EFFECTS OF INSTRUCTIONS AND VICARIOUS REINFORCEMENT SCHEDULES ON
EXTINCTION RESISTANCE AND RESPONSE RATE

by

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STATEMENT BY AUTHOR

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ABSTRACT

The relative effects of instructional variants and vicarious reinforcement contingencies upon the retention of observational learning were investigated. In a first phase, children were exposed to combinations of instructions (either "press fast for a long time," "press slow and stop soon," or no such instructions) and vicarious reinforcement schedules (either a variable ratio 6 schedule, continuous reinforcement, or no reinforcement) applied to a bar-pressing task. The dependent measures were responses to extinction, time to extinction, and rate of responding during extinction. Retention, using the same extinction resistance measures, was assessed in the second phase, three weeks later. No response-contingent direct reinforcement was given in either phase. The present study determined the effects of the independent variables applied in the first phase on responding during the second phase. A significant increase in responding between phases was found. Also significant were the instructional main effects. A consistent ordinal pattern of instructional effects across reinforcement conditions was found. The reinforcement variable significantly influenced retention phase responding only in terms of time to extinction, with a vicarious PRE obtaining. No consistent ordinal pattern of reinforcement conditions obtained across instructional conditions in the interactions. These results, along with the finding that the Instructional Variant accounted for much more of the
total variance than did the Vicarious Reinforcement variable, suggest that in this study a variable involving cognitive mediational processes appeared to have more of an effect upon retention than vicarious reinforcement schedules.
CHAPTER 1

INTRODUCTION

Bandura (1965) contends that the behavior of observers can be modified considerably through the witnessing of other people's behavior and its consequences for them. Such reinforcement contingencies applied to a model are referred to, in social learning theory, as vicarious reinforcement. It has been found that vicarious reinforcement can be just as potent as direct reinforcement in changing observer's behavior (Kanfer 1965). Several investigators have even indicated a superiority of vicarious over direct reinforcement (Berger 1961, Marlatt 1968).

Vicarious reinforcement schedules have also been found to be comparable to direct reinforcement schedules in terms of the kinds of factors which influence their efficacy, such as percentage (Bisese 1966, Kanfer 1965) and magnitude (Bruning 1965). In addition, a vicarious partial reinforcement effect (PRE) on extinction has been found by several investigators. Lewis and Duncan (1958) reported that the PRE occurred only when the subject was directly rewarded while participating in or observing the model's acquisition. The authors suggested that the PRE did not obtain for observers who were not directly rewarded because they had a lower degree of participation in the acquisition than the subjects who were rewarded along with the model.
However, Berger and Johansson (1968) found that a PRE did occur with observers who were not directly reinforced if the model displayed a positive emotional reaction on rewarded trials and a negative emotional reaction on nonrewarded trials. This finding is congruent with Bandura's definition of a vicarious reinforcement event as including "affective expressions of models undergoing rewarding and punishing experiences" (Bandura 1969, p. 31). Berger and Johansson also suggested that the emotional model may have caused greater extinction resistance by rendering the task more interesting or serious and hence increasing the subject's general motivation.

Berger and Johansson also speculated that one reason for the PRE in the absence of direct reinforcement was their use of peers as models. The authors argued that since Lewis and Duncan used a non-peer for a model, his acquisition performance might not have seemed as relevant to the subjects as it would have if the model were a peer.

The results of a study by Hamilton (1970) concurred with those of Berger and Johansson in obtaining a PRE on extinction both in conditions where the observer was directly reinforced and where he was not. This study also employed a peer as a model.

Borden and White (1973) also demonstrated a vicarious PRE. In this study, second graders were vicariously, but not directly, reinforced with M&M candy for bar-pressing and were then placed on extinction. It was found that a VR4 schedule was the most effective relative to CRF and VR10 schedules in producing resistance to extinction. The authors concluded that the results supported the position that direct and vicarious modes of reinforcement lie on a continuum.
The fact that Borden and White used an adult model would tend not to support Berger and Johansson's contention that the vicarious PRE may have been dependent upon the use of a peer as a model. Also, since the model did not emit differential emotional responses to the occurrence and non-occurrence of reinforcement, it would seem that Berger and Johansson's emotional response of the model in their study may not be crucial in such a paradigm.

Social learning theory holds that reinforcement is facilitative rather than necessary for learning, since there are factors other than response consequences that influence what people attend to. For example, when a subject's attention can be obtained through instructional means, the addition of positive reinforcement often does not increase vicarious learning.

