JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 1976, 26, 349-360 NUMBER 3 (NOVEMBER)

VARIABLES AFFECTING ESTABLISHMENT OF SCHEDULE-INDUCED ATTACK ON PICTORIAL TARGETS IN WHITE KING PIGEONS[1]

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White King pigeons exposed to food schedules before introduction of a colored photograph of a pigeon showed sustained schedule-induced attack on that image; additional birds given an early introduction to both the photograph and the schedule subsequently attacked the image at lower rates. Other pigeons attacked a second photograph of a pigeon regardless of whether it was introduced early or late. The late-introduction procedure was also effective in establishing attack on a projected image of a conspecific. The combined results showed that 14 of 17 White King pigeons given a late introduction to a pictorial target exhibited sustained attack against it and that a pigeon's initial reaction to a photograph of a conspecific when introduced early was a good predictor of subsequent schedule-induced attack on it.

Key words: photographic targets, rear-view-projected target, multiple schedules, fixed-time schedules, target introduction, schedule-induced attack, White King pigeons

Studies of schedule-induced attack in pigeons have been hindered by problems associated with the targets employed. Azrin, Hutchinson, and Hake (1966) found that all of their pigeons attacked a restrained, live conspecific, but only 25% (10 of 40) attacked a taxidermically stuffed pigeon. Although live targets have the advantage of supporting attack in virtually all birds, they were sometimes attacked so vigorously that the resultant damage (Azrin *et al.*, 1966; Cohen and Looney, 1973) and counterattack (Azrin *et al.*, 1966) raised humane as well as practical considerations (Webbe, DeWeese, and Malagodi, 1974). In general, attempts to resolve these problems by rotating targets across sessions (Richards and Rilling, 1972) or by using taxidermically stuffed pigeons (Azrin *et al.*, 1966) have not been entirely successful. Both target rotation and the use of stuffed targets allow for continuation of experimental sessions but do not preclude the possibility of damage to the target and the introduction of confounding variables in the form of uncontrolled target characteristics. This latter difficulty is illustrated in Azrin *et al.*'s study (1966), which found that some live target birds counterattacked so vigorously that the experimental subjects stopped attacking altogether. The same subjects resumed attacking when a less aggressive target was made available.

Alternative targets have been utilized to study schedule-induced attack. These include a mirror (Cohen and Looney, 1973; Dove, 1976; Moore, Tychsen, and Thompson, *in press*), a colored photograph or silhouette of a White Carneaux pigeon (Looney and Cohen, 1974), and a rear-projected image of a pigeon (Cohen, Yoburn, and Looney, 1976; Flory and Ellis, 1973; Rashotte, Katz, Griffin, and Wright, 1975). Two-dimensional pictorial targets eliminate most of the problems associated with the use of live and stuffed targets, but have the major disadvantage that many experimentally naive pigeons fail to attack them. To date, schedules that have been effective in establishing attack on live targets have been relatively ineffective in establishing attack on inanimate ones. The present experiments describe conditions under which experimentally naive pigeons exhibit schedule-induced attack on three colored images of a pigeon, Pictorial Targets A, B, and C (Figure 1).

[1]This research was supported in part by USPHS Grants RR07143 and R01 MH25514-01 to Northeastern University. We thank Daniel Callahan for assistance in conducting the research and M. A. Looney and Leila R. Cohen for their comments on the manuscript.

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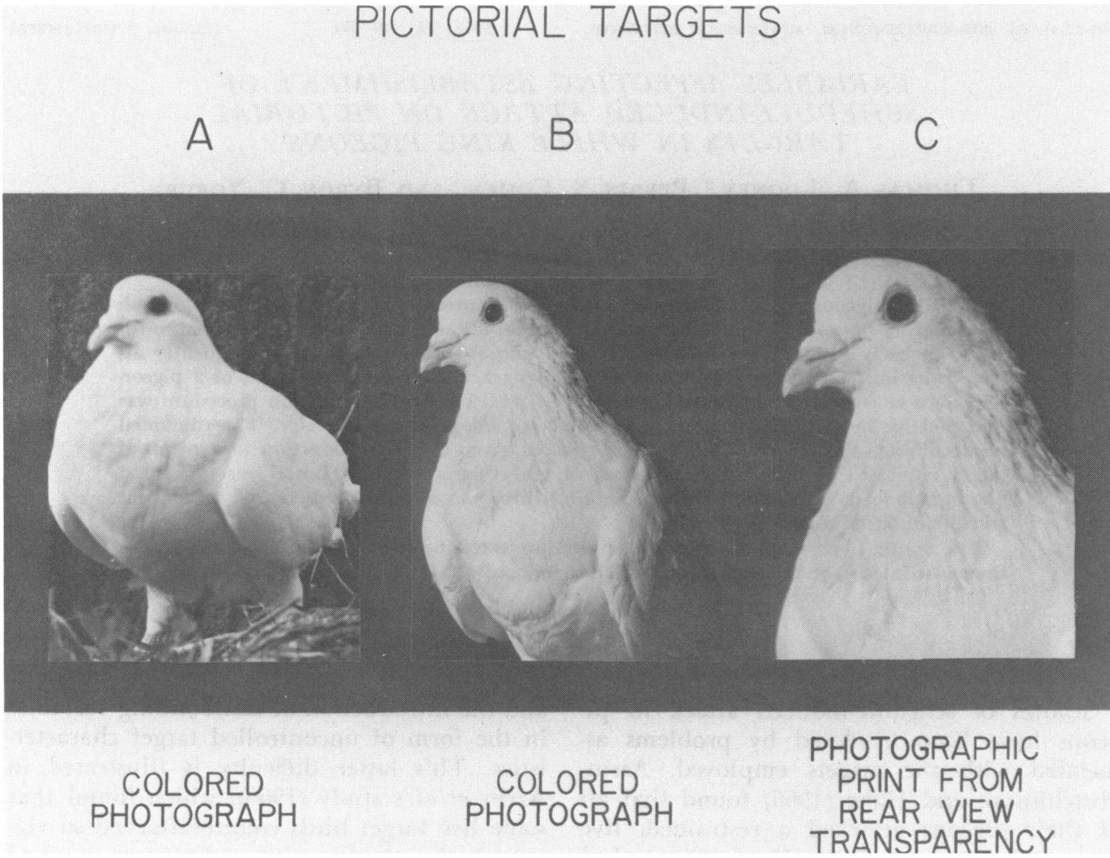

