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SOME TEMPORAL PARAMETERS OF NON-CONTINGENT REINFORCEMENT[1]

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In each baseline session, pigeons were exposed to a multiple schedule in which each of five distinctive stimuli was correlated with a different frequency of reinforcement. In one component, responses were reinforced with a probability of 0.10 (random-ratio schedule); in the other four components, responses were reinforced with different scheduled temporal frequencies averaging 30 to 240 sec between reinforcements (random-interval schedules). For periods lasting 30 sessions, contingent reinforcement was discontinued and reinforcement was presented independent of responding at irregular intervals averaging 30, 60, or 120 sec, while the sequence of stimuli continued. After each such period, the baseline was reinstated for 30 sessions. The data indicated that: (1) The rate of responding in the presence of all stimuli decreased as exposure to the non-contingent reinforcement procedure was prolonged, at all the frequencies of reinforcement employed; (2) The rate under the random-ratio schedule declined faster than the rates under all the random-interval schedules, presumably because the decrease in reinforcement frequency under this stimulus condition was greatest; (3) The decline in rates of responding under the stimuli correlated with the random-interval schedules tended to be greatest for the stimuli paired with the lowest frequencies of reinforcement.

Implicit in the concept of a reinforcement contingency, is the notion of a specific temporal relationship between a response and a reinforcer. Since reinforcement must always occur in close temporal contiguity with some response, it can be assumed that conditioning is taking place whenever a reinforcer is delivered. As Skinner (1948) pointed out, whether or not a response is pre-specified in no way alters the power of reinforcement to exert its effect. When reinforcers are delivered without reference to the ongoing behavior, the resultant effects are said to be produced by "superstitious" or non-contingent reinforcement. More specifically, a non-contingent schedule of reinforcement may be defined as one in which the distribution of interresponse times in no way affects the distribution of interreinforcement times (Schoenfeld and Farmer, 1970).

Under a contingent schedule of reinforcement, the resulting behavior is readily predictable because the temporal relationship between the response and the reinforcer is specified. This temporal specificity is, by definition, necessarily absent in a non-contingent reinforcement procedure. Even in the absence of this temporal specificity, it has been demonstrated that the delivery of reinforcers without a response requirement can maintain behavior previously established on an intermittent schedule of reinforcement (Skinner, 1938; Herrnstein, 1966; Zeiler, 1968). In these instances, the general finding has been that the non-contingent reinforcement procedures maintain behavior at lower rates than their contingent counterparts.

When a contingent reinforcement procedure is replaced by non-contingent reinforcement, the degree to which responding persists will depend upon the degree of adventitious relationship between responses and reinforcers. This relationship, in turn, depends upon the schedule of non-contingent reinforcement and on the preceding schedule of contingent reinforcement. In particular, the response rate generated by the baseline schedule may play

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a significant role in determining the effects of non-contingent reinforcement.

The definition of the schedule variable in the present investigation was within the context of the temporal classification of reinforcement schedules originally described by Schoenfeld, Cumming, and Hearst (1956), and further delineated by Farmer (1963). In this extension of the original system, the two defining parameters of a given schedule are cycle length (T), a repeating time interval, and probability of reinforcement (p). Additionally, the restriction that only the first response in any T cycle be capable of being reinforced was employed. When an organism responds at least once in each T cycle, and p is reduced to some value less than unity but greater than zero, then the ratio of T/p specifies the mean interreinforcement interval. Since reinforcement is equally probable for any T cycle, schedules defined in this manner are designated random-interval schedules (Farmer, 1963).

When T is held constant at a value shorter than the minimal interresponse time, a fixed probability applied to every emitted response results in reinforcement being equally probable for every response. In this instance, a second class of schedules called random-ratio is defined (Brandauer, 1958).

In all of the research to date, non-contingent reinforcers have been delivered at frequencies approximately equal to those employed during baseline determinations with contingent reinforcement (Skinner, 1938; Herrnstein, 1966; Zeiler, 1968). Skinner (1948) noted that frequency is an important parameter in determining the effectiveness of a non-contingent reinforcement procedure, since "The sooner a second reinforcement appears . . . the more likely it is that the second reinforced response will be similar to the first, and also that they will both have one of a few standard forms" (p. 169).

The present experiment focused upon schedule of reinforcement and interreinforcement interval as the basic parameters determining the effectiveness with which non-contingent reinforcement maintains behavior.

METHOD

Subjects

Four experimentally naive White Carneaux hen pigeons, 6 to 8 yr old at the start of the experiment, were maintained and trained at 80% (±15 g) of their free-feeding weights.

Apparatus

The experimental station consisted of a Lehigh Valley Electronics pigeon chamber (Model 1519C) containing a key as an operandum. A force of at least 25 g (0.245 N) was required to close the key switch. The chamber received overall illumination from a houselight located directly above the key. The houselight was off during the delivery of a reinforcer which consisted of 2.5-sec access to a lighted hopper of mixed grain. The chamber was ventilated by a blower that also provided some masking noise. The stimuli correlated with the different schedules of reinforcement were produced either by (a) transillumination of the transparent key with white, green or red light projected through a uniform diffusing ("milk" plastic) medium by a 24-v Lehigh Valley Electronics stimulus projector (Model 1348QL), or (b) pulsing the key transillumination at a frequency of 5 Hz with green or red light. All experimental contingencies were arranged with digital logic circuitry.

