THE EFFECTS OF DELAY AND INTENSITY OF PUNISHMENT ON ESCAPE BEHAVIOR

by

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TABLE OF CONTENTS

INTRODUCTION

Although many studies concerned with punishment have appeared in recent years, clear explanations of the many effects of punishment on behavior have not been forthcoming. In fact, even the definition of punishment is still a matter of some controversy. Each definition that has been put forward has been influenced somewhat by a theoretical explanation of the behavioral effects of punishment. However, this does not mean that any definition of punishment is firmly bound to a theory. All definitions allow some latitude, with some definitions of punishment being more firmly bound to a theoretical position than others.

In the present study, punishment is defined as the presentation of an aversive or noxious stimulus which is contingent upon a specified response of a subject (S) (cf. Church, 1963). The term contingent, in this definition, refers to the fact that the aversive stimulus is presented if, and only if, the S makes a certain response. In the present definition, the term aversive is extremely important and should be defined in an operational manner. It has been defined as any event, such as electric shock, which will lead to and support escape or avoidance learning (cf. Solomon, 1964). Some confusion has arisen in the literature because the punishing stimulus has not always been tested to see if it meets these requirements of being aversive.

This definition of punishment has been employed in the present experiment because it allows flexibility with regard to theoretical and empirical manipulations. While some definitions specify that punishment must suppress behavior (Azrin and Holz, 1966), no restriction upon the behavioral effects of punishment are inherent in the present definition. Although the present definition implies that contingency between response and punishment may be important, it does not rule out noncontingent explanations of punishment.

The results of a large number of recent experiments have shown that punishment may have a variety of effects on the resistance to extinction of both escape and avoidance behavior. Under certain circumstances, punishment may suppress such behavior in extinction, but under other conditions, it may actually lead to an increased tendency of the punished reactions to reoccur. This facilitation of punished escape or avoidance responses during extinction has been labeled either self-punitive or vicious-circle behavior (Brown, Martin, and Morrow, 1964).

Most of the experiments which have demonstrated the self-punitive phenomenon have employed a procedure consisting of two phases. In the initial phase, rats were taught either to escape or avoid electric shock in a straight runway. For this training, the start-box and the alley sections of the runway were electrified, leaving the goal-box as the only shock-free area.

Escape learning consisted of training the S to leave the electrified start-box and run across the electrified alley into the safe goal-box. If an avoidance learning procedure were used, the S could avoid the shock in the start-box and the alley by running to the goal-box within a predetermined number of seconds after the start of the trial. If the S failed to make the avoidance response, the shock came on; and the S would than have to escape the shock by running into the goal-box.

Extinction was initiated in the second phase of the procedure to establish self-punitive behavior by removing the shock from the start-box. Some of the Ss were punished for responding during extinction, while other Ss received no punishment. Punishment usually consisted of electrifying some portion of the alley between the start-box and the goal-box. A punished S could either remain in the nonelectrified start-box or run across the electrified portion of the alley between the start-box and the goal-box.

Two measures of resistance to extinction have been used in studies examining self-punitive behavior. One measure was the number of trials that was needed to reach some arbitrary extinction criterion. The other measure was the latency or speed of the response on each of the extinction trials. In both cases, the presence of self-punitive behavior referred to the fact that a group receiving punishment showed relatively more resistance to extinction than did a nonpunished group.

While the phenomenon of self-punitive behavior deals specifically with the level of resistance to extinction of a punished group relative to that of a nonpunished group, punishment may also affect the absolute level of resistance to extinction of the groups being punished. In this case, attention is focused on the differences between the punished groups, themselves, without regard to how a nonpunished group might have performed.

Studies investigating self-punitive behavior have focused attention mainly upon the various parameters of the punishing stimulus. Delay, intensity, and duration are the major parameters of stimuli which have been used as punishments in self-punitive studies. The effects of each of these parameters are considered in separate sections below. Another important aspect of the punishment situation has to do with the nature of the response which is emitted by a S at the time the punishing stimulus is terminated. Since a response which coincides with the termination of an aversive stimulus becomes stronger, this response may either facilitate or retard the resistance to extinction of the punished response. Consideration of the response which terminates the punishment will also be included in this review of self-punitive studies.

DELAY OF PUNISHMENT

In five experiments, the effects of delay of punishment on running in a straight alley have been investigated. Four of these experiments demonstrated self-punitive behavior, while one found that punishment suppressed resistance to extinction. However, in all five experiments, immediate punishment produced greater absolute resistance to extinction than delayed punishment.

One of the first studies concerned with self-punitive behavior was conducted by Brown, Martin, and Morrow (1964). In this study, 10 escape-training trials were given on each of 2 consecutive days. Rats were dropped through a trap door onto a grid-floor electrified with a 45-v. ac. shock, and allowed to escape down a 7 ft. alley. On the third day, an extinction procedure was gradually initiated over a period of 5 trials. There were two punished groups and one nonpunished group. The non-punished group experienced a gradual reduction of shock in the start-box and in the alley section of the runway. One punished group experienced this reduction only in the start-box; the alley was maintained at the original shock level. The other punished group experienced the shock reduction in the start-box and in the initial 5 ft. of the alley. The final 2 ft. of the alley for this group remained at the original shock level. The goal-box for all groups was not electrified either during original escape-training or during extinction. The results showed that the group punished in the entire runway virtually retained its running speed over a 60 trial extinction period. The group punished in the final 2 ft. of the alley eventually reached the 1-min. extinction criterion. However, more trials were needed for this group to reach the criterion than for the nonpunished group. Therefore, in this experiment, both punished groups showed self-punitive behavior. Moreover, the group punished in the entire alley showed a greater absolute resistance to extinction than the group punished only in the final 2 ft. of the alley. Although not mentioned by Brown, the group which was punished in the entire runway also received its punishment closer to the start-box and therefore, sooner than the group punished in the final 2 ft. of the alley. This confounding of delay and duration of punishment was also present in a number of other studies to be reviewed below.

Martin and Melvin (1964) conducted an experiment to directly assess the effects of delaying punishment on resistance to extinction of running in a straight alley. After 4 shaping trials, in which a shortened runway was used, 12 escape-training trials were conducted in the entire 6 ft. of the runway. The intensity of the shock during both training and punishment-extinction was 65 v. ac., delivered through a 10K ohm resistance. Immediately after escape-training, one of three extinction procedures was presented: (1) regular extinction, in which no portion of the alley was electrified, (2) short delayed punishment, in which the initial 8 in. of the alley were electrified, or (3) long delayed punishment, in which the final 8 in. of the alley were electrified. The group punished immediately was more resistant to extinction than either the delayed punished group or the group that received no punishment. In this experiment, the group receiving immediate punishment showed self-punitive behavior.

In a very similar experiment (Melvin, Athey, and Heasley, 1965), punishment was experienced by various groups during extinction in either the initial foot, the final foot, or in the entire 4 ft. runway. There was also a group that received extinction with no punishment. Extinction followed 4 shaping trials in a short runway and 12 regular escape-training trials in the 4 ft. runway. The shock used during original training and during punishment-extinction was a 70-v. ac. stimulus, delivered through a 10K ohm resistance. The group punished in the initial foot of the runway continued to run throughout the 35 trial extinction period. The other two punished groups eventually stopped running in extinction, but they took more trials to extinguish than the nonpunished group. Again, the group receiving immediate punishment showed greater absolute resistance to extinction than the group receiving delayed punishment.

In a recent study conducted by Melvin and Stenmark (1968), various delays and intensities of shock were used to punish a response motivated by fear. Initially, all Ss received 18 fear-conditioning trials. In these trials the Ss experienced a 65-v. ac. inescapable shock while they were confined in the start-box of a straight-alley. After this training, all Ss received 3 extinction trials. These trials served to establish a baseline for the running response of escaping the fear-producing cues of the start-box. Finally, the Ss were split into 4 punished groups, according to a 2 X 2 factorial design. There was also a non-punished group. One dimension of the factorial design was the delay of punishment, either the center or the final foot of the 4 ft. alley was electrified. The other dimension was the intensity of the punishing shock; either a 55-v. or a 75-v. ac. shock, delivered through a 10K ohm resistance was used. While the mean speed of running decreased for the nonpunished group, the speed increased for all of the punished groups. At the end of 40 trials, the punished Ss were running faster than the nonpunished Ss. Therefore, self-punitive behavior was obtained in this experiment. The differences between the groups receiving the different intensities of punishment were not significant. However, punishment in the center foot of the alley produced greater absolute resistance to extinction than punishment in the final foot of the alley.

Campbell and Smith (1966) were unable to obtain self-punitive behavior after training rats to a criterion of 4 consecutive avoidances in a straight alley. In their study, the noxious stimulus during avoidance training and during punishment-extinction was a 185-v. ac. shock, delivered through a 150K ohm resistance. During avoidance training, the noxious stimulus was given 5 sec. after the onset of a buzzer. If the Ss ran into the goal-box within the 5-sec. period, they successfully avoided the shock. After the avoidance criterion was met, the Ss were placed in one of 3 groups during extinction. One group received no punishment, while the other two groups were given a fixed duration punishment of 0.15 sec. This punishment was delivered either 4 in. from the start-box or 8 in. from the goal-box. There was no difference in resistance to extinction between the start-punished and the nonpunished groups. The group punished near the goal-box, however, needed significantly fewer trials to reach an extinction criterion than the other two groups. In this experiment, neither of the two punished groups showed self-punitive behavior.

Fitzgerald and Walloch (in press) investigated the effects of delay of punishment on the resistance to extinction of a wheel-turning escape response of rats. In the first of two experiments, 50 training trials were given on each of two consecutive days. On each trial, the S had to turn a small wheel in order to escape a 0.6-ma. ac. shock. A tone, serving as a warning stimulus, was presented approximately 1 sec. before the shock. In extinction, a shock (0.6 ma.) was presented to the punished groups according to a 3 X 3 factorial design. One dimension of the design was the delay of punishment. After the occurrance of a wheel-turning response in extinction, punishment was delayed either 2.5 sec., 6.0 sec., or 16.0 sec. The other dimension of the design was the similarity between the conditions of escape-training and those of punishment-extinction. In one group (High Similarity), punishment consisted of presenting a trial just like one of the original training trials. For another group (Medium Similarity), punishment consisted of presenting the warning stimulus and shock; and for the third group (Low Similarity), punishment consisted of shock alone. A group receiving no punishment was also included in the study.

The results of this study showed that there was a significant interaction between the similarity variable and delay of punishment. At a delay of 2.5 sec., all punished groups showed suppressed resistance to extinction relative to the non-punished group. When punishment was delayed 16 sec., the High Similarity group showed greater resistance to extinction than the nonpunished group and to the two other punished groups. The Medium and Low Similarity groups failed to differ significantly from the nonpunished group at the 16 sec. delay.

The second experiment, which was reported in the same article, was also concerned with the effects of delay of punishment on the resistance to extinction of a wheel-turning response. In this experiment, original escape-training was identical to that given in the first study. During extinction, the punished groups were arranged according to a 2 X 2 factorial design. One dimension of the design was the delay of punishment (either 6.0 sec. or 16.0 se.); the other dimension was the interval between the response terminating the punishment and the following extinction trial (either 2.0 sec. or 12.0 sec.). The punishment procedure was identical to the High Similarity condition used in the first experiment.

Both intervals had a significant effect on the absolute resistance to extinction of the punished groups. The groups having punishment delayed by 16 sec. took more trials to extinguish than those having a 6 sec. delay. The groups for which the next trial followed the termination of punishment by 2 sec. took longer to extinguish than the 12-sec. groups. Of the 4 punished groups, the only group that took more trials to extinguish than the nonpunished group was the one for which punishment was delayed by 16 sec. and the next extinction trial followed the termination of punishment by 2 sec. This replicated the results of the first experiment, for it was a High Similarity group experiencing these same intervals which showed punishment-facilitation. However, the second experiment demonstrated the specificity of the experimental situation needed to obtain this facilitation in a wheel-turning apparatus.

Two generalizations can be made from the experiments reviewed in this section. In each of the 5 studies employing a runway, immediate punishment produced greater absolute resistance to extinction than delayed punishment. On the other hand, the experiments conducted in a wheel-turning situation showed that delayed punishment produced greater absolute resistance to extinction than immediate punishment. These conflicting results may be due to the fact that in the runway situation immediate punishment was always delivered closer to the start-box than delayed punishment. This may have allowed the aversive effects of immediate punishment to generalize more readily to the start-box than the aversive effects of delayed punishment. If this occurred, the Ss given immediate punishment should have continued to leave the start-box and run longer than the Ss given delayed punishment.

INTENSITY OF PUNISHMENT

In seven experiments dealing with self-punitive behavior, the intensity of the punishing stimulus has been manipulated. Three of these experiments failed to obtain self-punitive behavior, and 4 were successful in showing the effect. The occurrance of self-punitive behavior was not determined by the intensity of the punishing shock. However, if self-punitive behavior was obtained, strong shock produced a greater self-punitive effect than weak shock. On the other hand, if punishment produced suppression, strong shock produced more suppression than weak shock.

Gwinn (1949) trained rats to escape from a 60-v. ac. shock in a circular runway. Two levels of punishment, 60 v. and 120 v., were used in extinction. There was also a nonpunished group. The results indicated that both of the punished groups took longer to extinguish than the nonpunished group. Moreoever, the group that was punished with the high intensity shock took longer to extinguish than the group punished with the low intensity shock.