Fig. 1. Pictorial targets. Colored Photos A and B were used in Experiments I and II, respectively, and Photograph C was printed from the transparency used for rear-view projected Image C in Experiment II. Photo C is virtually identical to the image projected on the screen.

EXPERIMENT I: ESTABLISHMENT OF SCHEDULE-INDUCED ATTACK ON PICTORIAL TARGET A: EARLY *VERSUS* LATE INTRODUCTION

Two types of evidence suggested that the effectiveness of a pictorial target in a schedule-induced attack situation might be related to the time when that conspecific target is first made available to the pigeon. Looney and Cohen (1974) reported evidence suggesting that extended exposure to reinforcement schedules before introduction of a pictorial target increased the probability of attack on that target. Other studies of intraspecific aggression in different situations and in different species (*e.g.*, Galef, 1970; Scott, 1958) suggested that preexposure of a pigeon to a conspecific in a non-attack-inducing situation would attenuate subsequent aggression toward that target. Consistent with this, schedule-induced attack studies that have failed to find sustained attack against an inanimate target under schedule conditions that would normally support attack against a live target have typically exposed the bird to the target before introduction of the food schedule (*e.g.*, Flory and Ellis, 1973).

Experiment I evaluated how time of target introduction affects the establishment of schedule-induced attack against a pictorial target. Pigeons in a late-introduction group were initially given extended exposure to food schedules before introduction of Photo A. Additional pigeons in an early-introduction group were exposed to the same schedule conditions used for birds in the late group except that Photo A was presented in the initial as well as in all subsequent experimental sessions.

METHOD

Subjects

Twelve experimentally naive, 4- to 6-yr-old male White King pigeons from Palmetto Pigeon Plant (Sumter, S.C.) were maintained at

75% (± 15 g) of their free-feeding body weights (555 to 735 g). They were visually isolated from each other in individual home cages under 16 hr of light followed by 8 hr of darkness. Water and health grit were continuously available. Wing and tail feathers were kept short by periodic trimmings throughout the experiment.

Apparatus

Two black operant pigeon chambers (34.9 by 34.9 by 30.8 cm high) with black, three-key intelligence panels were employed. Only the center key (25.1 cm above the floor) in each chamber was used. When reinforcement schedules were in effect, the key was transilluminated with either a white or green light and had a minimum force requirement for operation of 0.2 N as measured by a Jonard dynamometer. The food hopper (BRS/LVE 114-10) could be made available through a 5.0 by 5.7 cm opening centered on the intelligence panel 9.5 cm above the floor. A photocell was mounted below the food tray opposite the hopper light.

An 11.8 by 14.3 cm picture (Photo A, Figure 1) was mounted on a recording frame comparable to the one used by Looney and Cohen (1974). The surface of the photo was covered with a seamless strip of Scotch Brand Magic Mending Transparent Tape specially ordered from the Minnesota Mining and Manufacturing Co., St. Paul, Minnesota 55101. A force of approximately 0.4 N against the target was defined as one target response. The frame was centered on the back wall 7.6 cm above the floor and opposite the food hopper during sessions in which the photo was presented. With this arrangement, the pigeon did not brush against the target while eating from the food hopper. During sessions without a target, the rear wall containing the frame and photo was removed and replaced by a smooth black wall. Chamber illumination was provided continuously throughout each session by six, 6.3-V ac, 1.6-W houselights mounted on the roof of the chamber behind a ground glass shield. A wide-angle peephole was mounted on the chamber door and a blower and white noise generator provided ventilation and masked extraneous sounds. Experimental conditions and recordings were scheduled by relays, counters, and timers in an adjacent room.

Procedure

Multiple (*mult*) *fixed-ratio, fixed-ratio* (*FR, FR*) *condition.* Six pigeons were divided into two equal subgroups (early introduction and late introduction) matched for body weight. The three subjects in the early group were placed in the chamber for seven sessions with Photo A present but with no food schedule in effect. The target was then removed for either one or two sessions during which birds were hopper trained, then exposed to an FR 1 schedule in which every key peck was followed by 3-sec access to food timed from the moment of hopper presentation. The target was reintroduced in the next session and remained throughout the experiment. The reinforcement schedule was changed to a *mult* FR, FR schedule that consisted of one food presentation contingent on x key pecks in the presence of a white keylight alternating with one food presentation contingent on y key pecks in the presence of the green keylight. The keylights changed when the hopper presentation ended. During the first 15 sessions under this condition, the reinforcement schedule was gradually changed from *mult* FR 1, FR 1 to *mult* FR 15, FR 15 followed by an additional 10 sessions on a *mult* FR 25, FR 25 schedule. With the FR schedule requirement held at FR 25 in the presence of the green keylight, the other FR schedule was raised to FR 50, FR 75, and then FR 100 in the presence of a white keylight for 5, 5, and 30 sessions, respectively. Throughout Experiment I, sessions terminated after 60 min or 60 food presentations and were conducted six days per week during 12-hr periods that began 1 hr after the light was turned on.

