

The Influence of Awareness and Schedule of  
Reinforcement on Verbal Conditioning

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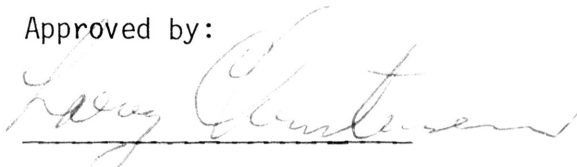
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Submitted in Partial Fulfillment of the Requirement of the  
University Undergraduate Fellows Program

1977 - 1978

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A handwritten signature in cursive script, appearing to read "Larry B. Christensen", written over a horizontal line.

Dr. Larry B. Christensen

April 1978

## ABSTRACT

This experiment was conducted to increase evidence which supports the concept that awareness is a necessary variable in verbal conditioning with human subjects. One hundred and twenty subjects were administered the Taffel Verbal Conditioning Task after being randomly assigned to either a continuous reinforcement schedule, a 75%, 50%, or 25% partial reinforcement schedule. Awareness of reinforcement contingency was assessed by a post-test questionnaire. An analysis of variance performed on the frequency with which aware subjects emitted the reinforced pronouns revealed a significance Group x Trials effect for both acquisition ( $p < .001$ ) and extinction ( $p < .05$ ). Nonaware subjects did not exhibit verbal conditioning, i.e., they did not reveal an increase in the reinforced response on any of the four reinforcement schedules. The influence of subject resistance behavior on verbal conditioning was also considered. The present study supports the conclusion that awareness of the reinforcement contingency is a necessary variable in verbal conditioning. The reactions of aware subjects to various schedules of reinforcement also adds to literature in support of the cognitive aspects regarding the conditioning human behavior.

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This thesis is written according to the format and style specified in the Publication Manual of The American Psychological Association, Second Edition.

## Acknowledgements and Dedication

I wish to commend Texas A&M University for supporting a program such as this at the undergraduate level. The Undergraduate Fellows Program has furthered my understanding of experimental design, has provided a stimulating academic environment, and has afforded an opportunity for the practical application of significant psychological principles.

I also acknowledge the dedicated support and leadership of the Fellows by Dr. Mel Friedman. Finally, the continual guidance and encouragement I received from Dr. Larry Christensen made possible the successful completion of this research. I wish to dedicate this honors thesis to Dr. Larry B. Christensen, a fine gentleman and professor.

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## The Influence of Awareness and Schedule of Reinforcement on Verbal Conditioning

During the past quarter of a century, numerous studies have been conducted on verbal conditioning. Much of the initial work was interpreted as evidence for conditioning without awareness (Greespoon, 1955, Krasner, 1958). It was widely accepted among researchers that the operant learning principles which were formulated on animal behavior could be directly applied to human behavior. The idea of direct application was extended to include several response classes including verbal behavior (Verplanck, 1956).

Recent research, however, does not support the concept of conditioning without awareness (DeNike, 1964; Dulay, 1961; Farber, 1963, Levin, 1961; Spielberger, 1962). Spielberger and DeNike (1966) have emphasized that verbal conditioning is not evidence for the direct application of operant principles to human verbal behavior. Contrary to earlier verbal conditioning studies, Spielberger (1962) used a more extensive post-test questionnaire and found no conditioning for subjects classified as unaware of the reinforcement contingency. Aware subjects do, however, demonstrate an increasing learning curve for the reinforced response class. The Taffle (1955) pronoun-sentence task has been employed in studies which indicate that subjects also engage in the cognitive activity of hypothesis testing during conditioning (Dulany, 1961; Page & Luming, 1968; Spielberger & DeNike, 1966). Not only must the subject become aware of the reinforcement contingency through hypothesis testing, but he must also exhibit a motivation to

cooperate (Orne, 1962; Page, 1968, 1969).