The importance of instructional variables in human learning was illustrated in a study by Rosenthal and Whitebrook (1970) in which subjects (children) who were exposed to instructions with no additional incentives equaled (and in terms of one dependent measure surpassed) subjects offered a monetary reward along with weaker instructions, in the imitative learning of grammatical parameters. Similarly, Rosenthal and Carroll (1972) presented a school-like task to economically disadvantaged children and found that a substantial incentive failed to enhance language learning. Zimmerman and Rosenthal (1972) demonstrated retention and generalization of a concept to novel stimuli by exposing subjects to modeling and to a verbal rule, while neither promising nor dispensing extrinsic reinforcers.
A study by Feist (1973) investigated the relative effects of both differential vicarious reinforcement and instructional variants, within the experimental framework of the Borden and White study. The experimenter and the model were both male clinical psychology graduate students in their twenties, dressed similarly in dress shirts and ties. The task was one of bar-pressing. Each subject was exposed to the model pressing the bar 120 times. In order to standardize his rate of response, the model wore an earpiece connected to a mechanism which produced clicking sounds at the rate of one click every .92 seconds. The subject, however, was given the following explanation of the function of the earpiece:

"This (experimenter holds up the earpiece) is so that you can listen into the machinery to make sure it's working right. If it's not working right, if it's broken, you'll hear a loud bell ring. If everything's 'okay,' you won't hear anything."

The model received reinforcement (mechanically-dispensed M&M's) on either a CRF schedule, a VR6 schedule, or he received no reinforcement. These latter three conditions made up the levels of the Vicarious Reinforcement variable (i.e., CRF, VR6, and NoSR+, respectively).

The second major independent variable was Instructional Variant: as soon as the model stopped responding and collected his M&M's (if any) the subject was told that it was his turn to play the game. He was told to either "press fast for a long time" (the Fast condition), "press slow and stop soon" (the Slow condition), or was not given any such instructions (the None condition).
The rationale behind using these particular instructions was that they were analogous to the levels of the Reinforcement variable. The Fast instructional condition would correspond to the VR6 schedule in terms of fostering a high, sustained response rate during extinction. The Slow instructional condition would correspond to the CRF schedule in terms of yielding a low response rate during a brief extinction period. The None instructional condition and the NoSR condition were controls for the effects of instructions and vicarious reinforcement, respectively.

The dependent measures were trials to extinction, time to extinction, and rate of responding during extinction. The experimenter began timing the subject when the first bar press was made. Timing ended when either (a) the subject indicated that he no longer wanted to play (e.g., by saying so or by getting up from his chair), (b) the subject had not made a response in 60 seconds, or (c) the subject had been responding for 15 minutes. During this period, the subject received no M&M's contingent upon his responding. However, at the end of the session, each subject was given a piece of wrapped, hard candy since he had "played the game so nicely."

The retention phase of the foregoing study constituted the present study. The basic question at issue was how the independent variables applied in the first phase would affect the subjects' performance approximately three weeks later. Thus the question addressed was how quickly the bar-pressing would extinguish during the second phase and whether such extinction was related to the variables employed in the first phase.
It was predicted that for all dependent measures, extinction would occur more rapidly during the second phase than during the first phase. It was also predicted that the following orders would obtain for main effects in terms of extinction resistance:

VR6 > CRF > NoSR*

Fast > None > Slow.

The differences between these conditions were expected to be significant.

The variables of Grade and Sex were extraneous factors which were analyzed for the purpose of control. It was expected that none of the effects involving these nuisance variables would be significant.
CHAPTER 2

METHOD

Subjects

The subjects (Ss) were 144 children enrolled in various Tucson parochial schools: 72 second graders and 72 third graders. Within each grade level, there was an equal number of males and females. The experimenter (E) was the 21-year-old male who had served as the model in the first study, again wearing a dress shirt and tie.

Apparatus

Each S sat facing a rectangular metal box 28.6 cm wide, mounted on a table. Within reach of S was a white plastic bar, 2.8 cm wide, protruding 2.5 cm from the box, mounted 5.1 cm from the bottom, and located 7.6 cm from the right side of the box. On the same side of the box was a plastic tube which, during the first phase, had dispensed M&M's into a small aluminum container located at about the same height as the bar, and 5.1 cm to the left of the bar. During the present study, the dispenser mechanism was again switched to "off" for each S, preventing the delivery of M&M candy reinforcement. A response counter was mounted on the reverse side of the box, hidden from the view of S. A stopwatch was used to measure the duration of Ss responding.

On top of the apparatus was a small plastic box containing the earpiece which had been used by the model in the previous phase as a
means for standardizing his response rate. For the sake of uniformity, each S again wore the earpiece and again the clicking sound was switched to "off" for Ss.