The three pigeons in the late-introduction group were presented with the same experimental conditions used for the early group except that the target was not placed in the chamber until the sixteenth session on the *mult* FR 25, FR 100 schedule. Birds in both groups that had median attack rates of 1.0 response per minute or more during the final five sessions with the target present were exposed to a series of 15 to 35 no-food (dark key) sessions, followed by reintroduction of the FR 25, FR 100 schedule for 15 to 20 sessions. For P3265 of the early-introduction group, the experiment was inadvertently terminated before the no-food condition was introduced.

Sessions in which no food was presented were terminated after 60 min.

Fixed-time (FT) condition. Six other pigeons were assigned to one of two subgroups (early introduction and late introduction) matched for body weight. The three birds in the early group received seven baseline sessions with Photo A present but no food schedule in effect. The photo was then removed for either one or two sessions while subjects were trained to eat from the food hopper. Subjects were then exposed to a series of FT schedules in which 7-sec access to food from the hopper, timed from interruption of the hopper photocell light, was presented every *x* sec. The values of the FT schedule were 5, 10, 15, 30, and 60 sec for five sessions each, followed by 40 sessions with FT 90-sec. Beginning with the 15-sec schedule, a protective contingency was arranged to delay scheduled food presentation until responding on the target had not occurred for 10 sec. Sessions began with a scheduled food presentation and terminated immediately after the sixteenth food presentation.

The three pigeons in the late group were presented with the same experimental conditions used for the early group except that Photo A was first introduced during Session 26 on the FT 90-sec schedule. Birds in both groups that had median attack rates of 1.0 response per minute or more during the final five sessions with the target present on the FT 90-sec schedule were exposed to 15 or 20 sessions with no food, followed by re-instatement of the FT 90-sec schedule for 15 to 25 sessions. One subject (P8851) was then exposed to an additional 25 sessions with no food, followed by 25 sessions with the FT 90-sec schedule and a second subject (P7358) was exposed to 15 additional sessions under the schedule and no-schedule conditions. Sessions in which no food was presented were terminated after 30 min.

Results and Discussion

The results obtained for all pigeons in the late and early groups are summarized in Figures 2 and 3, respectively. In those figures, overall attack rate (total target responses/total session time) is plotted as a function of successive sessions for individual birds. For pigeons in the late group (Figure 2), median attack rates during the final five sessions on the multiple and FT schedules ranged from 5.5 to 27.4 responses per minute. The topography and locus of those attacks were similar to those that Looney and Cohen (1974) reported in two of six naive White Carneaux pigeons that attacked the same photograph during exposure to fixed-interval (FI) reinforcement schedules. In both cases, informal observations indicated that pigeons charged and pecked the photograph, particularly in the area of the head and eye.

For all pigeons in the two late groups, the temporal pattern of attack on Photo A between food presentations was comparable to that observed on a mirror (Cohen and Looney, 1973, 1974), live (Cole and Litchfield, 1969; Cherek, Thompson, and Heistad, 1973), and stuffed (Flory, 1969, *a, b*) pigeon target in experimentally naive pigeons. Under the FT 90-sec schedule, attacks occurred after virtually every food withdrawal, and the probability of attack decreased as a function of time since food removal. Most attacks under the *mult* FR, FR schedules occurred immediately following each presentation of the green keylight correlated with the higher FR schedule. Comparable temporal patterns of schedule-induced attack on mirror (Cohen and Looney, 1973) and pictorial images (Looney and Cohen, 1974) also occur in pigeons that have a history of schedule-induced attack on a live pigeon.

For four of the six birds in the late-introduction groups (Figure 2), removal and re-instatement of the food schedule was accompanied by a corresponding decrease and then increase in attack rates. For P8851, attack rate decreased across sessions under the no-schedule condition, but there was overlap in terminal rates during the initial food and no-food conditions. More pronounced schedule control of attack occurred when the food schedule was removed and re-instated the second time. The finding that differential rates of attack are accentuated with successive alternations in schedule conditions is comparable to that found with successive alternations in target conditions (Looney and Cohen, 1974). For the entire 35 sessions in which the *mult* FR, FR schedule was removed, P4188 continued to attack the photograph at rates comparable to those that occurred with the schedule in effect. Perhaps additional alternations of schedule and no-schedule conditions for this bird also would have resulted in schedule control of attack.