Melvin and Martin (1964) tested the effects of two qualitatively different types of punishing stimuli on resistance to extinction of an escape response. One group was trained to escape from a 50-v. ac. shock, delivered through a 10K ohm resistance. A second group was trained to escape from a 101 db (reference level, .0002 dynes/cm.^{2}) buzzer. The Ss that were trained to escape the shock ran faster at the end of acquisition than the Ss trained to escape the buzzer. Each of the 2 training groups were split into 3 subgroups for extinction: (1) no punishment, (2) punishment with shock, and (3) punishment with buzzer. The intensities of the shock and the buzzer during punishment-extinction were the same as those used during original training.

The results of this experiment showed that the groups punished with shock were more resistant to extinction than either the nonpunished groups or the groups punished with the buzzer. The group trained to escape shock and punished with the buzzer was more resistant to extinction than the nonpunished group. There was no difference between the nonpunished groups and the group both trained and punished with the buzzer. In this experiment, three groups showed self-punitive behavior.

In an experiment reviewed in the previous section (Melvin and Stenmark, 1968) fear conditioning was used in place of either escape or avoidance training. Although all of the punished groups showed self-punitive behavior, the absolute levels of resistance to extinction of the punished groups were not differentially affected by the intensity of the punishment.

Beecroft (1967a) employed an avoidance training procedure to test the effects of various punishment intensities upon resistance to extinction of a running response. The shock levels used in acquisition were 55 v. and 70 v., delivered through a 10K ohm resistance. After reaching an acquisition criterion of 1 successful avoidance, the Ss were divided into 4 groups for extinction. The intensity of the punishing shock was set for each of the groups at either 0 v., 40 v., 55 v., or 70 v. Only the groups punished either with 55-v. or with 70-v. shocks exhibited self-punitive behavior. Greater absolute resistance to extinction was found at the 55-v. and the 70-v. shock levels than at the 40-v. shock level.

Seward, King, Chow, and Shiflett (1965) combined 3 levels of shock intensity during training with 3 levels of shock intensity during punishment-extinction. There was also a non-punished group. The intensities chosen were 95 v., 155 v., and 215 v. ac., delivered through a 150K ohm resistance. On each of 20 escape-training trials, the S was dropped onto an electrified grid and allowed to escape the shock by running the length of the alley into a nonelectrified or safe goal box. Extinction immediately followed this training. The results showed that a number of Ss in each of the groups were still running after the 60-trial extinction period. However, more Ss were running in the non-punished groups than in the punished groups. The level of shock used during original training and extinction did not effect the number of Ss reaching the extinction criterion. No group showed self-punitive behavior.

Seligman and Campbell (1965) trained rats in a straight alley to avoid a 300-v. ac. shock, delivered through a 150K ohm resistance. After the S had reached a learning criterion of 9 consecutive avoidances, extinction was initiated. The extinction procedures consisted of a 6 X 2 factorial design. One dimension of this design was the intensity of the punishment (0 v., 45 v., 72 v., 115 v., 185 v., or 300 v.); the other dimension was the duration of punishment (0.15 sec. or 2.0 sec.). The punishment was delivered as the S entered the goal-box, and all of the punished groups showed less resistance to extinction than the non-punished (0 v.) group. Moreover, the level of resistance to extinction of the punished groups was inversely related to the intensity of the punishing shock. The groups that were punished with high intensity of shock took fewer trials to reach the 3 different extinction criteria than the groups that were punished with low intensity of shock. No group exhibited self-punitive behavior.

Smith, Misanin, and Campbell (1966) found that resistance to extinction of an avoidance response was an inverse function of punishment intensity. High intensities of shock produced less absolute resistance to extinction than low intensities of shock.

The experiment was conducted in a two-way shuttle-box. The warning stimulus consisted of a light and a click which was followed after 5 sec. by a 185-v. ac. shock, delivered through a 150K ohm resistance. Extinction was initiated immediately upon the attainment of the criterion of either 2, 4, or 8 consecutive avoidance responses. Punished groups received shock of fixed duration (either 0.15 sec. or 2.0 sec.) as soon as an extinction response was made. Five shock intensities were employed (45 v., 72 V., 115 V., 185 v., and 300 v.); and there was also a non-punished group. All the punished groups showed less resistance to extinction than the nonpunished group, and the amount of suppression increased as the intensity of the punishment increased. No group showed self-punitive behavior.

To summarize, 3 out of the 7 experiments reviewed in this section found that punishment produced suppression. The magnitude of this suppression was directly related to the intensity of the punishing shock. That is, a punishing shock of high intensity produced less resistance to extinction than a shock of low intensity. On the other hand, when self-punitive behavior was obtained, the magnitude of the effect was greater at high intensities of shock than at low intensities of shock. Taken together, these results indicate that an intense punishing shock may either markedly suppress or facilitate resistance to extinction. Unfortunately, whether facilitation or suppression will occur cannot be predicted from the intensity of the shock alone.

DURATION OF PUNISHMENT

In a number of experiments, the effects of different durations of punishment on the resistance to extinction of an escape or an avoidance response have been studied. These experiments have already been reviewed in the above sections. However, in order to provide a complete review of the parameters of punishment that have been tested, it is necessary to re-examine these studies paying particular attention to the effects of the duration of punishment.

Melvin, Athey, and Heasley (1965) employed 3 punished groups and a control group which received no punishment. Separate groups were punished in either the initial foot, the final foot, or in the entire 4 ft. runway. For the group punished in the initial foot of the alley and the group punished in the entire runway, the shock was delivered as soon as the S left the start-box. The group punished in only the initial foot of the alley did not extinquish in the 100 trial testing period. The group shocked in the entire alley showed the greatest resistance to extinction of the other three groups. The group punished in the final foot ranked next; and the nonpunished group was least resistant to extinction. However, only the group punished in the initial foot of the alley was statistically different from the nonpunished group. The group punished in the initial foot of the alley was also more resistant to extinction than either of the two other punished groups. Therefore, both a short delay and a short duration of punishment was necessary to obtain self-punitive behavior in this study. Moreover, at equal delays of punishment, the absolute level of resistance to extinction was greater for the short duration than for the long duration of punishment.

Smith, Misanin, and Campbell (1966) employed 2 durations of punishment (0.15 sec. and 2.0 sec.). The punishment was delivered after an extinction response was made in a two-way shuttle-box. As will be recalled, the authors employed a 5 X 2 factorial design with duration and intensity of punishment as the major dimensions of the design. Each of the 10 punished group showed less resistance to extinction than the nonpunished group. Moreover, at every intensity of punishment, the 2.0 sec. duration of shock produced less absolute resistance to extinction than the 0.15 sec. duration.

Seligman and Campbell (1965) employed a 3 X 5 factorial design in extinction. Like Smith et al., the major dimensions of the design were the intensity and duration of punishment. The durations of punishment were 0.15 sec., 0.5 sec., and 2.0 sec. None of the punished groups exhibited self-punitive behavior. The groups receiving the 0.15 sec. punishment duration showed a greater absolute level of resistance to extinction than the groups given the 0.5 and the 2.0 sec. durations of shock.

The results of the experiments reviewed in this section clearly showed that a punishment of a long duration produced an absolute level of resistance to extinction that was below the level produced by short durations of punishment. All experiments in which the onset of the punishment was controlled showed this effect. However, in a few cases, the effect of duration of punishment on resistance to extinction was masked because duration was confounded with delay of punishment. In these cases, the delay variable proved to have a more powerful effect on resistance to extinction than the duration variable.

RESPONSE TERMINATION OF PUNISHMENT

The type of response made at the termination of punishment may have an important influence on the resistance to extinction of a punished escape or avoidance response. This follows from the fact that a response which is effective in terminating an aversive stimulus gains in strength. Therefore, if this response is compatible with the response which is being punished, the resistance to extinction of the punished response could be increased. On the other hand, if the response which terminates the punishment is incompatible with the punished response, then the resistance to extinction of the punished response could be decreased.

Only one experiment dealing with self-punitive behavior has employed a design which made the termination of punishment contingent upon a specific response. In the study conducted by Fitzgerald and Walloch (in press), the termination of punishment for some groups was made contingent upon a wheel-turning response that was identical to the response that was being punished. Although not all of these groups showed punishment-facilitation in extinction, the response contingent termination of punishment did appear to be a necessary condition for the effect.

Even though none of the other studies reviewed made the termination of punishment explicitly contingent upon a specified response, the conditions of the experiment were so arranged that a particular response did in fact always terminate the punishment. In fourteen of these experiments (Beecroft, 1967a, 1967b, 1967c, 1967d; Bender, 1967; Brown 1964, 1965; Gwinn, 1949; Melvin, 1964, 1965, 1967; Moyer, 1955, 1957; and Seward, 1960) a section of the runway was electrified during extinction. Since the Ss had been taught during original training to run down the alley to escape or avoid shock, the running response during extinction brought them into contact with the electrified portion of the grid. Once the S encountered the electrified section, two responses could be made to escape the punishing shock. The S could either run forward into the goal section or retreat into the starting section. Although both of these responses were possible, the Ss showing self-punitive behavior ran into the goal section. Therefore, even though the termination of punishment was not made contingent upon a response compatible with the original escape response, such a response did in fact accompany the removal of punishment. Self-punitive behavior was obtained in 11 of the 14 experiments in which this relationship was present.

In two studies (Melvin, 1966; Campbell, 1966), the entire runway was electrified for a fixed duration. In these experiments, the termination of punishment was again not contingent upon any given response. Nevertheless, the S could continue to run toward the goal box to escape the punishment. While Campbell found that punishment suppressed resistance to extinction, Melvin found self-punitive behavior.

In a number of studies, the conditions were such that the response which occurred at the termination of punishment was not likely to be compatible with the punished response. Two experiments (Seligman, 1965; Kintz, 1967) delivered the punishing shock after the S had reached the goal-box. Under these circumstances, the S was prevented from running to terminate the punishment, and self-punitive behavior was not obtained. Smith (1966) delivered the punishing shock after the S had reached one side of a two-way shuttle-box. This procedure, which was very similar to punishing the S in the goal-box, also failed to produce self-punitive behavior. Therefore, when the response that terminated punishment was not like the response being punished, self-punitive behavior was not obtained.

CONCLUSIONS

Self-punitive behavior has never been obtained when the experimental conditions prevented a response which was similar to the punished response from occurring at the termination of punishment. Although only one study explicitly made the termination of punishment contingent upon a response like the punished response, many studies have arranged the conditions so that the two responses were similar. However, the compatibility of the two responses did not insure that self-punitive behavior would be obtained.

Intensity and delay of punishment have been shown to be important parameters influencing the resistance to extinction of a punished escape or avoidance response. The magnitude of the effect of the punishment on behavior was directly related to the intensity of the punishment. In studies which obtained self-punitive behavior, strong punishment produced a larger effect than a weak punishment. In studies in which punishment suppressed behavior, the greatest suppression was found with the highest intensities of punishment. Unfortunately, intensity of punishment, per se, does not appear to be an adequate index of whether or not self-punitive behavior will be obtained.

In studies conducted in a runway, immediate punishment produced greater absolute resistance to extinction or less suppression than delayed punishment. This effect was obtained in both successful and unsuccessful attempts to find self-punitive behavior. However, when a wheel-turning situation was used, just the reverse relationship was obtained. Delayed punishment produced greater absolute resistance to extinction than immediate punishment.

When delay of punishment was equated, long durations of punishment produced lower levels of resistance to extinction than short durations. Each of 3 experiments found this result. In other studies, which found that a long duration of punishment produced greater resistance to extinction than a short duration, delay of punishment was not controlled.

The purpose of the present study was to examine the effects of delay and intensity of punishment on the resistance to extinction of a punished wheel-turning escape response in rats. Both of these parameters of punishment have been shown to be important factors influencing the resistance to extinction of running in a straight alley. However, only delay of punishment has been investigated in a wheel-turning situation (Fitzgerald and Walloch, in press). It will be recalled that in that experiment, response facilitation due to punishment was obtained only under the very special condition of delaying the punishing shock by 16 sec. after an extinction response and by presenting the next extinction trial 2 sec. after the termination of punishment. Furthermore, the punishment procedure that was used consisted of presenting a trial that was in every respect identical to one of the original escape-learning trials. These restrictions of the experimental conditions that produce punishment-facilitation in extinction are in sharp contrast to those that are known to produce self-punitive behavior in a runway. In the present study, the punishment procedure was modified after those producing self-punitive behavior in a runway to see if the same effect might be obtained in a wheel-turning situation. The major modification from the earlier wheel-turning study was to allow the S to turn the wheel up to the time that punishment occurred. This makes the present study more analogous to the runway as the S in that situation encountered the punishing shock while in the process of running.

METHOD

SUBJECTS

The Ss were 150 naive, female, Long-Evans hooded-rats, 90-140 days old, obtained from the University of Oregon Medical School animal colony. They were housed in communal cages, 6 to a cage, until about 1 wk. before they were to be used in the experiment. At that time, the Ss were placed in individual cages and randomly assigned to an experimental group. All Ss had free access to food and water in their home cages.