Design

The experimental design paralleled that of the first study, consisting of a 3 x 3 x 2 x 2 factorial (Vicarious Reinforcement x Instructional Variant x Grade x Sex, the latter two being nuisance variables). An additional factor consisted of a comparison between the results of the first phase (Feist's study) and the results of the retention phase (the present study). Once again, the dependent measures were trials to extinction, time to extinction, and rate of responding during extinction.

Procedure

After a mean of 23 days (range = 14-33 days) after each S had completed the first phase, he was brought back to the experimental setting and was given the following instructions:

"__________ (child's name), a while back you played a game for us. Well, today I'd like you to take another turn. Try your best to do a good job. Remember, this (E holds up earplug) is so you can listen into the machinery to make sure it's working right. If you don't hear anything, then the game is 'okay.'"

The experimenter then helped S put on the earplug. Again, S received no M&M's contingent upon his responding. However, at the end of the entire session, he was again given a piece of wrapped hard candy, regardless of the nature of his performance.
CHAPTER 3

RESULTS

The main effects and interactions of the independent variables Instructional Variant, Vicarious Reinforcement Condition, Trials (comparing the first and second phases or trials), Sex, and Grade were assessed with separate analyses of variance for each dependent measure. Comparisons between pairs of treatment groups were made with the Tukey Honestly Significant Differences Test (Kirk 1968). Significant effects were also evaluated in terms of percentage of the total variance accounted for with Omega squared ($\omega^2$) estimates.

Responses to Extinction

For a summary of the means, see Table 1. It was found that the main effects of both nuisance variables, Grade and Sex, were non-significant ($F_s = .029$ and $2.9; df_s = 1/108; p > .05$).

It was found that the Ss accelerated responding between the first ($\bar{X} = 1055.06$) and second ($\bar{X} = 1179.31$) phases ($F = 16.03; \ df = 1/108; \ p < .01; \ \omega^2 = .007$).

A second major finding was that the Instructional variable applied in the first phase was a significant factor in determining the responding in the retention phase ($F = 20.8; \ df = 2/108; \ p < .01; \ \omega^2 = .20$). The Tukey results indicated that the significance lay primarily in the difference between the Fast and Slow conditions.
Table 1. Mean Number of Responses to Extinction During Phase 2.

<table>
<thead>
<tr>
<th>Sex</th>
<th>VR6 Instructions</th>
<th>CRF Instructions</th>
<th>NoSR Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fast</td>
<td>None</td>
<td>Slow</td>
</tr>
<tr>
<td>Third Grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>1539.75</td>
<td>1509.25</td>
<td>1357.00</td>
</tr>
<tr>
<td>Males</td>
<td>1713.00</td>
<td>929.50</td>
<td>667.00</td>
</tr>
<tr>
<td>Second Grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>2070.00</td>
<td>1009.00</td>
<td>1059.25</td>
</tr>
<tr>
<td>Males</td>
<td>1584.50</td>
<td>1226.50</td>
<td>810.00</td>
</tr>
</tbody>
</table>
The instructional conditions, in order of decreasing resistance to extinction, were Fast ($\bar{X} = 1535.57$), None ($\bar{X} = 1090.39$), and Slow ($\bar{X} = 725.58$).

The Vicarious Reinforcement variable, on the other hand, had no significant main effect on the retention phase responses to extinction ($F = 1.54; df = 2/108; p > .05$).

However, there was an interaction between Instructional Variant and Reinforcement Condition ($F = 5.78; df = 4/108; p < .01; \eta^2 = .009$) (see Figure 1). The effect of the Instructional variable was the same taken at all three levels of the Reinforcement variable. That is, the Fast > None > Slow order was maintained. However, the effect of the Reinforcement variable was not constant across levels of the Instructional variable.

**Time to Extinction**

A summary of the means may be found in Table 2. Once again the main effects of Grade and Sex were non-significant ($F$s = .001 and 1.793; $df$s = 1/108; $p$s > .05). However, there was a significant interaction among Trials, Grade, and Sex ($F = 5.42; df = 1/108; p < .05; \eta^2 = .003$).

There was an increase between the first and second phases, but this effect was non-significant ($F = 2.91; df = 1/108; p > .05$).