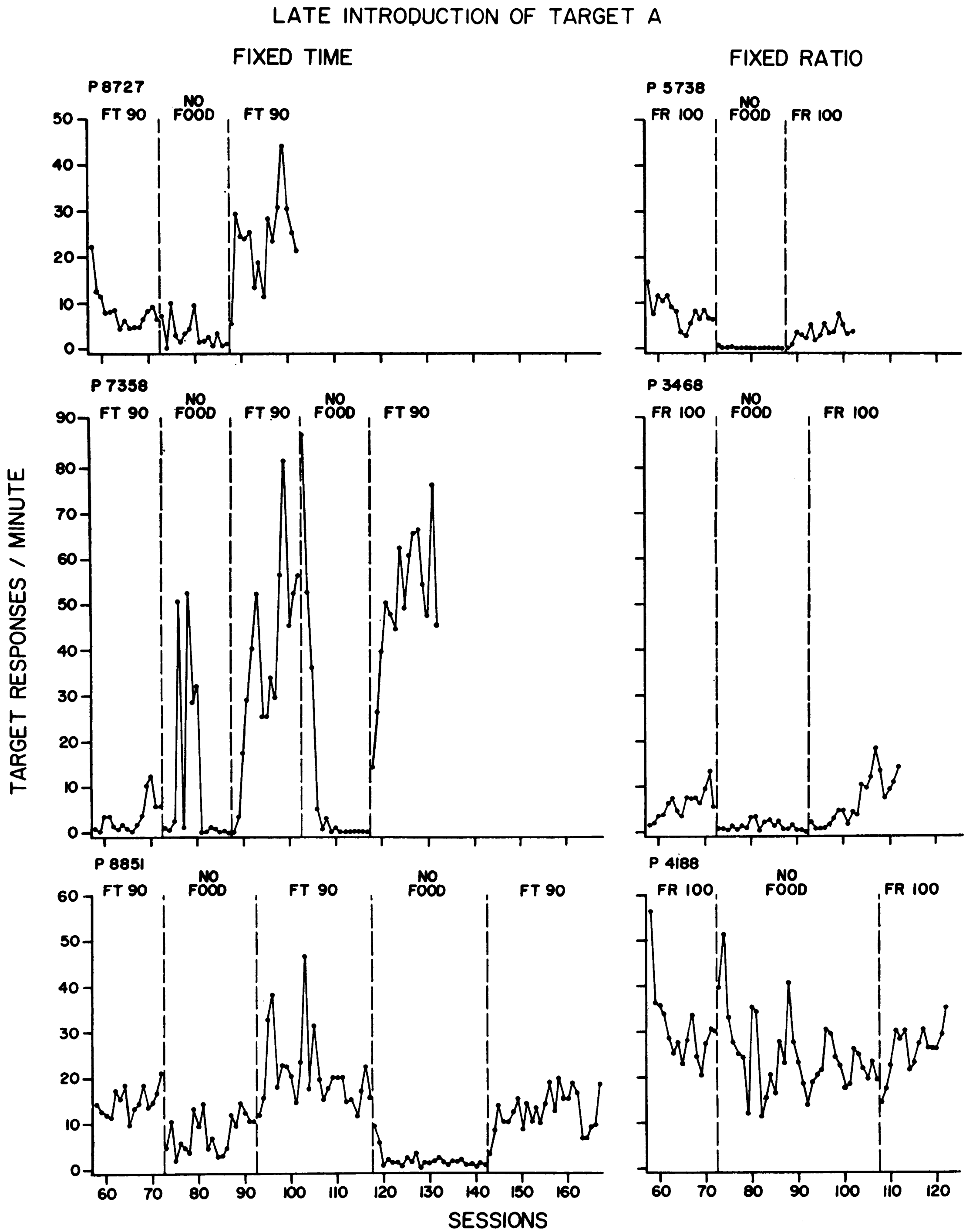

Fig. 2. Overall rate of responding (total responses per minute) on Photo-Target A as a function of successive sessions for pigeons given a late introduction to that target. Data on the left side of figure are for pigeons exposed to FT schedules and data on the right side are for birds exposed to *mult* FR 25, FR *x* schedules. In this case, the FR schedule in the varied component was FR 100. The dashed vertical lines correspond to changes in schedule conditions.

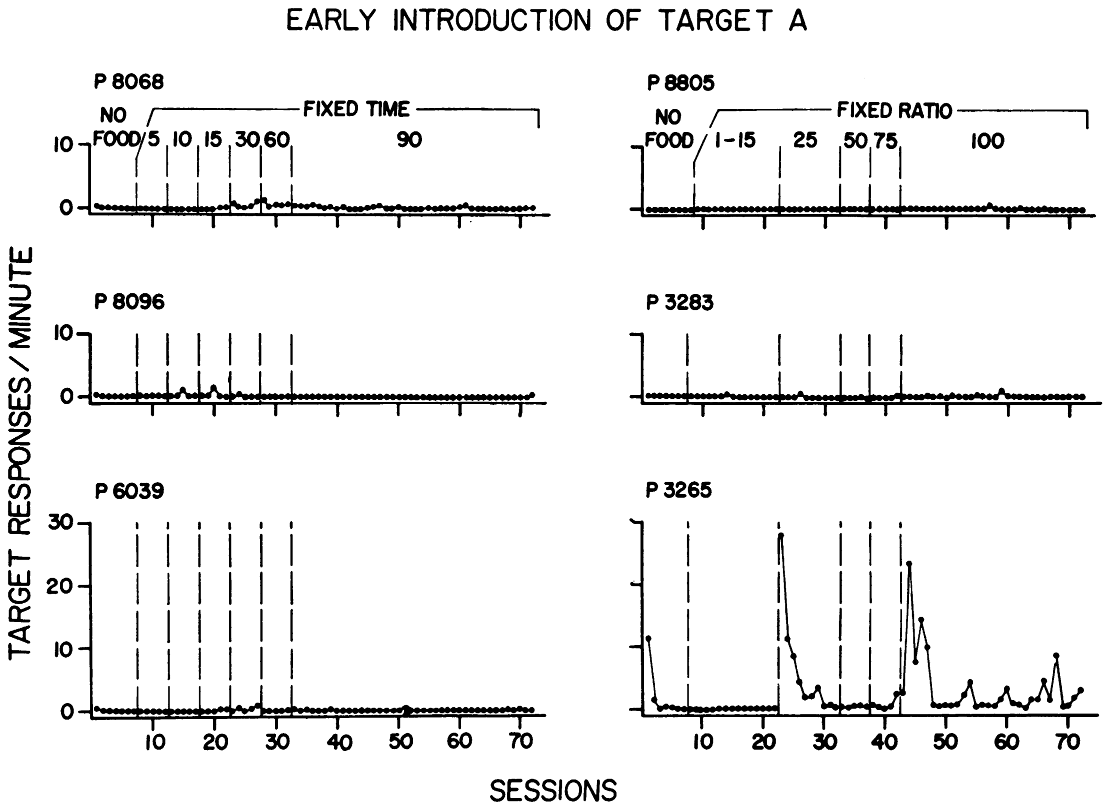

Fig. 3. Overall rate of responding (total responses per minute) on Photo-Target A as a function of successive sessions for pigeons given an early introduction to that target. Data on left side of figure are for pigeons exposed to FT schedules and data on the right side are for birds exposed to *mult* FR 25, FR *x* schedules. The FR value corresponds to that in the varied component of the *mult* FR FR schedule.

