SOME EFFECTS OF SCHEDULES OF VICARIOUS REINFORCEMENT AND RATE OF RESPONDING BY A MODEL UPON EXTINCTION IN AN OBSERVER

by

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ABSTRACT

Nine groups of ten elementary school children each viewed a model bar press at one of three different rates (three times a second, once a second, or once every three seconds) under one of three schedules of reinforcement (VR 10, VR 4, or CRF) and then participated in an extinction series. A vicarious PRE was demonstrated. Resistance to extinction was nonmonotonically related to schedule of reinforcement. Greatest resistance to extinction as measured by trials to extinction and time to extinction, was shown by subjects who observed a model under the VR 4 schedule, while subjects who observed a model under a CRF schedule showed least resistance to extinction. Subjects tended to imitate the rate at which they observed the model respond. Subjects who observed a model respond at the intermediate rate showed more resistance to extinction than subjects who observed a model respond at a fast or slow rate. Observing a model operate under a partial schedule of reinforcement produced a faster rate of responding by subjects than viewing a model under a continuous schedule. A no model control group tended to extinguish more quickly than the experimental groups.

INTRODUCTION

Vicarious reinforcement is an important construct in Bandura's (1969) theory of imitation. The process of contingently reinforcing the model has been shown to have substantial effects upon response performance in an observer (Bandura, Ross, and Ross, 1963; Bandura, 1965). The vicarious reinforcement phenomena would have greater utility if it could be demonstrated that the principles which govern direct reinforcement also apply to vicarious learning situations. The partial reinforcement effect (PRE) is a direct learning phenomena which has been the focus of some research efforts in the area of vicarious learning. PRE refers to the finding that subjects who learn a task under a partial schedule of reinforcement show greater resistance to extinction than subjects who learn the task under a continuous schedule.

Lewis and Duncan (1958) compared the resistance to extinction of college age subjects exposed to a 100% reinforcement schedule with those exposed to a 25% schedule on a modified slot machine task. (It is not clear from the research report whether a variable ratio (VR) or a fixed ratio (FR) schedule was used.) In the first experimental condition two groups observed a model and were rewarded when the model won. In the second condition two groups observed a model but

did not participate in the winning. In the third condition two groups were given a play by play description of a hypothetical player's performance and shared in the winning of the hypothetical player. In the fourth condition two groups were told of the hypothetical player's performance but were not rewarded. In the fifth condition (control) two groups actually participated in the acquisition series. In each condition one group was exposed to the 100% schedule while the other group was exposed to the 25% schedule in a series of eight acquisition trials. Following the acquisition series all subjects participated in an extinction series in which they were told they could play the game as long as they wished. The authors found that the PRE occurred only in those conditions in which subjects shared in the winnings of the model. They speculated that those subjects who were reinforced felt a higher degree of participation in the situation than subjects who merely observed or were told of the model's performance.

Berger and Johansson (1968) hypothesized that if the model in the Lewis and Duncan study had shown an emotional response to winning and losing, vicarious learning, in observers not directly reinforced, would be facilitated. They reasoned that viewing a model who expresses emotions would make the performance seem more salient to the observer. They speculated that the PRE would be shown in subjects who observe an emotional model. Two groups of college age subjects

observed a peer model who displayed an emotional reaction appropriate to his success on the task. Two groups of subjects observed a nonemotional model. Half of the subjects observed a model reinforced on a 100% schedule of reinforcement, while the remaining subjects observed a model reinforced on a 25% schedule. In the study a fake ESP task, in which subjects guessed the suits of playing cards, was used. Reinforcement consisted of feedback to the model that he had correctly guessed the suit of the card. Following the modeling conditions subjects participated in an extinction series. The results indicate that, regardless of the emotionality of the model, subjects exposed to a model under a 25% schedule of reinforcement showed greater resistance to extinction than those exposed to a model under a 100% schedule. The results also indicate that subjects exposed to an emotional model show more resistance to extinction over all conditions. The authors speculated that the emotional response shown by the model makes the task seem serious to the subject and increases his motivation. The authors also suggested that because they used a peer model they were able to demonstrate a completely vicarious PRE while Lewis and Duncan were not able to do so. In the Lewis and Duncan study the experimenter served as the model. It was reasoned that the use of a peer as the model makes his performance seem more relevant to the subject.

