Effects of induced aggression on a low fixed-ratio schedule of food reinforcement[1]

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Five rats were trained to barpress for liquid food reinforcement on FR6. Attack behavior was then studied under two conditions: (1) pairing experimental Ss with target animals, and (2) pairing experimental Ss and target animals with intermittent electrical shock. Pairing experimental Ss and target animals without shock did not elicit attack, nor was barpressing behavior appreciably disrupted. Only under conditions where experimental and target animals were paired and shock presented did attack occur. Barpressing behavior was severely suppressed under the final condition, and there appeared to be no recovery of response rates over several sessions.

Electrical shock has the property of eliciting fighting behavior in paired rats (Ulrich & Azrin, 1962), cats (Ulrich, Wolff, & Azrin, 1964), and squirrel monkeys (Azrin, Hutchinson, & Hake, 1963). Others have observed that FR positively reinforced schedules have aversive properties that are functionally related to attack (Hutchinson, Azrin, & Hunt, 1968). Hutchinson et al (1968), however, found no attack on a FR2 schedule until food reinforcement was no longer made available (extinction).

Results from investigations in avoidance and escape conditioning with paired animals (Azrin, Hutchinson, & Hake, 1967) indicate that the frequency of attack is a function of the frequency of electrical shock, and that the probability of attack decreases over sessions when the organism has the opportunity to prevent the presentation of the aversive stimulus.

The work of Hutchinson et al (1968) suggests that a positive-reinforcement schedule with a very low ratio requirement may not have the properties necessary to elicit attack. Research in the past has evaluated the effects of elicited attack on negative-reinforcement performance (Azrin et al, 1967). The present investigation dealt with the effect of elicited attack on a schedule of positive reinforcement containing a low ratio requirement.

METHOD

Ten adult female Long-Evans rats were used. Five Ss functioned as experimental animals, and the others were used as target rats. Experimental Ss were maintained at 75% of their ad lib weight and were deprived of water on a 23-h schedule. Reinforcement consisted of a mixture of 40% water, 40% milk, and 20% sugar. Purina lab pellets were provided in the home cages to maintain Ss' weights. Target animals were allowed free access to food and water. All animals were housed in separate home cages.

The apparatus consisted of an operant chamber, 12 x 7 x 10 in. A bar and a jeweled light were mounted on the face of the operant panel, with the magazine housed in the lower center of the panel. Reinforcement consisted of access for 3 sec to a motor-driven dipper which contained 1 ml of milk solution. Bar pressing produced an audible clicking sound. A Grason-Stadler E10865GS shock generator and scrambler provided electrical shock through the grid and walls of the chamber. A fan was utilized to mask noise. Control and recording equipment was housed in another portion of the laboratory.

Two Os, previously trained in detecting reflexive fighting responses, as described by Ulrich & Azrin (1962), recorded attack responses during sessions where animals were paired. Inter-O agreement exceeded 97%.

The procedure was divided into four conditions: (1) Experimental Ss responded on FR6 for liquid food reinforcement; (2) experimental Ss responded for liquid food reinforcement with experimentally naive target animals present; (3) experimental Ss responded on FR6 for liquid reinforcement with intermittent electrical shock presented; and (4) experimental Ss responded for liquid food reinforcement with target animals and intermittent electrical shock present.

During pretraining, all experimental Ss were trained by successive approximations to bar press on CRF for liquid food reinforcement. Ratio requirements were then progressively increased to FR6. Sessions were terminated after 50 reinforcements. After seven sessions on FR6, the second condition was initiated. S1, S2, and S3 were each paired with an experimentally naive target rat and run for one session. On the eighth session of FR6, the third condition was imposed. An electrical shock of .05 mA was presented every 6.0 sec for a 0.5-sec duration to S4 and to S5. Shock for S4 and for S5 was then progressively increased over sessions from the initial value to 1.2 mA. Increases in intensity occurred only if inspection of the cumulative records for the two previous sessions revealed that the pattern of responding was uniform, and that response gradients were smooth with no breaks. In the last condition, S4 and S5 were paired with experimentally naive target animals under FR6 and 1.2-mA shock. The last 14 trials consisted of alternating sessions of paired and single Ss. Paired sessions were terminated after 600

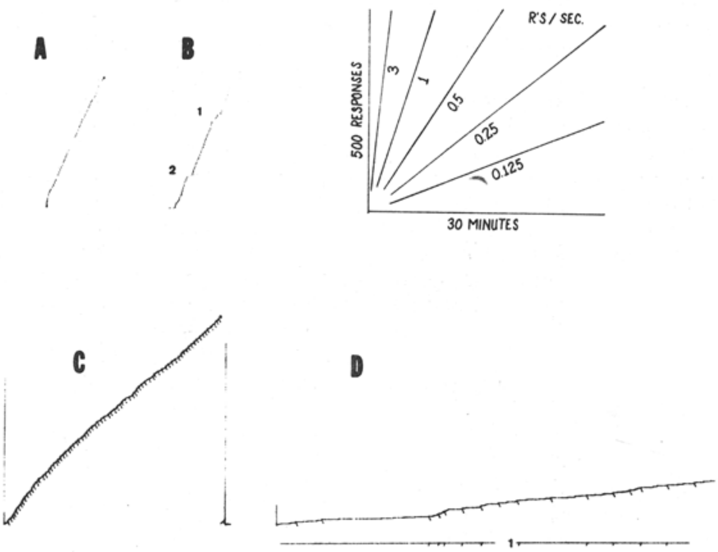

Fig. 1. Representative records of Ss under four conditions: (a) FR6 performance, single S; (b) FR6 performance, paired Ss; (c) FR6 performance, single S with electrical shock; (d) FR6 performance, paired Ss with electrical shock.