Although it is unclear why some pigeons continued to attack the pictorial target after the schedule was removed, persistent intraspecific aggression by food-deprived pigeons in the absence of a food schedule has been reported in other nonreproductive situations. Using a live conspecific target, Gerry (1975) demonstrated that without a food schedule in effect, the opportunity to attack can function as a reinforcer for food-deprived pigeons. Thus, the persistent attack in the absence of a food schedule in the present experiment is probably not related to the use of a pictorial target.

Whereas all six pigeons in the late group developed sustained rates of attack on Photo A, this was not the case for pigeons given an early introduction to that pictorial target (Figure 3). Only one (P3265) of the six pigeons in the early group showed attack rates comparable to those observed for pigeons in the late group, and for this bird, attack rates were lower across sessions than those observed for pigeons in the late group. Pigeon 3265 differed from the other five pigeons in the early group in a second respect. During the initial session in which it was exposed to the photo without a reinforcement schedule in effect, it had 665 target responses, whereas under identical conditions the remaining five pigeons in that group had a maximum of eight target responses. Thus, for pigeons in the early group, the initial reaction to Photo A was a good predictor of subsequent schedule-induced attack on that target.

Although the six pigeons in the two early groups had very few target responses, informal observation of those birds indicated that the few that did occur were directed toward the head of the photograph and were topographically similar to those that occurred in pigeons in the late groups. In short, rate but not locus or topography of attack differed between pigeons in the early- and late-introduction groups.

The finding that experience with a target can influence subsequent attack on it has been reported for other types of aggression. On the basis of his experiments on fighting in mice, Scott (1958) concluded that placing two animals together in a nonattack-inducing situation can inhibit subsequent aggression between those animals in other situations. Similarly, Galef (1970) found in a study of shock-associated aggression in feral rats that a novel target was readily attacked, while a familiar one was not. Paul, Miley, and Mazzagatti (1973) studying mouse- and pup-killing in rats made similar observations but noted the specificity of the effect to the type of target used during the early experience. This latter finding raises a question, in the present context, of whether pigeons in the early-introduction group that had low or zero rates of attack on Photo A also would exhibit comparable low attack rates on other types of pigeon targets, such as a silhouette, mirror, rear-view projected image, stuffed, or live pigeon. The data from Experiment I thus add generality to the results of these previous studies by demonstrating that with pigeons, prior experience or, conversely, lack of experience with a colored photograph can influence subsequent aggression toward it in the schedule-induced attack situation.

EXPERIMENT II: ESTABLISHMENT OF SCHEDULE-INDUCED ATTACK ON PICTORIAL TARGETS B AND C

Experiment I demonstrated that with White King pigeons, experience with Photo A before introduction of a food schedule attenuated subsequent schedule-induced attack toward that target. To examine the specificity of that phenomenon to Photo A, the portion of Experiment I involving an FT schedule was replicated with a different target, Photo B, Figure 1. In addition to exposing separate groups of pigeons to the early- and late-introduction procedures, a third group of pigeons was given an abbreviated-late introduction to Photo B. This new condition was included to evaluate the importance of the initial schedules to which pigeons in the late-introduction groups were exposed before introduction of the test schedule. Finally, to evaluate the efficacy of a projected image of a conspecific in establishing schedule-induced attack, a fourth group of birds was given an abbreviated-late introduction to pictorial target C, Figure 1.

METHOD

Subjects

Fourteen experimentally naive, 2- to 4-yr-old male, White King pigeons were maintained under the same conditions used in Experiment I.

Apparatus

The test chamber had the same intelligence panel and over-all dimensions as that used in Experiment I. Throughout the experiment, all three response keys on the panel were dark and electrically inoperative.

Pictorial target B. Photo B was mounted on the same recording frame used in Experiment I. The location of the target and the minimum force requirement needed to operate it were also the same as that used in Experiment I.

Pictorial target C. Centered on the rear chamber wall opposite the food hopper were two 11.5 by 15.3 cm Polacoat plastic screens spaced 8.5 cm apart, center-to-center. The bottom edges of the targets were 7.6 cm above the floor. To prevent damage to the screen and to eliminate reflections from it, the screen was completely covered with a piece of the seamless Scotch Brand Magic Mending Transparent tape that was used to cover photographic targets A and B. Each screen was suspended by two frame-mounted microswitches (Micro Switch #311SM701T) located behind an 11.5 by 15.3 cm opening in the black rear wall. During sessions in which a target was presented, the left screen, as viewed from inside the chamber, remained dark and a random-access projector (Cohen, Yoburn, and Looney, 1976) displayed a colored image of a conspecific (Photo C, Figure 1) on the right screen. Under those conditions, the houselights were turned off, leaving the right screen as the only source of illumination (approximately 1 ft-L) in the chamber. A response force of approximately 0.1 N applied at any point on the right screen was defined as one target response. During sessions in which no pictorial target was presented, the rear chamber wall and screens were replaced by the smooth black surface used in the preceding experiment. Under these conditions, chamber illumination was provided by two, 6.3-V ac, 1.6-W lights located on the ceiling 10.2 cm in front of the intelligence panel.