APPARATUS

The experiment was conducted in a 12 X 10 X 8 in. chamber which was located in a Grason-Stadler Animal Chest. A fan located in the wall of the chest provided a background noise of 86 db (reference level, .0002 dynes/cm.^{2}) to help mask extraneous sounds. The chamber had three metal walls. The fourth wall and the ceiling were constructed out of plexiglass. Metal rods, 3/8 in. in diameter, were placed 1/2 in. apart to provide a grid floor through which shock was delivered. A speaker was mounted in the ceiling of the chamber and a 1 watt, 28-v. dc. light was secured to one of the end walls. On the end wall opposite the light, a wheel measuring 2 in. in diameter was mounted 3 in. above the grid floor. The wheel protruded 1 in. into the chamber. The wheel was made from 1/8 in. diameter rods fastened 3/8 in. apart along the periphery of the end plates. A photo-electric cell and a light source were mounted outside the chamber in such a way that the light beam could pass through 4 holes equally spaced around the periphery of the end plates of the wheel. The holes were spaced so that the photo-cell was activated when the wheel was rotated a quarter revolution. The photocell was connected through an amplifier to the programing equipment.

The wheel was covered by a semi-circular metal shield whose diameter was slightly larger than that of the wheel. This shield was raised at the beginning of a trial and lowered after a response by means of a reversible motor operating a pulley. The experiment was programed with the aid of Masey-Dickenson solid state logic, located in an adjoining room. Scrambled shock was provided by a 60-cycle Grason-Stadler Stimulater, model E 6070B. The shock levels listed in this experiment refer to the dial positions on the Grason-Stadler instrument. The impedance offered by an average rat would probably lie between 33K ohms and 68K ohms. In this case, the intensity of the shock experienced by the S would be approximately 80% of the dial setting.

PROCEDURE

All Ss received 100 escape-training trials on a single day. Each of these trials began by having the light in the experimental chamber blink at a rate of 10/sec., with the shield being in the down position over the wheel. After 1 sec., a 0.5-ma. shock was introduced. The shield was raised 1 sec. later and at the same time a 2,000 Hz. tone, measuring 96 db (reference level, .0002 dynes/cm.^{2}), was presented. This tone was also interrupted 10/sec.

and its purpose was to signal to the S the beginning of the period in which the escape response was possible. When the S rotated the wheel, the shock, light, and tone were immediately terminated. The shield, however, remained in the up position for an additional 2.0 sec. This 2 sec. period provided an opportunity for the S to turn the wheel in the abscence of shock and insure that a vigorous wheel-turning response was established.

Immediately upon the completion of escape-training, extinction was initiated. There were 8 groups (N=15 in each case) that received punishment in extinction and 2 groups that received no punishment. The punished groups were arranged according to a 2 X 4 factorial design, with the dimensions being the Delay and Intensity of the punishing shock. The shock was given either immediately (0-sec. delay) after an extinction response was made or after a delay of 5 sec. At each of these delays one of 4 intensities were used: 0.5 ma., 0.8 ma., 1.3 ma., or 2.0 ma.

Extinction trials were exactly like escape-training trials except, or course, shock was not presented. An extinction trial began by having the light blink at a rate of 10/sec. The shield was raised and the interrupted tone was introduced 2 sec. after the light began to blink. If a response was not made within 60 sec., the shield came down and the light and tone were terminated. If a S in one of the punished groups made an extinction response, a shock was delivered at the proper delay and intensity. In the case of the 5-sec. delay groups, the Ss could continue to turn the wheel during the 5-sec. interval that separated the initial extinction response from the onset of the punishing shock. A S receiving immediate punishment was shocked as soon as the extinction response was made. Each S was required to turn the wheel in order to terminate the punishing shock. Immediately after this response, the punishing shock, light and tone were turned off. As in original escape-training, the shield remained in the up position for an additional 2 sec.

A separate control group was used for the immediate and for the delayed punished groups. These control groups were included in the design of the study to check on the possible effects that turning the wheel during the delay of punishment interval might have on resistance to extinction. Neither of the control groups received shock during extinction. For a S in the immediate control group, the light and tone were terminated immediately after the initial extinction response. For a S in the delayed control group, the light and tone remained on for an additional 5 sec. This 5-sec. interval corresponded to the delay of punishment interval experienced by the 5-sec. delay punished groups. As in original escape-training, the shield remained in the up position for 2 sec. after the light and tone were terminated for both nonpunished groups.

Escape-training and extinction trials were separated by intertrial intervals of 5, 10, 15, 20, and 25 sec. The intertrail interval began when the shield was lowered over the wheel. The sequence of these intervals was random, with a mean of 15 sec. Extinction was continued until the S met a criterion of 5 consecutive failures to respond within 60 sec. One S was terminated after failing to extinguish after 350 trials. Furthermore, a S that reached the extinction criterion without making a single response was not included in the statistical analysis. Such a S was not influenced by the experimental variables of delay and intensity of shock since these variables came into play only after an extinction response was made.

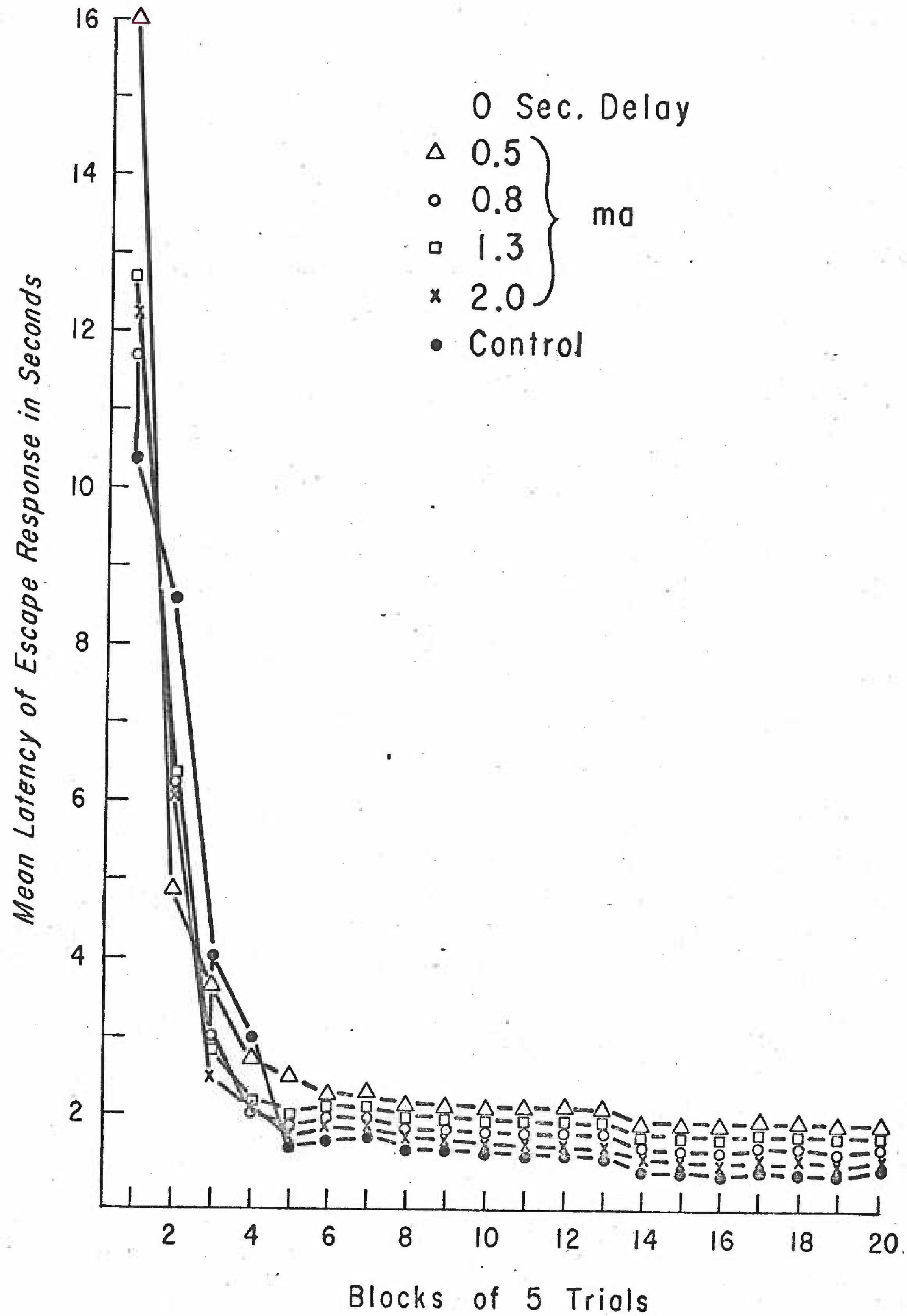
RESULTS

LATENCY OF ESCAPE RESPONSE

The mean latency of escape responses of each of the 0 and 5-sec. delay groups during original learning are plotted in Figures 1 and 2, respectively. These latencies were averaged over blocks of 5 trials and analyzed statistically in order to obtain some index of the progress of learning to escape from the shock. This analysis determined whether there were any differences between the groups in escape learning prior to the start of extinction. Since all groups received identical escape training, the latencies of their escape responses should have been similar.

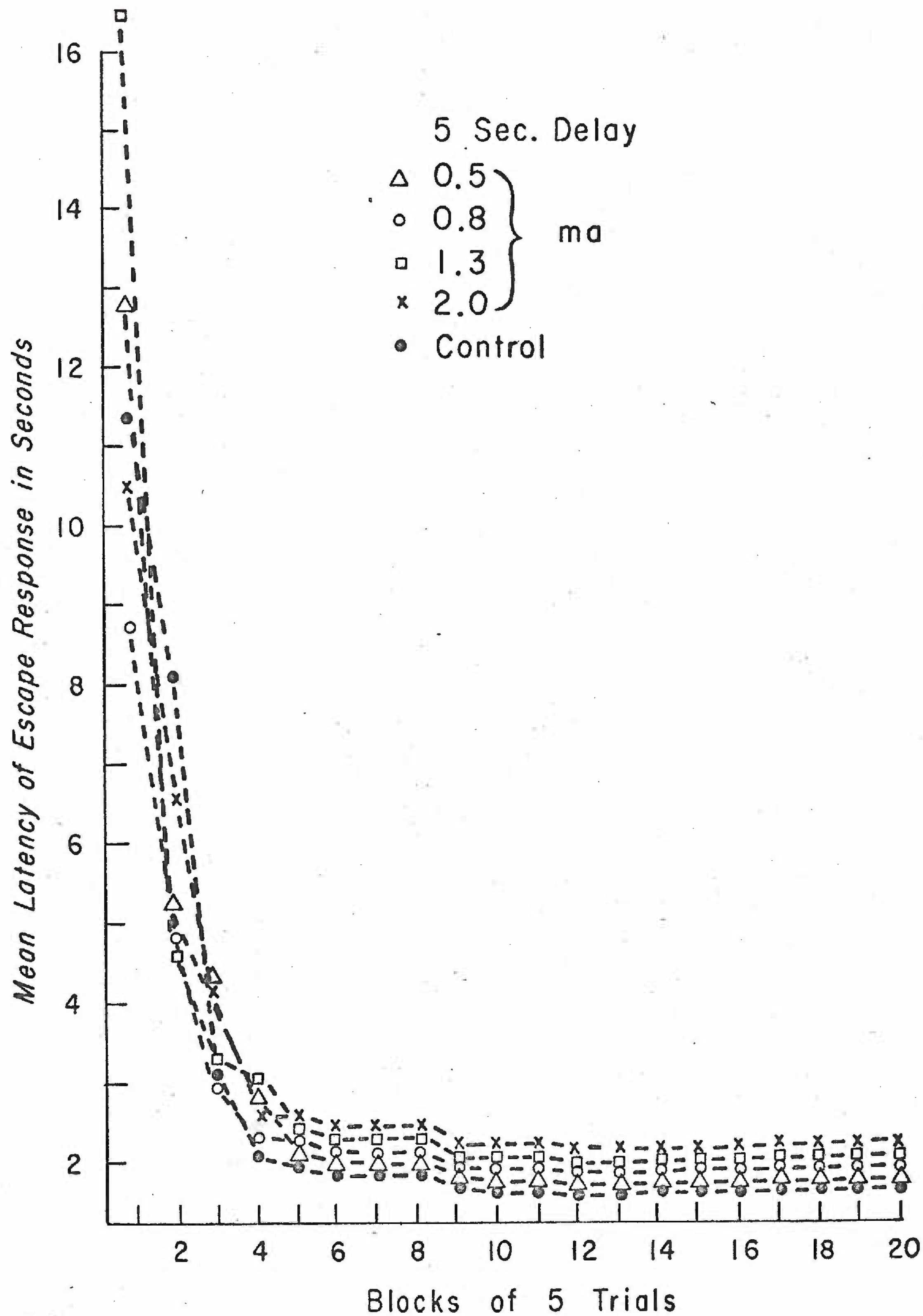
Figures 1 and 2 show that initially all groups took a long time to respond, with the shortest mean latency on the first block of 5 trials being 8.5 sec. There was also a substantial difference in the amount of time taken by the various groups to make a wheel-turning response on the initial trials with some groups responding with latencies almost twice that of other groups. All groups escaped the shock more quickly as training progressed. By trial block 5, the mean escape latency for all groups was approximately 2 sec.; and the time needed to respond fell to 1.6 sec. by the end of training. Along with the increased speed of responding, the differences between groups disappeared. By the end of the acquisition period, there was practically no difference between the mean escape latencies of any of the groups.

Figure 1. Mean response latencies for the 0-sec. delay punished groups during original escape training.



