Learning to resist mild or intense shock punishment and subsequent resistance to airblast punishment[1]

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Rats were trained to approach and consume food in the presence of either mild, intense, or no shock punishment and were subsequently tested with airblast punishment. The results showed that Ss learning to resist the intense shock punishment subsequently were significantly (p < .05) more resistant to airblast punishment than the mild punishment or the no punishment training groups. The difference between the mild and no punishment groups was not reliable.

Rats trained to approach and consume food in the presence of intermittent or gradually increasing electric shock punishment are subsequently more resistant to the effects of intense punishment (e.g., Banks, 1966; Miller, 1960). This learned resistance to punishment is not limited to the original aversive stimulus but includes novel punishments as well (Terris & Wechkin, 1967).

The purpose of the present experiment was to determine the relationship between the intensity of punishment resisted during training and the degree of subsequent resistance to a novel punishment during testing. In this experiment Ss were trained to resist either no shock, mild shock, or intense shock in order to obtain food and were subsequently tested with airblast punishment.

METHOD

The Ss were 36 naive Holtzman female rats, approximately 90 days of age at the start of the experiment. They were housed in individual cages and had continuous access to water in their home cages throughout the experiment. Six days prior to the beginning of the experiment, the Ss were put on a 22½-h food deprivation schedule which was maintained throughout the experiment.

The main apparatus was a straight-alley runway 36 x 4½ x 5 in., constructed of frosted Plexiglas walls with a hinged, clear Plexiglas top. The entire floor consisted of 1/8-in. stainless-steel rods with the centers spaced 3/8 in. apart. Placing an animal into the start end of the runway interrupted a photocell beam and activated a standard electric timer which would be terminated manually. The shock source has been described elsewhere (Terris & Enzie, 1967) and the airblast was delivered from an airgun having a source pressure of 20 psi and an opening 1/8 in. in diam. The airblast was delivered from behind the food dish, approximately 2 in. from the nose of the S.

On Days 1-6 of the experiment the Ss were trained to traverse the runway and eat Purina wet mash from a dish located in the goal end of the runway. Each S was given one trial on Day 1 of approach training and four trials on Days 2-6. Each trial consisted of placing the S into the start end and allowing the S to approach and consume food with the trial terminated 30 sec after the S began to eat.

On Days 7-16 electric shock punishment was introduced into the runway situation with Ss assigned to one of the three treatment groups: nonshock (N group), low shock (L group), or high shock (H group). On Day 7, the first day of shock training, all Ss were given four trials while on Days 8-16, Ss were given two trials. The animals in the L group (N = 12) received one 1-sec electric shock punishment when they began to eat. On the first trial of shock training the shock intensity was .15 mA and the intensity was increased by .013 mA on successive trials until the maximum level of .35 mA was reached for the L group. For the Ss in the H group (N = 12) the procedure was similar except that the shock increment was .03 mA per trial and the final level was .50 mA. For the Ss in the N group (N = 12), shock punishment was never administered. In all treatment groups, the Ss were allowed a maximum of 10 min to return to the food after the shock. Only one punishment was administered on each trial and when the S returned to the food, 30 sec of consummatory time was allowed.

On Days 17-21 airblast punishment was introduced into the runway situation. Only one trial was given on each day of airblast testing with all Ss receiving a maximum of one 1-sec airblast on each trial. Shock punishment was never administered during airblast testing. The trials were identical to those in the training phase except that airblast punishment was administered immediately after the animals nose touched the food dish. The animals were allowed a maximum of 10 min to approach the food and begin eating and a maximum of 10 min to return to the food after the airblast. As before, each S was allowed to return to the food and eat for 30 sec.

RESULTS AND DISCUSSION

All the Ss in the L group were able to resist the gradually increasing shock punishment, but 5 of the 12 Ss in the H group were unable to withstand the intense shock and completely stopped approaching the food during shock training. Those Ss not able to resist shock during training could not be tested with airblast and were not included in the subsequent analyses.