Klauck (1969) had pre-school subjects perform a lever press task. He investigated the effects of two different schedules of reinforcement to the model, a continuous

reinforcement schedule (CRF) and a VR3 schedule, as well as the effects of different types of verbal instruction on the vicarious PRE. Instructions varied from a command to do what the model does, to permission to do what the model does, to no instructions. Following the observation of an adult model, subjects participated in an extinction series in which they were allowed to bar press as long as they wished. Subjects who observed the model reinforced on the CRF schedule showed less resistance to extinction than those who observed the model on a partial reinforcement schedule. The results also indicate that subjects in the "command" condition showed significantly more imitation than those in the "permission" condition. Both conditions produced more imitation than the "no instruction" condition.

Hamilton (1970) had nursery school children perform a marble drop task. A peer model was used. Half of the subjects were reinforced on a 100% schedule while the remaining subjects were reinforced on a 50% schedule. Two groups of subjects were directly reinforced while two groups received vicarious reinforcement. Following these conditions subjects underwent two extinction series, one immediately following acquisition training and one a week later. The PRE was demonstrated in both the direct and vicarious reinforcement conditions. It was also found to occur in the second extinction series.

In each of the above studies a partial schedule of reinforcement was compared with a continuous reinforcement schedule. Three of the four studies reviewed demonstrated a vicarious PRE (Berger and Johansson, 1968; Klauck, 1969; Hamilton, 1970). A non-peer model was used in two studies; in one a vicarious PRE was demonstrated (Klauck, 1969) while it was not found in the other (Lewis and Duncan, 1958).

The present study was designed to substantiate findings of a vicarious PRE using a non-peer model and further to determine whether in a vicarious learning situation a thinner schedule of partial reinforcement would produce more resistance to extinction than a more dense partial schedule.

In the studies reviewed only the number of responses made by the model was controlled. The rate of responding on the part of the model was not reported and it is assumed that it was not controlled. The present experiment addressed the question of whether the rate at which the model responds affects the subject's performance during extinction. Ferster and Skinner (1957) have shown that different schedules of reinforcement generate different rates of responding. For example, a VR schedule typically induces a faster rate of responding than a CRF schedule. The effect of the rate of reinforcement to the model on the model's subsequent behavior could be an important variable in vicarious learning in a nonlaboratory setting. Such effects have not been systematically studied. The question arises whether the performance

of the subject is affected by observing a model respond in a manner consistent with the schedule under which he is operating. The present study was undertaken to help answer this question.

METHOD

Subjects

Subjects were 50 male and 50 female children enrolled in the second grade in three parochial schools in Tucson, Arizona. Subjects were selected and assigned to conditions on a random basis with the constraint that each condition include an equal number of males and females (five males and five females in each group). In one school the order of subject arrival was experimenter determined, while in two schools the order was teacher determined.

Apparatus

Subjects faced a wooden panel 76.2 cm. wide by 45.7 cm. high which was set upon a table. In the center of the panel was mounted a metal bar 7.6 cm. by 2.5 cm. A metal container into which M and M's (coated chocolate candies) were dispensed was located to the left of the bar. On the side of the panel not facing the subjects was mounted an MMD-1 Davis M and M dispenser.

Behind the wooden panel and not visible to subjects was a metal rack on which was mounted a Ralph Gerbrands Ratio Randomizer. The ratio randomizer controlled the rate at which M and M's were dispensed and was programmed with a CRF

schedule, a VR 4 schedule, or a VR 10 schedule. A counter which recorded the number of responses made by each subject was mounted on the metal rack. A Ralph Gergrands Harvard Cumulative Recorder was located behind the panel. A Clebar stopwatch was used to time the performance of each subject. A Solid State cassette tape recorder was placed behind the panel with an earplug extending around to the front of the panel. The tape recorder was used to signal to the model the rate at which to respond. It was shut off when it was the subject's turn to respond.

Experimental Design

The study was a 3x3x2 factorial design with an additional no model control condition. The variables were schedules of reinforcement to the model (CRF, VR 4, and VR 10), rate of responding by the model (three times a second, once a second, or once every three seconds), and sex of the observer (male or female). The subjects in the modeling conditions watched a model bar press for two minutes; the model was reinforced according to one of the three schedules used. (The number of reinforcements dispensed to the model varied across the rate conditions plus schedule conditions.) The subjects then participated in an extinction series in which they were allowed to bar press as long as they wished up to ten minutes. Subjects were never reinforced. The no model

control condition subjects participated in the extinction series without ever viewing the model.

Procedure

Subjects were tested individually by the experimenter in a small room located a short distance from the classroom. Both the experimenter and the model were college age females. The subject and the model were seated before a table on which the experimental apparatus was set.

