Effects of varying probability of a response-pause requirement on a regular reinforcement baseline[1]

W. N. SCHOENFELD,[2] JOHN FARMER, and CHRISTOPHER VICKERY, Queens College of the City University of New York, Flushing, N.Y. 11367

The bar-press response of two rats was maintained on a reinforcement schedule in which the probability (p) that a response-pause ("not-R") requirement would follow any given reinforcement (S^R) varied between zero (conventional "CRF") and unity (conventional "DRL"). Both the interresponse-time (IRT) and postreinforcement-pause (PS^RP) distributions were affected by this experimental variable. Recoverability of data was generally good at those p values tested but was markedly slow immediately following exposure to p = 1.00.

Some research (Schoenfeld & Farmer, in press) has shown that reinforcements applied to behavior other than responding (not-R, or R̸) produce systematic changes in response (R) measures. One experiment reported the effects of concurrently reinforcing both responding and not-responding, and another the effects of reinforcing the chain R̸ → R → R̸. The present study is of the chain R̸ → R under varying probabilities that the first link (R̸) is required for reinforcement.

For this study, R̸ is defined as a 5-sec period with no R (in this case, bar-press). The probability, p, that the R̸ link of the R̸ → R chain is required for reinforcement is varied from 0.0 to 1.0. When p = 0.0, the conventional CRF schedule obtains, while p = 1.0 defines the conventional DRL 5-sec schedule.

METHOD

Two Sprague-Dawley rats maintained at 80% body weight, with age-growth corrections estimated by Zucker's (1953) formula, served as Ss. After bar-press training, the animals were allowed 256 reinforcements (each reinforcement being 3 sec access to a condensed-milk and water mixture) at p = 0.0 in each of 10 successive sessions. The sequence of values assigned to p and the length of exposure to each p are given in Table 1.

RESULTS AND DISCUSSION

The data in Figs. 1 and 2 indicate that the independent variable, probability of the R̸ requirement, acted to control the interresponse time (IRT) and postreinforcement pause (PS^RP) distributions independently. (IRT distributions include all temporal separations of Rs in which no S^Rs occur.) The modal IRTs at about 5 sec developed at much lower probabilities than the 5-sec modal PS^RPs. At the lower probabilities ($p \leq 0.75$), the animals generally responded immediately after reinforcement and either were reinforced immediately or else paused for about 5 sec before responding again. Unreinforced responses, whether occurring shortly after a reinforcement or after a pause close to 5 sec long, were generally followed by a few short IRTs before the next long IRT started. This pattern of responding produced the bunching of IRTs at about 1 sec for both rats and corresponds to

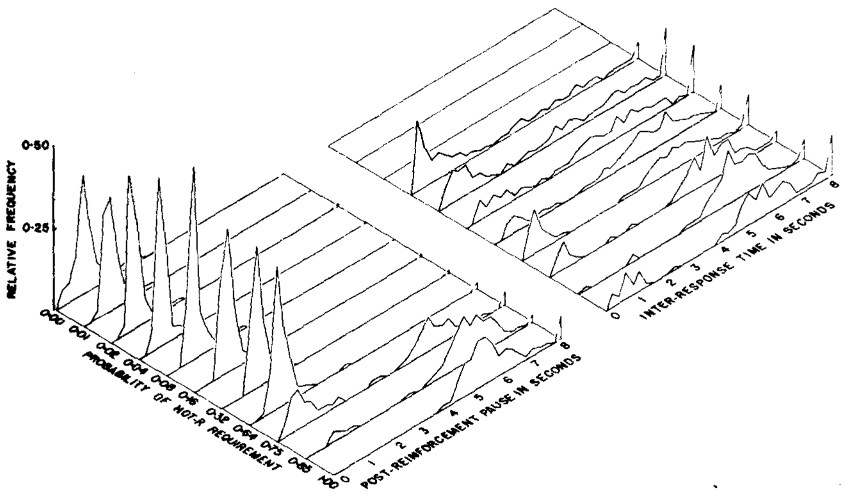

Fig. 1. Postreinforcement pause (PS^RP) and interresponse-time (IRT) distributions recorded from the last two to five sessions at each probability (p) of the R̸ requirement for Rat 1. (IRT distributions include all temporal separations of Rs in which no S^Rs occur.) The sample size for each PS^RP distribution is 255. The sample sizes for the IRT distributions are: p = 0.04, 169; p = 0.08, 179; p = 0.16, 233; p = 0.32, 273; p = 0.64, 384; p = 0.75, 158; p = 0.85, 109; p = 1.00, 195. Although the abscissa probability axis is arranged ordinally, Table 1 gives the actual sequence of exposures and the length of time (in sessions of 256 reinforcements each) spent at each probability value. No IRT distributions were constructed for p < 0.04 because the sample size was too small.

