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Sequential Effects of Contingent and Non-Contingent Punishment

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Sequential Effects of Contingent and Non-Contingent Punishment[1]

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Abstract: Hooded rats were given extensive training on a VI 60″ schedule until their response rate stabilized. Subsequently a punishment routine was initiated concurrently with the VI 60″ for nineteen one hour sessions. While this routine was in effect, half of the *Ss* were administered a brief shock whenever they bar pressed; the other half served as tandem controls so the shocks which they received were not correlated with bar pressing. Two levels of shock intensity were employed: .2 and .4 ma. Behavior was suppressed in both treatment groups though to a much greater extent in the contingent group. Variations in shock intensity produced no apparent differences. There was no evidence of recovery from the effects of punishment in the contingent group. In the non-contingent group, there was some adaptation to punishment although these *Ss* did not reach their pre-punishment level of responding during the nineteen punishment sessions.

This study was initiated to further investigate some punishment phenomena reported in earlier experiments by Estes (1944) and Azin 1960. Estes reported that an aversive stimulus would suppress ongoing behavior whether or not the occurrence of the aversive stimulus was correlated with the response. This conclusion was based upon two separate experiments. In the first, punishment was administered for 10 minutes to a group of rats whose bar pressing behavior had been stabilized on a fixed interval schedule. A control group received no punishment during this period. All *Ss* were then given six one hour sessions of extinction. During this period the bar pressing behavior of the experimental group was significantly suppressed. Subsequently the behavior of this experimental group was compared with a group of *Ss* in another experiment which was given thirty minutes of brief shocks uncorrelated with bar pressing. Estes observed that approximately the same amount of suppression occurred in both groups during extinction and that both groups recovered at about the same rate. These observations led Estes to conclude that "the temporal contiguity of a disturbing stimulus and stimuli which normally act as an occasion for a response yields a depression in rate of responding during subsequent periods of extinction very similar to that produced by actual punishment of the response". No attempt was made to equate

[1] This study was executed while the first author was an NSF Undergraduate Research Participant at Grinnell College.

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the number and distribution of shocks in the non-contingent group with those in the contigent group.

The other study which prompted the present work was one by Azrin (1960) which investigated the sequential effects of continued punishment. In this experiment, pigeons were maintained on a VI 60" schedule for a lengthy period in order to establish a baseline. They were subsequently subjected to a punishment routine such that every response was punished by a 30 v., 60 cy./sec. shock of 30 millisec. duration while *Ss* were concurrently reinforced on VI 60". After only ten one hour sessions, *Ss* returned to a level of responding that was slightly higher than the baseline. They maintained this level until punishment was terminated, at which point response rate increased to a higher level, finally returning to the level of the base line about eight days after punishment was terminated.

Previous work in our laboratory made us curious to see if we could also observe these adaptation and compensatory phenomna with rats. We had previously attempted to replicate Azrin's experiment with rats and were unable to do so in a small scale pilot study. We were also interested in looking at the long term effects of non-contingent aversive stimulation and studying the interaction of the response-shock contingency variable with two intensities of electric shock.

Method

The study was initiated with 18 hooded rats, approximately 250 days old, which had been maintained for about six weeks at 80% of their ad lib body weight. Twelve of these animals were to be maintained in the experiment after they had achieved a stable base level on VI 60" schedule. *Ss* were given twenty three 60 reinforcements sessions on VI 60" and the twelve most consistent responders were selected from this group. These were restrictively assigned to four treatments combinations of response-shock contingency and shock intensity. The differential treatments were started after the animals were all given an additional five one hour sessions on VI 60" to establish a base level.

All of the above and subsequent training was administered in Scientific Prototype Skinner boxes, 9⅛" x 8" x 8⅝", which had been automated. These boxes were enclosed in a sound attenuating chamber. Noise transients were further masked by an air blower located inside the chamber. Noyes 45 milligram Lab Rat pellets were always employed as reinforcers.

The shock intensities employed were .2 and .4 milliamp of .15 sec. duration. These stimuli were generated by a constant current shock source previously described (Dinsmoor and Hughes,

1956). The shock stimulus was scrambled to the floor, walls, and bar of the chamber.

Contingent and non-contingent *Ss* were run in tandem such that if a contingent S shocked himself, his tandem control would also receive a shock. All *Ss* were concurrently reinforced on VI 60" during the nineteen punishment sessions completed to date.