Once again the main effect of Instructional Variant was significant ($F = 4.45; df = 2/108; p < .05; \eta^2 = .001$) with the Fast condition yielding the greatest resistance to extinction ($\bar{X} = 814.19$), followed by the None ($\bar{X} = 753.52$) and Slow ($\bar{X} = 650.05$) conditions. In addition,
Figure 1. Interaction: Trials to Extinction.
<table>
<thead>
<tr>
<th>Sex</th>
<th>VR6 Instructions</th>
<th>CRF Instructions</th>
<th>NoSR Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fast</td>
<td>None</td>
<td>Slow</td>
</tr>
<tr>
<td>Third Grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>900.00</td>
<td>900.00</td>
<td>726.50</td>
</tr>
<tr>
<td>Males</td>
<td>900.00</td>
<td>776.25</td>
<td>720.50</td>
</tr>
<tr>
<td>Second Grade</td>
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<td></td>
</tr>
<tr>
<td>Females</td>
<td>900.00</td>
<td>726.50</td>
<td>900.00</td>
</tr>
<tr>
<td>Males</td>
<td>900.00</td>
<td>900.00</td>
<td>723.75</td>
</tr>
</tbody>
</table>

Table 2. Mean Number of Seconds to Extinction During Phase 2.
there was an interaction between Trials and Instructional Variant ($F = 3.24; \text{df} = 2/108; p < .05; \omega^2 = .003$).

The Reinforcement variable had a significant main effect ($F = 4.56; \text{df} = 2/108; p < .05; \omega^2 = .04$). The VR6 schedule resulted in the greatest extinction resistance ($\bar{X} = 829.75$), followed by the CRF ($\bar{X} = 724.17$) and NoSR+ ($\bar{X} = 663.85$) conditions.

The interaction between Instructional Variant and Reinforcement Condition was non-significant ($F = .033; \text{df} = 4/108; p > .05$) (see Figure 2).

**Response Rate During Extinction**

For a summary of the means for response rate (i.e., number of responses per second), see Table 3. As with the other two dependent measures, Grade and Sex yielded no significant main effects ($F_s = .05$ and .96; $\text{dfs} = 1/108; ps > .05$). An interaction was found among Trials, Grade, and Sex ($F = 5.76; \text{df} = 1/108; p < .05; \omega^2 = .003$).

A significant effect occurred in terms of an acceleration between phases 1 ($\bar{X} = 1.392$) and 2 ($\bar{X} = 1.535$) ($F = 18.39; \text{df} = 1/108; p < .01; \omega^2 = .011$).

The main effect of Instructional Variant was again significant ($F = 23.13; \text{df} = 2/108; p < .01; \omega^2 = .212$). Significant differences obtained between the Slow ($\bar{X} = 1.113$) and None ($\bar{X} = 1.412$) conditions ($p < .05$), and between the Fast ($\bar{X} = 1.866$) and Slow conditions ($p < .01$).

Although there was no significant main effect for Reinforcement Condition ($F = .13; \text{df} = 2/108; p > .05$), an interaction occurred between
Figure 2. Interaction: Time to Extinction. -- This effect was non-significant ($F = .033; df = 4/108; p > .05$).
Table 3. Mean Rate of Responding During Phase 2 Extinction.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Reinforcement</th>
<th></th>
<th></th>
<th></th>
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<tr>
<td></td>
<td>VR6 Instructions</td>
<td>CRF Instructions</td>
<td>NoSR Instructions</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fast</td>
<td>None</td>
<td>Slow</td>
<td>Fast</td>
<td>None</td>
<td>Slow</td>
<td>Fast</td>
</tr>
<tr>
<td>Third Grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>1.710</td>
<td>1.678</td>
<td>.913</td>
<td>2.350</td>
<td>1.440</td>
<td>.848</td>
<td>1.118</td>
</tr>
<tr>
<td>Males</td>
<td>1.905</td>
<td>1.055</td>
<td>1.120</td>
<td>2.533</td>
<td>1.798</td>
<td>1.388</td>
<td>2.018</td>
</tr>
<tr>
<td>Second Grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>2.300</td>
<td>1.330</td>
<td>1.178</td>
<td>1.868</td>
<td>1.065</td>
<td>1.128</td>
<td>1.670</td>
</tr>
<tr>
<td>Males</td>
<td>1.753</td>
<td>1.363</td>
<td>1.073</td>
<td>2.093</td>
<td>1.663</td>
<td>1.003</td>
<td>1.975</td>
</tr>
</tbody>
</table>
Instructional Variant and Reinforcement Condition ($F = 2.55; \text{df} = 4/108; p < .05; \omega^2 = .049$). The only significant differences between means were between the CRF-Fast condition ($\bar{X} = 2.102$) and each of the two conditions which were poorest in fostering extinction resistance, i.e., CRF-Slow ($\bar{X} = 1.042$) and VR6-Slow ($\bar{X} = 1.071$). As with the trials to extinction dependent measure, the Instructional conditions were ranked: Fast, None, and Slow in order of decreasing extinction resistance, taken at each of the three levels of the Reinforcement variable. But once again, the ordinal pattern of the levels of Reinforcement Condition was not uniform across levels of Instructional Variant (see Figure 3).
Figure 3. Interaction: Rate During Extinction. Rate was computed as number of responses per second.
CHAPTER 4

