

# Autoshaping pigeons' keypecking with a conditioned reinforcer\*

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Naive pigeons were autoshaped to keypeck for a tone which had previously been paired with food. Once the birds were pecking, they were switched to a multiple schedule in which they could keypeck on a FI 1-min schedule for the tone during one component, while the tone and food were paired in another component in which keypecking was punished (DRO 5 sec). Keypecking was maintained under these conditions.

The concept of secondary or conditioned reinforcement has had an important and little questioned place in the behavior theorist's analytical armamentarium, yet recent reviews of work on this subject (Wike, 1966; Siegel & Milby, 1969; Church, 1964; Bolles, 1967) have questioned the existence or extent of the empirical phenomenon referred to by secondary reinforcement. More specifically, conditioned reinforcement has been demonstrated, but often its effect has been considered weak, temporary, or subject to alternative explanation.

We are, therefore, reporting an experiment which again sought to demonstrate the occurrence of conditioned reinforcement with a new technique in the hope of making some progress toward the determination of the boundary conditions of conditioned reinforcement. We wished to determine, first, whether experimentally naive birds could learn to keypeck for the conditioned reinforcer instead of a primary reinforcer. Second, we wanted to see if such behavior could be maintained without primary reinforcement for keypecking by periodically repairing the conditioned reinforcer with an unconditioned reinforcer.

## METHOD

Two experimentally naive Silver King pigeons, about 6 years old, were deprived of food and maintained at 80% of their free-feeding weights. The experiment had four stages.

### Truly Random Control

After adaptation to, and magazine training in, a BRS-Foringer pigeon test chamber, the birds were given 5-sec exposures to each of the three stimuli: a red keylight, a 1000-Hz tone, and the

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full food magazine. (White masking noise of about 80 dB filled the experimental chamber except during the tone presentations.) Each of these stimuli, including the food magazine, was presented by an independent timer on a VI 1-min schedule during four daily 50-min sessions. This is a procedure devised by Rescorla (1967) as an appropriate control for classical conditioning experiments. The use of the procedure in this experiment was to control for sensory stimulation, while omitting the temporal contingencies between the stimuli.

### Conditioned Reinforcer Pairing

Following the truly random control phase, the Ss were given 5-sec presentations of the tone on a nonresponse contingent VI 1-min schedule (VT 1 min), followed by a 5-sec presentation of the food magazine. This schedule was used for 4 days, resulting in approximately 240 "free" tone-food pairings.

### Autoshaping and Conditioned Reinforcer Extinction

After the tone-food pairing of the conditioned reinforcer pairing stage, the Ss were presented our variant of the standard autoshaping sequence. Here the tone was substituted for the food of the Brown & Jenkins (1968) procedure. A green keylight changed to red 5 sec before the presentation of the 5-sec tone. This sequence was presented on a VT 1-min schedule. Keypecks during the green were recorded but had no programmed consequences, while pecks during red produced an immediate tone presentation. After the Ss began to keypeck, the keylight still turned red on a VT 1-min schedule, but the tone presentation was contingent on keypecking on a FI 5-sec schedule. This procedure remained in effect until the birds ceased pecking in the presence of the red light.

### Reshaping and Repairing

At this point, a three-component multiple schedule was instituted. Each component lasted 10 min, and the components were each presented five times daily in randomized sequences. In the response component, the keylight was red and keypecking on a FI 1-min schedule produced the 5-sec tone. (The FI performance was shaped by starting with a FI 5-sec schedule and raising it in 10-sec steps to FI 1 min.) The extinction component consisted of presenting a green keylight with no programmed consequences for keypecking. During the tone-food pairing component, the key was unilluminated and free food, preceded by the 5-sec tone, was dispensed on a VT 1-min schedule. In order to prevent adventitious reinforcement of keypecks during this component, any keypecks during the tone cancelled the scheduled magazine presentation (DRO 5 sec).

## RESULTS

During the tone-food pairing procedure of Stage 2, Bird 18 made three pecks and Bird 20 made zero pecks. Hence, it is unlikely that the keypeck response was strengthened by adventitious reinforcement. In the truly random control procedure, Bird 18 made seven, two, five, and zero responses, respectively, during the first 4 days. The other S did not keypeck.