Much of this recent research dealing with motives behind awareness and factors which contribute to an increasing learning curve has been limited to an analysis of acquisition and to the reinforcement of the response class by continuous schedules. Earlier studies which did not distinguish subjects as aware or non-aware did attempt to compare verbal conditioning on continuous reinforcement schedules with that on partial reinforcement schedules (Grossberg, 1956; Kanfer, 1954; Klien, 1954; McNair, 1957; Spivak & Papajohn, 1957). The conditioning which occurred in these experiments was attributed to simple operant conditioning principles. It was assumed that what was learned was the reinforced response rather than what cognitivists would refer to as an awareness of the contingency. Results indicated that different schedules of reinforcement affected the rate of responding just as they would in the operant conditioning of animals.

Kanfer (1954) and Spivak and Papajohn (1957) commented on the unexpected difficulty and inability to extinguish subjects on a partial reinforcement and variable interval schedule, attributing this lack of extinction to secondary reinforcement. Wiener (1970) observes, however, that responding during extinction tends to decline when subjects are informed that reinforcements are not available. Simpkins (1963) speaks of the subject's expectancy of reinforcement in extinction, finding two subjects who exhibited a U-shaped extinction curve. Both subjects stated that when they noticed the lack of reinforcement, they tried other hypotheses and when none of these responses worked,

they went back to their original hypothesis. These results seem to confirm the functioning of cognitive processes by aware subjects and provide an explanation for the inability to extinguish subjects on a partial reinforcement schedule.

In the area of acquisition, W. F. Brewer, cites several experiments (Baron & Kaufman, 1966; Baron, Kaufman & Stauber, 1969; Kaufman, Baron & Stauber, 1969; Tippman & Meyer, 1967) which reveal that telling subjects the correct contingency produces standard curves of performance that have been obtained from pidgeon studies. It is also reported that when instructions about the desired response are omitted, many subjects may fail to acquire the response inspite of reinforcement schedules which are considered to increase acquisition (Ader & Tatum, 1961; Ayllon & Azrin, 1964). This evidence suggests an interaction between awareness and various schedules of reinforcement.

The present study predicted generally that an increasing learning curve would depend on awareness or nonawareness and the particular schedule of reinforcement. It was hypothesized that those subjects who are determined by post experimental questionnaires to be aware would show conditioning across continuous reinforcement schedules (CRF), and across the 75%, 50%, and 25% partial reinforcement schedules (PRF). It also hypothesized that aware subjects on 50% and 25% reinforcement schedules would not show a significant decrease during extinction in responding, due to the subjects expectancy of reinforcement rather than principles of secondary reinforcement. A decreasing extinction curve was predicted for subjects on continuous and 75% reinforcement

schedules since it was hypothesized that the greater amount of reinforcement in these schedules would produce less subject expectancy of response in extinction. It was hypothesized that non-aware subjects would not show a significant increase in the reinforced response class on any of the reinforcement schedules.

According to Brehm's, (1966) reactance theory, subjects like to perceive that they have a choice in determining how they are going to respond and will resist a perceived manipulation. It is therefore predicted that there will be a greater percentage of non-cooperative or resistant subjects in the group receiving continuous reinforcement than in the other reinforcement groups. Subjects who are aware of the contingency should be more convinced of the experimenter's hypothesis in continuous reinforcement conditions than in partial reinforcement. Due to the greater frequency of reinforcement in continuous schedules subjects can validate their hypothesis on each trial. Therefore, subjects under partial reinforcement who are aware of the contingency would resist less to what they are not totally convinced is a manipulation.

It was also assumed that cognitive aspects of the conditioning of verbal behavior would be supported by subject comments in the post-experimental questionnaires.

### Method

#### Subjects

One-hundred twenty introductory psychology students, 60 male and 60 females were randomly assigned according to sex to one of four

treatment conditions. To control for sex of experimenter, half of the subjects were run by a female experimenter and half were run by a male experimenter. One subject's data was discarded because she knew the experimenter.

### Apparatus

The apparatus consisted of 105 stimulus cards and a plywood shield. Each stimulus card was a three x five index card in the center of which was typed a different past tense verb. Below the past tense verb were the six pronouns, I, WE, YOU, HE, SHE, THEY. Different orders of the pronouns were randomly assigned to each card, and the cards were arranged in random order.

The plywood shield separated the experimenter from the subject and was used as a presentation stand. A window just large enough for the presentation of the stimulus cards had been cut in the board.