For all conditions except the no-model control the instructions were as follows: "This (pointing to the bar press apparatus) is a new type of game. You play the game by pressing the bar like this (experimenter demonstrates one bar press). This is Miss _____. She came over to play the game with you today. Miss _____, this is (child's name). It will be Miss _____'s turn to play the game first and when she's finished it will be your turn to play. Watch the lady carefully so you'll know what to do when it's your turn to play. This (experimenter holds up earplug) is so you can listen into the machinery to make sure it's working right. If it's not working you'll hear a loud bell ring." The experimenter helped the model to adjust the earplug and told her to begin.

The model pressed the bar at a rate signalled by the tape and relayed via the earplug (three times a second, once a second, or once every three seconds). The model received

M and M's according to one of three schedules of reinforcement (CRF, VR 4, or VR 10). At the end of two minutes of responding the model was signalled by tape to stop. She then said, "I think I'll stop and give (child's name) a turn to play."

The model collected her M and M's and helped the child adjust his chair, while the experimenter went behind the panel to shut off the tape recorder and the reinforcing device. The experimenter then asked the subject, "Do you think you know how to play the game now?" If the subject expressed doubt the experimenter said, "You just press the bar down with your fingers." The experimenter helped the subject adjust the earplug and said, "Remember this is so you can listen into the game to make sure it is working right. If you don't hear anything the game is O.K. You can play the game as long as you want and when you wish to stop you can. You can start now."

The experimenter and the model retired to the side of the room and attempted to appear disinterested in the child's performance. If the subject had any questions during the experiment he was told, "You may play the game as long as you wish and you may stop whenever you feel like it." If the subject questioned whether the game was working he was told, "If the game were broken you would hear a loud bell ring." Each subject was allowed to respond until he indicated that he was finished (either verbally, or by removing the earplug,

or by not responding for one minute) or was stopped by the experimenter at the end of ten minutes. After the child stopped responding the experimenter said, "You didn't win any M and M's but you played the game so nicely I'll give you some anyway."

The procedure for the no model control was essentially the same as for the modeling conditions except subjects did not observe the model play the game first. The subject was brought to the experimental room, introduced to the model and told the bar press was a new type of game. The experimenter demonstrated one bar press. The subject was then told it was his turn to play the game and he could play as long as he wished. No M and M's were dispensed in the presence of the subject. After the child indicated he was finished he was given a package of M and M's and escorted back to the classroom.

The length of time the subject responded and the number of bar presses made were recorded for each subject.

RESULTS

The mean trials to extinction for each of the experimental and control conditions are shown in Table 1. The mean rates of responding during extinction are shown in Table 2 and the mean times to extinction are shown in Table 3. The results are presented graphically in Figures 1, 2, and 3 respectively.

The main sources of variance in each of the 3x3x2 analyses were rate of model's responding (fast, intermediate, or slow), schedule of reinforcement (CRF, VR 4, or VR 10), and sex of the observer (male or female). The results of the analysis of variance for trials to extinction is shown in Table 4. Significant effects were found for the model's rate of responding ($p < .001$) and for the schedule of reinforcement to the model ($p < .05$). Neither sex of the observer nor any of the interactions was significant. Resistance to extinction was greatest when subjects observed a model respond at the intermediate rate, next in the fast rate condition, and least in the slow rate condition. The VR 4 schedule produced the greatest resistance to extinction, the VR 10 schedule produced the next greatest resistance to extinction, and the CRF the least resistance. Multiple comparisons of means using the Tukey (a) procedure (Winer, 1962) indicated that

TABLE 1

MEAN NUMBER OF BAR PRESSES TO EXTINCTION
AS A FUNCTION OF SCHEDULE OF REINFORCEMENT
AND MODEL'S RATE OF RESPONSE

	Schedule of Reinforcement				
		VR 10	VR 4	CRF	
Model's Rate of Response	Slow	77.3	107.2	47.8	
	Intermediate	386.9	525.0	329.7	
	Fast	448.3	413.2	166.2	No Model Control
					88.6

TABLE 2

MEAN RATE OF RESPONDING DURING EXTINCTION (RESPONSES PER SECOND) AS A FUNCTION OF SCHEDULE OF REINFORCEMENT AND MODEL'S RATE OF RESPONSE

	Schedule of Reinforcement				
		VR 10	VR 4	CRF	
Model's Rate of Response	Slow	.35	.56	.43	
	Intermediate	1.19	1.31	.99	
	Fast	1.84	2.06	1.63	No Model Control
					1.24

