secondary reinforcer. It was also hoped to test the assumption that a neutral stimulus will acquire a reinforcing value by being paired with a secondary reinforcer.

The analysis of the data revealed the following:

1. The null hypothesis about the effect of awareness must be accepted. The awareness factor did not play a major role in determining the Ss' performance in this experiment.

2. The null hypothesis about the effect of conditions must be rejected. The mean deviation scores for the reinforced and the unreinforced suits differed significantly as a function of the training conditions. In addition, contrary to both theories of secondary reinforcement, S^r was established by both contiguity and discrimination training.

3. The null hypothesis about higher-order conditioned reinforcers must be rejected. The click, after being paired with a verbal reinforcer, served as a reinforcer.

II. CONCLUSIONS

It was concluded that the study did not find a difference between the reinforcers established through discrimination training and those through contiguity training. It was also concluded that it was possible in case of human subjects to pair a neutral stimulus with a secondary reinforcer and establish a secondary reinforcing value for the former. In addition, the role of awareness seemed to have created a slight difference but it did not reach a significant level to conclude that it played the major role in controlling the rate of responses.

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APPENDICES

APPENDIX A

INSTRUCTIONS

This is an experiment on extra-sensory perception. Either by looking at a white sheet of paper or closing your eyes, I want you to make a guess at a suit of playing cards which I will be looking at from now, to see if your guesses would match that of real answers.

The experiment will be in three phases: first to see your real ability, the second to let you know when the guesses are right, and the third to see if giving you the answers on the second phase would influence your performance in any way.

I want you to concentrate hard on the guesses but since the experiments by Dr. Long confirms the hypothesis that quick guesses produce better results, I want you to make a guess promptly after I give you a cue by saying "Guess!" Do you have any questions? Here is the first card, "Guess!"

APPENDIX B

POSTEXPERIMENTAL QUESTIONS

During the second phase of the test when I was giving you the right answers:

1. Did you usually give the first suit which came to your mind?

2. How did you go about deciding which of the suits to use?

3. Did you think you were guessing some of the suits more often than others?

Which suits?

Why?

4. What did you think about while going through the cards?

5. While going through the cards did you think that you were supposed to guess the suits in any particular way?

6. Did you get the feeling that you were supposed to change the way in which you guessed the suits?

Why?

(If, answering questions 1-6, S mentioned the fact that the experimenter clicked the card, questions 7-9 were not asked since they were designed to investigate S's awareness of the discrimination.)

7. Were you aware of anything else that went on while going through the cards?

8. Were you aware of anything about me?

9. Were you aware that I did something?

(If S failed to mention the click in answering this question, the interview was terminated.)

10. What did my clicking the cards mean to you?

11. Did you try to figure out what made me click the cards or why or when I was clicking the cards?

12. How hard would you say that you tried to figure out what was making me click the cards?

13. What ideas did you have about what was making me click the cards?

14. Would you say that you wanted me to click the cards?

Very much?

Some?

Didn't care one way or the other.

15. While going through the cards did you think that my clicking the cards had anything to do with the suits you chose for your guessing?

(If S verbalized a correct contingency at any time during the interview, the above schedule was discontinued and the following questions were asked.)

16. Is that something you were actually aware of while going through the cards or is it something you thought of just now?

17. Do you remember when, while going through the cards, that idea occurred to you?

18. Did the fact that you realized this have any effect on the way in which you guessed the cards? In other words, did you try and guess the suits in that way because I was clicking the cards?

(The same questions were repeated concerning the third phase of the experiment.)