### Procedure

The Taffle (1955) verbal conditioning task was administered to subjects in four experimental treatment conditions--continuous reinforcement schedule (CRF), 75% partial reinforcement schedule (PRF), 50% PRF, and 25% PRF schedules.

The subjects were led into the experimental room by the experimenter and seated at a table behind the plywood shield. The experimenter sat on the other side of the shield to present the stimulus cards to the subject. Upon presentation of the initial card, the following instructions were administered.

Now, when I present these cards, each time you'll see a word in the center of the card. I want you

to make up a sentence using this word. Below the word in the center, you will see another group of words. Take anyone of these and use it to start your sentence. Now, it isn't important whether your sentence is long or short, or complicated or simple. It is important, however, to answer as quickly as possible with the first sentence that enters your mind. Any questions? Let's begin.

The experimenter recorded the pronouns used by the subject on individual data sheets according to the assigned reinforcement schedule, the experimenter reinforced the subject by saying "good" in a flat unemotional tone when the subject began a sentence with "we" and "they", i.e., subjects on a 75% reinforcement schedule were randomly reinforced 75% of the time.

Modifications to Taffle's (1955) design included reinforcement of "we" and "they" pronouns rather than "he" and "she", the use of 105 conditioning trials rather than 80, and the use of partial reinforcement schedules. The first 15 trials were the baseline trials during which no reinforcement was given, the next 60 trials were reinforced for we-they responses according to the assigned reinforcement schedule, and the final 30 trials were extinction trials during which no reinforcement was given.

Following the verbal conditioning procedure, subjects were directed to another room and were administered an awareness of contingency questionnaire constructed according to Spielberger's (1962) and Page's (1969). Several of the questions attempted to assess the strategies used by subjects to discover the experimenter's hypothesis and to assess the nature of their reactions to the experiment. One question asked subjects if they attempted to construct sentences that

would cause the experimenter to say "good" more often, less often, or whether they attempted to disregard what the experimenter was saying and construct sentences in the manner in which they desired. Another question asked subject to indicate on a five point scale their cooperation or resistance regarding the experimenter's attempt to get them to say the we-they pronouns. After completing the questionnaire, subjects were debriefed and told the true nature of the study.

### Results

The awareness questionnaires were evaluated and 46 of the 120 subjects were determined to be aware. Each experimental condition or reinforcement group contained 30 subjects, and 63% of the subjects on CRF were determined to be aware. Thirty percent of the 75% schedule group, 37% of the 50% partially reinforced group, and 23% of the 25% schedule group were aware.

Spielberger (1962) and Dulany (1962) have indicated that nonaware subjects do not condition. Similar results from this experiment, depicted in Figure 1, reveal that the mean frequency of we-they responses does not vary across the 7 blocks of 15 trials for any of the four experimental groups.

Acquisition and extinction data of aware subjects was analyzed separately. Acquisition of me-they response was blocked into five sets of 15 trials, the first block designated as baseline. Extinction was grouped into two blocks of 15 trials. The frequency with which subjects emitted the we-they responses were computed for each block of fifteen trials.