TABLE 3

MEAN SECONDS TO EXTINCTION AS A FUNCTION OF SCHEDULE OF REINFORCEMENT AND MODEL'S RATE OF RESPONSE

	Schedule of Reinforcement			
		VR 10	VR 4	CRF
Model's Rate of Response	Slow	246.7	186.9	125.5
	Intermediate	273.2	393.2	279.3
	Fast	249.7	209.1	90.6

No Model Control
95.4

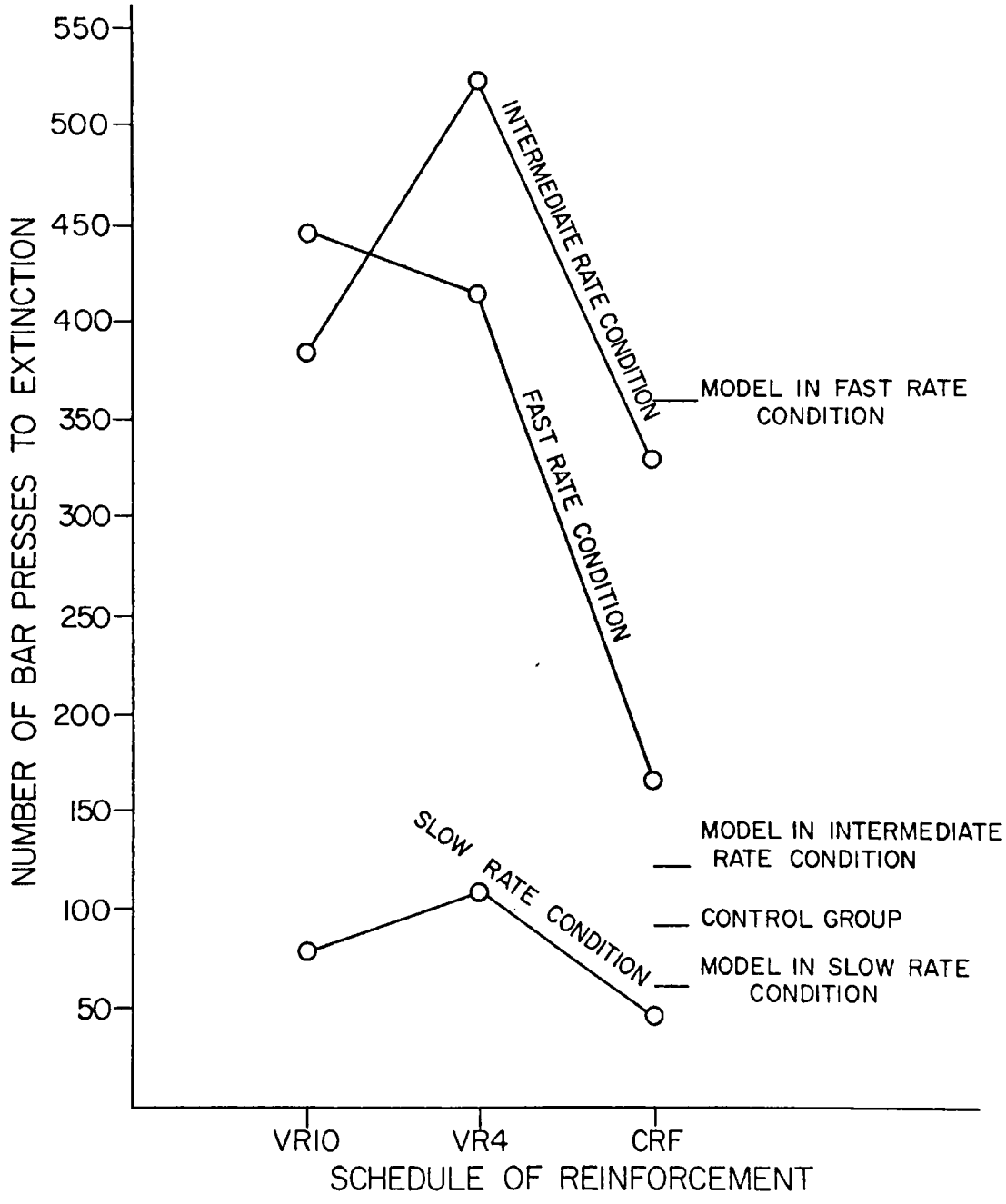

Figure 1. Mean Number of Bar Presses to Extinction as a Function of Schedule of Reinforcement and Model's Rate of Response.