Procedure

The experiment included three basic procedures: (1) baseline, (2) non-contingent reinforcement, and (3) baseline recovery. The baseline recovery stage was interpolated between each change to a new value of non-contingent reinforcement. Each stage of the procedure is discussed in detail below.

(1) *Baseline.* After the key-pecking response was shaped, the probability of reinforcement was reduced to 0.10 over 10 experimental sessions. The probability was held constant at 0.10, once this value had been reached. A schematic representation of a typical baseline session is shown in Fig. 1, which indicates the various schedules employed and the key stimulus with which each schedule was correlated. During all phases of training, each animal was exposed within a single session to T values of 0, 3, 6, 12, and 24 sec. The predicted mean interreinforcement interval (T/p) for each interval schedule is also shown in Fig. 1. At $T = 0$ no predicted mean interreinforcement interval is shown, since at this value the mean interreinforcement interval is a function of both the rate of responding and p. With a p

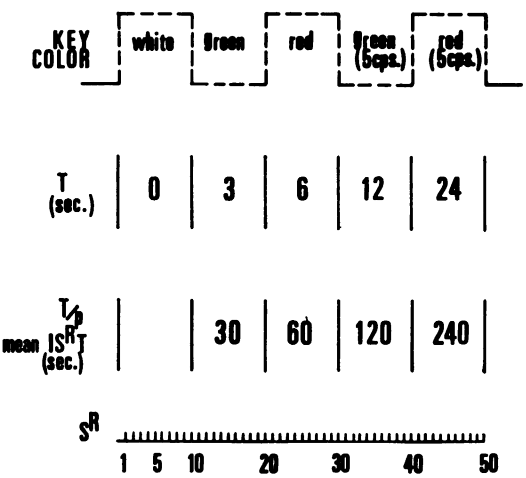

Fig. 1: Diagrammatic representation of a typical baseline session, indicating key stimuli, reinforcement schedule and reinforcer presentation. Variable durations of each reinforcement schedule are indicated by the discontinuous lines around each stimulus. Note that the stimulus durations varied over a large range, from 5 to 40 min under the random-interval schedules, and from 20 to 50 sec, depending upon the subject's rate, during random-ratio.

of 0.10, ten responses on the average are required for reinforcement. The order of presentation of schedules within a session was randomized, with the restriction that in every block of five sessions each schedule appear once in each ordinal position. Once in effect, a given schedule remained in force until 10 reinforcers had been delivered. A session was terminated following the tenth reinforcement obtained on the fifth schedule of the session. In this manner, a total of 50 reinforcements occurred in each experimental session. This procedure remained in effect for 75 sessions.

(2) *Non-contingent reinforcement.* The sequence of stimuli and the procedure for randomizing their presentation remained the same as in the baseline determinations, but reinforcers were delivered independent of responding. Non-contingent mean interreinforcement intervals of 30, 60, and 120 sec were employed. Additionally, two procedures for delivering the non-contingent reinforcers were used. Fixed non-contingent reinforcers were those that were delivered at a fixed time interval on T/p schedules composed of T values of 30, 60, and 120 sec and a p value of 1.00. These schedules correspond to fixed-interval schedules timed by the clock, except that no pre-specified response was required for reinforcement. In the case of the random non-contingent reinforcers, the mean interreinforcement interval was predetermined, but the sequence of intervals was free to vary. Random non-contingent reinforcers were delivered on T/p schedules composed of T values of 3, 6, and 12 sec, and a p value of 0.10. These schedules correspond to the random-interval schedules employed in the baseline procedure, except that no pre-specified response was required for reinforcement. Each subject was exposed to all non-contingent inter-reinforcement intervals in the following order: Subject 1—60 Random, 30 Fixed, 120 Random; Subject 2—60 Random, 120 Fixed, 30 Random; Subject 3—60 Fixed, 30 Random, 120 Fixed; Subject 4—60 Fixed, 120 Random, 30 Fixed. Each non-contingent reinforcement procedure remained in effect for 30 sessions.

(3) *Baseline recovery.* Following the thirtieth session of each non-contingent reinforcement procedure, the original baseline was reinstituted. These baseline recovery sessions remained in effect for the 30 sessions following exposure to a given non-contingent interreinforcement interval. In this manner, each change to a new value of non-contingent reinforcement was preceded by 30 sessions of exposure to the initial baseline.

RESULTS

The primary rate measure employed in the present investigation was computed by subtracting reinforcement duration and post-reinforcement pause from the time base on which the overall rate of responding was calculated. Running rate, rather than overall response rate, was used in order to demonstrate that the decline in rate under the non-contingent reinforcement procedures could not be explained solely by increases in the duration of the post-reinforcement pause.

To take into account differences in rate among the several baseline components, the data from the non-contingent reinforcement procedures are shown as percentages of baseline response rate. Throughout the entire experiment, the data obtained over the period spanning the first three reinforcements in every session were excluded from all calculations to allow for accommodation to the experimental chamber.