- CRF schedule
- △ 75% PRF schedule
- 50% PRF schedule
- 25% PRF schedule

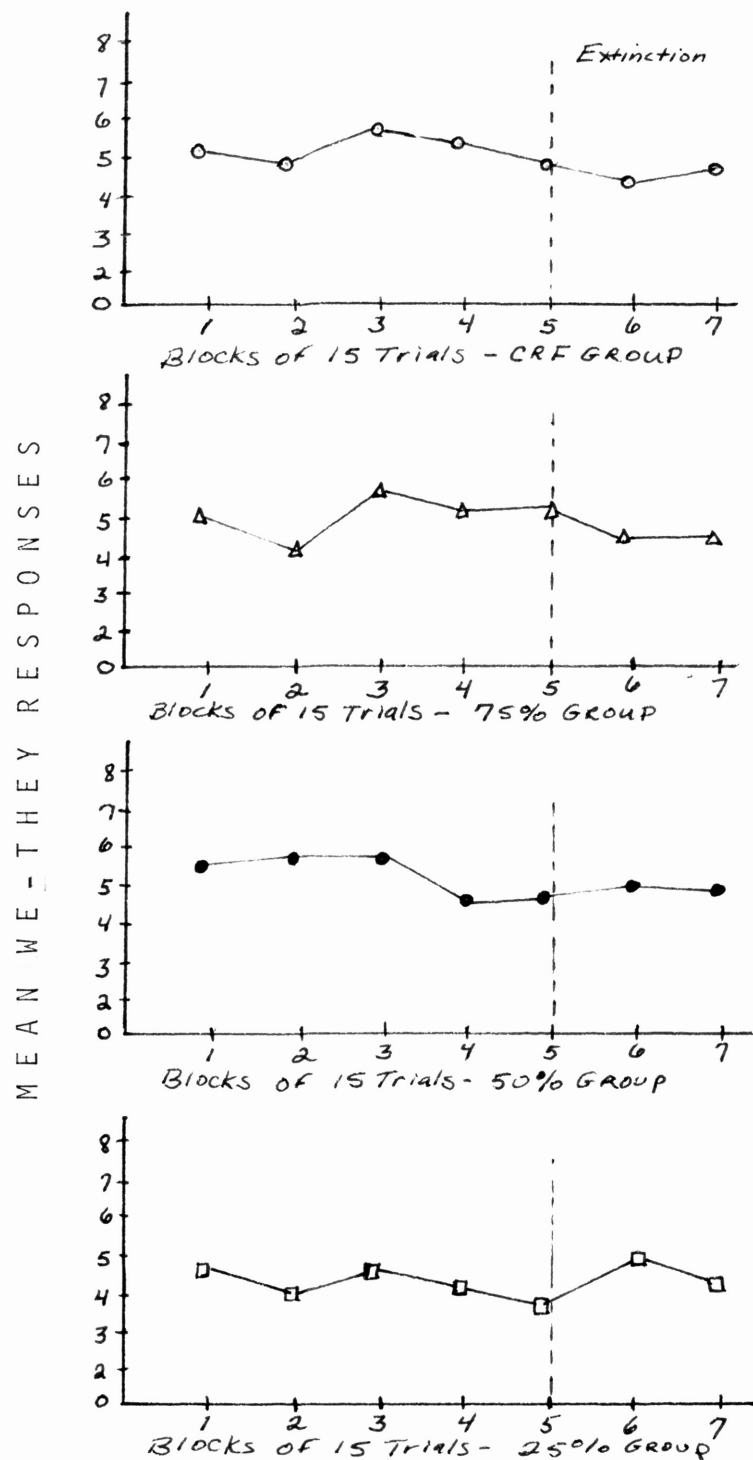


Figure 1. Mean Frequency of We-They Responses for each of seven blocks of 15 trials across four reinforcement schedule groups

The frequency of we-they responding in acquisition and extinction was then analyzed separately by a mixed-models analysis of variance. The between effect was the four reinforcement schedule groups, and the within effect was the 5 and 2 blocks of 15 trials. The analysis of acquisition yielded a significant effect for experimental groups,  $F(3,42) = 3.57$ , ( $p < .025$ ); trials  $F(4,168) = 38.70$ , ( $p < .001$ ); and the Groups x Trials interaction,  $F(12,168) = 9.73$ , ( $p < .001$ ).

The significant effect for the schedule groups revealed that the four groups differed in the frequency of we-they pronouns. The CRF group emitting the greatest frequency of we-they responses ( $M = 8.73$  across blocks of 15 trials). Next was the 75% group ( $M = 7.43$ ), then the 25% group ( $M = 6.14$ ) and finally the 50% group ( $M = 6.09$ ). The significant effect for trials revealed that the subjects increased the frequency of emission of we-they pronouns from the first or baseline block of trials ( $M = 4.83$ ) to the last block of trials ( $M = 8.87$ ). Importantly, there was a significant interaction effect revealing that the frequency with which the pronouns were used across blocks of trials depended on the particular schedule of reinforcement. Acquisition trials in Figure 2 indicate that there is no major increase in we-they responses for either the 25% or 50% partially reinforced groups, when compared to the increase evidenced by the 75% and CRF schedule groups.