0 Sec. Delay
0.5
0.8
1.3
2.0
ma
Control
Mean Latency of Escape Response in Seconds
16
14
12
10
8
6
4
2
2
4
6
8
10
12
14
16
18
20
Blocks of 5 Trials

Figure 2. Mean response latencies for the 5-sec. delay punished groups during original escape training.



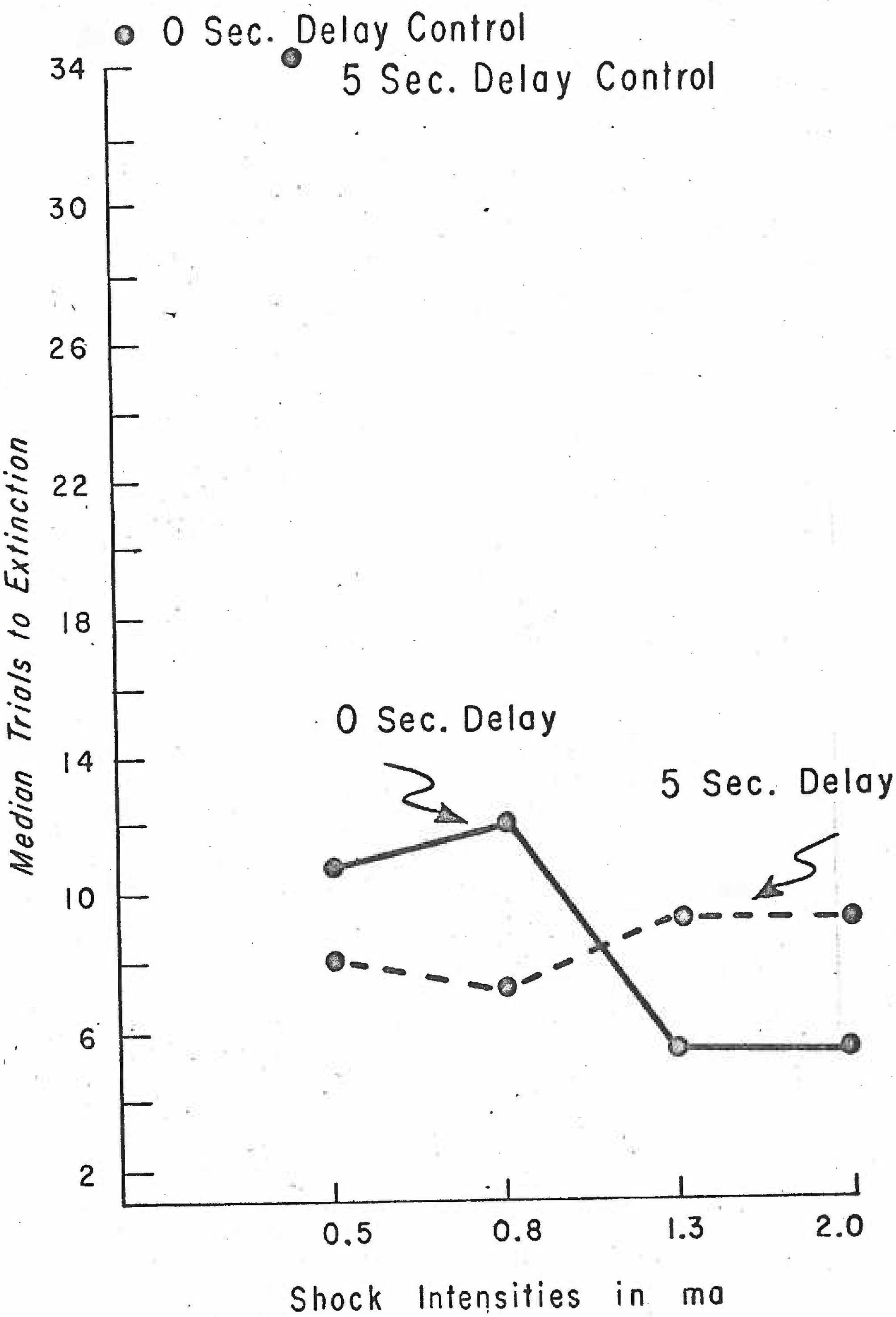
5 Sec. Delay
0.5
0.8
1.3
2.0
ma
Control
Mean Latency of Escape Response in Seconds
Blocks of 5 Trials
2
4
6
8
10
12
14
16
18
20

An analysis of variance supported the observations made from Figures 1 and 2. The main dimensions of this analysis were shock level, delay of punishment, and trials. The main effect of Trials was highly significant (F=175, df=19/2660, p .001). This reflects the substantial decrease in response latencies during escape learning. There was also a significant Shock Level X Trials interaction (F=1.65, df=76/2660, p<.01). This interaction supports the observation that the mean escape latencies of the groups converged as training progressed. The other main effects and interactions were not significant.

TRIALS TO EXTINCTION

In this experiment, 5 consecutive failures to respond within 60 sec. was employed as the extinction criterion. The median number of trials taken by each group to reach this criterion is plotted in Figure 3. It is clear that each of the punished groups took fewer trials to reach the extinction criterion than the nonpunished groups. Among the punished groups, themselves, there appears to be an interaction between intensity and delay of punishment. The 0-sec. delayed punishment groups took slightly more trials to reach the extinction criterion at high intensities of shock than at low intensities of shock. The opposite effect was exhibited by 5-sec. delayed punishment groups. At low intensities, the median trials to extinction was approximately twice the median at high intensities. In contrast to the punished groups, there appeared to be no difference in trials to extinction

Figure 3. Median trials taken to reach the extinction criterion by punished and nonpunished groups as a function of shock intensity.


0 Sec. Delay Control
5 Sec. Delay Control
34
30
26
22
18
14
10
6
2
Median Trials to Extinction
0 Sec. Delay
5 Sec. Delay
0.5
0.8
1.3
2.0
Shock Intensities in ma

between the two nonpunished groups.

A Wilson (1956) nonparametric analysis of variance was applied to the data of the punished groups. This test is similar to the Median Test (Siegel, 1956), and it makes no assumptions about the underlying distribution of the statistical population. The main effects of delay and intensity of punishment were not significant. The apparent interaction between these main effects also failed to reach significance.

Since neither intensity nor delay of punishment had a significant effect upon trials to extinction, the data from the punished groups were combined. The nonpunished groups were not different from each other (Median Test); and their data were also combined. A Median Test was then used to compare the punished and the nonpunished groups. The difference between these groups was significant (X^2=10.68, df=1, $p<.01$). The punished groups took fewer trials to reach the extinction criterion than the nonpunished groups.

Each of the punished groups was compared with the appropriate nonpunished group by means of a Mann-Whitney U Test. The results of these tests are listed in Table 1. Each of the 0-sec. delay punished groups was significantly below the matched nonpunished group. While the 1.3-ma. and 2.0-ma. groups were significant at the .002 level, the 0.5-ma. and the 0.8-ma. groups were significant at the 0.5 level. For the 5-sec. delayed groups, the 0.5-ma. group was not significantly different from the

Table 1. Results of individual Mann-Whitney U tests comparing the trials to extinction of the punished groups with the appropriate nonpunished control group.

0-sec. delay	Medians	U	n_1/n_2	p
0.5 ma. vs. control	11 vs. 35	62.0	15/15	.05
0.8 ma. vs. control	12 vs. 35	58.0	15/15	.05
1.3 ma. vs. control	5 vs. 35	33.5	15/15	.002
2.0 ma. vs. control	4 vs. 35	22.0	15/15	.002

5-sec. delay	Medians	U	n_1/n_2	p
0.5 ma vs. control	11 vs. 37	67.0	15/15	n.s.
0.8 ma. vs. control	8 vs. 37	63.0	15/15	.05
1.3 ma. vs. control	9 vs. 37	62.5	15/15	.05
2.0 ma. vs. control	9 vs. 37	63.0	15/15	.05

matched nonpunished group. All of the remaining 5-sec. delay punished groups were significantly below the nonpunished group at the .05 level.

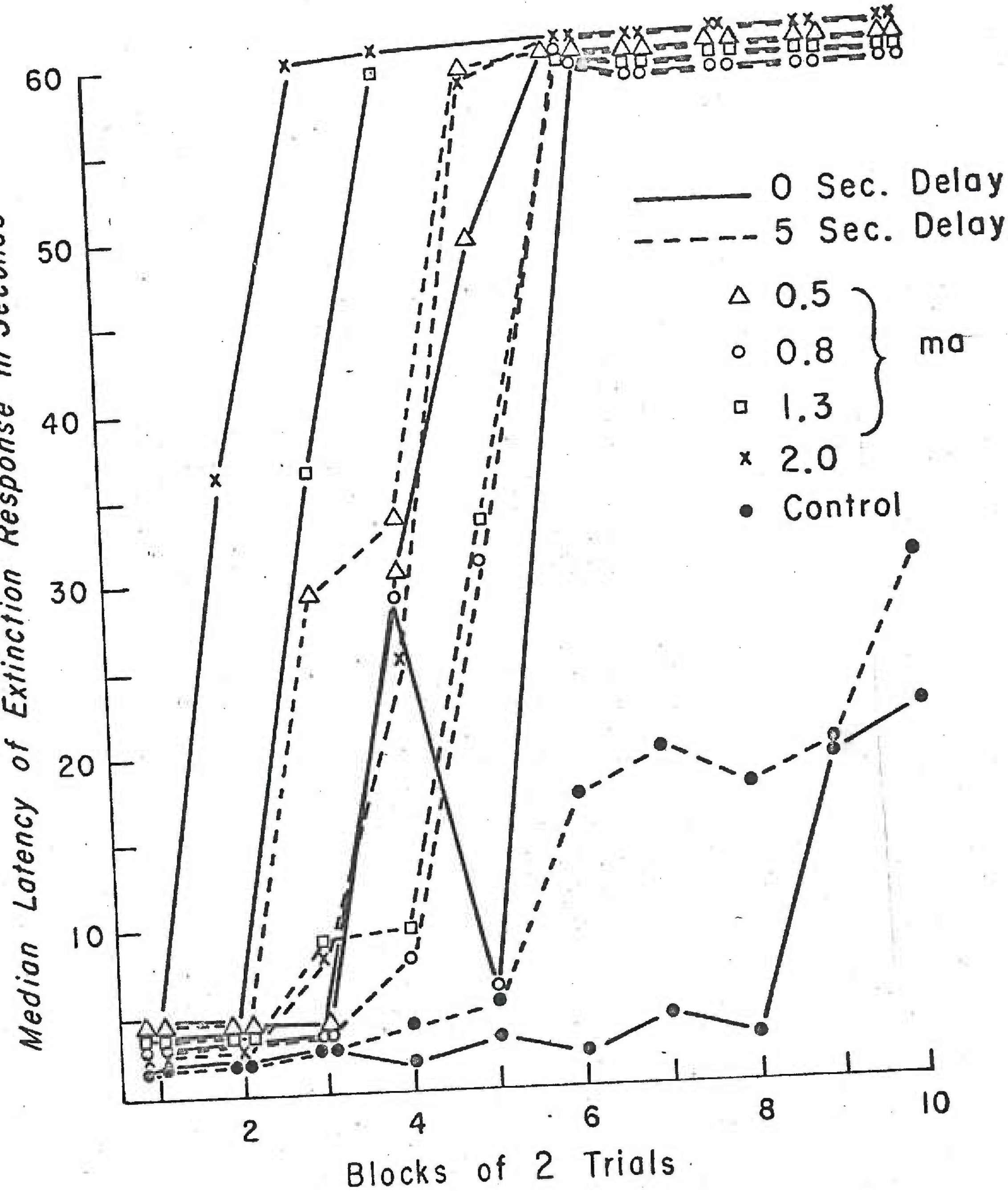
Punishment, therefore, reduced the number of trials to extinction. When taken together, the punished groups were significantly below the nonpunished groups in trials to extinction. However, when individually compared with the nonpunished groups, all of the punished groups did not reach the same level of significance. The groups punished with the strong intensities of shock fell further below the matched nonpunished group than the groups punished with the weak intensities of shock.

LATENCY OF RESPONSE DURING EXTINCTION

The median latencies of responses during the first 20 extinction trials for the various groups are plotted in blocks of 2 trials in Figure 4. From this figure, one can see that the response latencies of the punished groups increased more rapidly than those of the nonpunished groups. By the sixth block of trials the medians of all the punished groups had reached the 60 sec. maximum. However, the nonpunished groups were still responding with latencies shorter than 30 sec. after the tenth block of trials. There also appears to be a systematic difference between the latencies of the punished groups.

For the 0-sec. delay condition, the groups punished with the strong intensities of shock (2.0-ma. and 1.3-ma.) had longer

Figure 4. Median response latencies of punished and non-punished groups during extinction.



Median Latency of Extinction Response in Seconds
60
50
40
30
20
10
2
4
6
8
10
Blocks of 2 Trials
0 Sec. Delay
5 Sec. Delay
0.5
0.8
1.3
2.0
ma
Control

response latencies than the groups punished with the weak intensities of shock (0.8-ma. and 0.5-ma.). This relationship between punishment intensity and extinction behavior did not seem to hold in the 5-sec. delay groups. In the 5-sec. delay condition, the group punished with the 0.5-ma. shock had the longest response latencies. Of the remaining groups, the two groups punished with the strong intensities of shock (2.0-ma. and 1.3-ma.) had longer response latencies than the group punished with the weak shock (0.8-ma.). A difference between the two non-punished groups also seems apparent. The 5-sec. delay control group appears to have responded with longer latencies than the 0-sec. delay control group.

