Schedule-induced aggression: Access to an attackable target bird as a positive reinforcer*

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Three male homing pigeons were trained on a two-key MULT FR-hi FR-lo schedule with a restrained, but nonaccessible targe bird present. A tone always signaled whether a high or a low FR requirement was in effect. Responses on either key produced food, but choice of only one of the keys simultaneously produced access to the restrained target. Access was contingent on key position for two of the birds and on key color for the third. Choice data across trials indicated that in the FR-hi periods Ss had a gradually increasing preference for the access key, but during the FR-lo periods no such increase in preference occurred. These results suggest that access to a target bird is reinforcing when the S is confronted with a difficult FR schedule. Confrontation with an easy FR schedule does not produce the reinforcing effect.

Recent investigations have demonstrated that many species of animals will attack members of the same species, of different species, or even inanimate objects when exposed to physically painful stimulation such as electric footshock (Ulrich, Hutchinson, & Azrin, 1965), tailshock (Azrin, Hutchinson, & McLaughlin, 1965), and physical blows (Azrin, Hake, & Hutchinson, 1965). More recently, it has been shown that extinction of a positively reinforced response or the introduction of a relatively difficult schedule of positive reinforcement are events that are aversive (Wagner, 1963; Thompson, 1964; Azrin, 1961) and that are also capable of eliciting overt aggressive responses (Azrin, Hutchinson, & Hake, 1966; Gentry, 1968; Cole & Litchfield, 1969).

Aggressive responding produced by pain, extinction, or schedules of reinforcement is unique in that no easily recognizable reinforcer is present to perpetuate the aggressive response. That is, the execution of the aggressive response does not serve to alleviate the noxiousness of the painful or frustrating stimulus, nor does it make food attainment any easier. Rather, the elicited response seems to be self-sustaining, dependent only on the presence of the aversive stimulus and a suitable target object. This suggests that access to an attackable object could be reinforcing to an organism stimulated with either a painful stimulus or an aversive schedule of reinforcement.

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Azrin, Hutchinson, & McLaughlin (1965) have shown that access to an attackable object is reinforcing for shock-stimulated Ss. Monkeys were placed in restraint chairs with a chain manipulandum directly in front of them. By pulling the chain, a biteable rubber ball became accessible for 2 sec. Prior to initiation of tailshock the base rate of chain pulling was near zero; when inescapable tailshocks were introduced, the rate increased dramatically. Finally, when the chain-pulling response was extinguished (shocks continued but chain pulling no longer produced the ball), the rate of responding fell to a near-zero level. These results indicate that access to the attackable ball was a sufficient reinforcer to maintain the operant response.

While the reinforcing properties of access to an attackable object have been demonstrated in the pain-induced situation, no such data are available for the situation involving schedule-induced aggression. The present experiment attempted to demonstrate that access to a restrained target bird is differentially reinforcing during frustrating vs nonfrustrating schedules. To accomplish this, pigeons were trained to respond for food on a MULT FR-hi FR-lo schedule. With the initiation of either FR component, the S could choose between two colored response keys; choice of the discriminable access key resulted in a target bird being presented, while choice of the nonaccess key did not. It was reasoned that differential responding to gain access should occur, depending on whether the FR requirement was difficult and frustrating (FR-hi) or easy and nonfrustrating (FR-lo). More clearly, it was predicted that the access key should be chosen more frequently FR-hi than during FR-lo.

SUBJECTS

The Ss were six adult male homing pigeons, three serving as experimental Ss and the remaining three as targets.

APPARATUS

A standard two-key pigeon chamber, 14 x 11 x 11 in., was used. Adjoining the chamber on the side to the right and rear of the manipulandum panel was a lighted target bird restraint chamber, 11 x 4 x 10 in. A black, solenoid-operated guillotine door, 4 x 5 in., located in the upper-right rear corner was the only opening connecting the experimental and the restraint chambers. When this door was open, visual and/or physical contact between the experimental and target birds was possible; when the door was closed, neither was possible.