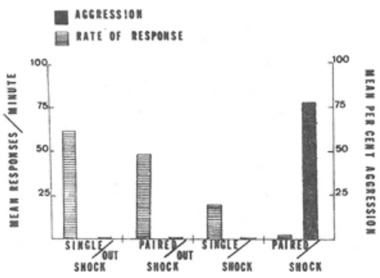

Fig. 2. Mean response rates and mean per cent of attacks under four conditions of FR6 performance: (1) single S, (2) paired Ss, (3) single S with shock, (4) paired Ss with shock.

shocks; single sessions after 80 reinforcements were obtained.

RESULTS

Figure 1 illustrates cumulative response rates for the four conditions of the experiment. Portions of the figure, designated A and B, represent S2's performance on FR6 alone and when paired with the target, respectively. C and D depict FR6 performance of S4 under 1.2-mA electrical shock and under the same condition, but with a target animal present. Response rates were similar for other Ss not shown.

Under the condition where animals were paired without shock, the initial portion of the session was disrupted by the introduction of the target animal. Exploratory and grooming responses of one animal by the other were typical behavior observed; however, after the initial disruption, Ss began to respond at rates similar to those obtained when Ss were responding on FR6 without the target animals present. Disruptions occurred later in the session (Figs. 1B, 1, and 2), but, again, the disrupted behavior was similar to that shown in the initial portion of the session.

The effects of 1.2-mA electrical shock upon FR6 responding can also be seen in Fig. 1C. Response rates decreased sharply in comparison to FR performance without shock, but overall response rates remained uniform. When Ss were paired and intermittent shock was administered, almost complete deterioration of operant responding by the experimental Ss occurred (Fig. 1D). Rates were substantially lower than those obtained under the other conditions. Furthermore, few obtained reinforcers were ingested. Fighting appeared to disrupt the experimental Ss' orientation to the food hopper and to the manipulandum. The downward stroke on the event pen (Fig. 1D) represents the few reinforcements ingested.

Figure 2 represents the mean response rates per minute and the per cent of fighting responses for Ss under each condition. Mean response rates for all experimental Ss without shock and without targets were 63/min. Rates for S1, S2, and S3 without shock, when paired with targets, decrease to 47 responses per minute. Under this condition, no aggressive behavior was elicited.

The mean response rates for S4 and S5 under conditions of shock, when no presence of a target appear to be functions necessary for the elicitation of attack. The conditions where S4 and S5 were paired with target animals and shock was delivered, response rates were reduced to a very low value. Accurate rates of responding could not be calculated because attack between S and the target animal often caused incidental depression of the response bar. Fighting behavior was elicited at a mean per session of 78% over seven sessions. Immediately after the presentation of most of the shocks, both Ss and target animals stood on their hind legs and struck at each other with their heads and front paws. Ss showed a very poor orientation toward the bar on all pairings with target animals and shock. Even in instances where the experimental Ss were positioned near the bar, very few operant responses were made. Over the seven sessions, where experimental Ss were paired with target rats and intermittent shock was presented, the probability of elicited attack and the frequency of the operant response remained unchanged.

DISCUSSION

The low FR schedule of positive reinforcement employed in this study did not have sufficient aversive qualities to induce aggression in rats. With a schedule requirement so low, post-reinforcement pauses may not have been discriminative for nonreinforcement and, thus, may not have had the aversive properties discussed by Hutchinson et al (1968). Such low FRs as the one employed here minimize the possibility of aversive properties existing as found in FR schedules with higher requirements (e.g., Gentry, 1969).

It is possible that the physical positioning of the targets may have prevented the experimental Ss from bar pressing and, therefore, severely disrupted operant rates when intermittent shock was present. However, this conclusion may be rejected for two reasons: First, pairing experimental Ss and experimentally naive target rats without shock did not reduce operant rates appreciably; and second, in the condition where rats were paired with shock, elicited attack occurred irrespective of the positioning of either animal.

Therefore, it appears from this investigation that both the presence of a target animal and periodic presentation of shock are necessary for severe disruption of low FR responding for liquid food reinforcement. Further, shock and the presence of a target appear to be functions necessary for the elicitation of ataack. The liquid food reinforcement had sufficient strength to sustain uniform responding on FR6 when animals were paired without shock and also when electrical shock was presented to a single S. Only when both periodic shock and a target animal were present did operant responding deteriorate and aggressive behavior predominate.

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NOTES

1. Based in part on a paper, "The Effects of Pain Elicited Aggression on a Food Maintained Schedule of Reinforcement," presented at the annual meeting of the Rocky Mountain Regional Psychological Association, Albuquerque, N. Mex., 1966.

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