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A RESPONSE-INITIATED FIXED-INTERVAL SCHEDULE OF REINFORCEMENT[1]

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On a tandem fixed-ratio one fixed-interval schedule, the first response after reinforcement initiates a fixed interval of time and the first response after the interval has elapsed is reinforced. Pigeons trained with that schedule of food reinforcement paused after reinforcement for a period of time that approximated the fixed-interval duration for values of that duration ranging from 3.75 to 60 sec. Cumulative records revealed response patterns best described as break-and-run.

On a fixed-interval (FI) schedule of reinforcement, the first response emitted after an interval of time has elapsed is reinforced. Usually, the interval is initiated by the termination of the preceding reinforcement. Mechner, Guevrekian, and Mechner (1963) and Chung and Neuringer (1967) have described FI schedules in which the intervals were initiated by the first response after reinforcement. Because the exteroceptive stimulus conditions remained unchanged from one food reinforcement to the next, the procedure used by Chung and Neuringer (1967) may be designated as a tandem schedule (*tand* FR 1 FI) in which a single response (FR 1) initiated an FI component.

When a *tand* FR 1 FI schedule is arranged, the time interval between reinforcements will be minimal when the FI is initiated as quickly as possible after reinforcement. The pigeons used by Chung and Neuringer (1967), however, paused for a period of time after reinforcement before initiating the FI, even though pausing lowered reinforcement rates below the maximum possible. In fact, Chung and Neuringer (1967) found that post-reinforcement pause duration increased as the FI duration of the *tand* FR 1 FI schedule was increased from 1 to 15 sec. Perhaps the increase in reinforcement rate as a consequence of reducing post-reinforcement pause duration was not sufficient, with the fairly short FI values used by Chung and Neuringer (1967), to maintain short post-reinforcement pauses. The present study was implemented to extend the observations of Chung and Neuringer (1967) to FI values longer than 15 sec.

METHOD

Subjects

Two adult male Silver King pigeons, obtained from Palmetto Pigeon Plant, were maintained at approximately 80% of their free-feeding weight. Both had previous experience with fixed-interval and variable-interval schedules of food reinforcement.

Apparatus

The experimental chamber was enclosed in an ice chest. A ventilation fan provided masking noise. A translucent plastic response key was mounted 8.5 in. (216 mm) above the floor behind a 0.75-in. (19-mm) diameter hole through one wall of the chamber. When the key was transilluminated by a blue light, a force exceeding 20 g (0.18N) applied to the key broke an electrical contact that operated control and recording circuits and also produced a click by activating a relay mounted behind the front wall of the chamber. The key was disconnected from the control circuit when darkened. The reinforcing event was a 5-sec presentation of mixed grain, which was accessible through an opening below the key. When grain was available, the feeder opening was illuminated and the key darkened. The keylight and the feeder light were the only

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sources of illumination in the chamber. Power for the keylight was obtained from a transformer isolated from the main power supply.

Procedure

Because of their prior training, the birds did not require preliminary key training. The basic schedule used throughout the experiment was a *tand* FR 1 FI schedule. The first response after reinforcement (or the first response in a session) initiated the FI and the first response after the interval had elapsed produced food.

The FI of the *tand* FR 1 FI schedule was increased in an ascending series: 3.75, 7.5, 15, 30, and 60.0 sec. A second determination was made with the FI set at 30 sec.

Each session contained 61 reinforcements and terminated automatically at the end of the sixty-first. Data were not recorded until after the first food reinforcement had been obtained in a session. With a few exceptions, sessions were scheduled daily. From 12 to 30 sessions were allowed for performance to stabilize at each value.

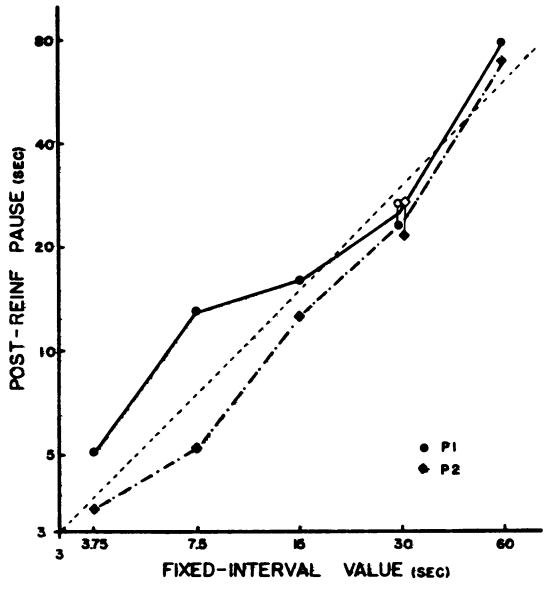

Fig. 1. Post-reinforcement pause plotted over FI value of the *tand* FR 1 FI schedule. Both axes are plotted in logarithmic units. Points represent median values based on the last five sessions devoted to condition. Closed symbols indicate medians from initial exposures to the schedules; open symbols indicate redetermined medians. The dashed diagonal line indicates the relation holding when post-reinforcement pause equals FI value.