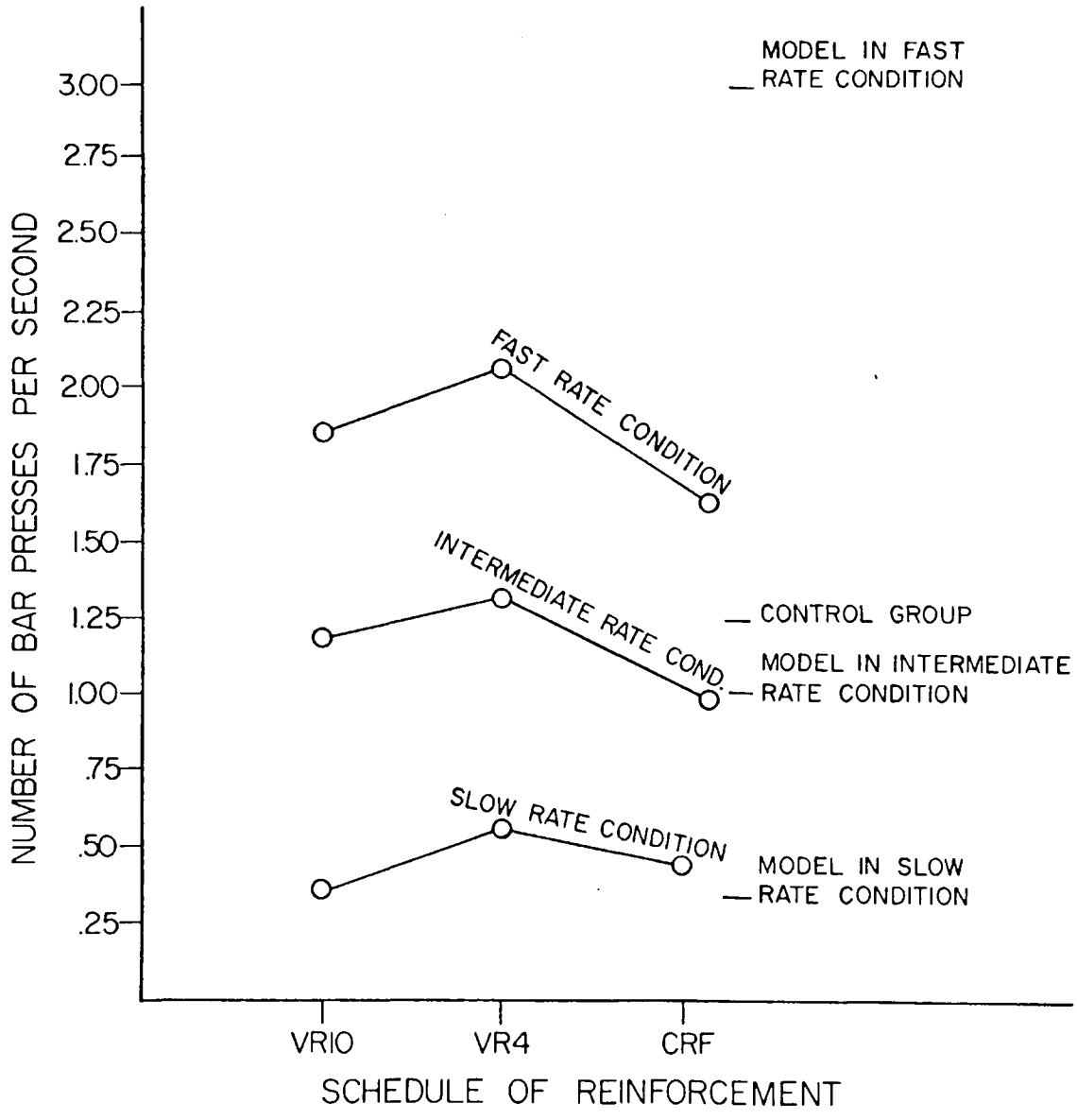

Figure 2. Mean Rate of Responding During Extinction as a Function of Schedule of Reinforcement and Model's Rate of Response.