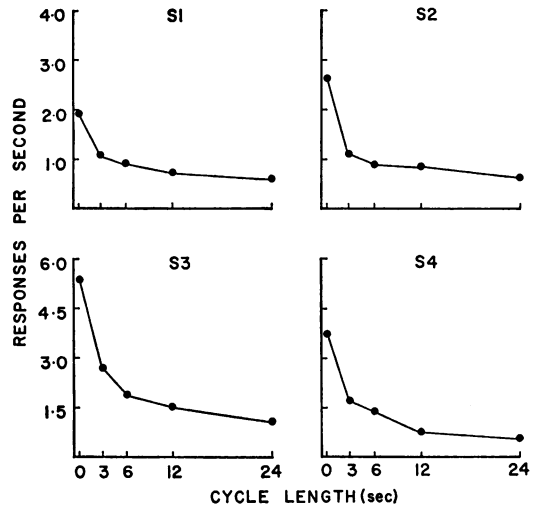

Fig. 2. Response rate as a function of cycle length for the baseline procedure for Subjects 1, 2, 3, and 4. The function was obtained by pooling the data over Sessions 71 to 75.

The values of T and p employed in the present investigation had previously been shown to produce a relatively wide range of response rates (Cole, 1968). This finding was confirmed by the data presented in Fig. 2. For all of the subjects, the rate of responding was a decreasing generally monotonic function of the length of T. The pooled response rates for the last five sessions of each baseline determination are shown in Table 1. For each of the four subjects, following every one of the non-contingent reinforcement procedures employed, the basic function was recovered. Although some variation in response rate was found from one determination to the next, no systematic deviation was noted. However, since differences in rate did occur, the data from the non-contingent reinforcement procedures are shown as percentages of the immediately preceding baseline rate of responding.

Figure 3 shows the response rate in each stimulus condition under the 60-sec non-contingent reinforcement procedure expressed as a percentage of the baseline response rate for each subject. The functions relating relative response rate to the number of sessions of exposure under the non-contingent reinforcement procedure were generally decreasing. This relationship was evident in the presence of all the stimuli previously correlated with the baseline schedules. Although not all the functions were monotonic, the trend appeared to be evident. As exposure to the 60-sec non-contingent reinforcement procedure was prolonged, the rate of responding decreased. For three of the four subjects, the first five sessions of exposure to the non-contingent procedure were sufficient to produce decreases below the baseline response rate of approximately 50%. The decline in rate during this period was typically gradual and orderly and resembled the functions shown in Fig. 3. This decrease in response rate was accompanied by increases in the durations of the post-reinforcement pauses (Table 2).

Table 1

Pooled response rate in responses per second for the last five sessions of the baseline procedure preceding the conditions shown.

	Cycle Length (sec)				
	0	*3*	*6*	*12*	*24*
S1					
60	1.99	1.10	0.94	0.65	0.52
30	2.78	0.87	0.70	0.69	0.55
120	2.54	0.79	0.84	0.55	0.45
End	2.24	0.85	0.92	0.66	0.51
S2					
60	2.62	1.11	0.90	0.89	0.63
120	3.87	1.02	0.94	0.60	0.43
30	3.51	0.93	0.81	0.60	0.55
End	3.19	1.12	0.80	0.61	0.48
S3					
60	5.58	2.70	2.03	1.58	1.12
30	5.23	2.25	1.86	1.31	1.16
120	5.03	2.18	1.59	1.20	0.94
End	5.17	2.10	1.49	1.17	0.88
S4					
60	3.75	1.81	1.43	0.76	0.60
120	2.85	1.43	1.12	0.62	0.44
30	2.67	1.41	1.16	0.69	0.55
End	3.33	1.72	1.31	0.85	0.56

For three of the four subjects, the relative response rates for the stimuli correlated with the $T = 3$, $T = 6$, and $T = 12$ baseline schedules were very similar. Differential effects at this parameter value were observed only for the $T = 0$ and $T = 24$ stimuli. The decline in rate from the baseline level was generally most rapid in the presence of the $T = 0$ stimulus. For the stimuli correlated with the random-interval baseline schedules, the response rate declined most rapidly in the 240-sec component.

No differentiation was noted between the behavior maintained by the random and fixed non-contingent procedures. In both cases, the