Because the extinction performance was analyzed apart from acquisition, a rate transformation was performed on the data which brought subjects to the same place at the end of acquisition. In this way, a separate analysis on the transformed scores yielded data which

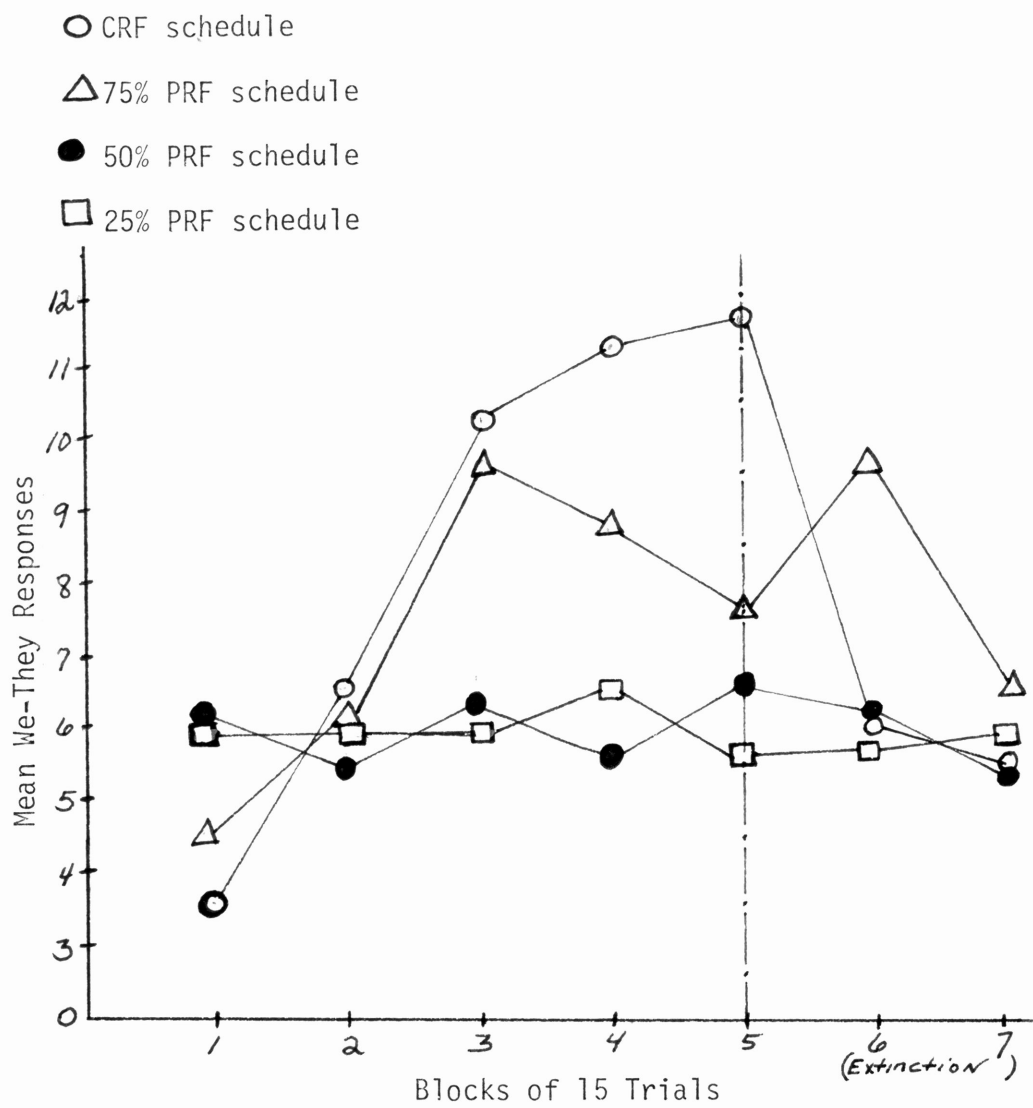


Figure 2. Mean Frequency of We-They Responses for Extinction and Acquisition

could be compared within and between all four schedules. The mixed models analysis of extinction yielded a significant effect for experimental groups, ( $F(1,44) = 26.7$ , ( $p < .001$ ); trials  $F(1,44) = 3.16$  ( $p < .05$ ).