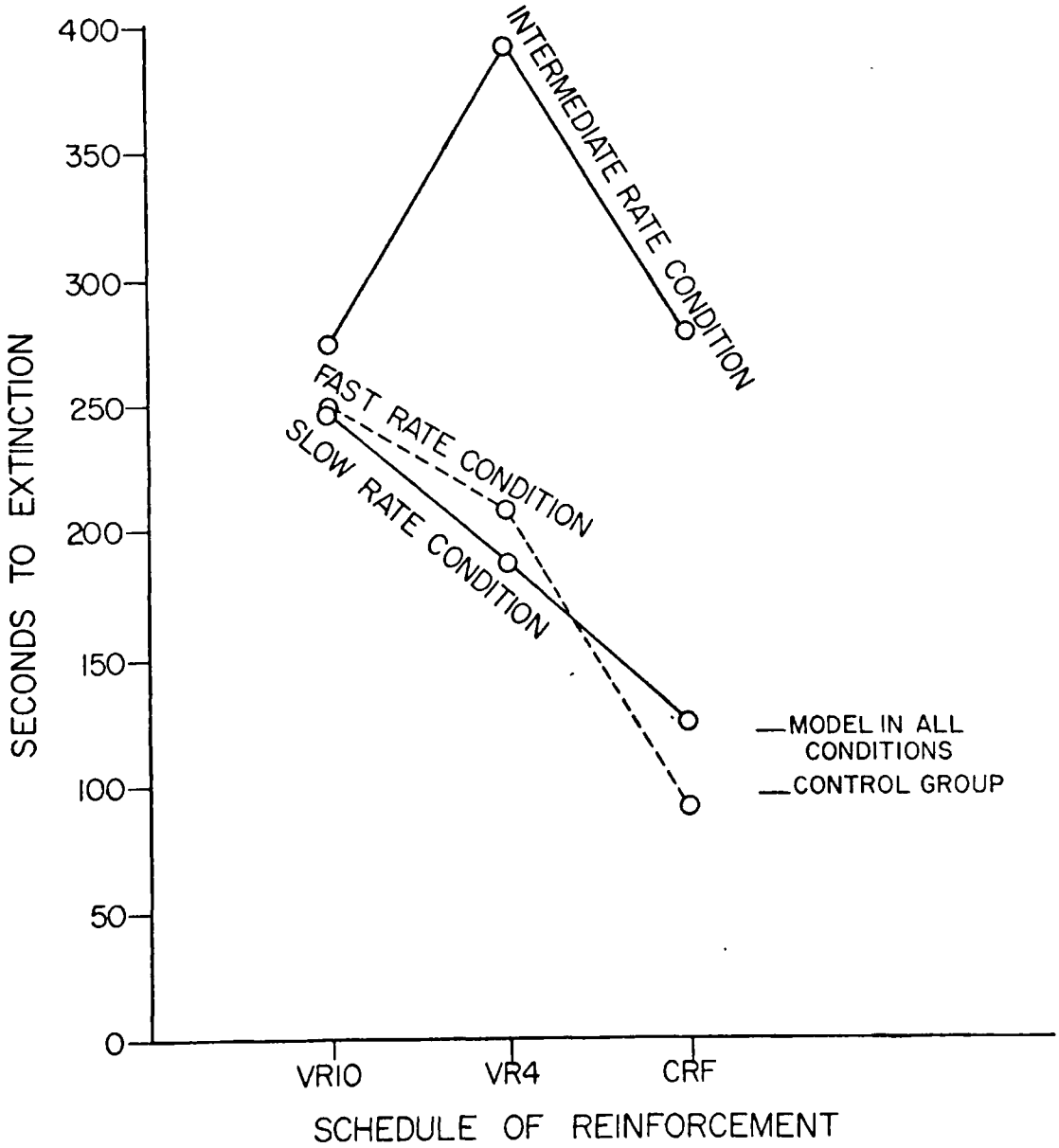

Figure 3. Mean Time to Extinction as a Function of Schedule of Reinforcement and Model's Rate of Response.

TABLE 4

ANALYSIS OF VARIANCE OF BAR PRESSES TO EXTINCTION

Source	df	MS	F
Rate of Response (A)	2	942,833.81	14.085**
Schedule of Reinforcement (B)	2	225,210.41	3.36*
Sex (C)	1	123,506.17	1.845
AxB	4	60,394.45	
AxC	2	59,658.88	
BxC	2	160,939.41	2.404
AxBxC	4	87,572.61	
Error	72	66,938.58	

** $p < .001$
* $p < .05$

significant differences in means exist between the slow and intermediate rate groups ($p < .01$) and between the slow and fast rate groups ($p < .01$). Significant differences were also obtained between the CRF schedule and the VR 4 schedule ($p < .05$). Multiple comparisons of means using the Scheffe test (Winer, 1962) indicated that significant differences in means exist between the two partial schedules and the continuous schedule ($p < .1$).[1]

The results of the analysis of rate of responding during extinction are shown in Table 5. As in the previous analysis significant effects found were for rate of responding ($p < .001$) and schedule of reinforcement ($p < .05$). Neither sex of the observer nor any of the interactions was significant. Subjects tended to imitate the model's rate of responding. Subjects who observed a model perform at a fast rate showed a fast rate of responding, those who observed an intermediate rate of responding performed at an intermediate rate, and those who observed a slow rate performed at a slow rate. Subjects who observed a model reinforced according to the VR 4 schedule showed the fastest rate of responding, subjects in the VR 10 condition showed the next fastest rate of responding, and those in the CRF condition performed the most slowly. Tukey tests indicate that for rate of responding,

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[1]The $p < .1$ level is deemed significant due to the conservative nature of the Scheffe method and to the a priori theoretical concerns sponsoring the particular comparison.

