

Response-independent food presentations decelerate low rate responding

DIANE DeA. EDWARDS, JOANNE W. LUCAS, and GARY A. LUCAS

University of Missouri at Kansas City, Kansas City, Missouri 64110

Response rates stabilized at between 4 and 5 responses/min on a DRL 15-sec schedule of reinforcement. When reinforcers were delivered independently of responses, response rates decreased over several sessions to 0.4 responses/min. An extinction procedure also decreased response rates, but more rapidly. Response deceleration was compared on fixed-time schedules following DRL, FI, and FR schedules.

The effects of food delivered independent of responses have been reported using fixed-interval (Appel & Hiss, 1962; Herrnstein, 1966; Edwards, West, & Jackson, 1968; Zeiler, 1968) and fixed-ratio (Edwards, Peek, & Wolfe, 1970) schedules. In all cases, response rates decreased when food was presented independent of responses.

The results further indicated that rate of response decreased more rapidly following fixed-interval than fixed-ratio baselines. A major difference between training under fixed-interval vs fixed-ratio schedules involves the overall rate of response. It may be that the effectiveness of response independent food presentations in decreasing rates is related to the initial or baseline rate of response.

Differential reinforcement of low rates (DRL) is a schedule which produces a low rate of response, and if baseline rates of response control how rapidly response-independent food decreases response rates, then DRL baselines should decrease more rapidly than either fixed-interval or fixed-ratio rates. This study was performed to test the prediction that response rates acquired under DRL schedules will decrease faster than either FI or FR.

METHOD

Subjects

Five albino Sprague-Dawley rats served as experimental Ss. These rats were approximately 200 days old at the start of the experiment and were maintained at their 80% ad lib weights. Each S had been trained on fixed-ratio schedules in previous experiments.

Apparatus

A Model 1316 C Lehigh Valley rat chamber served as the experimental space. The reinforcer was a 25% sucrose solution delivered via a 0.06-cc-capacity dipper. Relay circuitry manufactured by Lehigh Valley and Grason-Stadler automatically programmed all experimental conditions. Responses were recorded on digital counters and a cumulative recorder (Scientific Prototype, CR2D). White noise was present continuously.

Procedure

The duration of each session terminated after 50 sucrose presentations. Once stable response rates were obtained on a DRL 15-sec schedule of reinforcement (Schoenfeld, Cummings,

& Hearst, 1956), sucrose was presented every 15 sec regardless of the rat's behavior (FT 15 sec). One rat was exposed to an FT 17-sec schedule of response-independent sucrose presentations because, during the DRL 15-sec schedule performance, barpresses were typically spaced 17 sec apart.

Depending upon the behavioral effect of the FT 15-sec procedure, two steps were followed: (1) if the response rates decreased to a near zero rate, the DRL 15 sec was reintroduced, or (2) if the response rates decreased, but not to zero, the response independent presentations of sucrose occurred twice as often (FT 7.5 sec) or one-half as often (FT 30 sec).

Changing the interval of response-independent sucrose presentations from one which more closely matched the baseline schedule might be sufficient to provide a reduction in response rates.

Once rates decreased to near zero under response-independent sucrose presentations, the DRL 15-sec schedule was reinstated. The final manipulation for all rats was an extinction procedure, during which no sucrose was available.

RESULTS

Table 1 presents the median response rate for the last 3 days under each condition. In all Ss, response rates decreased by at least a factor of four during the FT 15-sec phase, as compared to the rates during DRL 15 sec. Only four out of the five Ss were exposed to the extinction phase, and three out of the four decreased their response rates by a factor of six.

Figure 1 shows daily response rates for S 1 across all experimental sessions. These data are typical for all the Ss during DRL 15 sec, FT 15 sec and representative of all but S 5 during extinction. During DRL 15 sec, responding stabilized at 4.7 responses/min. Following an initial increase in responding, rates decreased to near zero after approximately 600 response independent

Table 1
Median Response Rate of the Last Three Sessions Under
DRL 15 Sec, FT 15 Sec, and Extinction

S	DRL 15 Sec	FT 15 Sec	DRL 15 Sec	Ext
Rat 1	4.8	0.18	4.0	0.8
Rat 2	3.8	0.08	3.8	0.24
Rat 3	6.8	0.56	5.8	
Rat 4	5.8	0.08	3.5	0.68
Rat 5	4.2	1.0	4.5	6.0