Procedure

Pictorial target B. Nine pigeons were assigned to one of three groups of three, matched for body weights. Pigeons in two of the groups were exposed to the same sequence of experimental conditions used for birds in the FT, early- and late-introduction groups in Experiment I. The remaining three pigeons in the abbreviated-late introduction group were first magazine trained and then immediately shifted to the FT 90-sec schedule for 25 sessions without the target present. This abbreviated-late introduction procedure was identical to the late-introduction procedure, except that FT schedules with intervals shorter than 90 sec were not used. For pigeons in both late groups, Photo B was first presented during Session 26 on the FT 90-sec schedule. After 15 to 20 sessions on the FT 90-sec schedule with the photo present, all pigeons that had median attack rates of 1.0 response per minute or more were exposed to a no-food condition for 20 to 25 sessions and then re-exposed to the FT 90-sec schedule for an additional 20 to 25 sessions.

Pictorial target C. Five pigeons were exposed to an abbreviated-late procedure similar to that described above. Without the projected image (Photo C, Figure 1) present, pigeons were magazine trained and then exposed to 25 sessions on an FT 90-sec schedule. Each of 10 food presentations during a session consisted of 10-sec access to food as timed from the moment of interruption of the hopper photocell light. A session began with the first scheduled food presentation and terminated 90 sec after the final food presentation.

During the twenty-sixth session on the FT 90-sec schedule, the projected image was introduced. During that and all subsequent food sessions with the target available, a protective contingency ensured that a minimum of 17.5 sec occurred between a target response and food presentation. After 20 to 25 sessions with the image present, the pigeons that had median attack rates of 1.0 response per minute or more during the final five sessions with the target present were exposed to a series of 20- to 25-min sessions in which the target was presented but the food was not scheduled, and then re-exposed to the FT 90-sec schedule for an additional 20 to 25 sessions. One pigeon (P7041) was exposed to a second series of 30 no-food sessions followed by 30 additional sessions on the FT 90-sec schedule. Sessions were conducted six days per week.

Results and Discussion

The results obtained for all pigeons exposed to Photo B in the late- and early-introduction groups are summarized in Figures 4 and 5, respectively. Overall attack rate is plotted as a function of successive sessions for individual birds. Figure 4 shows that although all pigeons in both late groups initially attacked Photo B, attack rates decreased for P8675 and P7193 to less than one attack per minute and were variable from session to session. The remaining four pigeons, however, exhibited sustained attack rates with medians during the final five sessions on the FT schedule ranging from 4.4 to 8.6 responses per minute. For all birds, the topography, locus of attack on the target, and temporal distribution of attacks within a fixed-time interval resembled those for birds in Experiment I. Removal and re-instatement of the FT schedule was accompanied by a corresponding decrease and then increase in attack rate.

Whereas the early introduction of Photo A in Experiment I was relatively ineffective in supporting attack, the early introduction of Photo B was as effective (Figure 5) as the late introduction of that target (Figure 4) in this experiment. Again, removal and re-instatement of the food schedule was accompanied by a corresponding decrease and then increase in attack rates. Of the three pigeons in the early-introduction group that attacked Photo B, two of them also had many (79 or more) attacks on it during the initial no-food baseline session. Thus, combining the data from Photo A in Experiment I and Photo B in this study, all three pigeons in the early groups that had 79 or more attacks during the initial no-food baseline session also exhibited schedule-induced attack. Furthermore, of the six pigeons in the early groups that showed eight or fewer attacks on either Photo A or B in the initial baseline session, only one (P8104) subsequently showed sustained attack rates on that target. These results are consistent with Flory and Ellis' (1973) finding that pigeons that failed to attack a rear-view projected image of a con-