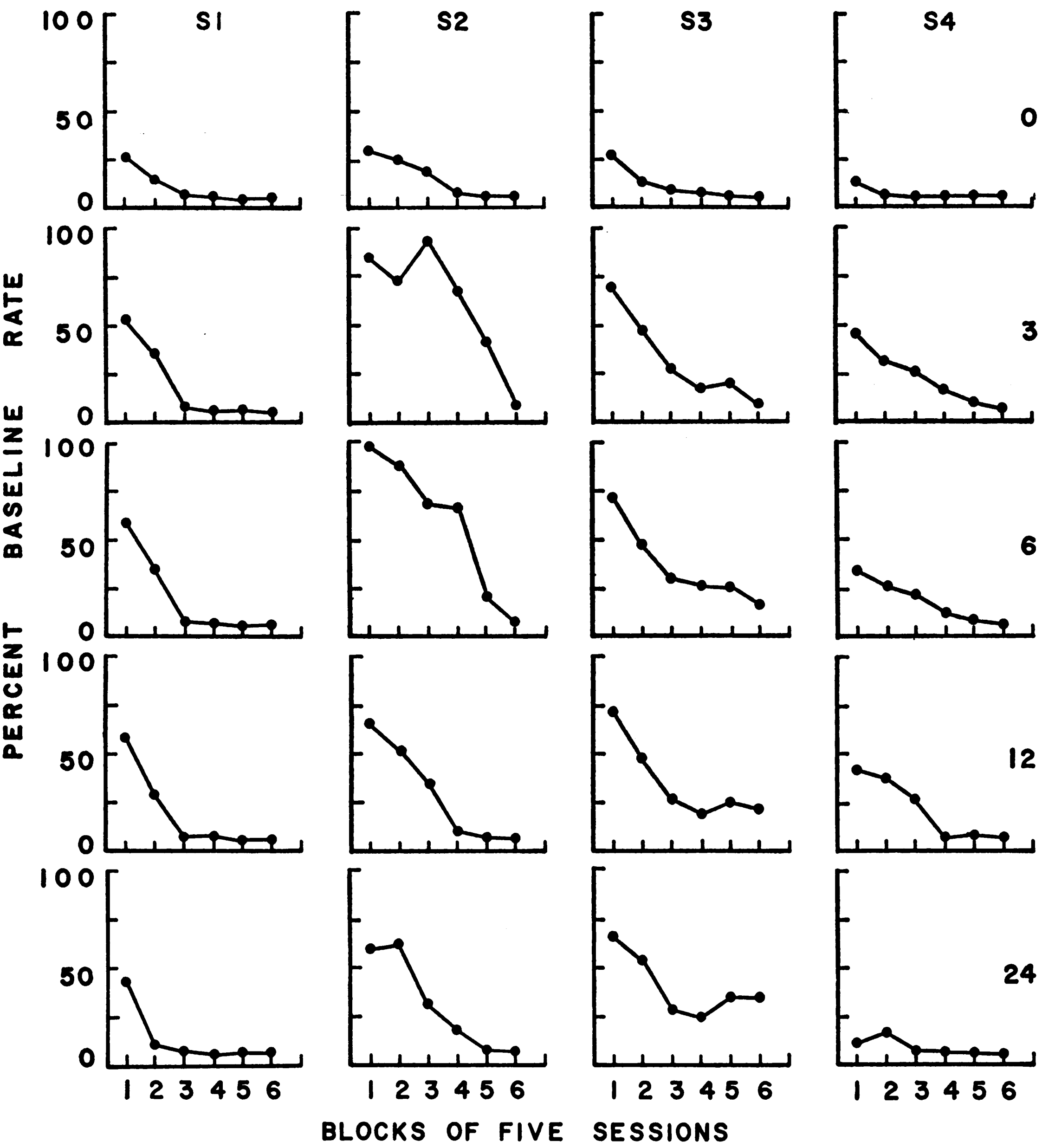

Fig. 3. Per cent baseline rate as a function of blocks of five sessions of exposure to the 60-sec non-contingent reinforcement procedure for Subjects 1, 2, 3, and 4. The numbers inset into each row indicate the cycle lengths with which each stimulus was correlated.

post-reinforcement pauses were elevated above the baseline level (Table 2), suggesting that responding, when maintained, occurred later in the interval between reinforcements.

As shown in Fig. 4, the institution of a 120-sec non-contingent reinforcement procedure resulted in a behavioral disruption that was qualitatively similar to that produced by the 60-sec non-contingent procedure. As exposure to the procedure lengthened, the rate of responding decreased in the presence of all the stimuli previously correlated with the baseline procedure.

For the random-interval schedules, the decline in rate was generally more rapid for the components that resulted in lower baseline

Table 2

Mean post-reinforcement pause in seconds for the conditions shown. The baseline data are mean pause durations for Sessions 71 to 75.

	Cycle Length (sec)				
	0	*3*	*6*	*12*	*24*
S1					
Base	1.1	1.3	1.5	2.3	5.0
60 (days 1-5)	1.7	1.7	4.0	6.3	11.9
60 (days 1-30)	6.2	2.3	11.9	13.7	26.7
30 (days 1-5)	2.5	3.4	5.6	10.0	11.0
30 (days 1-30)	7.0	7.0	9.5	14.3	15.4
120 (days 1-5)	5.8	1.9	16.9	16.1	28.7
120 (days 1-30)	45.9	18.9	27.1	60.6	82.5
S2					
Base	0.7	0.9	1.3	2.1	3.1
60 (days 1-5)	1.5	1.0	2.2	3.6	6.5
60 (days 1-30)	6.1	5.3	6.6	12.9	9.6
120 (days 1-5)	11.3	2.1	9.4	17.6	18.3
120 (days 1-30)	13.8	12.9	17.6	20.6	22.5
30 (days 1-5)	3.6	7.3	4.2	14.9	9.0
30 (days 1-30)	4.5	9.2	9.0	17.6	8.7
S3					
Base	0.7	0.9	1.0	1.5	2.0
60 (days 1-5)	1.5	1.0	2.6	3.6	6.3
60 (days 1-30)	7.9	3.9	6.7	8.4	11.2
30 (days 1-5)	2.6	1.4	2.6	5.5	10.4
30 (days 1-30)	8.2	4.4	9.7	11.6	17.4
120 (days 1-5)	2.1	1.4	1.9	5.1	17.0
120 (days 1-30)	11.8	6.5	12.2	13.4	27.5
S4					
Base	0.9	0.9	1.3	3.2	5.8
60 (days 1-5)	7.1	2.3	8.3	10.5	20.5
60 (days 1-30)	9.9	6.3	12.6	14.4	26.9
120 (days 1-5)	6.8	1.3	3.1	8.0	34.0
120 (days 1-30)	40.6	14.2	26.9	30.2	58.9
30 (days 1-5)	4.4	1.2	4.8	6.5	10.2
30 (days 1-30)	4.9	6.6	8.5	10.0	12.6

response rates. As was the case for the 60-sec non-contingent reinforcement procedure, the decline in rate from the baseline level for the random-ratio component was very rapid.