A 3 x 3 in. piece of 1/8-in. Plexiglas located in front of the guillotine door and parallel with the floor of the experimental chamber (¼ in. from the floor) served as an aggression measuring device. This platform was hinged on one end so that when it was depressed by a force exceeding 25 g, a microswitch was operated which caused a pulse generator to feed electrical impulses into a printout counter at the rate of 2 pulses/sec. This aggression platform device was located in such a way that the experimental bird was forced to stand on the platform in order to get close enough to the target to aggress. As long as the experimental bird stood on the platform, pulses were fed into the recording device, thereby recording the duration of aggression on each trial.

An eight-channel tape reader used in conjunction with standard electromechanical programming equipment controlled the trial-to-trial sequence of (1) the FR schedules, (2) the tonal S^D, (3) the key color (red and green on each trial, random as to position), and (4) the food reinforcement. A second printout counter recorded whether the right or left key was initially chosen on each FR sequence.

The experimental chamber and adjoining restraint apparatus were lighted continuously by a 30-W overhead houselight. Both chambers were located in a darkened sound-attenuating 5 x 10 ft cubicle; the programming apparatus was located in an adjacent room.

PROCEDURE

Preliminary Training

Experimental Ss were food deprived to approximately 80% of their free-feeding weights; each S then received standard key-peck training in the two-key chamber with no target

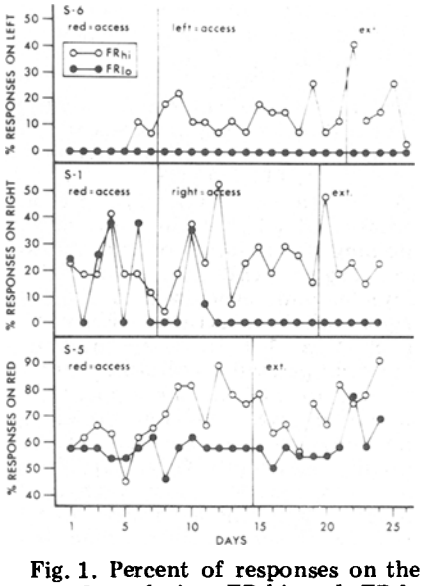

Fig. 1. Percent of responses on the access key during FR-hi and FR-lo schedules.

present and the access door closed and inoperative. A MULT FR-hi FR-lo schedule was gradually introduced, with a tonal S^D (tone vs no tone) signaling throughout each FR whether FR-hi or FR-lo was in effect. While the FR-lo component was equivalent for all Ss (FR2), the FR-hi component varied, depending on the point at which the individual Ss began showing schedule strain (long postreinforcement pauses, etc.). This strain point was used as a crude index of aversiveness. Thus, S 1 and S 6 received MULT FR2-FR75 and S 5 received FR2-FR55.

With the initiation of each FR, Ss could make a first response on either the red or the green key for food, the choice between the two having no differential consequences of any kind. Once responded to, the chosen key was locked in for the remainder of that FR run (until reward was received), while the nonchosen key became inoperative and darkened during the corresponding period.

Habituation Training

To habituate the S to the sight and sound of the solenoid-operated guillotine door, initial responses on the red key caused the door to open, thereby revealing a lighted but empty restraint chamber. The access door remained open until the FR run was completed. Initial responses on the green key did not serve to open the access door.

To insure that roughly equivalent experience responding to both keys was obtained, Ss were forced to alternate between the right and left keys on successive trials. When the Ss had begun to voluntarily alternate between the keys, the procedure was dropped. On the 3 days immediately preceding the initiation of access training, Ss received free-choice trials with the red-key response, continuing to open the access door to the empty restraint chamber. This was done to determine if any key preference existed prior to introduction of access training with the target bird present.

Access Training

During access training, a target bird was present in the restraint chamber facing toward the S. The target bird's legs were placed in a stock device and loosely tied with insulated wire. The stock consisted of two 1-in.-diam holes, approximately 1 in. apart, in a ¾-in. pine board. This device fit securely into the bottom of the restraint chamber, allowing the target to stand but not to ambulate. At the onset of each FR sequence an initial red-key response resulted in the access door's being raised, thereby making visual and/or physical contact between the birds possible. The red key remained locked in, and the door remained open until the FR run was completed. Throughout training, initial key choice had no effet on the MULT FR-hi FR-lo schedule.

