ACQUISITION OF THE AUTOSHAPED KEY PECK AS A FUNCTION OF AMOUNT OF PRELIMINARY MAGAZINE TRAINING¹

G. D. STEINHAUER, G. H. DAVOL, AND A. LEE

UNIVERSITY OF MONTANA

Three experiments evaluated the effect of magazine training on acquisition of the pigeon's key peck during autoshaping. In Experiment I, pigeons were exposed to two days of extended magazine training, followed on the third day by keylight-only presentations. All pigeons pecked the keylight early in the keylight-only session. Experiment II examined the relationship between the number of magazine-training trials and trials to the first peck. Pigeons were given either 0, 3, 10, or 25 magazine-training trials followed by the standard autoshaping procedure. The number of trials to the first peck was related to the number of magazine-training trials. In Experiment III, pigeons were exposed to the standard autoshaping procedure without prior magazine training. The data from Experiment III suggested that key pecking will occur only after the response of eating from the lighted hopper has occurred. Taken together, these results suggest that initial magazine training is an important variable in autoshaping. Key pecking is discussed as a generalized consummatory response.

Key words: autoshaping, magazine training, key peck, pigeons

Brown and Jenkins (1968) provided evidence that the response of pecking a key can be acquired when pigeons are exposed to presentations of a lighted key followed by a lighted grain hopper. In this autoshaping procedure, keylight and grain-hopper pairings were arranged to occur independent of the pigeon's behavior, yet all 36 pigeons began pecking the key. Hearst and Jenkins (1974), in a review of the autoshaping literature, concluded "... that contingent pairings of CS (*keylight*) and US (*grain*) are mainly responsible for bringing about the first key peck." (p. 2). Brown and Jenkins also studied pigeons in a number of control procedures designed to eliminate nonassociative factors from consideration in the analysis of autoshaping. In one such condition (trials-only), pigeons were placed in the apparatus and 8-sec presentation of the keylight occurred on a variable-time schedule (VT 60-sec). None of the birds in this condition pecked the lighted key. In a similar study, Hitzing and Safar (1970) gave 12 pigeons two 80-trial keylight-only sessions followed by two sessions of magazine training, and finally two more keylight-only sessions.

While no key pecks occurred during the initial keylight-only sessions, 10 of the 12 pigeons pecked the key during the keylight-only trials, which followed magazine training. Seven of these pigeons pecked the lighted key on its first presentation and an eighth pecked on the second trial. Hitzing and Safar concluded that pairings of the keylight and grain were not necessary for key-peck acquisition. Hearst and Jenkins noted that Hitzing and Safar "... did not experimentally assess the need for the initial sessions of CS only trials in bringing about their reported effects." (p. 48). They also noted that the Hitzing and Safar experiment was conducted in a nonstandard apparatus with lighting conditions that differed from those used in other autoshaping research. The first experiment reported below studied key pecking in the Hitzing and Safar procedure using a conventional apparatus, and without the initial keylight-only trials.

EXPERIMENT I

METHOD

Subjects

Four experimentally naive, adult Columba pigeons obtained from Mogul-Ed, Oshkosh, Wisconsin, were maintained at 80% of their

¹Reprints may be obtained from G. D. Steinhauer, Department of Psychology, University of Montana, Missoula, Montana 59801.

free-feeding weights throughout the experiment.

Apparatus

Subjects were studied in a standard, three-key, operant-conditioning chamber, manufactured by Lehigh Valley Electronics (Model #1519C). Only the center key was used. White noise in the experimental room and the ventilation fan in the experimental chamber served to mask extraneous sounds. The control and recording equipment were in an adjoining room.

Procedure

On Day 1, a pigeon was placed in the chamber with the hopper raised and filled to the brim. The hopper light was on and the houselight off. After the pigeon had eaten for 20 sec, the hopper was lowered and the houselight came on. Throughout this experiment, the hopper light came on when the grain hopper was raised and went off when the hopper was lowered. The houselight was off when the hopper was raised and on at all times when grain was not available. For the remainder of Session 1, the grain hopper was presented 19 times on a VT 30-sec schedule with a range of 5 to 55 sec in 5-sec increments. On the first four of these magazine-training trials, the hopper was in the raised position for 8 sec. The hopper was up for 4-sec on the final 15 presentations. On Day 2 of magazine training, 25, 4-sec presentations of the grain hopper occurred on the VT 30-sec schedule. On Day 3, 80, 8-sec keylight-only presentations occurred on a VT 60-sec schedule. This session was identical to the Brown and Jenkins trials-only condition. The houselight was on throughout this session. Pecks on the key during this phase terminated the keylight but were not followed by grain. Key pecks were recorded during all phases of the experiment.