A comparison of Fig. 3 and 4 revealed that response rates were initially maintained at a higher value, and declined less rapidly for the 60-sec non-contingent reinforcement procedure than for the 120-sec non-contingent procedure.

As was the case with the 60-sec non-contingent reinforcement procedure, the post-reinforcement pauses were elevated above the baseline values (Table 2), but no evidence of a temporal discrimination was noted with either the random or fixed 120-sec non-contingent reinforcement procedures.

The results under the 30-sec non-contingent reinforcement procedure were generally similar to those shown for the 60- and 120-sec non-contingent procedures (Fig. 5). As exposure to this non-contingent reinforcement schedule continued, the rate of responding declined in the presence of all the stimuli previously correlated with the baseline procedure.

For Subjects 1 and 2, the decline in response rate during the 30-sec non-contingent reinforcement procedure was most gradual in the presence of the stimuli previously correlated with the 30- and 60-sec random-interval baseline schedules. For Subjects 3 and 4, differential schedule effects were observed only at the $T = 0$ and $T = 24$ values. At the other values, the declines in response rates were very similar.

The post-reinforcement pauses were again elevated above the baseline values (Table 2), but as was the case with the 60- and 120-sec non-contingent reinforcement procedures, no evidence of a temporal discrimination was noted with either the random or fixed procedures.

When the data from the four subjects were combined (Fig. 6) a clearer indication of the relationship emerged. The decline in response rate at all values of non-contingent reinforcement employed, was more rapid for the stimuli correlated with the baseline schedules that generated lower response rates.

DISCUSSION

It has been suggested that non-contingent reinforcement procedures maintain behavior as a result of (1) the accidental contiguity between responses and non-contingent reinforcers, (2) the slowness of extinction relative to conditioning, and (3) the notion that reinforcement requires only an approximate rather than an exact temporal contiguity in order to strengthen a response (Herrnstein, 1966). It may be more profitable, however, in light of the evidence that indicates a decline in maintained behavior as exposure to a non-contingent reinforcement procedure increases (Skinner, 1938; Herrnstein, 1966; Zeiler, 1968), to focus upon the factors that may contribute to this decline.

The decrease in rate of responding noted during all of the non-contingent reinforcement