RESULTS

Figure 1 shows that the median post-reinforcement pause for both birds lengthened as the FI was increased. In order to provide a reference for making comparisons, Fig. 1 also shows the matching line, or the relation that would have been obtained if post-reinforcement pause durations equalled FI values over the range studied. The obtained data do not appear to deviate systematically from the matching line, nor are the deviations large. Reinstatement of the *tand* FR 1 FI 30-sec schedule after exposure to the *tand* FR 1 FI 60-sec schedule produced post-reinforcement pauses that approximated values observed during the initial exposure to the 30-sec interval duration.

Figure 2 illustrates the patterns of responding generated by the *tand* FR 1 FI schedule by showing selected cumulative record segments from each of the *tand* FR 1 FI schedules for Subject P 1. The records confirm the positive relationship between post-reinforcement pause duration and FI value and further reveal a pattern of responding best described as break-and-run. Cumulative records for P 2 appeared essentially similar to those for P 1.

DISCUSSION

On *tand* FR 1 FI schedules, the time interval between consecutive food reinforcements will be shortest when the response that initiates the FI is emitted as soon as possible after reinforcement. That the birds did not develop this strategy for minimizing interreinforcement time was clearly demonstrated by the systematic relation between post-reinforcement pause and FI duration. On fixed-ratio schedules, the time between reinforcements will be minimal when responding is started as soon as possible after reinforcement and maintained at the highest possible rate until the next reinforcement. Nevertheless, pigeons on fixed-ratio schedules pause after reinforcement for a time that increases with the response requirement (Felton and Lyon, 1966; Powell, 1968). The similarities between fixed-ratio schedules and *tand* FR 1 FI schedules, with respect to post-reinforcement pause durations, may be more than superficial. The relatively constant response rate following the post-reinforcement pause on fixed-ratio schedules (Felton and

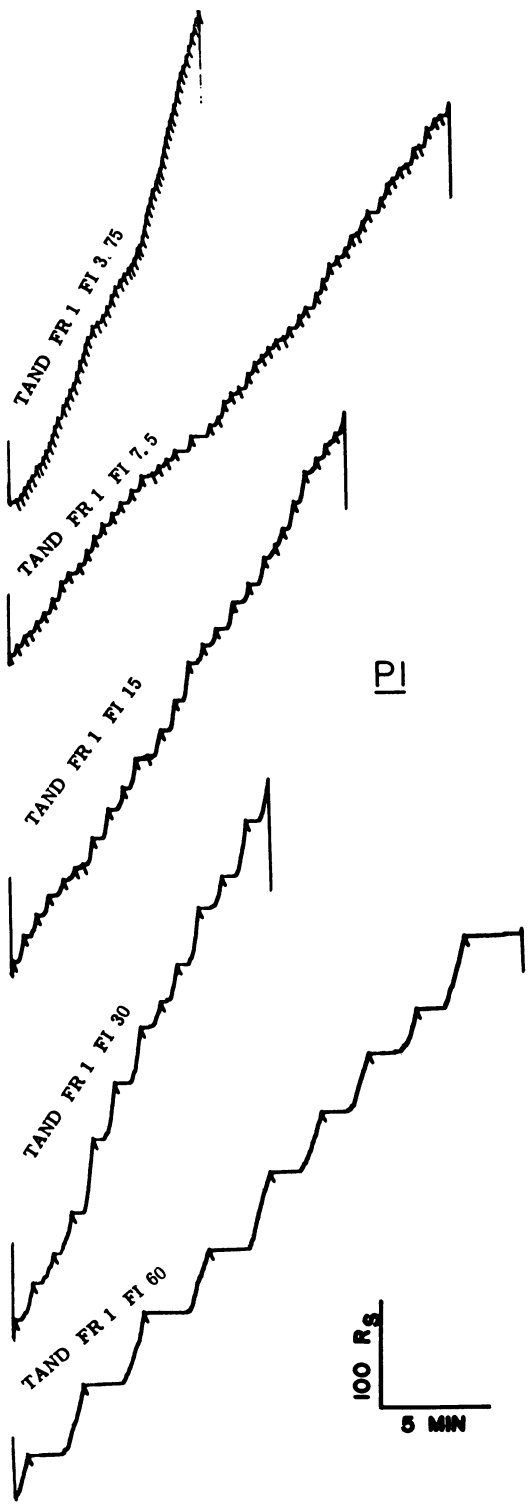

Fig. 2. Selected cumulative records from each value of the *tand* FR 1 FI schedule for P 1. Reinforcements are denoted by the slash marks.

Lyon, 1966) ensures that a relatively fixed time interval will intervene between the first response after reinforcement and the next reinforcement. Data obtained by Neuringer and Schneider (1968) and Killeen (1969) support the view that temporal factors control post-reinforcement pause durations on fixed-ratio schedules. Those writers implicated the inter-reinforcement time, but an interpretation based on the time interval separating the first response after reinforcement from the next reinforcement seems equally plausible.

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