RESULTS

On Days 1 and 2, all pigeons were observed eating from the hopper, but none pecked the key. On Day 3, the keylight-only session, all pigeons pecked the lighted key. The trial on which the first peck occurred was 1, 2, 4, and 6, for the four pigeons. Key pecking was not maintained, with nine such responses being the largest total of pecks made by a single pigeon during the 80-trial session. No pecks oc-

curred on the key when the keylight was off. The fact that all four pigeons pecked the lighted key early in the keylight-only session suggests that keylight and grain-hopper pairings may not be a necessary condition for engendering key pecks. It is also of interest that key pecking was not maintained during the keylight-only session. Hitzing and Safar's data suggested that pairings were not necessary for acquisition, but were required for key pecking to be maintained. These results demonstrate that the data obtained by Hitzing and Safar are not unique to their apparatus or lighting conditions.

EXPERIMENT II

There is another potentially important difference between these studies and the Brown and Jenkins keylight-only condition. In both the Hitzing and Safar study and Experiment I above, the pigeons were given 45 magazine-training trials before the keylight-only session. In the Brown and Jenkins study, all pigeons received 11 magazine-training trials before the experimental treatments were administered. This difference in amount of magazine training may account for the discrepant results in the keylight-only procedures. Experiment II was conducted to ascertain if a systematic relationship exists between amount of magazine training and trial of the first key peck in auto-shaping of the pigeon's key peck.

METHOD

Subjects and Apparatus

Sixteen experimentally naive pigeons were obtained from the same supplier and maintained in the same manner as those in Experiment I. The apparatus was the same used in Experiment I.

Procedure

Four groups of four pigeons were given different amounts of magazine training before autoshaping. The four levels of preliminary magazine training were zero magazine-training trials, three magazine-training trials, 10 magazine-training trials, and 25 magazine-training trials. The 16 pigeons were randomly assigned to the experimental conditions. Pigeons in the zero magazine-training condition were placed in the chamber with the autoshaping procedure in effect. Forward pairings of the keylight

and magazine operation (keylight offset immediately followed by grain-hopper onset) were scheduled on a VT 60-sec schedule with a range of 30 to 90 sec in 5-sec increments. When the keylight came on, it remained on for 8 sec. Offset of the keylight was immediately followed by a 4-sec operation of the grain hopper. The houselight was on during the inter-trial interval and during keylight presentations. Pecks on the lighted key turned off the keylight and resulted in the 4-sec operation of the grain hopper. This autoshaping procedure corresponds to that used by Brown and Jenkins (1968).

Pigeons in the three conditions receiving magazine training were placed in the chamber with the magazine raised and the hopper filled to the brim. During magazine training, the food hopper was operated by the experimenter using a remote-control switch. The experimenter observed the pigeon through a small lens in the chamber wall. When the pigeon had eaten from the filled magazine for 10 sec, it was lowered and the first magazine-training trial occurred 30 sec later. A magazine-training trial consisted of holding the hopper in the up position until the pigeon had eaten from it for 4 sec. These trials were separated by a fixed 30-sec interval. This procedure ensured that subjects ate from the hopper for the appropriate number of trials. The autoshaping procedure was placed in effect immediately following 3, 10, or 25 such trials. The dependent measure for this experiment was the trial on which the first key peck occurred. Pigeons were studied until they pecked the lighted key or for 100 autoshaping trials, whichever occurred first.

RESULTS

Table 1 shows the trial of the first peck for the four groups and the mean for each. For the four pigeons in the zero magazine-training condition, no pecks occurred within the 100-trial session. Pigeon 2 was studied for 26 additional trials (126 total) and did not peck the key. Subsequent attempts to magazine train two pigeons in this condition were unsuccessful. Pigeon #8 in the 25 magazine-trials condition ate from the hopper for the initial 10-sec period and on the four subsequent presentations of the hopper. Following the fifth presentation of the hopper, this pigeon did not approach the hopper for 2 hr, at which time the experimenters terminated the session. Sub-

Table 1

Trial on which the first key peck occurred for each of the pigeons in the four conditions of Experiment II.

<i>Condition</i>	<i>Subject</i>	<i>Trial of First Peck</i>	<i>Group Mean</i>
Zero magazine trials	2	100	100.00
	11	100	
	7	100	
	5	100	
Three magazine trials	1	32	16.75
	1M	17	
	12	6	
	6	12	
10 magazine trials	4	10	24.00
	2M	41	
	14	15	
	1E	30	
25 magazine trials	3	1	2.30
	9	2	
	10	4	
	8	—	

sequent attempts to magazine train this pigeon were unsuccessful.

A Kruskal-Wallis one way analysis of variance by ranks was conducted on the dependent measure, trial of the first peck, for the four groups. Results confirmed that amount of magazine training did affect the trial of the first peck in the autoshaping procedure: $H(3) = 11.65$, $p < 0.05$. In general, the greater the number of magazine-training trials, the fewer the number of autoshaping trials before the first key peck.