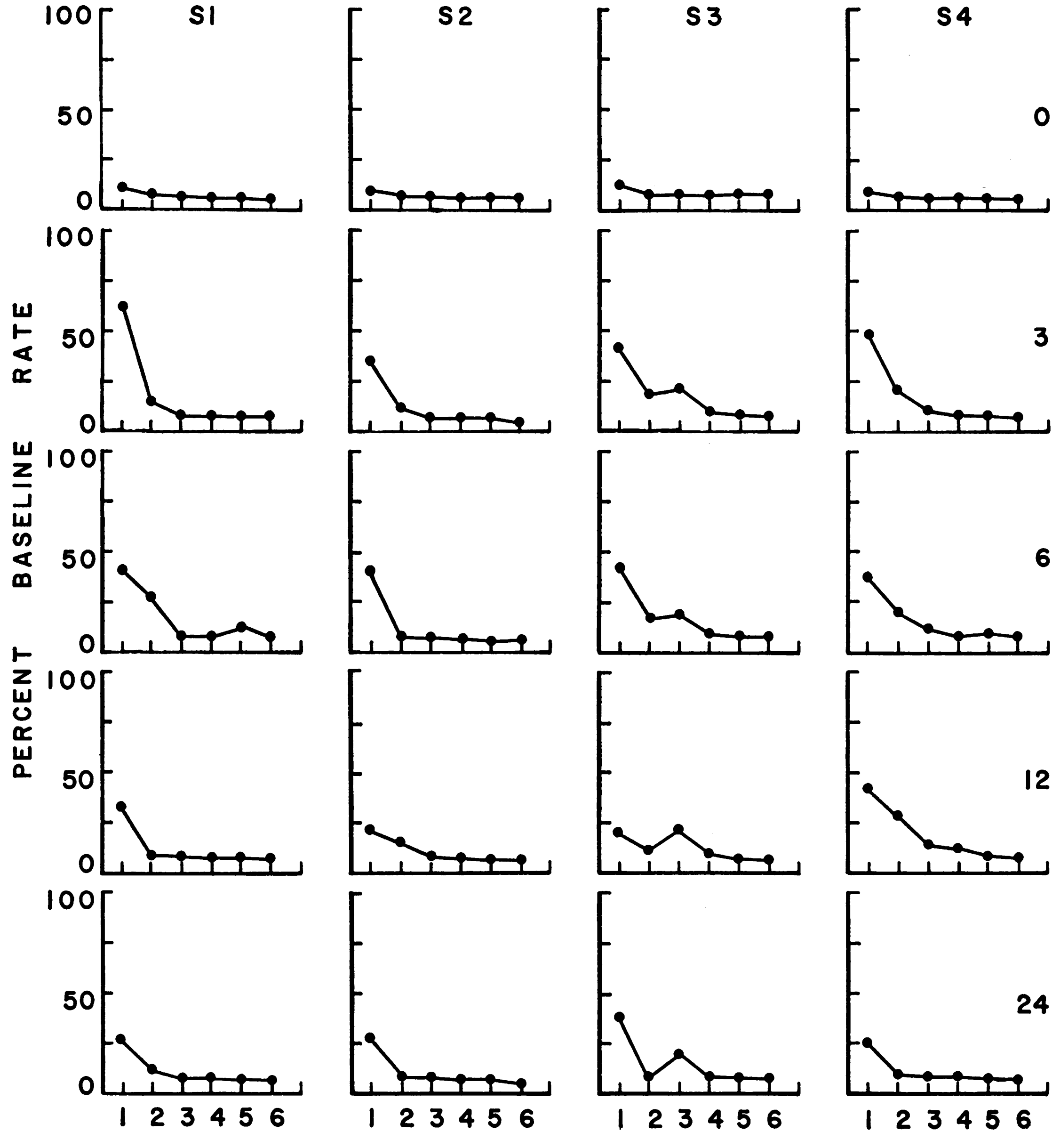

Fig. 4. Per cent baseline rate as a function of blocks of five sessions of exposure to the 120-sec non-contingent reinforcement procedure for Subjects 1, 2, 3, and 4. The numbers inset into each row indicate the cycle lengths with which each stimulus was correlated.

procedures employed in the present investigation may be attributed at least in part to the response-reinforcer variability that may be presumed to be inherent in the procedure. Since the delivery of a reinforcer is not dependent upon the emission of a specified response, the possibility exists that some other behavior will intervene between a response and a non-contingent reinforcer. As this intervening behavior becomes strengthened it will occur at a higher rate, accompanied by a decrease in the rate of key pecking.

The relationship between responses and reinforcements after the shift from contingent to