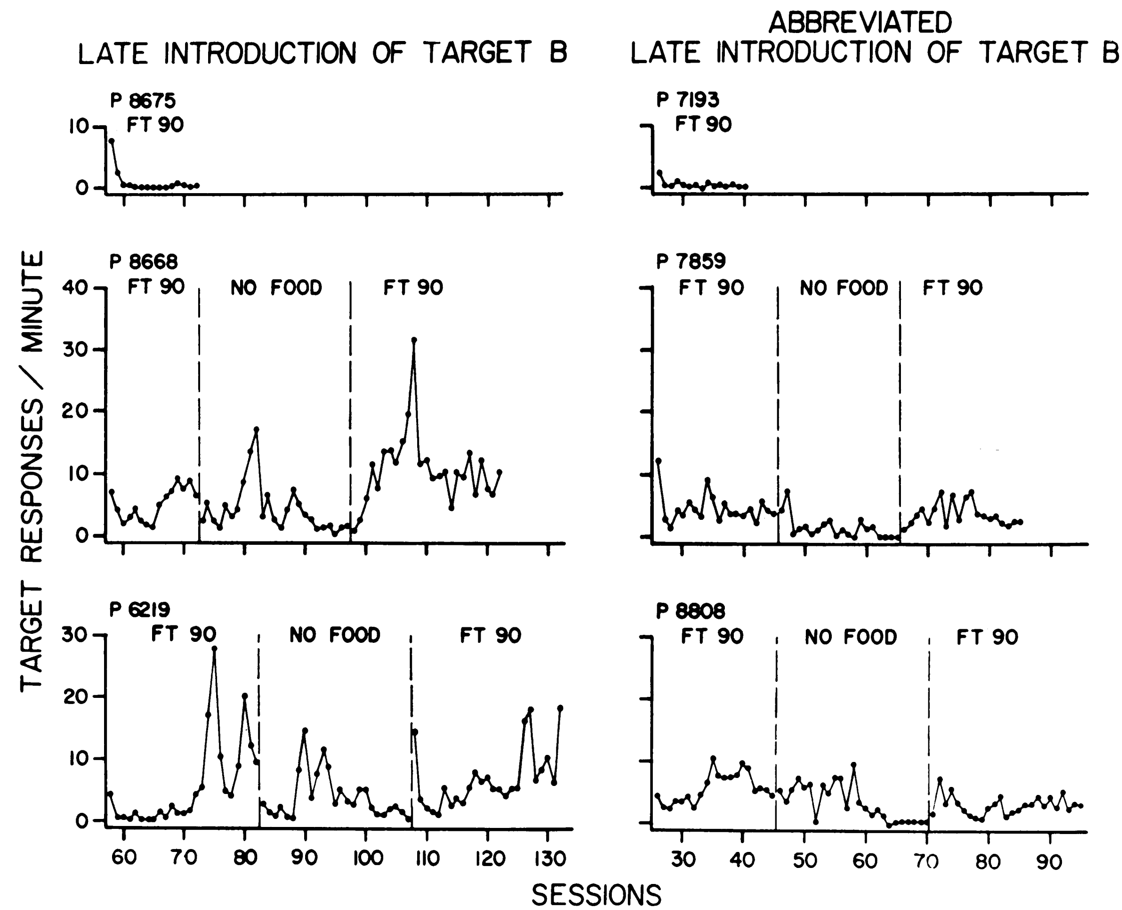

Fig. 4. Overall rate of responding (total responses per minute) on Photo-Target B as a function of successive sessions. Data on the left side of the figure are for pigeons given a late introduction to Target B and data on the right side are for birds given an abbreviated-late introduction to Target B (see text for explanation).

specific during a no-food baseline condition subsequently failed to exhibit sustained schedule-induced attack on that target.

The different results obtained with the early introduction of Photos A and B in Experiments I and II may have been due to individual subject differences in reactivity (*i.e.*, "aggressiveness", "timidity") to an image of a pigeon as well as to differences in the eliciting properties of the *particular* photographic images used. This latter possibility seems likely, since Photos A and B (Figure 1) differed in several ways. For example, Photo A, previously used by Looney and Cohen (1974) is a picture of a White Carneaux pigeon, whereas Photo B is one of a White King pigeon. These photographs differ in several other aspects such as background and posture, but the most striking difference to a human observer is that the pigeon in Photo B is larger and clearer than the one in Photo A.

Figure 6 plots rate of attack on the projected image (Photo C, Figure 1) as a function of sessions for individual birds. All pigeons exhibited some attack on the projected image and four of the five pigeons showed sustained attack rates during the FT 90-sec schedule condition. For all five birds, the topography and locus of attack on the projected target and the temporal distribution of attacks within the 90-sec interval were comparable to those reported by Flory (1969*b*) as well as those described above. Removal and re-instatement of the food schedule were accompanied by a corresponding decrease and then increase in attack rate for three of four birds. As was the case for P8851 in Experiment I, schedule control of attack rate did not occur for P7041

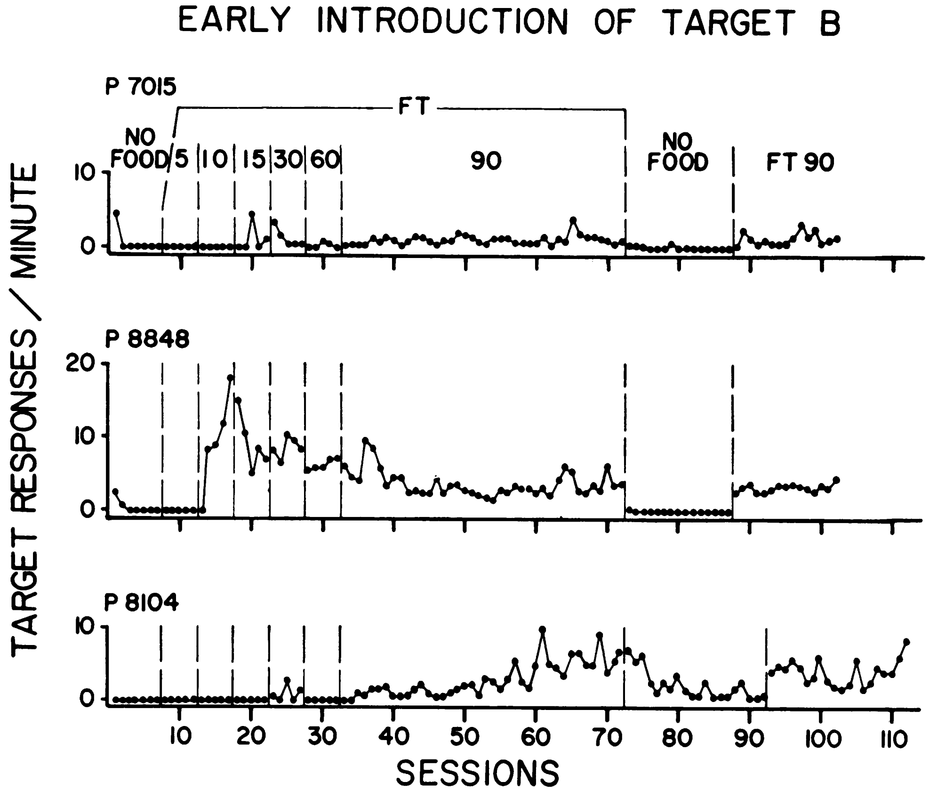

Fig. 5. Overall rate of responding (total responses per minute) on Photo-Target B as a function of successive sessions for pigeons given an early introduction to that target.

until the food schedule was removed and reinstated a second time.