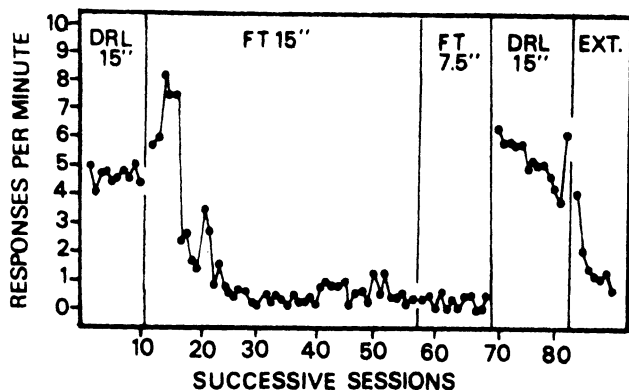


Fig. 1. Daily response rates across all experimental phases for S1. Note the comparable decreases in rate of response for the FT and extinction procedures.

presentations of sucrose (FT 15 sec). FT 7.5 sec produced 5 sessions out of 11 when no barpresses occurred at all.

The reintroduction of DRL 15 sec resulted in an immediate increase in response rate, and extinction reduced response rates to near zero within seven sessions.

Figure 2 presents a summary chart of all Ss (range and

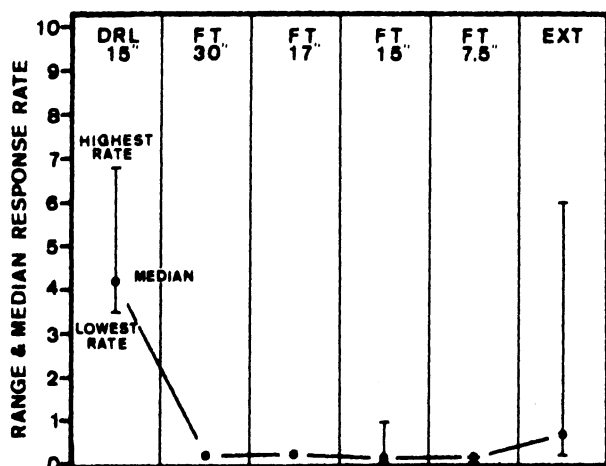


Fig. 2. Range and median response rates across six experimental phases for all Ss. Doubling or halving the FT interval did not change the median or range of response rate.

median response rates) across six experimental phases. The data from all five Ss have the following characteristics: (1), stable DRL 15-sec performance at approximately 4.0 responses/min. (2) deceleration in rate equivalent to at least a factor of four during response-independent sucrose presentations. (3) little change in response deceleration either by doubling (FT 30 sec) or halving (FT 7.5 sec) the response-independent sucrose presentation schedule, and (4) equivalent reductions in response rate by both the FT and extinction procedures.

DISCUSSION

Response-independent sucrose presentations following a DRL history were comparable to extinction in decreasing responding to near zero rates. Since response-independent presentations of sucrose remove the response-reinforced dependency while extinction removes both the dependency and the reinforcer, the more rapid decrease in response rate resulting from extinction may be primarily a result of the removal of the food. These findings support those reported by Edwards, West, and Jackson (1968), using fixed-interval schedules, and by Edwards, Peek, and Wolfe (1970), using fixed-ratio schedules.

Data from Edwards, West and Jackson (1968) show that response rates dropped after 700 presentations of response-independent food following fixed-interval schedules, but when baseline performance was maintained by fixed-ratio schedules, rates did not decrease until approximately 2,500 response-independent food presentations had occurred (Edwards, Peek, & Wolfe, 1970). Data from the present study show that response rates maintained by DRL schedules drop after about 500-600 FT presentations of food.

REFERENCES

- Appel, J. B., & Hiss, R. H. The discrimination of contingent from noncontingent reinforcement. *Journal of Comparative & Physiological Psychology*, 1962, 55, 37-39.
- Edwards, D. D., Peek, V., & Wolfe, F. Independently delivered food decelerates fixed-ratio rates. *Journal of the Experimental Analysis of Behavior*, 1970, 14, 301-307.
- Edwards, D. D., West, J. R., & Jackson, V. The role of contingencies in the control of behavior. *Psychonomic Science*, 1968, 10, 39-40.
- Herrnstein, R. J. Superstition: A corollary of the principles of operant conditioning. In W. K. Honig (Ed.), *Operant behavior*. New York: Appleton-Century-Crofts, 1966. Pp. 33-51.
- Schoenfeld, W. N., Cummings, W. W., & Hearst, E. On the classification of reinforcement schedules. *Proceedings of National Academy of Science*, 1956, 42, 563-570.
- Zeiler, M. D. Fixed and variable schedules of response-independent reinforcement. *Journal of the Experimental Analysis of Behavior*, 1968, 11, 405-414.

(Received for publication November 13, 1973.)