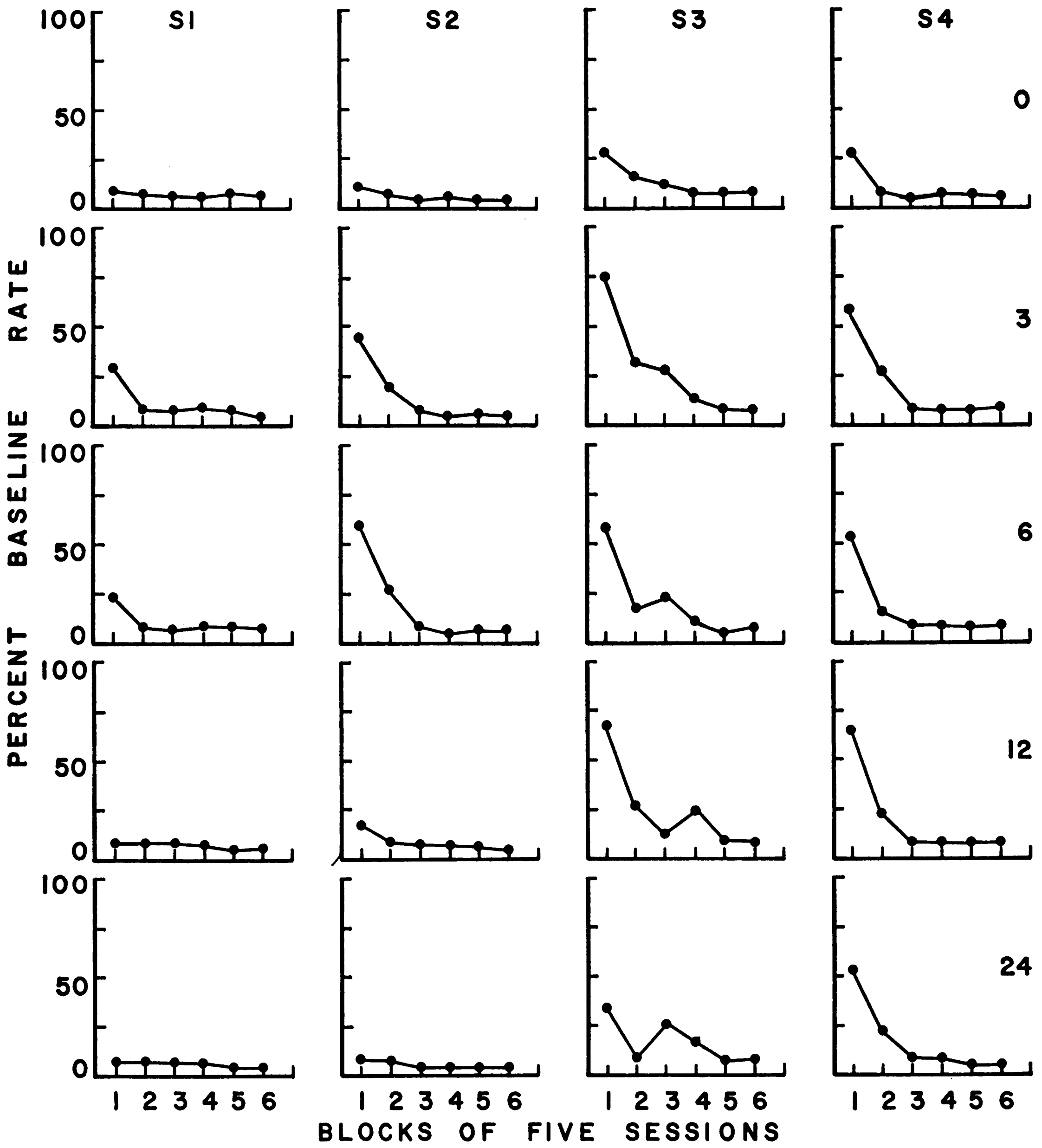

Fig. 5. Per cent baseline rate as a function of blocks of five sessions of exposure to the 30-sec non-contingent reinforcement procedure for Subjects 1, 2, 3, and 4. The numbers inset into each row indicate the cycle lengths with which each stimulus was correlated.

non-contingent reinforcement depends upon the prevailing response rate and the rate of non-contingent reinforcement. These will determine the rate of increase in the strength of behaviors that were previously ineligible for reinforcement, "not-responding" (Schoenfeld and Farmer, 1970).

This can be seen most clearly in Fig. 6. The decline in response rate, under each value of non-contingent reinforcement, was more rapid for those baseline schedules that generated lower baseline response rates. Presumably this was due to the fact that the more widely spaced the responses, the greater the probability that non-contingent reinforcers would follow some behavior other than a key-pecking response.

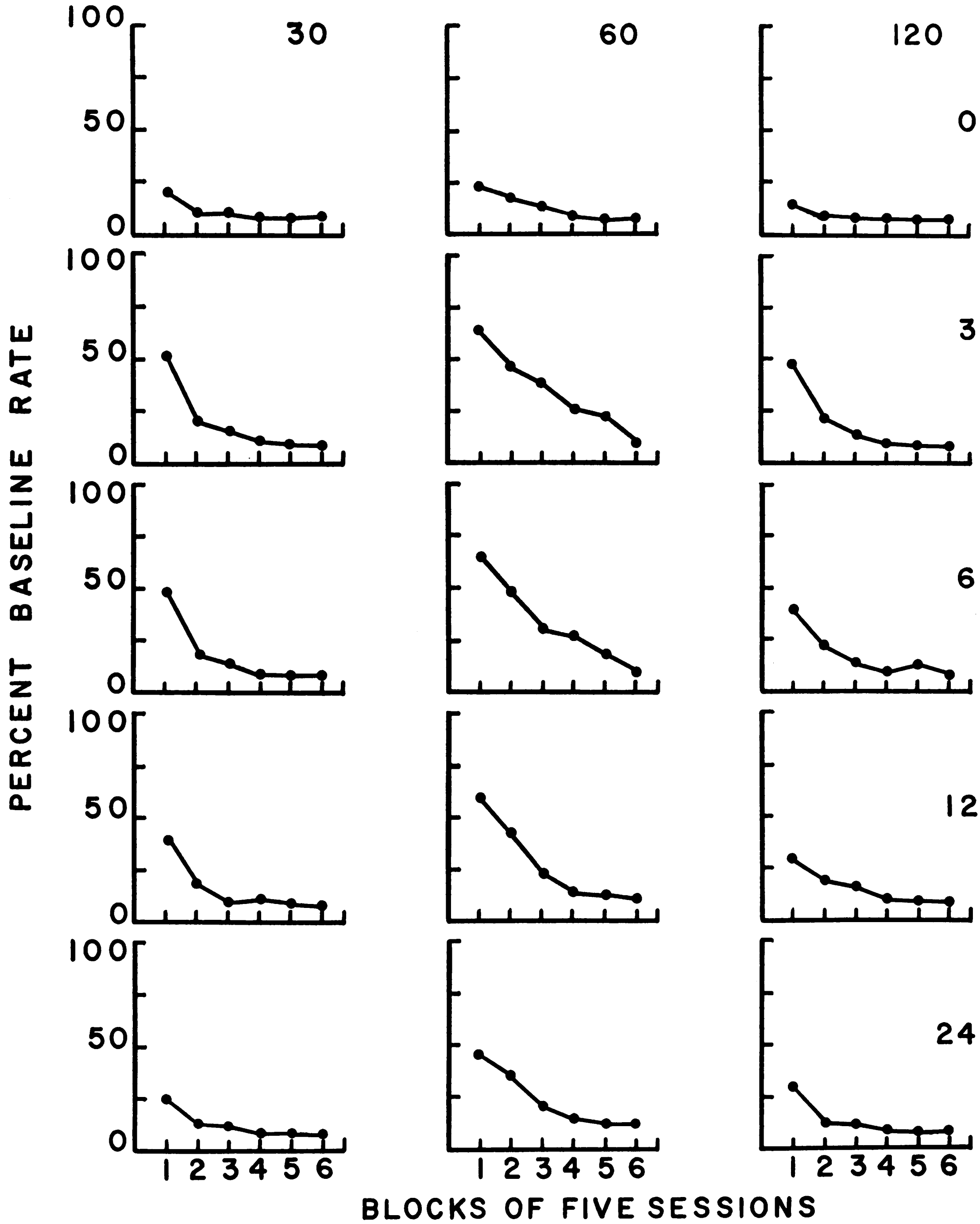

Fig. 6. Per cent baseline rate as a function of blocks of five sessions of exposure to the 30-, 60-, and 120-sec non-contingent reinforcement procedures. The numbers inset into each row indicate the cycle lengths with which each stimulus was correlated. The functions were obtained by averaging the data from all four subjects.

