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# Autoshaping to a dark key

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**The present study examined the failure to autoshape of the forward-pairing dark-key subjects in Brown and Jenkins' (1968) original demonstration of autoshaping. Twelve dark-key subjects and three light-key controls were given magazine training and autoshaping trials under a variety of conditions. All dark-key subjects came to peck at light offset as CS. The results are examined in connection with the generalization hypothesis of autoshaped keypecking.**

In the initial demonstration of autoshaping by Brown and Jenkins (1968), the only forward-pairing group that generally failed to peck at a stimulus predicting response-independent food presentation was the dark-key group. For these subjects, the response key was lighted during the intertrial interval and darkened during the 8-sec CS trial that preceded magazine tray operation. The authors suggested that a nonlighted key was less localizable, and, considering the poor contrast between a dark key and the background, found it "remarkable" that any subjects in this group pecked at all (two of six birds pecked at the dark key after 140 trials).

All of Brown and Jenkins' birds underwent the same magazine training procedure: The lighted food tray was elevated until subjects ate from it for 10 to 15 sec, after which it was lowered and darkened. Subsequent food presentations, both in magazine training (10 trials) and autoshaping, occurred with a lighted hopper during magazine operation and a dark hopper during nonfood periods. In this procedure, then, pecks to the lighted (elevated) food hopper were reinforced, while pecks to the unlighted (lowered) food hopper were not. As Logan (1971) and Steinhauer, Davol, & Lee (1976) have suggested, birds exposed to this type of procedure might be expected to peck at the lighted key as a generalized response of pecking the lighted grain hopper. If such a generalization effect was active in the emergence of initial autoshaped responses, the failure of Brown and Jenkins' dark-key subjects might be explained in terms of the negative generalization relationship between the predictive stimulus (keylight offset) and food presentation (lighted magazine).

The present study was undertaken to examine the failure of the dark-key group in Brown and Jenkins' original experiment and to test the hypothesis that first keypecks in an autoshaping procedure are generalized pecks to the food hopper.

Some of these results were presented at the 1978 meeting of the Rocky Mountain Psychological Association, Denver, Colorado.

## METHOD

### Subjects

Fifteen experimentally naive wild homing pigeons, maintained at approximately 80% of free-feeding weight, were divided into five groups of three subjects each.

### Apparatus

A three-key operant pigeon chamber was used, with only the center key functional (outside keys were covered). A houselight, located on the top of the front panel, remained lit throughout all experimental sessions. Experimental events were controlled by electromechanical equipment in an adjacent room, and white masking noise was present throughout all sessions.

### Procedure

**General.** Magazine training occurred with the houselight on. Subjects were allowed to eat from the elevated food hopper for 10 sec before the tray was first lowered. Subsequent magazine trials consisted of tray elevation for approximately 3 sec, with the intertrial interval (ITI) averaging 30 sec. Each subject experienced 20 magazine trials, although some subjects required additional trials before reliably approaching and eating from the food hopper during 3-sec food presentations. The keylight and hopper-light conditions during magazine training varied, as noted below.

Autoshaping began on the day following successful magazine training, with 50 8-sec CS presentations, each followed by a 3-sec response-independent food presentation. The ITI averaged 60 sec. Hopper and key illumination varied according to group (see below).

**Group 1.** Magazine and key illumination for Group 1 were arranged to create the complement of the standard autoshaping conditions. During magazine training, the keylight was on and the hopper was dark during food presentation and lighted during the ITI. On autoshaping trials the key was lighted during the ITI and became dark for the 8-sec CS, followed immediately by response-independent food. The hopper was darkened during the 3-sec food presentation and lighted during the ITI.

**Group 2.** Conditions for Group 2 were arranged to replicate the conditions for Brown and Jenkins' (1968) dark-key subjects, prior to first keypeck. (In the Brown and Jenkins procedure, a response-dependent contingency delivered food immediately after a keypeck.) During magazine training, the keylight was off. The magazine was illuminated during food presentation and darkened when lowered. During autoshaping, the key was lighted for the ITI and darkened for the 80sec CS interval. The hopper was lighted when elevated and darkened when lowered.