In Fig. 1 the first portion of the graph, labeled

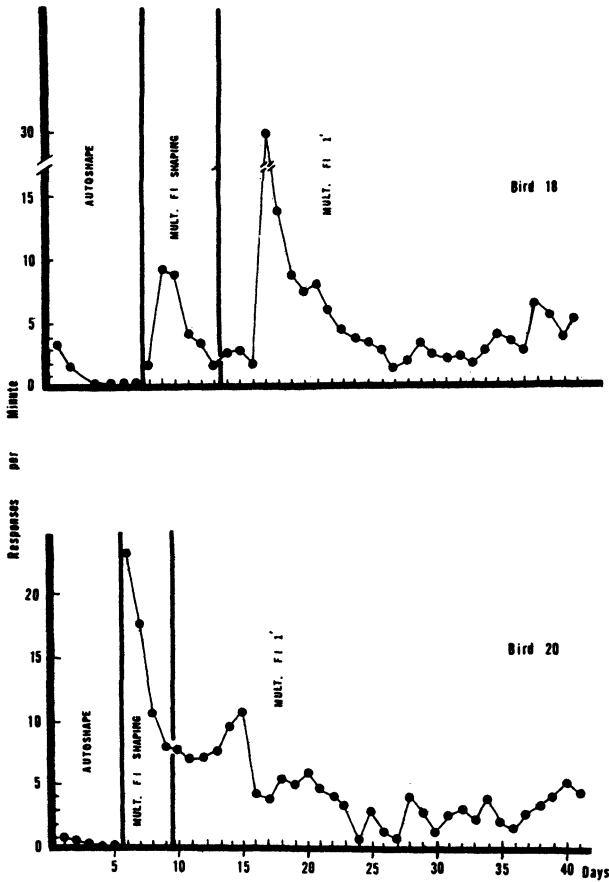


Fig. 1. Response rates of Birds 18 and 20 during the auto-shaping, FI shaping, and the FI 1-min schedule of the response component during the multiple schedule.

Autoshape, shows data from the autoshaping and conditioned reinforcer extinction stage following the tone-food pairings. Birds 18 and 20 both learned to keypeck during the first day of this period. Their keypecking rates, however, decreased rapidly to zero, reflecting the extinction of the conditioned reinforcer.

In the second portion of the figure, labeled Multiple FI Shaping, the data from the three-component multiple schedule (reshaping and repairing) are presented. During this period the fixed interval was being progressively increased. Note that this resulted in a decrease in response rate for both Birds 18 and 20.

In the final portion of the graph (to the right of the

second vertical line), responding was allowed to stabilize on the FI 1-min schedule as indicated. (The increase in rate for Bird 18 on Day 17 was due to an E error. On this day the schedule was accidentally lowered to FI 6 sec and the magazine light came on at the same time the tone was on.) The cumulative records from this portion of the experiment failed to show the typical FI scallop described by Ferster & Skinner (1957). The records for the response component could best be characterized as grainy with occasional long pauses. This failure to obtain scalloping when using a conditioned reinforcer has also been reported by Zimmerman & Hanford (1966), Thomas (1969), and Thomas & Johanson (1970).

It can be seen from Table 1 that very little responding occurred in the extinction and pairing components. Bird 20 was the only bird to show significant responding, and this was in the tone-food pairing component. However, adventitious food reinforcement of keypecking was prevented by the DRO contingency.

## DISCUSSION

The third stage of this experiment, in which the birds were autoshaped while the conditioned reinforcer was being extinguished, reproduces the results of many experiments in this area by showing conditioned reinforcement to be, at most, a weak variable. In contrast to this, during the multiple schedule of the repairing and reshaping stage, which contained interspersed tone-food pairings, the strength of the conditioned reinforcer was maintained, as evidenced by continued responding at rates similar to those found by other investigators (Zimmerman, 1969). This corroborates the "reconditioning hypothesis" proposed by Wike (1969).

The present technique may be an improvement over other methods of maintaining behavior with a conditioned reinforcer, since the Ss never respond for primary reinforcement. Other techniques which maintain behavior for long periods of time with conditioned reinforcers, such as the chain schedules used by Ferster & Skinner (1957), the concurrent free-food procedure of Zimmerman & Hanford (1966), the multiple schedule technique of Thomas & Johanson (1970), and higher order schedules (Kelleher, 1966), all necessitate the training of the Ss to respond for primary reinforcement and then switching them over to conditioned reinforcement. The result of using both conditioned and primary reinforcement is that the behavior maintained by the conditioned reinforcer may be affected by response induction, or possibly even by a contrast phenomena from the primary reinforced behavior. This technique prevents such effects and provides some additional evidence for the acquisition and long-term maintenance of discriminated behavior on the basis of conditioned reinforcement.

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Table 1

Average and Maximum Number of Responses Per Session in the Extinction and Pairing Components During the Multiple Schedule

	Extinction		Pairing	
	Average	Range	Average	Range
Bird 18	0.36	0-9	0.50	0-7
Bird 20	6.96	0-37	26.00	0-135

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