This would account for the more rapid decline in response rate for the $T = 24$ schedule at all non-contingent reinforcement values, since this schedule resulted in the lowest baseline response rates.

Conversely, a high density of non-contingent reinforcement, coupled with a high response rate, would result in a greater probability of contiguous occurrences of responses and reinforcers. This would account for the more gradual decline in rate at shorter T values, since the more closely spaced the responses, the lower the probability that non-contingent reinforcers would follow some behavior other than a key-pecking response.

The one possible exception to this general statement was for the $T = 0$ schedule. Based on the interpretation mentioned above, the behavior should have been maintained for the longest duration in the presence of the $T = 0$ stimulus, since this schedule resulted in the highest baseline response rates. The rapid decline in response rate in the presence of this stimulus at all the values of non-contingent reinforcement employed, can be attributed in part to the effects of extinction. It has been established, with contingent schedules of reinforcement, that marked reductions in reinforcement frequency can result in reductions in response rate due to the effects of extinction (Ferster and Skinner, 1957). It is reasonable to assume that a similar process was operating during the present investigation. At each value of non-contingent reinforcement there was a marked decrease in reinforcement frequency below the baseline value for the $T = 0$ stimulus. As the response rate declined, initially due to the reduction in reinforcement frequency, the probability that "not-responding" would be strengthened by non-contingent reinforcers was concomitantly increased. This would further contribute to the decline in response rate. The rapid decline in rate in the presence of the $T = 0$ stimulus can then be attributed to two factors: the strengthening of "not-responding" as previously discussed, coupled with the added effects of extinction.

In an attempt to establish procedural continuity, an analogy may be drawn between the present investigation and experiments employing delay of reinforcement procedures. In a contingent schedule of reinforcement, the interposition of a delay between responses and reinforcers results in a decline in the rate of responding (Ferster, 1953). Generally, this decline in rate has been attributed to the strengthening of intervening behavior, an explanation presented above in connection with non-contingent reinforcement procedures. This common explanation provides a rationale for relating the two groups of procedures. Additionally, a non-contingent reinforcement procedure may be conceptualized as a schedule in which a variable delay of reinforcement is in effect. In this case, the delay assumes the status of a dependent variable, since the number of intervening responses determines the actual size of the delay. This is to be contrasted with fixed delay of reinforcement procedures, which provide an invariant response-reinforcer interval.

Contingent and non-contingent reinforcement procedures set the boundaries of a continuum of response-reinforcer intervals. Within these boundaries may be located all of the procedures described above. Fixed delay of reinforcement procedures are located toward the contingent end of this continuum since they provide invariant response-reinforcer intervals. Variable delay of reinforcement procedures are located toward the non-contingent end of this continuum since the response-reinforcer intervals are allowed to vary. Viewed in this way, apparently diverse experimental manipulations may be incorporated within a unifying framework. The degree to which a given procedure maintains behavior depends upon the location of that procedure along the response-reinforcer interval continuum.

REFERENCES

Brandauer, C. M. *The effects of uniform probabilities upon the response rate of the pigeon.* Unpublished doctoral dissertation, Columbia University, 1958.

Cole, B. K. *Reinforcement schedule and probability of stimulus change as determinants of stimulus control.* Unpublished doctoral dissertation, Columbia University, 1968.

Farmer, J. Properties of behavior under random interval reinforcement schedules. *Journal of the Experimental Analysis of Behavior,* 1963, **6,** 607-616.

Ferster, C. B. Sustained behavior under delayed reinforcement. *Journal of Experimental Psychology,* 1953, **45,** 218-224.

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

Herrnstein, R. J. Superstition: a corollary of the principles of operant conditioning. In W. K. Honig

(Ed.), *Operant behavior: areas of research and application.* New York: Appleton-Century-Crofts, 1966. Pp. 33-51.

Keller, F. S. and Schoenfeld, W. N. *Principles of psychology.* New York: Appleton-Century-Crofts, 1950.

Schoenfeld, W. N., Cumming, W. W., and Hearst, E. On the classification of reinforcement schedules. *Proceedings of the National Academy of Sciences,* 1956, **42,** 563-570.

Schoenfeld, W. N. and Farmer, J. Reinforcement schedules and the behavior stream. In W. N. Schoenfeld (Ed.), *The theory of reinforcement schedules.* New York: Appleton-Century-Crofts, 1970. Pp. 215-245.

Skinner, B. F. *The behavior of organisms.* New York: Appleton-Century-Crofts, 1938.

Skinner, B. F. 'Superstition' in the pigeon. *Journal of Experimental Psychology,* 1948, **38,** 168-172.

Zeiler, M. D. Fixed and variable schedules of response independent reinforcement. *Journal of the Experimental Analysis of Behavior,* 1968, **11,** 405-414.

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