**Group 3.** In the Brown and Jenkins procedure (see Group 2), the response key was dark during magazine training. To control

for the possibility that magazine training in the presence of a dark key (that is, in the presence of the CS) retarded acquisition of autoshaped keypecking in the Brown and Jenkins dark-key group, Group 3 subjects experienced magazine training with the key constantly lighted. All other conditions in magazine training and autoshaping for Group 3 were identical to those for Group 2.

**Group 4.** Magazine training and autoshaping for Group 4 were characterized by a constantly illuminated food hopper. The key was dark during magazine training and the hopper was lighted, whether elevated for food presentation or lowered during the intertrial interval. During autoshaping, the key was lighted during the ITI and darkened for the 8-sec CS period preceding food.

**Group 5.** This was a standard light-key autoshaping group, included to compare speed of acquisition of the dark-key groups with subjects autoshaped to a more salient CS. The key was dark during magazine training; the hopper was lighted when elevated after the 8-sec CS and darkened during the ITI. The hopper was lighted during food delivery and dark at all other times.

## RESULTS AND DISCUSSION

Table 1 shows the results of all five groups in terms of trials to first peck, key state of first peck, and trials to acquisition, defined as five consecutive trials containing at least one keypeck (Newlin & Lolordo, 1976).

Contrary to the results of Brown and Jenkins (1968), all birds in the dark-key groups began pecking the predictive stimulus (dark key) within 103 trials, with most subjects pecking prior to Trial 50 (i.e., Session 1). Subjects eventually came under clear stimulus control by the dark key: When assessed on Trials 250-300, each bird pecked on at least 96% of the CS trials, while the percentage of total pecks on the key during the ITI for 14 birds was 6% or less, and 13% for Subject C-9. As keypecking was readily acquired with a dark but predictive CS, it is clear that localizability factors do not prevent the acquisition of autoshaped keypecking when the CS is a darkened key.

**Table 1**

| | | Subject | Trial of 1st CS Peck | Trials to Acquisition | Key State of 1st Peck |
|---|---|---|---|---|---|
| GROUP 1* | | | | | |
| Hopper | Dark (S+) | B-2 | 32 | 54 | Dark (CS) |
| | Light (S−) | B-5 | 25 | 25 | Dark (CS) |
| Key | Dark (CS) | B-10 | 10 | 54 | Dark (CS) |
| | Light (ITI) | Mean | 22 | 44 | |
| GROUP 2** | | | | | |
| Hopper | Light (S+) | A-4 | 46 | 283 | Dark† (CS) |
| | Dark (S−) | A-5 | 37 | 143 | Light (ITI) |
| Key | Dark (CS) | A-7 | 23 | 40 | Light (ITI) |
| | Light (ITI) | Mean | 35 | 155 | |
| GROUP 3* | | | | | |
| Hopper | Light (S+) | C-3 | 18 | 26 | Light (ITI) |
| | Dark (S−) | C-4 | 30 | 56 | Light (ITI) |
| Key | Dark (CS) | C-5 | 103 | 116 | Light (ITI) |
| | Light (ITI) | Mean | 50 | 66 | |
| GROUP 4** | | | | | |
| Hopper | Light (S+) | C-8 | 49 | 66 | Dark† (CS) |
| | Light (S−) | C-9 | 89 | 154 | Light (ITI) |
| Key | Dark (CS) | C-10 | 64 | 79 | Light (ITI) |
| | Light (ITI) | Mean | 67 | 100 | |
| GROUP 5** | | | | | |
| Hopper | Light (S+) | D-5 | 5 | 33 | Light (CS) |
| | Dark (S−) | D-10 | 16 | 23 | Light (CS) |
| Key | Light (CS) | D-20 | 32 | 32 | Light (CS) |
| | Dark (ITI) | Mean | 18 | 29 | |

**Key on during magazine training. **Key off during magazine training. †Did not follow trend to generalize.*

Groups 1 and 2 compared the effect of magazine training in the presence or absence of the CS. (In Group 1, the keylight was on during magazine training; in Group 2, the keylight was off). Since there was no significant difference between these groups in the number of trials to first peck (the main dependent variable in Brown and Jenkins' study), it is unlikely that the magazine training procedure of Brown and Jenkins (training in the presence of the CS) was responsible for the failure of their birds to acquire dark-key autoshaping. Group 2, magazine trained in the constant presence of the CS (dark key), did require more trials to reach acquisition criteria than did Group 1, although the difference did not reach significance.