A Wilson (1956) nonparametric analysis of variance was conducted using the data of the punished groups. The main effects of the analysis were Intensity of shock, Delay of punishment, and Trials. Intensity ($\underline{X}^2=23.19$, $\underline{df}=3$, $p<.001$) and Trials ($\underline{X}^2=315.21$, $\underline{df}=9$, $p<.001$) were highly significant while the main effect of Delay of punishment did not reach the .05 level of significance. The interaction between Delay and Intensity of shock was also significant ($\underline{X}^2=16.26$, $\underline{df}=3$, $p<.01$). This interaction indicates that intensity of punishment affected the 0-sec. delay groups and the 5-sec. delay groups in a different manner. This difference can be seen in Figure 4 and has been described above.

A Wilson (1956) test was conducted on the two nonpunished groups. The difference between the groups was not significant nor was the interaction between groups and trials. However, the main effects of trials reached significance ($\underline{X}^2$=20.51, $\underline{df}$=9, $\underline{p}<.05$). Therefore, both of the nonpunished groups increased the latency of their responses during extinction. Moreover, there was no significant difference in the time taken to respond by the two nonpunished groups as extinction progressed.

A Wilson (1956) nonparametric analysis of variance was also used to compare the latencies of the punished groups with the latencies of the nonpunished groups in extinction. The main effect of Trials was highly significant ($\underline{X}^2$=319.43, $\underline{df}$=9, $\underline{p}<.001$). This showed that both the punished and nonpunished Ss took longer to respond as extinction progressed. The main effect of Punishment vs. Control was also highly significant ($\underline{X}^2$=58.01, $\underline{df}$=1, $\underline{p}<.001$). In extinction, the punished groups took longer to respond than the nonpunished groups. The Trials X Punishment vs. Control interaction was also significant ($\underline{X}^2$=20.31, $\underline{df}$=9, $\underline{p}<.05$). At the beginning of extinction, there was practically no difference in response latencies between the punished and nonpunished groups. By the 20th extinction trial, however, the punished groups were taking more time to respond than the nonpunished groups. The significant interaction indicates that the difference between punished and nonpunished groups became larger as extinction progressed.

Table 2. Results of individual Mann-Whitney U Tests comparing the latencies of the extinction response of the punished groups with the appropriate control group.

0-sec. delay	Medians	U	n_1/n_2	p
0.5 ma. vs. control	57.9 vs. 3.2	73.5	15/15	n.s.
0.8 ma. vs. control	32.0 vs. 3.2	80.0	15/15	n.s.
1.3 ma. vs. control	58.0 vs. 3.2	60.0	15/15	.02
2.0 ma. vs. control	58.0 vs. 3.2	38.0	15/15	.002

5-sec. delay	Medians	U	n_1/n_2	p
0.5 ma. vs control	58.0 vs. 5.8	85.0	15/15	n.s.
0.8 ma. vs. control	58.0 vs. 5.8	89.0	15/15	n.s.
1.3 ma. vs. control	58.0 vs. 5.8	64.0	15/15	.05
2.0 ma. vs. control	58.0 vs. 5.8	62.0	15/15	.05

The median latency of each of the punished groups was compared with the appropriate nonpunished control group by means of a Mann-Whitney U test. The results of these tests are listed in Table 2. At 1.3-ma. and 2.0-ma. shock intensities, the punished groups took significantly longer to respond than the nonpunished groups.

The punished groups, when considered together, responded with longer latencies in extinction than the nonpunished groups. However, individual group comparisons showed that only the two highest shock intensities significantly suppressed behavior relative to the nonpunished groups.

SUBJECTS THAT RESPONDED AFTER THEIR FIRST FAILURE

For Ss in the punished groups, shock followed each extinction trial on which a wheel-turning response was made. Therefore, the first time that these Ss did not receive shock was the first extinction trial on which they failed to respond. Their behavior after this initial exposure to a nonshocked trial was investigated by observing whether or not the Ss responded again after their first failure to respond.

Table 3 lists the number and percentage of Ss in each group that responded at least once after the first failure to respond on an extinction trial. Table 3 clearly indicates that a larger proportion of the nonpunished Ss responded after their initial failure than the punished Ss. A Chi Square test showed that there was no significant difference between the number of Ss that responded after their initial failure in the punished groups.

Since a Chi Square test indicated that the differences between the punished groups were not significant, the data from these groups were combined and compared with the combined data from the nonpunished groups. The difference between these combined scores was significant (X^2=3.84, df=1, $p < .02$). More Ss in the nonpunished groups responded after their first failure to respond than Ss in the punished groups.

Table 3. Number and percentage of Ss in each punished and nonpunished group that responded at least one time after their initial failure to respond during extinction.

GROUP	NUMBER OF Ss	PERCENTAGE OF Ss
Immediate Nonpunished	11	72%
Delayed Nonpunished	12	80%
Combined Nonpunished	23	77%

Immediate 0.5 ma.	10	67%
Immediate 0.8 ma.	4	27%
Immediate 1.3 ma.	4	27%
Immediate 2.0 ma.	5	33%
Delayed 0.5 ma.	4	27%
Delayed 0.8 ma.	5	33%
Delayed 1.3 ma.	7	47%
Delayed 2.0 ma.	8	53%
Combined Punishment Extinction	47	39%

DISCUSSION

The results of the present study failed to provide any evidence of self-punitive behavior. When considered together, the punished groups took fewer trials to reach the extinction criterion and had longer response latencies on extinction trials than the nonpunished groups. Moreover in the 0-sec. delay condition, Ss punished with intense shocks (2.0-ma. and 1.3-ma.) had longer response latencies than the Ss punished with weak shocks (0.8-ma. and 0.5-ma.). In the 5-sec. delay condition, this relationship between behavior and shock intensity did not hold. The Ss punished with the 0.5-ma. shock had the longest response latencies. Of the remaining 5-sec. delay groups, those punished with strong shocks (2.0-ma. and 1.3-ma.) had longer response latencies than the group punished with the weak shock (0.8-ma.).

At the present time, most successful attempts to establish self-punitive behavior have been conducted in a straight alley. In spite of the number of demonstrations of the phenomenon in this situation, no clear explanation of self-punitive behavior can be given at the present time. The current study attempted to isolate the parameters of the runway studies which might produce self-punitive behavior.

In many of the runway studies showing self-punitive behavior, a portion of the grid floor between the start-box and goal-box was electrified during punishment-extinction. Under these conditions, the punished Ss were in the process of running when they encountered the shock. In an earlier wheel-turning study (Fitzgerald and Walloch, in press), a metal shield prevented the Ss from responding at the time that punishment was delivered. Therefore, while wheel-turning reactions could not occur at the onset of punishment in that study, running brought the S into contact with the electrified portion of the grid in runway studies.

The present study was designed to eliminate this difference between the wheel-turning and straight alley situations. In this study, the metal shield was not lowered during the delay of punishment interval. Therefore, most Ss were spinning the wheel at the time the punishing shock was introduced. This procedure should have made the present study analogous to the runway situation. Nevertheless, no evidence of self-punitive behavior was obtained.

In runway studies, Ss not only ran into the electrified portion of the alley, they also escaped from that section of the alley by running into a safe goal-box. Therefore, the same response that brought the Ss into contact with the punishment also terminated the punishment. Studies (eg. Kintz, 1967) that have made a running response unlikely at the termination of the punishment were unsuccessful in obtaining self-punitive behavior.

In the earlier wheel-turning study (Fitzgerald and Walloch, in press), punishment was response terminated for some of the groups. For other groups, the termination of punishment was not contingent upon the Ss behavior. With an appropriate delay of punishment interval, the groups for which punishment was response terminated took more trials to reach the extinction criterion than the groups experiencing noncontingent shock termination. Therefore, response termination of punishment seemed to be a necessary condition for obtaining punishment-facilitation of wheel-turning. However, the establishment of this contingency, by itself, has not insured that punishment will increase resistance to extinction.

Although response facilitation by punishment has frequently been obtained in the straight alley, it has been difficult to observe in a wheel-turning situation. This suggests that some important aspect of the runway situation has been overlooked when wheel-turning was examined. In runway studies which obtained self-punitive behavior, the S was originally taught to escape from the shock and fear-producing cues of the start-box to the safety cues of the goal-box. In the wheel-turning chamber, by contrast, the S was confined within a relatively homogeneous area. Stimuli were introduced into the chamber to warn the S of the onset of shock. These stimuli should have served, in an analogous sense, the same function as the fear-producing cues of the start-box. However, the stimuli in the wheel-turning situation might not have been as effective as the start-box cues in signaling the onset of shock.

Many investigators, including Brown (1964), Melvin (1966), Seward (1965), and Campbell (1965), have indicated that the fear-producing cues provided by the start-box may be important for obtaining self-punitive behavior. This consideration, often discussed in the context of the fear hypothesis, was originally proposed by Mowrer (1950). According to the fear hypothesis, the cues of the start-box acquire fear-producing qualities by being paired with shock during original escape or avoidance training. During extinction, when shock is no longer present in the start-box the S continues to leave the start-box and run down the alley because of the motivating effects of the fear in the start-box. In regular extinction, shock is never presented in any section of the runway and the fear in the start-box eventually extinguishes. This leads to the cessation of running. However, in punishment-extinction, the S encounters shock in some portion of the alley. Since shock is part of the total stimulus situation, the cues of the start-box may maintain their fear-producing qualities. The S continues to run as long as the cues of the start-box elicit fear. Therefore, a punished S would be expected to run longer than a nonpunished S; and self-punitive behavior might be explained by the fear hypothesis.

Melvin and Stenmark (1968) conducted a study which directly supported the fear hypothesis. It will be recalled that in this study, the Ss were initially given a series of inescapable shocks while they were confined in the start-box. Under these conditions, the cues of the start-box could acquire fear-producing qualities. However, the S had no opportunity to learn an escape response. During extinction the start-box was no longer electrified and the Ss were given the opportunity to escape the fear-producing cues of the start-box by running down the alley into the goal-box. While some of the Ss were never shocked during extinction, a portion of the alley was electrified for other Ss. The speed of running down the alley decreased rapidly for the nonshocked Ss. On the other hand, the Ss which were punished actually ran faster as punishment-extinction progressed. Since fear, rather than shock, motivated the Ss to leave the start-box, the increase in the running speed of the punished Ss might be attributed to an increase in the level of fear. In any case, fear seems to have been the prime motivating force for running in that experiment.

Although fear-producing cues have often been discussed, the cues associated with the abscence of shock have not received equal attention. Nevertheless, these safety cues could significantly influence self-punitive behavior. Under proper conditions a stimulus aasociated with the abscence of shock can have effects which are opposite the effects of a fear-producing stimulus.

One of the first experiments demonstrating the effects of a safety signal was conducted in Solomon's laboratory (Rescorla and LoLordo, 1965). This study consisted of three phases. In the first phase, a fear-motivated response was firmly established. The response was a hurdle jump in a two-way shuttle-box. In order to avoid all shocks, the S had to make at least one response every 30 sec. After some training, every S jumped at a stable rate which was fast enough to avoid most shocks. In the second phase of the experiment, a stimulus was associated with inescapable shock. This stimulus, then, should have obtained fear-producing qualities. A second stimulus was always associated with the absence of shock. This stimulus should than signal a safe period. In the third phase of the study, the S was again placed in the shuttle-box. After a stable rate of jumping was obtained, the two stimuli used in the second phase were introduced successively into the shuttle-box. When the fear-producing stimulus was introduced, the Ss increased their rate of jumping. On the other hand, the safety signal caused the Ss to jump at a slower pace. In this study, the fear and safety cues had opposite effects on behavior.

Perhaps, both fear-producing and safety cues must be maintained in the situation to observe self-punitive behavior. During extinction, fear seems to motivate the Ss to leave the start-box. However, fear-reduction may also be necessary to maintain a vigorous instrumental response. If the start and goal boxes had equal fear-producing qualities, the instrumental response would not be reinforced by fear-reduction. Therefore, if fear-reduction is necessary for self-punitive behavior, the cues of the goal-box must have safety qualities in contrast to the fear-producing stimuli of the start-box.

A stimulus which could have served as a safety signal was noticably absent from many of the studies which failed to find self-punitive behavior. In the runway studies by Campbell (1966) and Seligman (1965), the goal-box and the start-box were interchanged. Although this procedure made it possible to run the experiment without handling the Ss, it also made it impossible for the goal-box to serve as a clearly defined safety area. In fact, no stimulus was uniquely associated with the absence of shock. Both of these studies found that punishment suppressed behavior. Perhaps, the absence of the fear-reducing or safety cues of a unique goal-box could explain these suppressive results.

Smith (1966) used a two-way shuttle-box in his study. During training, the S was shocked in both compartments of this apparatus. Therefore, no portion of the shuttle-box could serve as the fear-reducing safety cue. Like the runway studies in which the start and goal boxes were interchanged, Smith found that punishment suppressed resistance to extinction.

Kintz and Bruning (1967) punished the Ss while they were confined in the goal-box. Such a procedure should have quickly given the cues of the goal-box fear-producing qualities. Punishment, of course, suppressed running during extinction.