GENERAL DISCUSSION

One factor that possibly contributed to the efficacy of the attack-inducing procedures used in these experiments, and one that has received little attention in the literature, is the strain of pigeon employed. Most experiments that have reported failures to establish schedule-induced attack on inanimate targets have employed White Carneaux pigeons as opposed to homers, feral pigeons, Silver Kings, or White Kings. Although Azrin *et al.* (1966) reported that they were unable to find a strain difference among several strains of domestic pigeons, observations in our laboratory suggest that White King pigeons are more likely to attack a pictorial target, under the procedures used in this study, than are White Carneaux pigeons. White Kings also tend to be more vocal and attack more vigorously than White Carneaux pigeons. In this latter respect, pigeon breeders at the Palmetto Pigeon Plant also report that in the reproductive situation, White Kings are more aggressive toward other pigeons and humans than are White Carneaux pigeons. Although it may be difficult to equate target characteristics (*e.g.*, posture) in comparing schedule-induced attack across pigeon strains, data obtained with a variety of targets such as a mirror, picture, stuffed, and live pigeons will be helpful in clarifying this issue.

Taken together, the results of Experiments I and II demonstrated that a pigeon's initial reaction to a pictorial target when presented alone is a good predictor of subsequent schedule-induced attack toward that image and that prior experience with a colored photograph can impede the subsequent establishment of schedule-induced attack. When photographic and projected targets were used in conjunction with a late-introduction procedure, they were almost as effective in establishing schedule-induced attack as were live conspecific targets used in previous studies

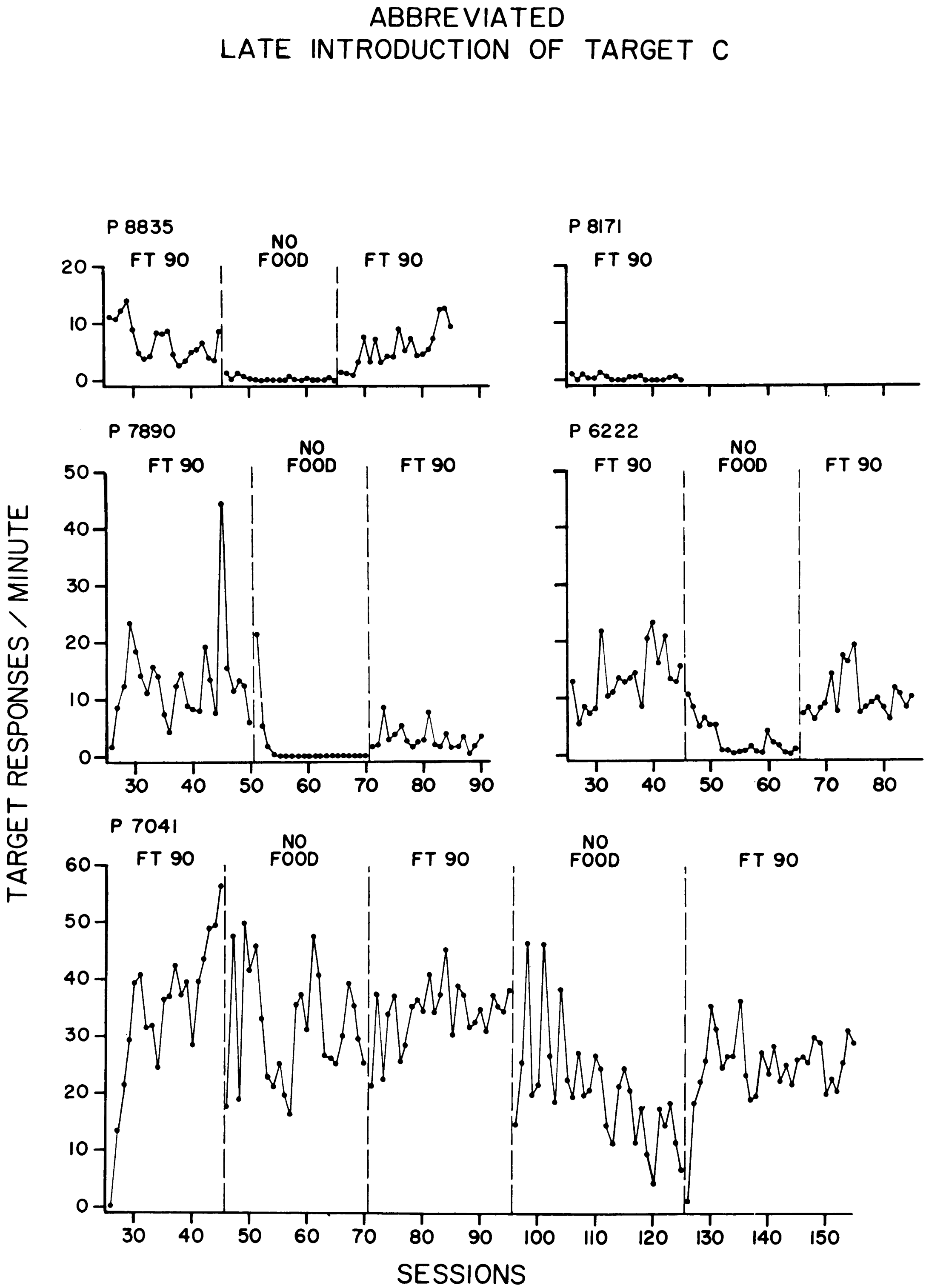

Fig. 6. Overall rate of responding (total responses per minute) on projected Target C as a function of successive sessions for pigeons given an abbreviated-late introduction to that target.

(*e.g.*, Azrin *et al.*, 1966). These results contrast sharply with the relative ineffectiveness of inanimate targets in other studies and, in particular, those studies that have used a projected image (Flory and Ellis, 1973).

With the aid of pictorial targets, it now will be possible to ask more sophisticated questions about the reinforcing, releasing, and directive properties of visual conspecific images and how those images interact with conspecific-type auditory stimulation (*cf.* Stout, Wilcox, and Creitz, 1969) to control attack. This should provide, in part, an empirical basis for relating schedule-induced aggression in pigeons to other types of intraspecific aggression in that species (*e.g.*, Whitman, 1919).

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Received 14 October 1975.
(Final Acceptance 20 May 1976.)