TABLE 5

ANALYSIS OF VARIANCE OF RATE OF RESPONDING DURING EXTINCTION

Source	df	MS	F
Rate of Response (A)	2	14,736,406.4	8.496**
Schedule of Reinforcement (B)	2	663,029.3	3.823*
Sex (C)	1	71,064.9	
AxB	4	86,620.8	
AxC	2	54,189.6	
BxC	2	34,616.1	
AxBxC	4	165,186.6	
Error	72	173,441.6	

** $p < .001$
* $p < .05$

significant differences exist between all pairs of means ($p < .01$). The Tukey test also indicates that there exists a significant difference in the subjects rate of responding between the VR 4 schedule and the CRF schedule ($p < .05$).

The results of the analysis of variance for time during extinction are shown in Table 6. As in the previous analyses significant effects found were for rate of responding ($p < .001$) and schedule of reinforcement ($p < .05$). Resistance to extinction was greatest when subjects observed the model perform at an intermediate rate, next greatest in the slow rate condition and least in the fast rate condition. As for the trials to extinction measure, the VR 4 schedule produced the greatest resistance to extinction, the VR 10 schedule the next greatest resistance and the CRF the least resistance. Multiple comparisons of means using the Tukey test indicate that reliable differences in means exist between the slow and intermediate rate ($p < .01$), and between the intermediate and fast rate ($p < .01$). Also, significant differences exist between the VR 4 schedule and the CRF schedule ($p < .05$), and between the VR 10 schedule and the CRF schedule ($p < .05$). The VR 4 schedule and the VR 10 schedule times to extinction were not found to be significantly different. The Scheffe test indicated that the VR 4 schedule and the VR 10 schedule differ significantly from the CRF schedule ($p < .05$).

The Dunnett test (Winer, 1962) showed that the control group had significantly fewer trials to extinction than

TABLE 6

ANALYSIS OF VARIANCE OF TIME TO EXTINCTION

Source	df	MS	F
Rate of Response (A)	2	170,337.42	8.122**
Schedule of Reinforcement (B)	2	89,937.92	4.288*
Sex (C)	1	50,504.71	
AxB	4	30,405.44	
AxC	2	41,953.34	
BxC	2	50,422.58	2.40
AxBxC	4	28,121.91	
Error	72	20,972.08	

** $p < .001$
* $p < .025$

the VR 4 intermediate rate condition ($p < .01$), the VR 4 fast rate condition ($p < .05$), and the VR 10 fast rate condition ($p < .05$). The controls also significantly differed from the VR 4 intermediate rate condition ($p < .01$), and the CRF intermediate rate condition ($p < .05$), in time to extinction, with the control subjects showing more rapid extinction than the experimental conditions. The control subjects showed a significantly faster rate of responding than subjects exposed to a model who performed at a slow rate ($p < .01$). The controls also showed a significantly slower rate of responding than subjects exposed to a model who performed at a fast rate under the VR 4 schedule ($p < .05$) and the VR 10 schedule ($p < .01$).

DISCUSSION

The present results indicate that partial schedules of reinforcement produce greater resistance to extinction than a continuous schedule as measured both by trials to extinction and time to extinction. The present results substantiate the demonstration of a vicarious PRE by Berger and Johansson (1968), Klauck (1969), and Hamilton (1970). The present study substantiates Klauck's finding of a vicarious PRE with a non peer model. This finding casts doubt on the explanation given by Berger and Johansson (1968) that they were able to obtain a vicarious PRE while Lewis and Duncan (1958) were unable to do so because a peer model was used in their study.