EXPERIMENT III

Taken together, the results of Experiment I and the zero magazine-training group of Experiment II suggest that pigeons must be eating from the lighted hopper in order for key pecking to occur in the autoshaping procedure. Three additional pigeons were studied in the zero magazine-trials condition to evaluate that possibility further.

METHOD

Subjects, Apparatus, and Procedure

Three experimentally naive pigeons, obtained and maintained as in Experiments I and II served. The apparatus and procedure were identical to those reported for the zero magazine-trials condition in Experiment II, with the following exceptions. These pigeons were studied during 100 autoshaping trials

per day until key pecking occurred. The experimenter observed the pigeons and recorded whether they were eating from the hopper.

RESULTS

Table 2 shows the trial on which the pigeons were first observed eating, the trial of the first key peck, and the minimum number of trials on which these pigeons were observed to be eating before the first key peck. All three pigeons were eating from the hopper regularly before the first key peck occurred. These data suggest that in the autoshaping procedure, pigeons must be eating from the lighted grain hopper before key pecking occurs.

GENERAL DISCUSSION

These experiments indicate that magazine training is an important variable in the acquisition of autoshaped key pecking by pigeons. Such training can occur within the standard autoshaping procedure, as it did in Experiment III. Existing accounts of autoshaping emphasize the role of the keylight and grain-hopper pairings in key-peck acquisition, rather than the role of grain-hopper presentations themselves. Future attempts to understand the autoshaping phenomenon must deal with the data obtained in Experiment I above, and by Hitzing and Safar (1970), which indicate that key pecking can be engendered by magazine training alone. Such training is an intrinsic part of the pairings procedure used in autoshaping.

Logan (1971) suggested that in autoshaping, pecks on the lighted key occur as generalized pecks at the lighted grain hopper. Since key pecking is now known to be engendered, but not maintained, by magazine training, generalization can account for only the initial key pecks in autoshaping. Hitzing and Safar reported that key pecking was maintained only when the keylight and grain-hopper pairings procedure was instituted. During this procedure, any pecks on the lighted key are followed by reinforcement (grain-hopper presentation) with a delay of 0 to 8 sec, depending on when the peck occurs during the keylight presentation. Although the autoshaping procedure is a response-independent procedure from the point of view of the experimenter, it contains the conditions that allow for the occurrence of a key peck as a generalized consummatory re-

Table 2

Trial on which the pigeons in Experiment III were first observed eating, trial on which the first key peck occurred, and the number of trials on which the three pigeons were observed eating before the first key peck.

Subject	Trial First Observed Eating	Trial of First Peck	Trials Eating
DS 21	75	109	34
DS 8	166	172	6
DS 20	36	44	8

sponse and the subsequent reinforcement of that response, either immediately or with a short delay. On this account, evidence for or against the operation of generalization from pecking the lighted hopper to pecking the lighted key would concern only initial pecks and not maintained responding. Bilbrey and Winokur (1973) for example, emphasized that maintained responding did not occur when the grain hopper and keylight were presented on random schedules. In their procedure, the grain hopper did not follow the keylight and if key pecks did occur, they were not followed by reinforcement. Accordingly, it would be expected that pigeons would emit generalized pecks on the lighted key but such responding would not be maintained. Most of Bilbrey and Winokur's pigeons pecked the lighted key, but key pecking was not maintained. A combined generalization and operant reinforcement account of autoshaping is consistent with the results obtained by Jenkins and Moore (1973), in which the topography of the key peck closely resembled a drinking response when water was the reinforcer, and the eating response when grain was the reinforcer. The fact that pigeons continue pecking during an omission procedure (Schwartz, 1972; Schwartz and Williams, 1972) might also be interpretable as a generalization effect. In that procedure, key pecking never ceased because the trials on which key pecks did not occur, and reinforcement was given, strengthened the stimulus control of pecking by the hopper light. As long as the hopper light and keylight are highly similar, key pecks will presumably occur as generalized pecks at the lighted grain hopper.

A generalization account of initial pecks in the autoshaping procedure explains the relationship between amount of magazine training and trial to the first peck reported in Experi-

ment II, due to the increased stimulus control by the hopper light that develops with increasing magazine training. But some data do not seem to be in agreement with this analysis. Engberg, Hansen, Welker, and Thomas (1972) reported that substantial amounts of magazine training (900 trials) retarded key-peck acquisition in autoshaping. Engberg *et al.* interpreted this finding as indicating "learned laziness", or acquisition of a response of inactivity in the presence of free food. Alternatively, incompatible responses may be established during the extended magazine training, thus retarding key-peck acquisition (Schwartz, Reisberg, and Vollmecke, 1974).

The finding that amount of magazine training affects acquisition of the auto-shaped key peck suggests a mechanism by which the response-independent keylight and grain-hopper pairings procedure leads to the response of key pecking. Additional studies manipulating the nature and amount of magazine training may contribute to our understanding of the autoshaping phenomenon.

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