The significant effect for the schedule groups again revealed that the four groups differed in the frequency of we-they pronoun usage during extinction. The 75% schedule group emitted the most we-they responses in extinction ( $M = 7.89$  across blocks of 15 trials) and the other three groups emitted approximately the same frequency of we-they responses (50%,  $M = 5.86$ ; CRF,  $M = 5.82$ ; 25%,  $M = 5.79$ ).

The marginally significant effect for trials reveals that overall subjects decreased the frequency of we-they pronouns from block six to block seven in extinction (Block 6,  $M = 6.7$ ; Block 7,  $M = 5.76$ ).

The final significant interaction effect, depicted in Figure 2, reveals that the frequency with which the pronouns were emitted across blocks of extinction trials depended on the particular schedule of reinforcement. Also, comparing means of the frequency of we-they responses on block five and block six, reveals that subjects on CRF decreased by a mean of 5.69 from the last block of acquisition. Subjects on the 75% schedule increased by a mean of 1.56, 50% subjects decreased by a mean of .55, and there was no change in mean frequency for subjects on a 25% reinforcement schedule.

The percentages of resistant-aware subjects in each schedule group were 32% of the subjects on CRF, 11% on 75%, 18% on the 50% groups, and none in the 25% group.

### Discussion

The present study extends our knowledge of the factors which influence human conditioning. Specifically, it was found that both awareness and schedule of reinforcement influence the conditioning of verbal responses. Experimental hypotheses were supported in part. Nonaware subjects did not exhibit an increasing learning curve with respect to the reinforced response class on any of the four reinforcement schedules. Also supporting the hypothesis, subjects determined to be aware did show an increase in we-they responding on the CRF and 75% reinforcement schedules. Contrary to the hypothesis, however, aware subjects on 50% and 25% reinforcement schedules did not increase in we-they responding. Due to this lack of conditioning, no significant results could be determined for the 50% and 25% schedule extinction curves. Exhibiting a decrease in we-they responding, the continuous reinforcement group extinguished according to the experimental hypothesis. Subjects on the 75% reinforcement schedule decreased emission of the reinforced response class in extinction with the exception of an unexpected increase in responding at the onset of extinction. Finally, the hypothesis which predicted a larger percentage of resistant subjects in the CRF schedule group was supported.

The finding that nonaware subjects did not condition adds to earlier findings in the area of awareness and conditioning (Spielberger & Page, 1962, 1968, 1969). Also increasing our knowledge in this area is the specific finding that nonaware subjects did not condition on partial reinforcement schedules. Because behavioristic learning

theory states generally that partial reinforcement schedules produce a stronger unconscious conditioning response, this studies lack of PRF conditioning lends greater support to cognitive theories of learning.

Subjects determined to be aware of the contingency did demonstrate increased we-they responding on the CRF and 75% reinforcement schedules, but did not increase on the 50% and 25% reinforcement schedules. The lack of conditioning in aware subjects on 50% and 25% schedules, however, does not negate the influence of cognitive processes. What seems to be happening is that the infrequency of reinforcement on PRF schedules leads aware subjects to be less sure of their hypothesis. Post-test questionnaires revealed that 25% to 50% PRF subjects were constantly doubting whether their hypothesis was consistent with the experimenter's, as compared to subjects on CRF and 75% PRF who indicated greater confidence in their hypotheses. A typical post-test response to a strategy question revealed, "I knew she was saying 'good' when I began my sentences with we and they. So, I tried to do this to get her to say 'good', but then she didn't do it everytime. Therefore, I wasn't always sure I was right. It made me test other pronouns to get her to say good." This shifting around to test other pronouns tended to hold subject's we-they responses on the 50% and 25% schedules to a minimum as evidenced by Figure 2.