For S 5 the red-key response continued to give access for all 14 days of access training. For S 1 and S 6, however, it was necessary to change the access contingency after 7 days due to the fact that both Ss had developed irrelevant position preferences (S 6 = right, S 1 = left). By adopting position preferences, access to the target was gained at a purely chance level (50%) during both FR-hi and FR-lo, and the potential rate of food attainment was unaffected in that the FRs were independent of key choice. The establishment of these position preferences suggests that gaining access of 50% of the trials is sufficiently "satiating" to the Ss that they are not motivated to make differential responses to gain more frequent access. A procedural change was thereby necessitated. This change involved making access contingent on key position rather than key color. Thus, for access, S 6 was required to choose the left key and S 1 the right key. By changing the contingency in this way, the Ss would now have to make the normally nonpreferred, low-frequency response in order to get access. Fourteen and 12 additional access-training days under these new contingencies were received by S 6 and S 1, respectively.

Throughout access training, daily sessions were continued until each S had received a total of 53 food reinforcements of mixed grain (3-sec duration). Of the 53 trials, 50% were on FR-hi and 50% on FR-lo. Access contingencies for individual Ss across days are contained in Fig. 1.

Extinction of the Access Response

Extinction sessions were similar to the training sessions; food reinforcement continued to be administered on the MULT FR-hi FR-lo schedule and the access door continued to operate when the appropriate response was made. Unlike access-training trials, the attackable target bird was never present in the restraint chamber.

RESULTS AND DISCUSSION

During the last 3 days of habituation training, free-choice trials were given with the red-key response opening the access door on an empty restraint chamber. While these results are not presented, observation of Day 1 scores in Fig. 1 indicates that by the end of this habituation period, S 6 had developed a right-key preference and S 1 a left-key preference. The establishment of these patterns was unfortunate in that chance levels of responding, prior to initiating the target birds, would have been a desirable baseline to work from. These response patterns were believed to be purely adventitious, as they were uncorrelated with either access-door openings or the FR schedules. It was indicated that more days of forced alternation training should have been included in the habituation training phase.

Access Training

Choice performance for individual Ss is presented in Fig. 1. When access was contingent on the red-key response, S 6 directed nearly all initial responses to the right key. This resulted in a 50% rate of access during both FR-hi and FR-lo runs, since red occurred right on approximately half the trials. On the last 2 days of the red-key contingency, S 6 made several responses during the FR-hi component to the red key when it was on the left. To accentuate the desired effect, however, a change in the access contingency was made. When the contingency was subsequently switched to the left key, the percent of responses on that key gradually increased during FR-hi sequences but remained at zero during FR-lo. These results suggest that when the S was confronted with the "frustrating" schedule, access to the target was an effective reinforcer.

For S 1, access responses during the red-key contingency were predominately on the left key (approximately 80%), and no consistent differences in key preference between FR-hi and FR-lo were apparent. When the access contingency was switched to the right key, right responding in FR-hi increased but did not in FR-lo. For S 5, preference on Day 1 for the red

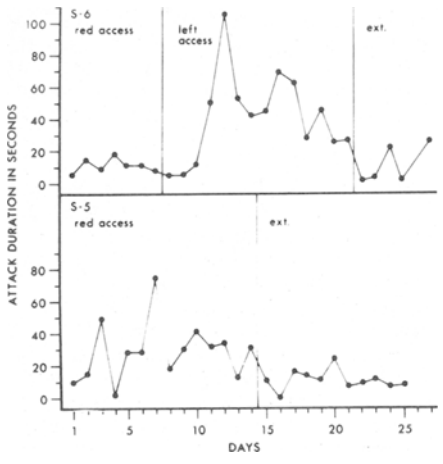

Fig. 2. Median attack duration in FR-hi.

key was equivalent for FR-hi and FR-lo at approximately 58%. As training progressed, access responding during FR-hi gradually increased to a final level (over Days 9-14) of approximately 80%. Access responding during FR-lo remained relatively stable over days at 58%. Thus, all three Ss exhibited a differential preference for the access key during FR-hi. This finding supports the notion that access was serving as a reinforcer.