Results and Discussion

At this stage of the experiment there appear to be no reliable differences produced by shock intensity so that the data was combined across this variable and is presented as Figure 1. An

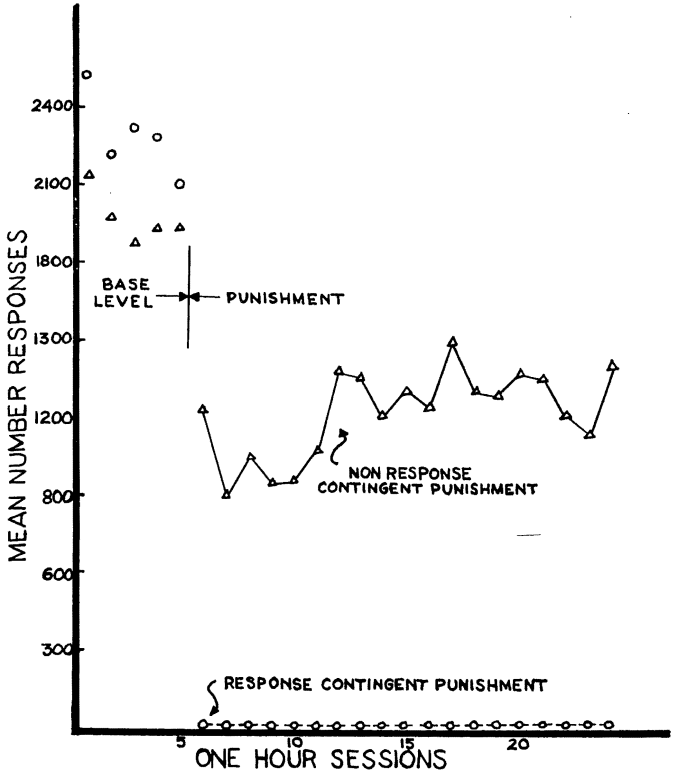

Figure 1. Effect of contingent and non-contingent aversive stimulation (shock) on the bar pressing behavior of rats on a concurrent VI 60" schedule.

elaborate statistical analysis is not required to see what has happened in the experiment to date. During the five pre-punishment baseline sessions *Ss* were responding at a relatively stable rate. When the punishment routine was initiated, the rate of bar pressing dropped off in both groups though to an obviously

greater extent in the contingent group. In the contingent group, there is obviously no indication of recovery over the nineteen sessions. The average overall rate in the contingent group for these nineteen sessions was 2.8 responses/hr.; in the non-contingent group the average rate was 1224.4 responses/hr. There does appear to be some evidence of recovery in the non-contingent group. If this continues at approximately the same linear rate, these *Ss* will apparently take fifty to sixty sessions to return to the baseline. Nothing in the data suggests that the contingent group will return to the baseline as long as the punishment routine is in effect.

These results are obviously not in agreement with Azrin's (1960) observations on the sequential effects of punishment in pigeons. The differences between the results of the present study and those obtained by Azrin may be due to species, shock level, method of shock delivery, or experimental routine. The data available do not enable us to specify which of these variables may be operating. On the other hand, our results certainly substantiate previous work (Azrin, 1956) which indicates that non-contingent punishment does not suppress behavior to the same extent as response correlated punishment. It now appears obvious that generalizing Estes' (1944) conclusions to all punishment situations is certainly not warranted.

Although the contingent and non-contingent routines produced differential suppression, our data do show that non-contingent punishment does suppress behavior and that this suppression persists over a considerable length of time. This suppression may be due to one or both of two factors. One is that the stimuli which set the occasion for bar pressing may acquire aversive properties, as in the CER studies (Hunt and Brady, 1951). There is also the possibility, however, that the prolonged suppression in the non-contingent group is artifactual to our particular experimental routine. These *Ss* could adventiously receive infrequent shocks while they were touching, holding, or pressing the bar if their tandem partners happen to deliver shock at that time. Our data indicate that this did occur very infrequently but the possibility must be considered that it was frequent enough to suppress behavior in the non-contingent group.

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A Study of the Change in Intelligence Distribution[1]

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Abstract: A statistical study was conducted which indicates that significant changes in mean and variance of IQ scores for an Iowa farm group have changed significantly over a twenty year period. Factors accounting for this change are suggested.

The problems involved in the study were:

(1) Had the mean or distribution of IQ scores of the group engaged in farming changed significantly since 1941?

(2) If so, was it sufficient to involve a change in the whole community?

(3) Lastly, if change had occurred, had selective migration been an active factor?

The area under observation was a commercial farming district of 186 square miles in Central Iowa. The school population numbered over 1000. There were no large towns within the area.

Comparisons were made between the ninth grade students of 1941-1943 and the ninth graders of 1961-1963. The groups were also subdivided on a farm-nonfarm basis and by sex. The findings were:

(1) The mean IQ of the community had risen about 6 points, the modal IQ 10 points during the twenty-years period.

(2) The mean IQ score of the farm group had risen significantly, the nonfarm group's had not.

(3) The farm group had a significantly smaller percentage scoring below 90 than did the nonfarm group.

(4) The farm group of 1961-1963 had a smaller percentage scoring below 90 (only 1.8 percent) than did the farm group of 1941-1943.

(5) The nonfarm group had a significantly larger percentage

[1] Based on M.A. Thesis, "A Study of the Change in Intelligence Distribution Over a Twenty Year Period in Central Iowa," by Beverly S. Young, State College of Iowa, Cedar Falls, January, 1964.

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