Many subjects on 50% and 25% reinforcement schedules expressed frustration which tended to lead to lower we-they responding. One subject reported, "I knew she wanted me to use we and they because

she said 'good'. But there was some kind of pattern to it. I couldn't figure it out, so I blew it off." In these instances, frustration seemed to head to an apathetic response.

Another explanation for lower responding in these PRF groups may be derived from the fact that several aware subjects reported multiple hypotheses. The infrequency of reinforcement yields subject uncertainty regarding the validity of any one hypothesis; therefore, subjects may tend to refer to multiple hypotheses with respect to the reinforcement contingency. Responding on the basis of these multiple hypothesis, subjects exhibit continual testing and response shifting throughout the experiment. It may then be concluded that each of these suggested explanations for low we-they responding by subjects designated as aware, on 50% and 25% PRF schedules, lends support to the cognitive aspects of behavioral conditioning.

Another factor may have contributed to the decreased responding by aware subjects on 50% and 25% schedules. The amount of reinforcement which each experimental group received was not controlled for. Every subject experienced 105 trials; therefore, the PRF subjects did not have as much opportunity for reinforcement as CRF subjects. Future research should attempt to extend the number of trials for subjects on partial schedules to control for this problem.

This unequal reinforcement may also have accounted for the finding that 60% of the CRF group became aware of the contingency as compared to only 23% in the 25% schedule group.

This study results on aware subjects resistance behavior also indicates cognitive reactions to various conditioning schedules of

reinforcement 32% of the aware subjects receiving CRF indicated resistance (on the questionnaire) to the experimenter's attempt to lead them into using a certain pronoun, as compared to no resistant subjects in the 25% schedule group. According to Brehm's (1966) reactance theory, subjects like to feel as though they have a freedom of choice in determining the responses which they will make. Consequently, when they assume that the experimenter is attempting to manipulate them, this destroys their feeling of freedom and they will resist the perceived manipulation.

Applying Brehm's theory to reinforcement schedules, the following conclusions might be drawn. Subjects on continuous reinforcement schedules have an opportunity to validate or invalidate their hypothesis on every trial. Just as these continually reinforced subjects soon become sure of their hypotheses, they may also be as quickly convinced that their freedom of choice is being manipulated and resistance will follow. Subjects on partial reinforcement schedules, due to periodic random reinforcement, are not as sure of their hypotheses. Consequently, they are not as likely to feel manipulated. The finding that more subjects resisted on CRF schedules than PRF schedules might be attributed to the idea presented here that a subject may not resist until he is absolutely sure that his freedom of response choice is being manipulated.

Subjects on PRF schedules who resisted reported statements such as, "I tried to disregard what the experimenter said and make up sentences like I wanted to." This statement can be compared to a common questionnaire remark made by subjects on CRF schedules, "I



tried to use pronouns which would make the experimenter say 'good' less often." So, the resistance in the PRF group seems to have been more of an apathetic response as compared to the more extremely resistant responses of the CRF subject's. In conclusion it can be seen that these results also provide evidence in support of awareness influences on verbal conditioning.

CRF subjects extinguished as expected because they quickly picked up the fact that the experimenter was no longer saying 'good' to we-they responses. Responses on the post-test questionnaire indicated that during extinction these subjects began shifting around to test whether the experimenter would say "good" to the other pronouns. Subjects on 75% reinforcement schedules also decreased in we-they responses during extinction. Surprisingly, however, these subjects exhibited increased responding at the onset of extinction.

This unexpected finding may be validly explained in terms of an awareness aspect. It has been cited that subjects who receive continuous reinforcement demonstrate an immediate shifting to other pronouns at the onset of extinction, which results in decreased we-they responding. The subjects who have received sporadic reinforcement on partial schedules do not begin to try other pronouns immediately. These subjects tend to persist in we-they responding in the initial phases of extinction because of an acquired expectancy of periodic reinforcement.

In review, this experiment has considered several areas of subject verbal conditioning behavior. It may be concluded that the analysis of subject acquisition and extinction behavior, subject response to

different schedules of reinforcement, and the analysis of subject awareness and resistance has greatly contributed to to the literature which holds that awareness is a necessary cognitive component of the conditioning process.

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