

CONCURRENT PERFORMANCES: A BASELINE FOR THE STUDY OF REINFORCEMENT MAGNITUDE¹

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When a pigeon's pecking on a single key was reinforced by a variable-interval (VI) schedule of reinforcement, the rate of pecking was insensitive to changes in the duration of reinforcement from 3 to 6 sec. When, however, the pigeon's pecking on each of two keys was concurrently reinforced by two independent VI schedules, one for each key, the rate of pecking was directly proportional to the duration of reinforcement.

A major problem in the investigation of the effect of duration or magnitude of reinforcement on performance is that, frequently, the effect is either small or transient. In a study by Jenkins and Clayton (1949), for example, the key-pecking of pigeons was reinforced on a variable-interval (VI) schedule of reinforcement, with a reinforcement duration of either 2 or 5 sec. Only a slight effect of duration, evident primarily on a statistical basis rather than in the data for each pigeon, was demonstrated. Another study, by Keesey and Kling (1961), also using VI reinforcement for the key-pecking of pigeons, demonstrated large differences in the rate of pecking with varying magnitudes of reinforcement, but only during the first few minutes of individual sessions or immediately following a change of procedure. The present experiment compares the effect of magnitude of reinforcement on the performance of pigeons in a single-key procedure with that in a two-key, or concurrent, procedure, and suggests the concurrent performance as an appropriate baseline for the study of the effects of magnitude of reinforcement on maintained performances.

METHOD

Subjects and Apparatus

Three adult, male, White Carneaux pigeons, maintained at about 80% of free-feed-

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ing body-weight, served in daily, 1-hr sessions in an experimental chamber similar to that described in a previous paper (Catania, 1962). Two translucent response-keys were mounted on one wall of the chamber and were illuminated from behind by yellow light. Centered below the keys was a standard pigeon feeder, which could make grain available for brief periods of time.

Procedure

Pecks on a given key were reinforced with grain 2 min, on the average, after a preceding reinforcement for a peck on that key, but the interval varied from one reinforcement to the next (VI 2-min). Reinforcement was programmed either on a single key or, by two independent VI schedules, on two keys (concurrent VI 2-min VI 2-min). When the single key was used, the other (that on the right) was covered with tape. The sequence of reinforcement durations with each procedure and the number of sessions for each are summarized in Table 1.

Table 1
Reinforcement durations (in seconds) in the single-key and in the concurrent procedures.

VI 2-min		Concurrent VI 2-min VI 2-min		
SINGLE KEY	Sessions	LEFT KEY	RIGHT KEY	Sessions
4.5	10	4.5	4.5	16
6.0	13	6.0	3.0	12
3.0	13	3.0	6.0	14
4.5	13	4.5	4.5	13

During the two-key procedure, a change-over delay (COD: Herrnstein, 1961) of 2 sec was in effect. Reinforcement could not occur

for 2 sec following each changeover from one key to the other. This delay separated in time a response on one key and reinforcement for a subsequent response on the other, and therefore prevented responding on one key from coming under the partial control of the reinforcement schedule for the other.

RESULTS

The open circles in Fig. 1 show, for each of the three pigeons, the rates of pecking on the single key. The rates are averages over the last three sessions with each duration. A change in duration from 3.0 to 6.0 sec had no systematic effect on the rate of key-pecking. Evidence that the change in duration did, however, change the magnitude of reinforcement (the amount of grain eaten) was that, for each pigeon, the gains in weight during each session were largest when reinforcement was 6 sec and smallest when reinforcement was 3 sec.

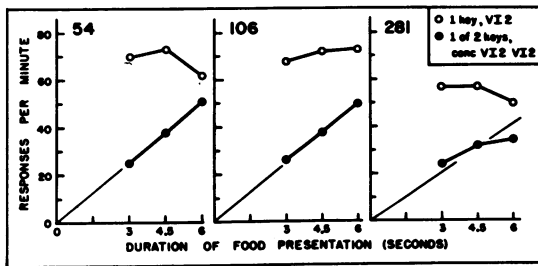


Fig. 1. The rate of responding, for three pigeons, maintained by three reinforcement durations. The open circles show responding on a single key; the closed show responding on one of two keys.

The closed circles in Fig. 1 show the rate of pecking on a key as a function of reinforcement duration in the concurrent procedure. For ease of presentation, the rate has been averaged across the two keys for each duration. With the concurrent procedure, response rate was linearly related to reinforcement duration. The exception, for Pigeon 281, may have been because this pigeon was performing, during

most of the sessions represented in the figure, with an injured wing.

DISCUSSION

The linear relationship between response rate and reinforcement duration is similar to that which holds between response rate and reinforcement rate (Herrnstein, 1961). For both reinforcement duration and reinforcement rate, the linear relationship depends in part upon interaction between the reinforcement schedules on the two keys. In the present data, this is reflected by the fact that the rate of pecking on one of two keys was consistently lower than the rate of pecking, maintained by the same schedule and reinforcement duration, on a single key. A quantitative account of these interactions has been suggested in a recent paper (Catania, 1963).

The present results point up the concurrent procedure as a useful tool, which permits the study of variables that are apparently without effect for the single key. Also, in showing that variables that seem irrelevant for the single key may have large effects when responding is reinforced concurrently on each of two keys, the results dictate careful control of experimental conditions for this procedure.

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