Whether the food magazine was light or dark when elevated did not appear to affect speed of acquisition, nor did magazine training with a dark hopper significantly increase the number of magazine trials necessary for subjects to reliably approach and eat from the food hopper, as compared to subjects magazine trained with a lighted hopper. In terms of first-peck data, the only group that significantly differed from the others was Group 4 (hopper constantly lighted), in which first peck was retarded in comparison to Groups 1, 2, and 5 (Mann-Whitney $U = 0$, $p = .05$). No other intergroup comparisons were significant.

The key state of first peck was recorded for all birds. If a generalization effect was active in directing the first keypeck in autoshaping, it would be expected that the first peck would occur to the key state that matched the condition of the hopper during food presentation (S+). If, on the other hand, CS predictiveness was solely responsible for the emergence of keypecking, it would be expected that first pecks would occur to the CS. Thirteen of the 15 subjects did match first keypeck with the S+ hopper state, regardless of whether the matching key state was present during the CS or ITI. The subjects that did not follow this trend to generalize (A-4 and C-8) pecked first at the predictive CS rather than at the ITI key state, indicating (as noted by Brown and Jenkins) that the generalization process is not solely responsible for directing first keypeck. Further, the tendency to generalize first pecks had no retarding effect on subsequent autoshaping. Birds that first pecked during the ITI came under stimulus control by the CS as quickly as those first pecking to the CS. As such, the tendency to match first keypecks to the S+ hopper condition is a relatively weak and transient effect.

The present data do not support the generalization

account of autoshaped keypecking suggested by Davol, Steinhauer, and Lee (1977) and Steinhauer, Davol, and Lee (1976). In that account, the magazine light is assumed to acquire discriminative control over pecking during magazine training, resulting in generalized pecks to the illuminated key during autoshaping. Initial keypecks are assumed to be reinforced either by an explicit response-reinforcer contingency or indirectly by the independent delivery of food after a short delay. Sustained pecking could be the result of generalization, the response-reinforcer contingency, or both. While the present study found evidence for the development of weak discriminative control by the magazine light, that control was short-lived; initial light- or dark-key pecks were not maintained if they fell on the ITI stimulus, and subsequent pecking to the CS developed in spite of a generalization process that should favor either a failure to autoshape or continued pecking to the ITI.

It seems clear, then, that neither a generalization process nor localization factors were responsible for the failure of the Brown and Jenkins dark-key birds to autoshape to the offset of keylight. The discrepancies between these data and those of Brown and Jenkins (1968) and Davol et al. (1977) may be due to the differences in the strain of pigeon used or differences in the preexperimental histories (captive vs. wild) of the subjects. However, Oberdieck, Cheney, and Strong (1978) also failed to replicate Davol et al. (1977), and, as it turns out, the pigeons in those studies, as well as in the present, were all wild-caught homers. It seems the only reasonable explanation must be that the phenomena at issue (localizability, generalization) are fragile, transitory, and as likely as not to appear. The predictiveness account, on the other hand, seems more viable (Gamzu & Williams, 1973). In all our recent work (Oberdieck et al., 1978; Oberdieck, Mueller, & Cheney, 1977; Oberdieck & Cheney, Note 1), the birds always came quickly to peck the CS, regardless of CS, ITI, hopper, or houselight conditions.

## REFERENCE NOTE

1. Oberdieck, F., & Cheney, C. *Effects of context and stimulus parameters on autoshaping.* Paper presented at the annual meeting of the Psychonomic Society, Washington, D.C., 1977.

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