In contrast to the experiments which found that punishment suppressed behavior, studies demonstrating self-punitive behavior have often established the goal-box cues as a safety signal. At least the procedures employed in these studies would have made the establishment of the safety qualities probable. Eight experiments (Beecroft, 1967a, 1967b, 1967c, 1967d; Brown, 1964, 1965; and Melvin, 1966, 1968) employed a wooden-floor goal-box and a duplex start-box. In these studies, the S was initially placed in the upper level of the bi-level start-box. As the trial began, a trap door opened and the S fell to the lower level which was electrified. Since the electrified alley was continuous with the lower portion of the start-box, the S ran down the alley into the wooden goal-box. Under these conditions, the S probably had little difficulty differentiating the cues of the start-box from those of the goal-box. Therefore, the start-box could have had fear-producing qualities while the goal-box had fear-reducing or safety qualities. Although Gwinn (1949), Martin (1964), and Melvin (1965, 1967) did not employ a duplex start-box, their procedures probably made the goal-box distinct enough from the start-box to serve as a safety cue. All of the above studies demonstrated self-punitive behavior. In each of these studies, the goal-box could have served as a safety signal. Therefore, a safety signal may be a necessary condition for self-punitive behavior.

The results of a single experiment (Seward, 1965) failed to support this hypothesis about a safety signal. In this study, a duplex start-box was employed at the initiation of a trial. Therefore, the cues of the start-box were very different from the cues of the goal-box. Nevertheless, punishment suppressed behavior. The reason for the suppression was not apparent.

In the present wheel-turning study, only the absence of external stimuli and the Ss internal cues produced by responding signaled the safety period. There was no external stimulus that was uniquely associated with the freedom from shock. However, as indicated above such a stimulus may be necessary to obtain self-punitive behavior. The addition of a stimulus which is associated with the absence of shock may allow self-punitive behavior to be obtained in a wheel-turning situation.

In the present study, delay of punishment by itself had no effect on the absolute level of resistance to extinction. In the earlier wheel-turning study (Fitzgerald and Walloch, in press), the groups receiving the long delay of punishment took more trials to extinguish than the groups receiving the short delay of punishment. On the other hand, the opposite results were obtained in runway studies, with immediate punishment producing greater absolute resistance to extinction than delayed punishment.

The increased resistance to extinction of immediate punishment observed in the runway might be due to the generalization of fear. With immediate punishment, shock was delivered near the start-box, whereas, with delayed punishment shock was delivered further down the alley. Because of the proximity of shock to the start-box, fear should generalize to the start-box more readily with immediate punishment than with delayed punishment. In the wheel-turning apparatus, these spatial considerations are not revelant; and consequently, the effects of delaying punishment may be very different.

While delayed punishment produced greater resistance to extinction than immediate punishment in the earlier wheel-turning study (Fitzgerald and Walloch, in press), there was no significant effect of delay of punishment in the present study. This difference in results might be explained on the basis of the ease with which the punishing effects of wheel-turning could be discriminated. In the earlier study, a shield prevented continued wheel-turning during the delay of punishment interval. Therefore, the <u>Ss</u> in the delayed punishment groups may have been making responses other than wheel-turning at the time that the punishment was delivered. Under these conditions, it might have been difficult for the Ss to associate the punishment with wheel-turning. In the present study, the Ss were turning the wheel at the onset of punishment. For the Ss in the 5-sec. delay groups, the shield remained in the up position during the delay interval. For the 0-sec. delay groups, shock was introduced immediately following the extinction response. For this reason, the contingency between wheel-turning and punishment might have been learned easily in the present study.

Although the intensity of punishment in the present study had no differential effect on trials to extinction, it did influence the latencies of the extinction response. Under the 0-sec. delay condition, groups punished with intense shocks (2.0-ma. and 1.3-ma) had longer response latencies than groups punished with weak shocks. When punishment was delayed 5-sec., the group receiving 0.5-ma. punishment had the longest response latencies. However, amoung the remaining groups, those experiencing intense punishment (2.0-ma. and 1.3-ma.) had longer response latencies than the group receiving the weak shock (0.8-ma.). Therefore, with the single but significant exception of the 5-sec. delay group receiving 0.5-ma. shock, intense punishment suppressed behavior to a greater degree than weak punishment. In the introduction, studies investigating the effects of punishment intensity in a self-punitive situation were reviewed. Five of these experiments found that punishment suppressed behavior. In each of these five studies, suppression was an increasing function of the intensity of punishment. With the exception noted above, the same relationship between intensity of punishment and suppression of behavior was obtained in the present experiment when response latencies were analyzed.

The extinction criterion of five consecutive failures to respond within 60 sec. was quite stringent. However, most S receiving punishment failed to respond on the four consecutive trials following the trial on which they made their initial failure. Therefore, the first trial on which a S failed to respond within 60 sec. could have been used as the extinction criterion for the punished groups without changing the results of the experiment. A 60-sec. extinction criterion has been employed in most of the successful attempts to obtain self-punitive behavior. For this reason, it seems unlikely that the suppressive effects of punishment observed in the present experiment were due to the artificial restraints of the extinction criterion.

The Ss in the nonpunished groups usually responded one or more times after their initial failure to respond. Therefore, the extinction criterion employed in the present experiment may have elevated the resistance to extinction of these groups. However, if the median trials to extinction of the nonpunished groups had been much lower it would have been difficult to show a suppressive effect of punishment on wheel-turning. It seems certain that the failure to find self-punitive behavior in the present study was not due to an unusually high level of resistance to extinction of the control groups, but rather to the suppressed behavior of the punished groups.

The amount of original training used in other experiments has varied widely. There is no evident relationship between the amount of original training and the effects of punishment on resistance to extinction of an aversively motivated response. Beecroft and Bouska (1967a) obtained self-punitive behavior after 8 shaping and 2 escape-training trials. Beecroft and Brown (1967b), on the other hand, obtained self-punitive behavior employing 50 escape-training trials. The modal number of original training trials used in runway studies is 15. Since 100 training trials were employed in the present experiment, overtraining could have been a factor leading to punishment suppression. At the present time there is not enough evidence to judge this possibility adequately as too few experiments have been conducted in which an extended amount of training was employed.

The 15 sec. intertrial interval used in this study is similar to the interval used in 4 other experiments. One of these experiments (Campbell, 1966) found that punishment suppressed behavior; another experiment (Gwinn, 1949) found self-punitive behavior. The two remaining experiments (Moyer, 1955, 1957) found no difference between the punished and the nonpunished groups.

Somewhat longer intertrial intervals produced similar results. From these data, a relationship between the length of the intertrial interval and the effects of punishment upon resistance to extinction cannot be formulated.

A number of investigators (see Seward, 1965) have mentioned a discrimination hypothesis to account for self-punitive behavior. According to this hypothesis, self-punitive behavior is likely to occur when the stimulus conditions of original training and punishment-extinction are highly similar. However, Melvin and Martin (1966) have obtained evidence directly contradicting the predictions of this hypothesis. In this study, the similarity between the conditions of training and punishment-extinction was not related to the magnitude of the self-punitive phenomenon. Melvin and Stenmark (1968) found self-punitive behavior when neither escape nor avoidance training was used. In this experiment, a running response was not even used during original fear conditioning. However, self-punitive running was obtained in extinction. The wheel-turning study by Fitzgerald and Walloch (in press) also indicates that the discrimination hypothesis may not be the explanation of self-punitive behavior. In this study, the conditions of punishment for the High Similarity groups exactly replicated the conditions of escape training. Nevertheless, punishment-facilitation was obtained only when a long delay of punishment interval was employed. If the discrimination hypothesis were an adequate explanation of self-punitive behavior, all of the High Similarity groups should have shown punishment-facilitation and the long delay of punishment interval should not have been a necessary condition for the effect.

In conclusion, the fear hypothesis still appears to have the most support as an explanation of self-punitive behavior. However, investigators employing this hypothesis have focused almost exclusively on the fear-producing cues of the start-box and have neglected the fear-reducing or safety cues provided by the goal-box. These safety cues may play an important part in the establishment of self-punitive behavior. Therefore, it is not unreasonable to assume that self-punitive behavior may depend upon the relationship between cues that are fear-producing and cues that are fear-reducing.

SUMMARY

The present study attempted to establish self-punitive wheel-turning responses following escape training. An earlier study was successful in showing punishment-facilitation of wheel-turning only when a long delay of punishment interval was employed. In order to see whether this facilitation could be obtained under a wider set of experimental conditions, the present study attempted to make the wheel-turning apparatus more analogous to the straight-alley situation. Since all clearly successful attempts to obtain self-punitive behavior have been conducted in a runway, this situation seemed a good model on which to pattern the wheel-turning study.

The major difference between the previous wheel-turning study and the present one was that the _S_ was allowed in the present study to turn the wheel during the delay of punishment interval. Therefore, the _S_ was in most cases actively spinning the wheel at the time the punishing shock was introduced. However, the earlier wheel-turning study employed a shield to prevent wheel-turning during the delay of punishment interval. Since in straight-alley studies _Ss_ ran into the shocked portion of the grid, the present study was more analogous to that situation than the previous wheel-turning study.

In the present study, all _Ss_ were given 100 escape-training trials. After this training, the _Ss_ were split into 8

groups receiving punishment and 2 control groups which were not punished. The punished groups were arranged according to a 4 X 2 factorial design. The dimensions of the design were shock level (0.5 ma., 0.8 ma., 1.3 ma., and 2.0 ma.) and delay of punishment (0 sec. and 5 sec.). A separate control group was used for each delay of punishment.

Considered together, the punished groups took fewer trials than the nonpunished groups to reach the extinction criterion of 5 consecutive failures to respond within 60 sec. The punished groups also had longer response latencies in extinction than the nonpunished groups. Individual comparisons between punished and nonpunished groups showed that some of the groups punished with weak shocks were not significantly different from the nonpunished groups in response latency.

When the punished groups were considered by themselves, neither delay nor intensity of shock had any significant effect on trials to extinction. However, intensity did have an effect on the latency measure. In the 0-sec. delay condition, groups punished with high levels of shock took more time to respond than groups punished with low levels. This relationship held in the 5-sec. delay condition with the significant exception of the 0.5-ma. group. Delay of punishment, however, had no effect on the latency of the extinction response.

The results of the present experiment were compared with earlier wheel-turning and runway studies. In runway studies which obtained self-punitive behavior the start-box had fear-producing qualities while the goal-box had fear-reducing or safety qualities. The absence of specific, external, safety cues in the wheel-turning situation may have hindered the attempts to establish self-punitive behavior in that situation.

REFERENCES

Azrin, N. H. & Holz, W. C. Punishment. in Honig, W. K. (Ed.) *Operant Behavior: Areas of Research and Application*. New York: Appleton-Century-Crofts, 1966.

Beecroft, R. S. & Bouska, S. A. Learning self-punitive running. *Psychonomic Science*, 1967a, *8*, 107-108.

Beecroft, R. S. & Brown, J. S. Punishment following escape and avoidance training. *Psychonomic Science*, 1967b, *8*, 349-350.

Beecroft, R. S. Bouska, S. A. & Fisher, B. G. Punishment intensity and self-punitive behavior. *Psychonomic Science*, 1967c, *8*, 351-352.

Beecroft, R. S. Near-goal punishment of avoidance running. *Psychonomic Science*, 1967d, *8*, 109-110

Brown, J. S. Martin, R. C. & Morrow, M. W. Self-punitive behavior in the rat: Facilitative effects of punishment on resistance to extinction. *Journal of Comparative and Physiological Psychology*, 1964, *57*, 127-133.

Brown, J. S. Anderson, R. C. & Weiss, D. Self-punitive behavior under conditions of massed practice. Journal of Comparative and Physiological Psychology, 1965, 60, 451-453.

Campbell, B. A. Smith, N. F. & Misanin, J. R. Effects of punishment on extinction of avoidance behavior: Avoidance-avoidance conflict or vicious circle behavior. Journal of Comparative and Physiological Psychology, 1966, 62, 495-498.

Church, R. M. The varied effects of punishment on behavior. Psychological Review, 1963, 70, 369-402.

Fitzgerald, R. D. & Walloch, R. A. Resistance to extinction of a punished wheel-turning escape response. Journal of Comparitive and Physiological Psychology, in press.

Gwinn, G. T. The effects of punishment on acts motivated by fear. Journal of Experimental Psychology, 1949, 39, 260-269.

Kintz, B. L. & Bruning, J. L. Punishment and compulsive avoidance behavior. Journal of Comparitive and Physiological Psychology, 1967, 63, 323-326.

Martin, R. C. & Melvin, K. B. Vicious circle behavior as a function of delay of punishment. Psychonomic Science, 1964, 1, 415-416.

Melvin, K. B. Athey, G. I. & Heasley, F. H. Effects of duration and delay of shock on self-punitive behavior in the rat. Psychological Reports, 1965, 17, 107-112.

Melvin, K. B. & Martin, R. C. Facilitative effects of two modes of punishment on resistance to extinction. Journal of Comparative and Physiological Psychology, 1966, 62, 491-494.

Melvin, K. B. & Stenmark, D. E. Facilitative effects of punishment on establishment of a fear motivated response. Journal of Comparative and Physiological Psychology, 1968, 65, 517-519.

Moyer, K. E. A study of some of the variables of which fixation is a function. Journal of Genetic Psychology, 1955, 86, 3-31.

Moyer, K. E. The effects of shock on avxiety-motivated behavior in the rat. Journal of Genetic Psychology, 1957, 91, 197-203.

Mowrer, O. H. Learning Theory and Personality Dynamics. New York: Ronald Press, 1950.