Extinction of the Access Response

Inspection of the extinction data presented in Fig. 1 reveals an inconclusive picture with respect to the predicted decrement in access-key preference. While S 6 showed a steep decline in access responding on the last day of extinction, conclusive evidence of extinction was lacking. Both S 1 and S 5 showed no decrease in preference for the access key in spite of the fact that S 5 received extended extinction trials (583). These results suggest that a choice response reinforced by access to a target bird does not undergo extinction when it is being simultaneously maintained by food reinforcement. This result is not too surprising in view of the fact that continued responding on the access key did not increase Ss' work requirements relative to responding on the nonaccess key, nor were food contingencies during extinction more stringent for access vs nonaccess keys. While Azrin, Hutchinson, & McLaughlin (1965) did observe extinction of the pain-elicited access response, their experimental situation differed from the one used in the present experiment in that access responding did not simultaneously produce two reinforcers.

Measurement of Aggression

The duration of aggression, defined as total platform time, was measured on each daily FR-hi trial; aggression in FR-lo was never observed. For S 6 and S 5 the median duration of aggression during FR-hi was calculated for each day of acquisition and extinction. These data are reported in Fig. 2. Aggression data for S 1 are not included as the S never mounted the platform or physically attacked the target, but instead stood in front of the platform and made threatening gestures toward the target (head bobbing, cooing, and feather ruffling). Aggression data for S 5 and S 6 serve to confirm the notion that the Ss were aggressive during the FR-hi periods. Interestingly, these median-attack durations decreased across days for both S 5 and S 6. Several possible explanations of these results exist. First, if it can be assumed that aggressive responding is an emotional response, then, like the closely related phenomenon of behavioral contrast (Terrace, 1966), prolonged exposure to the aversive stimulation should cause the response to decline or disappear. A second explanation is that the aggressive behavior by the experimental S is ultimately punished in that the target bird usually counteraggresses by striking back at the S. Third, it is possible that as the animal spends time aggressing, he learns that the aggressive acts ultimately lead to a delay of food reinforcement. More clearly, for every second spent attacking the target, the S is voluntarily delaying completion of the FR and hence, delaying food reinforcement. Any of these explanations, singly or in combination, can adequately explain the attack decrement across access training trials.

During extinction sessions the amount of time spent on the aggression platform was reduced for S 5 and S 6 though not to an absolute zero level. While attack of the target bird was no longer possible, Ss persisted in returning to the platform, presumably in search of the target bird. It is important to note that both Ss were observed to attend to the empty restraint chamber almost constantly during these periods. This is in contrast to the possibility that they were merely retreating to the platform in order to escape from the food manipulandum or that they were accidently stepping on the platform due to increased locomotor activity.

SUMMARY

In summary, choice data during access training strongly suggests that access to an attackable target bird is reinforcing during the aversive FR-hi schedule. The higher relative preference for the access key during FR-hi (as opposed to during FR-lo) indicates that a frustrated S finds access reinforcing while a nonfrustrated one does not. The low absolute rates of access responding for S 1 and S 6 do not detract from this conclusion in any way, but rather suggest that the Ss' desire to gain access and attack becomes rapidly satiated with repeated target-bird encounters. With regard to choice data in extinction, few if any conclusions can be drawn. Given the precedures used in the present experiment, logical grounds exist for predicting a decrement in the choice response not to occur.

As a new aggression-measuring device the aggression platform proved to be reasonably good. Its location in the chamber was such that normal random movements almost never depressed the platform, but when aggression was induced the platform was depressed for approximately the duration of the observed aggressive response. Further work is needed to substantiate the correlation between platform depressions and the observed durations of attack.

While the overall results of the present experiment are highly suggestive that access to a target is reinforcing to a frustrated organism, one possible confounding does exist. To eliminate the possibility that access to an empty restraint chamber or to a chamber containing a visible but nonattackable target is reinforcing, the addition of appropriate control groups would have been desirable.

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