Fixed-interval-induced aggression*

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Pigeons attacked live target birds during periods of fixed-interval food reinforcement. The attacks largely occurred between reinforcement and the first response which initiated the next fixed interval. The interreinforcement distribution of attack responses changed over successive sessions.

The presentation of unconditioned aversive stimuli has been shown to elicit aggressive attack in a number of species (Ulrich, Hutchinson, & Azrin, 1965; Ulrich, 1966). Reinforcement schedules have also been found capable of evoking aggression. The onset of extinction following a period of continuous reinforcement resulted in attack behavior in pigeons (Azrin, Hutchinson, & Hake, 1966) and rats (Thompson & Bloom, 1966). Fixed-ratio (FR) schedules produced aggressive attacks in squirrel monkeys (Hutchinson, Azrin, & Hunt, 1968), pigeons (Gentry, 1968; Flory, 1969), and rats (Gentry & Schaeffer, 1969).

With interval schedules of reinforcement, in contrast to ratio schedules, reinforcement frequency is relatively independent of the response rate and the probability of reinforcement changes with time. Thus, it becomes important to compare the two types of schedules in generating aggression. The present study sought to determine if an interval reinforcement schedule was capable of inducing aggressive fighting in pigeons. The reinforcement schedule selected for study was a response-initiated fixed-interval schedule (Mechner, Guevaekian, & Mechner, 1963). On such a schedule, the first response after reinforcement initiated the next fixed interval and the first response after the interval was reinforced. This schedule was chosen rather than a simple fixed interval for two reasons: (1) to prevent the superstitious reinforcement of prolonged aggressive attacks, and (2) to allow the separation of attack responses occurring during the postreinforcement pause from those occurring after initiation of fixed-interval responding.

SUBJECTS

Six experimentally naive male White Carneaux pigeons from 6 months to 1 year old were used. Three birds served as experimental Ss and were maintained at 80% free-feeding weight. The other three pigeons served as

targets and were maintained at free-feeding weight. Each target bird was paired with an experimental S for the entire experiment. All pigeons were housed in individual cages, with water and grit continuously available.

APPARATUS

The experimental space was a standard pigeon test chamber containing a single response key. During food delivery, the magazine was illuminated and the response key light was extinguished. Reinforcement consisted of a 3-sec access to grain. The chamber was illuminated by an overhead light.

The apparatus for recording aggressive attacks was similar to that described by Azrin et al (1966). The target pigeons were restrained in a Plexiglas box by metal bands fastened over each wing. The restraining box was mounted on a metal frame containing an adjustable spring and microswitch. A force of at least 100 g exerted against the front of this box by the experimental S resulted in a switch closure. Each switch closure was recorded as an attack response. The restraining box was located on the side of the chamber opposite the response key. Plexiglas shields on either side of the restraining box prevented the experimental S from getting behind the target.

The apparatus was located in a ventilated sound-attenuating enclosure. All programming and recording were performed by electromechanical equipment in an adjacent room.

PROCEDURE

The procedure was an ABAB design consisting of alternating conditions of no reinforcement (A) and FI 60-sec reinforcement (B). Each condition remained in effect for five 45-min sessions. Sessions were conducted daily.

During the first condition (no reinforcement), a baseline level of aggressive behavior was recorded prior to any history of food reinforcement. The experimental S and the target were placed in the chamber with the response key inoperative. After 5 sessions, the target was removed and the experimental pigeons were shaped to keypeck. After 3 sessions of continuous reinforcement, a

fixed-interval reinforcement schedule was instituted and the interval value was gradually increased over sessions to 60 sec. Stable responding at the terminal schedule value (FI 60 sec) required from 15 to 18 sessions. The targets were then introduced, and the second condition was initiated. Following 5 sessions of FI 60-sec reinforcement, the response key was taped over during the third condition of no reinforcement. Subsequently, the final condition of FI 60-sec reinforcement was reinstated.

RESULTS

Figure 1 shows the frequency of aggressive responses in all four conditions of the experiment for two of the experimental Ss. The performance of the third S was essentially the same. During the initial day of pairing (prior to any reinforcement history), there was a high rate of attack responses. Over subsequent sessions of no reinforcement, the frequency of attack responses decreased rapidly, and no aggressive responses occurred on the final day of the initial condition. A

Fig. 1. Frequency of aggressive attacks for two Ss during no-reinforcement and FI 60-sec reinforcement conditions.

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Fig. 2. Interreinforcement distribution of attack responses for three Ss. Striped bars show total attacks during first exposure to FI schedule, and white bars show replication (60-0, attacks between reinforcement and first response to initiate interval; 0-20, first third of interval; 20-40, second third of interval; 40-60, third third of interval).

marked increase in the frequency of attack responses was observed during the second condition on a FI 60-sec schedule. Following the return to the no-reinforcement condition, the aggressive responses gradually decreased to zero. Reinstatement of the FI 60-sec schedule in the final condition resulted in a similar increase in the rate of attack responses.

The attack responses occurred primarily after reinforcement, although aggressive responses were observed following the initiation of fixed-interval responding. Figure 2 shows the interreinforcement distribution of attack responses for the three Ss. The first interval (60-0 sec) included all attack responses that occurred between the delivery of reinforcement and the initiation of the fixed interval. The other three divisions represent three equal 20-sec segments of the fixed interval. Most

attack responses followed reinforcement presentation: 97% for SP25, 93% for SP30, and 78% for SP31. Within the fixed interval, the frequency of attack responses was highest early in the interval and decreased as the time for reinforcement approached. The interreinforcement distribution of attack responses for two of the Ss changed over successive sessions. During the second five sessions of FI 60-sec reinforcement, all attack responses of SP25 occurred between reinforcement presentation and the initiation of the fixed interval. The distribution of attack responses for SP30 shifted to the first segment of the fixed interval and to the postreinforcement pause.

DISCUSSION

The results indicate that aggressive behavior can be evoked by instating an interval schedule of food

reinforcement. The attack responses occurred primarily during the postreinforcement pause. Similar observations have also been reported during schedules of fixed-ratio reinforcement with monkeys (Hutchinson et al, 1968) and pigeons (Gentry, 1968).

Over sessions, the interreinforcement distribution of attack responses shifted toward the postreinforcement pause and the first segment of the fixed interval. Hutchinson et al (1968) reported a similar shift in the distribution of aggressive biting to the postreinforcement pause and early stages of the ratio run during fixed-ratio responding in squirrel monkeys. The low incidence of attack responses during the final segment (40-60 sec) of the fixed interval appears to preclude the maintenance of aggressive behavior by superstitious reinforcement.

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