Rescorla, R. A. & LoLordo, V. M. Inhibition of avoidance behavior. *Journal of Comparitive and Physiological Psychology*, 1965, *59*, 406-412.

Seligman, M. E. & Campbell, B. A. Effect of intensity and duration of punishment on extinction of an avoidance response. *Journal of Comparative and Physiological Psychology*, 1965, *59*, 295-297.

Seward, J. P. & Raskin, D. C. The role of fear in aversive behavior. *Journal of Comparative and Physiological Psychology*, 1960, *53*, 328-335.

Seward, J. P. King, R. M. Chow, T. & Shiflett, S. C. Persistence of punished escape responses. *Journal of Comparative and Physiological Psychology*, 1965, *60*, 265-268.

Siegel, S. *Nonparametric Statistics for the Behavioral Sciences*. New York: McGraw-Hill, 1956.

Solomon, R. L. Punishment. *American Psychologist*, 1964, 19, 239-253.

Smith, N. F. Misanin, J. R. & Campbell, B. A. Effect of punishment: Facilitation or inhibition? A reply to Martin and Melvin. Psychonomic Science, 1966, 5, 363-364.

Wilson, K. V. A distribution-free test of analysis of variance hypothesis. Psychological Bulletin, 1956, 53, 96-101.

Appendix A

Latencies of the escape response during acquisition in seconds.

5-SEC. DELAY NONPUNISHED

5-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10
1	13.96	3.80	1.68	1.32	1.32	1.24	1.16	1.16	1.08	1.88
2	5.28	5.88	1.28	1.48	1.28	1.28	1.76	1.32	1.32	1.80
3	6.60	4.52	9.24	2.88	7.52	4.28	3.28	1.60	3.16	1.60
4	14.64	49.16	5.60	3.84	3.44	1.64	1.24	1.48	2.00	1.72
5	16.80	2.44	1.36	2.80	1.36	1.68	1.36	1.28	0.88	2.24
6	4.68	7.12	1.52	1.40	1.48	1.28	1.04	4.08	1.12	1.08
7	20.96	3.00	6.00	1.52	1.56	1.28	1.32	1.44	1.72	6.44
8	1.44	1.00	1.04	1.00	0.96	0.92	0.96	1.08	1.08	0.84
9	8.00	4.00	3.36	1.88	1.12	1.84	1.12	1.12	1.24	1.20
10	14.24	10.32	3.56	1.60	1.56	1.64	1.32	1.32	1.16	1.28
11	14.40	10.68	4.92	3.40	3.16	1.56	1.44	1.24	1.44	1.32
12	2.88	3.44	1.40	1.20	1.08	1.24	3.20	1.20	1.68	1.24
13	20.84	4.72	1.60	2.28	1.44	1.36	1.40	1.24	1.20	1.28
14	8.84	4.60	1.36	1.36	1.76	1.56	1.84	1.76	1.28	1.52
15	18.44	6.48	3.40	2.80	2.00	3.20	2.20	13.28	6.56	1.72
$\overline{X}$	11.46	8.07	3.15	2.05	2.06	1.81	1.64	2.30	1.79	1.81

5-SEC. DELAY NONPUNISHED

5-trial blocks

Ss	11	12	13	14	15	16	17	18	19	20	$\bar{\bar{X}}$
1	1.00	1.80	1.08	1.32	1.12	1.00	0.84	1.08	1.08	1.44	2.01
2	2.48	1.20	1.68	1.56	1.48	1.48	1.96	1.44	1.36	1.32	1.93
3	3.36	2.52	3.36	1.52	1.24	1.64	4.28	1.32	1.84	1.64	3.37
4	1.80	1.40	1.76	2.24	1.32	1.56	1.40	1.36	2.08	1.76	5.07
5	1.44	0.96	1.24	2.68	2.12	0.96	1.16	1.08	0.96	2.20	2.35
6	1.16	1.16	0.96	1.24	1.76	0.76	0.80	0.92	0.88	0.76	1.76
7	1.32	1.28	1.48	1.24	1.36	1.48	2.12	1.28	1.12	1.60	2.97
8	0.80	0.72	1.40	1.04	1.20	1.08	1.00	1.12	1.72	1.44	1.09
9	1.16	2.36	2.08	1.12	1.04	1.16	1.00	1.12	1.08	1.24	1.19
10	1.44	1.36	1.40	1.24	1.00	0.72	0.96	1.32	1.04	0.96	2.47
11	3.00	1.48	1.28	1.20	2.08	1.24	1.32	1.48	1.00	1.00	2.93
12	1.40	1.28	1.28	1.16	1.88	1.20	1.04	1.00	1.28	1.32	1.57
13	1.24	1.32	1.40	1.16	1.24	1.24	1.28	1.28	1.28	3.60	2.62
14	1.24	1.16	1.28	1.44	2.36	1.44	1.16	1.68	2.24	1.36	2.06
15	1.48	1.64	1.52	1.36	1.88	1.60	1.64	1.48	1.72	1.64	3.80
$\bar{X}$	1.62	1.44	1.54	1.43	1.53	1.23	1.46	1.26	1.37	1.55	

5-SEC. DELAY, 0.5-ma. SHOCK

5-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10
1	6.44	2.84	4.08	1.44	1.68	1.68	1.20	1.32	2.28	1.20
2	11.80	3.24	19.00	4.89	2.00	1.40	1.88	1.36	1.28	1.60
3	4.96	15.20	5.32	3.84	2.04	2.08	1.64	1.68	1.32	1.24
4	15.04	2.32	1.56	3.04	1.12	1.24	1.48	1.24	0.92	2.64
5	8.96	13.36	2.12	1.44	1.88	1.24	1.48	1.32	2.88	1.36
6	3.32	4.56	5.32	5.36	2.72	2.92	2.16	2.68	2.88	3.08
7	19.64	1.36	1.40	1.52	1.64	1.36	1.40	1.32	1.32	1.28
8	12.68	3.88	2.32	2.52	1.60	1.46	3.04	2.36	1.32	1.40
9	11.28	2.40	2.44	1.88	1.60	1.24	1.46	1.52	1.16	1.32
10	10.96	2.88	4.68	3.00	1.76	1.68	1.32	1.36	2.12	1.64
11	10.56	4.56	4.44	4.12	2.60	1.96	1.52	1.96	1.88	1.52
12	46.24	9.32	2.88	1.48	1.16	1.32	1.20	0.84	1.24	1.76
13	11.76	6.12	5.28	3.00	5.16	6.08	2.68	3.00	2.76	4.64
14	13.44	4.16	2.60	2.64	3.08	2.32	2.48	2.32	4.16	2.60
15	5.76	4.12	2.48	1.80	1.92	1.44	2.56	1.84	1.40	1.12
$\overline{X}$	12.85	5.35	4.39	2.79	2.13	1.96	1.82	1.91	1.92	1.89

5-SEC. DELAY, 0.5-ma. SHOCK

5-trial blocks

Ss	11	12	13	14	15	16	17	18	19	20	$\overline{X}$
1	1.56	1.68	1.32	1.68	1.60	1.32	1.28	1.12	1.28	1.24	1.91
2	1.28	1.46	1.40	1.20	1.16	1.12	1.08	1.48	1.32	0.96	3.03
3	1.28	1.20	1.52	1.36	1.24	1.56	1.60	1.52	1.48	1.32	2.67
4	0.84	2.00	3.08	1.08	1.92	0.96	1.00	1.32	2.08	1.12	2.34
5	1.36	1.44	1.32	1.48	1.36	1.20	1.48	1.36	1.32	1.40	2.48
6	1.92	3.20	2.24	1.76	2.68	1.84	1.88	1.48	1.32	1.60	2.74
7	2.44	0.96	0.88	1.12	3.24	2.20	1.68	1.28	1.52	1.28	2.44
8	1.64	1.68	4.20	1.48	2.08	1.48	1.44	1.52	1.48	1.72	2.56
9	1.32	1.44	1.12	1.36	1.12	1.12	1.32	1.76	1.20	1.20	1.96
10	1.36	1.76	1.16	1.28	1.28	1.28	1.36	1.44	1.32	1.16	2.24
11	2.08	1.44	1.32	1.48	1.32	1.28	1.28	1.20	2.64	1.60	2.53
12	1.04	1.44	1.36	1.12	1.12	1.08	0.92	0.96	0.76	0.84	3.90
13	2.84	2.60	2.56	2.68	2.64	2.64	2.52	2.64	2.44	2.52	3.82
14	2.52	2.16	2.40	2.68	2.56	4.04	2.56	2.48	2.56	2.52	3.31
15	1.16	1.68	1.24	0.80	1.44	2.20	0.96	1.08	1.00	0.84	1.81
$\overline{X}$	1.64	1.69	1.80	1.50	1.78	1.68	1.49	1.50	1.58	1.42	

5-SEC. DELAY, 0.8-ma. SHOCK

5-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10
1	3.36	2.56	2.24	1.80	0.88	0.84	1.24	0.92	0.80	0.96
2	10.12	2.24	1.44	2.76	1.20	1.52	1.36	1.92	1.28	1.92
3	2.64	7.96	1.32	1.72	1.68	1.68	1.36	1.08	1.32	1.16
4	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32
5	11.12	4.00	9.40	1.36	4.84	1.68	1.04	1.64	1.28	1.80
6	13.68	4.20	1.72	2.24	1.56	1.24	1.56	0.96	1.12	1.16
7	6.20	7.76	3.88	1.68	1.76	2.96	2.12	1.36	1.24	2.48
8	4.72	5.64	2.36	1.40	2.16	1.68	1.36	1.44	1.08	1.48
9	9.68	1.52	1.12	1.88	1.32	1.12	1.16	0.92	1.20	1.52
10	9.20	1.52	2.64	3.24	2.44	2.36	1.16	1.64	1.80	1.00
11	22.60	11.44	2.32	2.00	2.56	1.40	1.28	1.36	1.68	1.32
12	7.76	8.08	3.36	1.80	1.68	1.48	1.76	1.28	1.40	1.28
13	15.88	1.48	1.56	2.04	1.52	1.52	1.24	1.20	1.24	1.24
14	10.00	5.76	5.00	7.72	4.48	2.44	1.48	1.36	1.84	1.76
15	3.20	6.84	3.68	2.60	2.68	2.52	2.92	1.44	1.60	2.32
$\overline{X}$	8.76	4.82	2.89	2.37	2.13	1.17	1.49	1.32	1.34	1.51

5-SEC. DELAY, 0.8-ma. SHOCK

5-trial blocks

Ss	11	12	13	14	15	16	17	18	19	20	$\overline{X}$
1	1.00	0.88	0.84	0.84	0.92	0.92	0.76	0.96	0.88	0.88	1.22
2	1.44	1.32	1.24	2.00	1.48	1.20	2.40	1.36	1.56	1.44	2.06
3	1.12	1.28	1.16	1.20	1.28	1.04	1.00	1.44	1.16	1.12	1.68
4	1.32	1.32	1.32	1.32	1.32	1.28	1.24	1.44	1.28	1.36	1.32
5	1.12	1.00	1.32	1.24	1.44	0.84	1.08	1.32	0.88	1.00	2.47
6	1.36	1.16	1.08	1.44	1.08	1.16	1.60	1.04	0.92	1.16	2.07
7	1.40	1.36	1.88	1.16	1.44	1.24	1.32	1.16	1.24	1.68	2.26
8	1.40	1.32	1.12	1.04	1.16	1.16	0.88	1.20	1.00	1.00	1.73
9	1.12	1.12	1.04	1.28	0.88	1.24	1.12	1.12	1.00	1.16	1.62
10	1.52	1.40	1.20	1.24	2.64	2.24	1.20	1.24	1.60	1.12	2.12
11	1.32	1.68	1.36	3.24	1.68	1.68	1.88	1.24	1.48	2.16	3.28
12	1.16	1.76	1.40	2.32	3.64	3.52	1.92	1.32	1.36	1.28	2.47
13	1.24	1.04	0.84	1.04	1.08	1.12	1.12	1.16	1.12	1.12	1.99
14	2.32	1.60	1.64	1.32	1.60	2.08	1.36	1.32	1.48	1.60	2.90
15	2.48	1.60	1.40	1.28	1.48	1.40	1.52	1.40	1.72	2.00	2.30
$\overline{X}$	1.42	1.32	1.25	1.46	1.54	1.47	1.39	1.24	1.24	1.33	

5-SEC. DELAY, 1.3-ma. SHOCK

5-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10
1	11.20	2.04	2.72	4.04	2.16	2.12	2.36	1.40	1.92	1.28
2	34.52	2.08	1.08	0.96	1.04	0.88	0.88	0.88	0.68	0.88
3	23.16	4.04	3.80	2.36	2.56	1.28	1.24	1.20	1.32	1.76
4	22.76	4.40	6.08	6.44	3.28	1.32	1.24	1.60	1.92	1.52
5	10.88	3.24	2.04	1.36	1.48	1.40	1.40	1.04	2.60	1.92
6	21.20	1.84	2.12	2.12	2.36	1.88	3.08	1.76	1.32	1.76
7	29.36	5.08	1.48	3.40	1.76	1.96	2.16	1.60	1.92	1.52
8	19.32	3.08	1.84	1.88	1.36	1.72	1.16	1.16	1.28	1.76
9	14.08	4.08	2.44	1.44	1.48	3.04	1.24	1.28	1.52	1.24
10	9.52	13.92	3.52	5.92	2.80	1.60	1.60	2.04	1.36	1.52
11	10.08	8.92	7.60	7.48	2.08	1.88	1.24	2.64	1.60	1.40
12	5.96	3.84	4.00	2.40	2.76	2.68	3.24	2.76	3.08	1.28
13	8.56	6.84	4.20	3.08	4.00	3.20	2.68	3.00	2.64	2.96
14	14.92	2.12	3.44	1.48	2.44	1.60	1.24	2.80	3.20	1.48
15	10.80	3.12	1.72	1.32	1.04	1.00	1.28	1.20	2.08	1.12
$\overline{X}$	16.42	4.58	3.21	3.04	2.17	1.83	1.73	1.76	1.90	1.56