Because of the skewness of the scores, all approach and return latencies were converted to log latencies and the mean log approach and return latencies for the three treatment groups during airblast testing are shown in Fig. 1. In order to determine if all three treatment groups entered airblast testing with the same approach strengths, a one-way analysis of variance was performed on the approach latencies on the first trial of airblast testing. A statistically unreliable F was obtained ($F < 1$) and since these latencies were obtained *before* airblast was administered, it indicates that the three groups of Ss entered airblast testing with similar approach strengths. A similar analysis of the log approach latencies on Trial 5 of airblast testing also yielded an unreliable F ratio ($F = 1.86$, $df = 2/28$, $p > .05$).[2] A one-way analysis of variance was performed on the mean log return latencies of the five trials of airblast testing and a statistically reliable F ratio was obtained ($F = 6.82$, $df = 2/28$, $p < .01$). Testing for simple effects it was

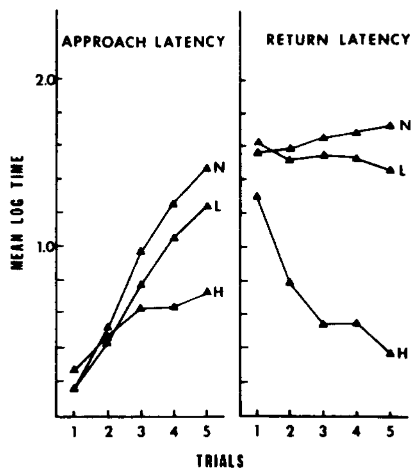

Fig. 1. Mean log approach and return latencies during airblast testing for the no-punishment (Group N) low-punishment (Group L) and high-punishment (Group H) training groups.

found that while the difference between L and N groups was not reliable ($t = .59$, $df = 28$), the L and N groups combined were reliably different from the H groups ($t = 3.64$, $df = 28$, $p < .01$).

These results indicate that Ss trained to resist the intense level of shock showed greater resistance to airblast punishment than did either the mild punishment or no punishment Ss. Since it was possible that the superior performance of the H group was due to the removal of the five most "emotional" Ss during the shock training phase, the data were reanalyzed after excluding the five Ss most affected by airblast in both the N and L groups. In terms of the log approach latencies, the analyses indicated that as before all groups entered airblast testing (Test Trial 1) with the same approach strengths ($F = 2.26$, $df = 2/18$) and that by the last trial of airblast testing the differences among the groups were also not statistically reliable ($F = 1.21$, $df = 2/18$). A reanalysis of the mean log return latencies, however, did yield a reliable F ratio ($F = 3.98$, $df = 2/18$, $p < .05$) with tests for simple effects indicating that while there was no reliable difference between the N and L groups ($t = .70$, $df = 18$) the N and L groups combined were reliably different from the H group ($t = 2.83$, $df = 18$, $p < .05$). These additional analyses indicate that the superior resistance to airblast of the H group was not likely to be due to the systematic exclusion of the most emotional Ss.

While the results do suggest that there is a positive relationship between the intensity level of the training punishment and subsequent resistance to novel punishments, the probability of being able to resist a punishment is inversely related to its intensity. Although not tested in this experiment, it seems likely that those Ss not able to resist the training punishment may be more susceptible to the effects of novel punishments in the same situation.

The failure to find a difference between the N and L groups was surprising since Terris & Wechkin (1967) found that Ss learning to resist .25 mA were subsequently better able to withstand an airblast punishment even more intense than the one used in the present experiment. One possible explanation for this could be due to the manner in which shock punishment was introduced during the shock training phase. Terris and Wechkin introduced the .25 mA at full strength while the .35 mA used in the present study was gradually introduced. Consistent with this hypothesis was the observation in pilot animals that .35 mA introduced at full strength typically produced signs of aversiveness (i.e., withdrawing from food, vocalization, flinching, etc.) but the Ss in the present study rarely showed any sign that .35 mA was aversive.

The results of this experiment are not likely to be due to the mere experience of shock since Miller (1960) found that experience with gradually increasing shock in a nonrewarded context had no reliable effect upon subsequent responsiveness to punishment.

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NOTES

1. This research was supported in part by Public Health Service Mental Health Grant No. 15699-01.

2. All probability statements are based on two-tailed tests.