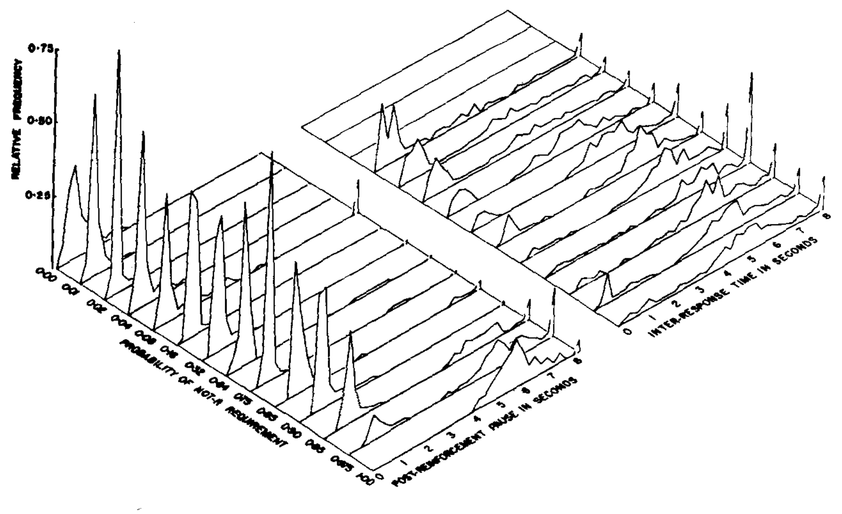

Fig. 2. Same as Fig. 1 for Rat 2. IRT sample sizes are: P = 0.04, 174; p = 0.08, 321; p = 0.16, 688; p = 0.32, 203; p = 0.64, 264; p = 0.75, 282; p = 0.85, 298; p = 0.90, 274; p = 0.95, 188; p = 0.975, 180; p = 1.00, 773.

Table 1

Rat 1		Rat 2	
p	Number of Sessions	p	Number of Sessions
0.00	10	0.00	10
0.01	5	0.01	5
0.02	7	0.02	7
0.04	7	0.04	7
0.08	11	0.08	11
0.16	13	0.16	13
0.32	10	0.32	10
0.64	10	0.64	10
1.00	10	1.00	10
0.64	51	0.64	51
0.75	10	0.75	10
0.65	15	0.85	13
1.00	12	0.90	10
0.00	33	0.95	10
0.32	10	0.975	13
		1.00	14
		0.32	10

findings reported elsewhere for conventional DRL schedules (Sidman, 1956; Ferraro et al, 1965).

The recovery data presented in Figs. 3 and 4 demonstrate the powerful effect of the sequence in which the animals were exposed to the various probabilities. Once the animals had been exposed to p = 1.00, return to the original performance at p = 0.64 was gradual; only after more than 50 sessions had both animals recovered their earlier pattern of responding, and Fig. 3 shows that Rat 1 still made more PS^RPs of about 5 sec than originally. Nonetheless, the form of the distributions was recovered in all cases.

It is evident that the simple stream of behavior (. . . $R \rightarrow S^R \rightarrow R \rightarrow S^R$ . . .) can be controlled systematically by varying the frequency with which a ℟ requirement is introduced into the stream. In the present case, the effect upon the inter-R time (or, IRT) measure was seen at lower probabilities than the effect upon the $S^R \rightarrow R$ (or, PS^RP) time measure. The length of the required ℟ that is introduced into the behavior stream will, of course, be a parameter of the result reported here.