DISCUSSION

Retention Between Phases

After extinction during the first phase it would seem reasonable that subjects would extinguish even more quickly during the second phase. However, not only did the second phase extinction fail to occur more quickly than first phase extinction, but there was actually a significant increase in trials and rate during extinction. Some of the responding in the second phase could be accounted for in terms of a spontaneous recovery effect—i.e., an extinguished response reappearing contingent upon a subsequent presentation of the CS after a lapse of time. However, this does not explain the acceleration between phases. One explanation of this effect is that at the beginning of the second phase, S was asked to take another turn and was told to try his best to do a good job. This may have engendered in the child a sense of having performed inadequately during the first phase. Hence various social influence factors may have motivated the child to improve his performance.

Another factor could have been the reinforcement provided at the end of the first phase in the form of a piece of hard candy given S for "playing the game so nicely." Thus although S received no M&M's contingent upon his responding, he did receive reinforcement for participating. This could have artifactualy contaminated Phase 2 results.
One set of factors which could have contributed to the responding in both phases consisted of the demand characteristics of the experimental setting. The Es could have been construed by Ss to be authority figures, perhaps functioning in a teacher role associated with approval of perseverance. Also, the study was conducted in the child’s school with the conspicuous endorsement of his teacher.

**Instructional Effects**

The following findings appear to lend support to social learning theory’s emphasis on the potency of mediational factors in human learning:

1. There was a retention, after three weeks, of the instructional main effects for all three dependent measures.
2. The predicted Fast > None > Slow order of extinction resistance was maintained for all three dependent measures.

**Vicarious Reinforcement Effects**

Further support for an emphasis on mediational processes was found in the fact that vicarious reinforcement operations were manifest after a three-week delay in the Instructional Variant x Reinforcement Condition interaction. This would suggest the possibility of some form of cognitive representation of the vicarious reinforcement contingencies.

The VR6 > CRF > NoSR+ order of time to extinction concurs with the literature claiming a vicarious PRE. However in terms of the other two dependent measures, the VR6 schedule was not clearly the superior reinforcement condition. In fact, in terms of the Instructional Variant x Reinforcement Condition interaction, a CRF condition was the most
effective one for extinction resistance, and significantly surpassed the two weakest conditions, one of which included a VR6 schedule.

One explanation of this instance of superiority of a CRF over a VR6 schedule could be that the temporal lag mediated greater salience for reinforcement magnitude than for the schedule. That is, in the CRF conditions the actual number of M&M's which S observed accumulate in the aluminum container was greater than the number of M&M's accumulated in the VR6 conditions. Hence a crucial factor determining S's responding in this instance may have been the amount of reinforcement anticipated by S rather than the schedule with which the reinforcement units were dispensed. A future study could control for this by either dispensing six M&M's at a time on the VR6 schedule (rendering the amounts of accumulated SR the same between VR6 and CRF conditions) or by simply not accumulating the candies as they are dispensed (by letting them slide down a tube away from the view of S).

Instructions and Reinforcement: Relative Efficacy

The Instructional Variant applied in the first phase was a significant factor in determining the responding in the retention phase, in terms of all three dependent measures. In contrast, the Vicarious Reinforcement variable had a significant effect on the retention phase only in terms of time to extinction. In addition, the significant main effects of the Instructional Variant accounted for over ten times as much of the total variance as the significant main effect of Vicarious Reinforcement. Thus one might conclude that in this study, a variable
presumably related to cognitive, symbolic processes (Instructional Var-
iant) seemed to have more impact upon retention than vicarious reinforce-
ment schedules. This lends further credence to the social learning
theory postulate of mediational prerequisites for retention of such
effects over time.

However, it must be noted that much of this discussion hinges on
the specific dependent measure employed as an index of "extinction re-
sistance." Borden (1973) dealt with this issue by pointing out that
only one study prior to her own (Davidson and Walker 1970) had ac-
nowledged the influence the extinction measure can have on the experi-
mental conclusions. Furthermore, there is no a priori basis for assum-
ing one extinction measure to be comparable to another.
LIST OF REFERENCES