The present results indicate that observing a model operate under a more dense partial schedule (VR 4) resulted in more resistance to extinction than observing a model operate under a less dense partial schedule (VR 10), as measured by trials to extinction and time to extinction. Observing a model operate under a continuous schedule resulted in the least resistance to extinction according to both measures. These results agree with the direct learning literature in which percentage of reinforcement and resistance to extinction has been related by an inverse U shaped function (Grant

and Schipper, 1952; Grant, Hake and Hornseth, 1951; Lewis, 1952; Lewis and Duncan, 1957). Grant and Schipper (1952) believe the nonmonotonic function to be due to the operation of two processes. The first involves the discrimination of the acquisition phase of the experiment from the extinction phase. With a more dense schedule of reinforcement the discrimination is facilitated, resulting in less resistance to extinction. The second process involves learning during the acquisition phase. A more dense schedule of reinforcement results in better performance up to some point in training. Thus below some optimal number of trials as the percentage of reinforcement increases so does the level of performance, resulting in greater resistance to extinction. Grant and Schipper's explanation seems to fit the present data. Their theory may be used to explain why Lewis and Duncan (1958) did not obtain a vicarious PRE effect. However, further research efforts are necessary to clarify the nature of the function relating the number of acquisition trials and percentage of reinforcement.

The rate at which the model responded was shown to have a significant effect upon the subjects' performance. Subjects who observed a model bar press slowly performed at a slower rate than those who observed a model bar press at an intermediate rate. The latter subjects, in turn, responded more slowly than those who saw the model respond at a fast rate. In addition to influencing the rate at which subjects responded, the model's rate of response had an effect upon

resistance to extinction in the observer. The intermediate rate of responding produced the maximum resistance to extinction. Perhaps the intermediate rate of responding is more comfortable to subjects and produces better performance. It is interesting to note that control subjects who did not observe a model responded at a rate similar to those subjects who observed the model respond at the intermediate rate.

The present results indicate that observing a model operate under a partial schedule produces a faster rate of response in an observer than viewing a model under a continuous schedule. This finding is consistent with the direct learning literature in which partial schedules have been found to produce a higher asymtotic level of performance than continuous schedules (Bruning, 1964; Ryan, 1966; Ryan and Watson, 1966).

The present findings have some bearing on clinical and classroom situations. It seems possible to shape a relatively enduring response pattern in an individual by having him observe a model who is reinforced according to a partial schedule. The present results seem to indicate that observing a model on a more dense partial schedule produces a more longlasting response than observing a model on a more thin schedule. However, further research is necessary to clarify the exact nature of this function.

REFERENCES

Bandura, A. Influence of the models' reinforcement contingencies on the acquisition of imitative responses. Journal of Personality and Social Psychology, 1965, 1, 589-95.

Bandura, A. Principles of behavior modification. New York: Holt, Rinehart, and Winston, 1969.

Bandura, A., Ross, D., & Ross, S. A. Imitation of film-mediated aggressive models. Journal of Abnormal and Social Psychology, 1963, 66, 3-11.

Berger, S. M., & Johansson, S. L. Effect of a model's expressed emotions on an observer's resistance to extinction. Journal of Abnormal and Social Psychology, 1968, 10, 53-58.

Bruning, J. L. The effects of magnitude of reward and percentage of reinforcement on a lever movement response. Child Development, 1964, 35, 281-285.

Ferster, C. B., & Skinner, B. F. Schedules of reinforcement. New York: Appleton-Century-Crofts, 1957.

Grant, D. A., Hake, H. W., & Hornseth, J. P. Acquisition and extinction of a verbal conditioned response with differing percentages of reinforcement. Journal of Experimental Psychology, 1951, 42, 1-5.

Grant, D. A., & Schipper, L. M. The acquisition and extinction of conditioned eyelid responses as a function of the percentage of fixed-ratio random reinforcement. Journal of Experimental Psychology, 1952, 43, 313-320.

Hamilton, M. L. Vicarious reinforcement effects on extinction. Journal of Experimental Child Psychology, 1970, 9, 108-113.

Klauck, K. A. The effects of instructions and schedules on imitation. Unpublished doctoral disseration, The University of Arizona, 1969.

Lewis, D. J. Partial reinforcement in a gambling situation, Journal of Experimental Psychology, 1952, 43, 447-50.

Lewis, D. J., & Duncan, C. P. Expectation and resistance to extinction of a lever-pulling response as a function of percentage of reinforcement and amount of reward. Journal of Experimental Psychology, 1957, 54, 115-120.

Lewis, D. J., & Duncan, C. P. Vicarious experience and partial reinforcement. Journal of Abnormal and Social Psychology, 1958, 57, 321-326.

Ryan, T. J. Instrumental performance as related to several reward schedules and age. Journal of Experimental Child Psychology, 1966, 3, 398-404.

Ryan, T. J., & Watson, P. Children's response speeds as a function of sex and verbal reinforcement schedule. Psychonomic Science, 1966, 6, 271-272.

Winer, B. Statistical principles in experimental design. New York: McGraw Hill, 1962.