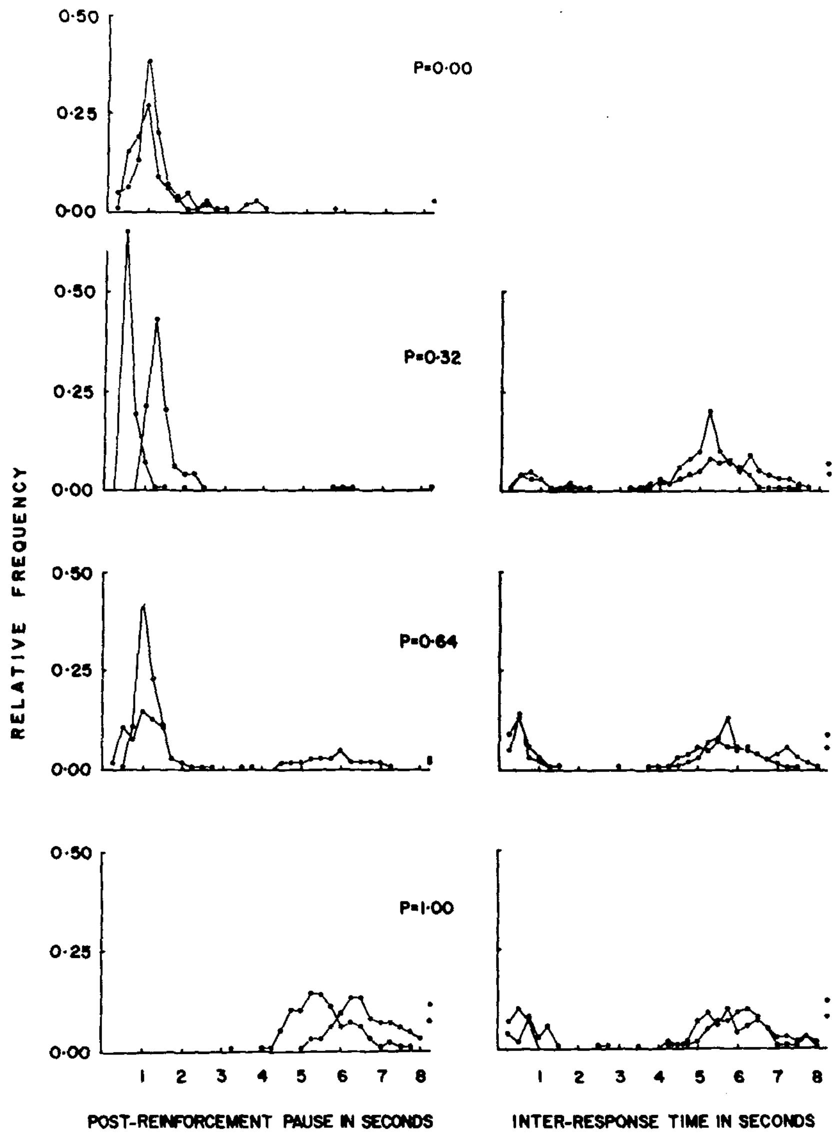

Fig. 3. PS^RP and IRT distributions for original (filled circles) and recovery (open circles) exposures to various probabilities of the ℟ requirement for Rat 1. Sample sizes for the original IRT distributions are given in the legend for Gif. 1 and were as follows for the redeterminations: p = 0.32, 180; p = 0.64, 161; p = 1.00, 153.

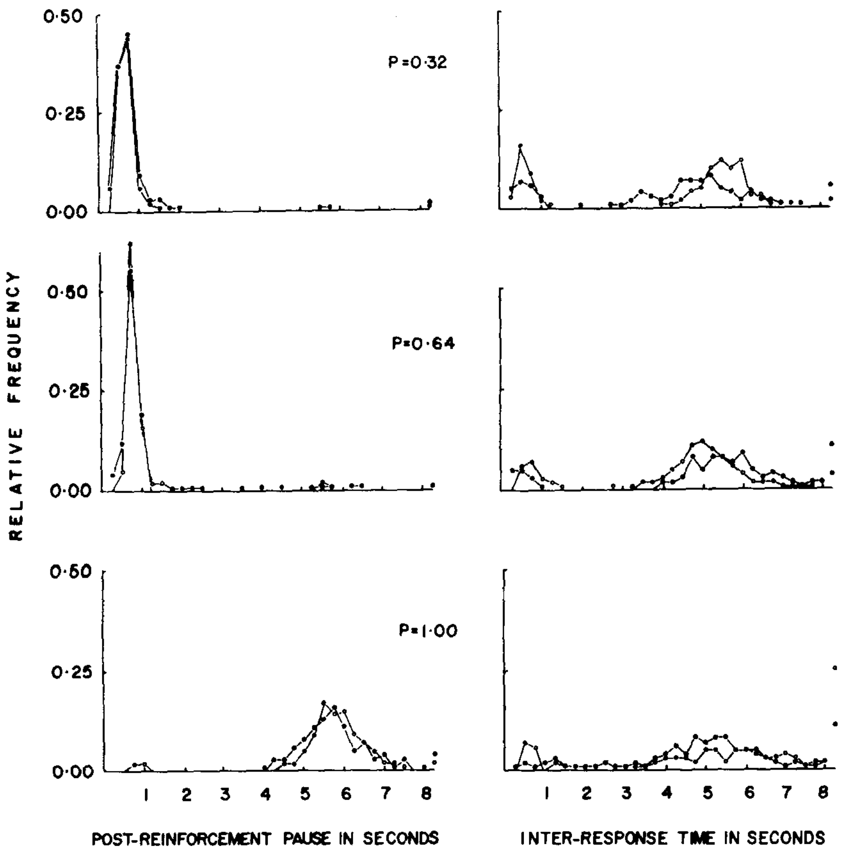

Fig. 4. Same as Fig. 3 for Rat 2. Sample sizes for IRT recovery functions are: p = 0.32, 182; p = 0.64, 399; p = 1.00, 177.

REFERENCES

FERRARO, D. P., SCHOENFELD, W. N., & SNAPPER, A. G. Sequential response effects in the white rat during conditioning and extinction on a DRL schedule. Journal of the Experimental Analysis of Behavior, 1965, 8, 255-260.

SCHOENFELD, W. N., & FARMER, J. Reinforcement schedules and the "behavior stream." In W. N. Schoenfeld (Ed.), *Theories of reinforcement schedules.* New York: Appleton-Century-Crofts, in press.

SIDMAN, M. Time discrimination and behavioral interaction in a free operant situation. Journal of Comparative & Physiological Psychology, 1956, 49, 469-473.

ZUCKER, L. Growth criteria. In: *Rat quality, a consideration of heredity, diet, and disease.* Proceedings of the National Vitamin Foundation Symposium. New York: National Vitamin Foundation, 1953.

NOTES

1. This investigation was supported by Public Health Research Grants MH 08006 and MH 12964 from the National Institute of Mental Health.

2. Also of Cornell University Medical College.