5-SEC. DELAY, 1.3-ma. SHOCK

5-trial blocks

Ss	11	12	13	14	15	16	17	18	19	20	$\overline{X}$
1	1.32	1.24	2.40	1.64	1.20	1.64	2.44	1.20	2.00	1.32	2.38
2	0.56	0.72	0.72	0.60	0.60	0.84	0.72	0.72	0.88	0.72	2.54
3	1.28	1.20	1.16	1.40	1.20	1.12	1.12	1.44	1.08	0.92	2.73
4	1.28	1.40	1.64	1.52	1.20	1.40	1.04	1.44	1.96	1.36	3.24
5	1.44	1.08	1.64	1.36	1.40	1.52	1.24	1.40	1.32	1.44	2.06
6	1.32	1.40	1.60	1.44	1.28	1.92	1.40	2.48	1.60	1.36	2.76
7	1.60	1.56	1.56	1.12	1.32	1.48	1.32	1.28	1.56	1.44	3.22
8	0.92	1.08	0.88	1.16	1.20	1.12	1.16	1.12	1.20	1.00	2.27
9	1.28	1.48	1.28	1.24	1.32	1.32	1.48	1.28	1.36	1.30	2.25
10	1.72	1.00	1.48	1.56	1.56	1.56	1.68	1.68	1.76	1.44	2.96
11	2.04	3.52	1.36	1.44	1.48	1.52	1.76	1.36	1.52	1.64	3.12
12	1.32	2.12	1.68	1.40	2.12	1.96	1.76	1.32	1.52	1.44	2.43
13	2.68	2.68	2.64	2.68	2.72	2.64	2.40	2.52	2.44	2.44	3.35
14	2.56	1.40	1.40	1.48	1.76	1.36	1.28	1.20	1.16	1.20	2.47
15	1.12	0.96	1.60	0.88	0.96	1.32	1.20	0.92	1.16	3.08	1.89
$\overline{X}$	1.50	1.60	1.54	1.40	1.42	1.52	1.47	1.42	1.50	1.47	

5-SEC. DELAY, 2.0-ma. SHOCK

5-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10
1	6.04	8.92	4.84	2.40	1.28	2.64	1.12	3.40	1.24	1.04
2	7.08	17.04	2.08	1.24	3.44	1.48	1.44	0.88	1.08	3.12
3	12.48	8.52	4.80	1.16	1.48	2.28	1.84	1.20	1.16	1.20
4	14.48	18.12	6.56	4.92	3.08	1.76	1.96	1.72	1.68	1.60
5	8.36	2.52	3.72	3.72	1.56	1.40	1.32	1.72	1.76	1.46
6	7.36	1.92	1.40	1.24	1.12	1.28	1.32	1.88	1.76	1.20
7	3.92	2.88	2.56	4.12	2.92	4.96	1.60	1.48	1.76	1.28
8	17.36	11.16	2.96	3.72	2.40	1.32	1.44	2.12	1.52	3.04
9	2.60	5.36	2.60	1.64	4.20	3.40	1.44	1.96	1.44	1.40
10	35.80	6.04	1.56	1.72	1.36	1.28	1.20	1.40	1.52	1.48
11	7.12	2.40	1.48	4.20	1.36	1.28	1.44	1.36	1.44	1.44
12	12.44	4.80	21.08	2.44	2.88	1.48	1.48	2.48	1.40	2.12
13	3.76	2.68	1.92	2.52	2.80	3.48	3.60	2.08	2.28	3.24
14	11.60	3.72	2.32	1.32	2.32	1.44	1.32	1.12	1.28	1.60
15	7.92	1.56	2.20	1.44	1.72	2.28	2.40	1.28	1.36	1.20
$\overline{X}$	10.55	6.51	4.14	2.52	2.26	2.12	1.66	1.74	1.51	1.76

5-SEC. DELAY, 2.0-ma. SHOCK

5-trial blocks

Ss	11	12	13	14	15	16	17	18	19	20	$\overline{X}$
1	1.32	1.32	1.36	1.32	1.28	1.56	1.20	1.32	1.20	1.28	2.30
2	1.24	1.56	1.00	1.04	1.20	1.24	1.56	0.76	0.92	1.12	2.53
3	1.04	1.60	1.00	0.96	1.00	1.00	0.92	1.20	1.04	1.08	2.34
4	2.36	1.68	1.84	1.56	1.80	1.56	1.80	2.08	1.60	1.80	3.70
5	1.28	1.28	1.24	2.60	1.16	2.68	1.16	1.20	1.20	1.16	2.12
6	1.88	1.60	1.36	1.04	1.12	1.12	0.92	1.08	1.00	1.04	1.63
7	4.08	1.60	2.12	1.24	1.44	1.32	1.24	1.56	1.68	1.76	2.28
8	1.92	4.60	5.28	1.40	5.08	3.12	1.28	6.92	1.20	1.96	3.99
9	1.36	4.36	1.40	1.56	1.24	1.28	1.36	1.48	1.24	1.24	2.13
10	1.36	1.24	1.40	1.24	1.28	1.36	1.20	1.20	1.16	1.04	3.29
11	1.40	1.36	1.48	1.44	1.12	1.84	1.32	1.20	1.56	1.12	1.86
12	2.80	1.04	1.44	3.22	1.20	1.16	1.28	2.16	1.16	1.84	3.50
13	1.76	1.68	1.96	1.52	1.40	1.80	1.52	1.68	2.32	1.52	2.27
14	1.28	2.24	1.12	1.04	1.24	1.08	1.60	1.44	1.24	1.68	2.10
15	1.28	2.28	1.08	1.24	1.32	4.44	1.20	2.04	1.28	1.72	2.06
$\overline{X}$	1.76	1.96	1.61	1.49	1.53	1.77	1.30	1.82	1.32	1.42	

0-SEC. DELAY NONPUNISHED

5-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10
1	15.08	2.16	1.48	1.36	1.28	4.56	1.92	1.20	2.24	1.44
2	8.16	4.20	2.28	1.84	2.32	2.44	1.60	1.36	1.60	1.32
3	3.96	3.36	2.00	1.44	2.04	1.00	1.36	1.28	1.68	1.08
4	5.48	5.76	3.92	2.88	1.84	2.64	1.32	1.36	1.92	1.36
5	8.84	8.80	8.40	3.72	3.64	2.04	3.20	1.36	1.52	1.44
6	19.76	6.04	5.28	7.16	2.16	1.76	1.92	1.80	2.56	4.28
7	7.16	7.48	7.96	3.20	1.60	4.28	2.28	1.28	1.40	2.00
8	15.68	35.96	2.40	1.44	1.72	1.16	1.08	1.60	1.20	1.24
9	19.24	2.76	1.32	2.84	2.60	1.44	1.72	1.96	2.84	1.40
10	15.60	6.72	10.52	1.36	1.46	2.12	2.88	1.12	1.20	1.24
11	8.20	10.44	4.84	10.16	1.32	1.64	3.08	1.08	1.32	1.24
12	6.04	15.24	4.40	3.28	2.32	1.84	3.12	1.92	2.24	2.00
13	8.04	4.48	1.56	1.52	2.16	2.16	1.32	2.00	1.28	1.24
14	14.56	16.28	4.64	3.40	1.32	2.32	1.16	1.20	1.36	1.24
15	0.60	0.60	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
$\overline{X}$	10.43	8.69	4.09	3.07	1.87	2.12	1.89	1.39	1.65	1.53

0-SEC. DELAY NONPUNISHED

5-trial blocks

Ss	11	12	13	14	15	16	17	18	19	20	$\overline{X}$
1	1.28	1.52	1.24	1.08	1.00	1.16	3.08	1.12	1.12	1.08	2.32
2	1.24	1.28	1.24	1.36	1.08	1.08	1.20	1.32	1.28	3.96	2.10
3	2.96	1.28	1.12	1.24	1.44	1.92	1.32	1.24	1.36	1.24	1.72
4	1.32	1.64	1.36	1.20	1.32	1.32	1.32	1.20	1.32	1.28	2.09
5	1.60	1.52	1.28	1.36	1.32	1.20	1.36	1.32	1.32	1.28	2.83
6	1.24	1.28	1.76	1.36	1.40	2.48	1.40	1.32	2.20	3.40	3.53
7	1.12	2.60	1.28	1.88	1.28	1.40	3.04	1.76	2.20	1.24	2.82
8	1.68	1.28	1.24	1.28	1.36	1.16	1.16	1.12	1.12	1.16	3.80
9	2.00	1.64	1.52	1.36	1.56	1.12	1.52	1.40	1.44	1.32	2.65
10	1.36	1.80	1.00	0.80	1.08	0.84	0.92	1.04	0.92	1.04	2.75
11	1.96	0.92	1.32	3.16	1.40	1.76	1.16	1.28	1.24	1.00	2.93
12	1.72	1.72	2.92	2.12	2.64	1.60	2.00	1.28	1.76	1.52	3.08
13	1.24	1.64	1.12	1.12	1.40	1.12	1.04	1.52	1.20	1.28	1.92
14	1.20	1.24	1.12	1.32	1.08	1.68	1.16	1.24	1.16	1.16	2.99
15	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.42
$\overline{X}$	1.49	1.45	1.33	1.40	1.39	1.35	1.47	1.24	1.33	1.49	

O-SEC. DELAY, 0.5-ma. SHOCK

5-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10
1	10.24	4.48	4.96	1.36	1.60	2.80	1.68	2.52	1.60	2.84
2	12.24	4.72	1.84	3.48	2.08	1.88	3.60	1.92	1.72	1.96
3	16.44	2.52	2.60	1.40	1.28	4.00	1.24	1.28	1.20	1.64
4	8.40	4.60	3.60	10.88	2.96	1.84	3.44	2.60	1.88	1.64
5	25.92	7.04	4.60	2.20	6.16	1.52	1.36	1.64	1.32	1.96
6	15.84	2.28	1.36	1.36	1.72	1.60	1.04	1.80	1.20	0.80
7	13.88	2.80	3.80	1.96	1.72	1.40	1.88	1.72	1.24	1.88
8	7.56	3.72	2.92	2.68	2.16	2.36	1.84	1.60	2.36	1.68
9	9.48	1.68	2.08	2.08	1.72	2.56	1.36	1.24	1.76	1.36
10	6.48	4.92	6.08	4.12	4.48	3.12	1.68	1.96	1.12	2.24
11	19.44	16.64	3.48	2.00	1.76	1.76	1.96	1.40	2.44	2.00
12	18.48	3.96	1.28	1.48	2.60	1.76	1.32	1.72	1.36	1.72
13	12.00	5.12	3.40	2.64	2.76	3.28	1.69	1.92	1.20	2.64
14	40.12	5.08	1.96	2.12	1.68	1.44	2.12	1.36	1.44	1.44
15	24.00	3.92	11.96	1.48	2.08	1.76	1.36	1.24	1.44	1.52
$\overline{X}$	16.03	4.89	3.73	2.75	2.45	2.20	1.84	1.73	1.55	1.82

0-SEC. DELAY, 0.5-ma. SHOCK

5-trial blocks

Ss	11	12	13	14	15	16	17	18	19	20	$\overline{X}$
1	1.64	2.48	1.52	1.96	1.32	1.56	1.56	1.40	2.28	1.32	2.56
2	1.56	2.00	1.84	2.56	1.80	1.52	1.60	1.80	1.44	1.50	2.66
3	1.40	1.00	1.68	1.08	1.08	0.88	2.04	1.04	1.08	0.88	2.29
4	2.08	2.16	1.32	1.76	2.00	1.40	1.36	1.36	1.36	1.64	2.91
5	1.24	1.44	1.24	1.44	2.20	1.12	1.20	1.48	1.40	1.08	3.38
6	1.00	1.16	1.20	1.12	1.12	0.96	0.80	0.92	1.16	1.00	2.01
7	1.24	2.60	1.24	1.56	1.24	1.76	1.48	1.60	1.48	1.72	2.41
8	2.56	1.80	3.44	2.00	2.24	1.44	1.64	1.36	1.36	1.84	2.43
9	1.36	1.16	1.32	6.16	1.40	1.56	1.36	3.00	1.28	1.32	2.26
10	0.96	0.84	1.16	1.12	1.04	1.48	0.96	0.88	0.92	0.92	2.32
11	1.28	1.32	1.68	1.28	1.25	1.48	1.36	1.20	1.48	1.28	3.32
12	1.16	1.20	1.36	1.00	1.60	1.40	1.48	1.28	1.16	1.44	2.50
13	1.84	1.60	1.28	1.44	1.40	1.24	1.24	1.24	0.88	1.88	2.53
14	1.24	2.00	1.20	1.88	1.64	1.64	1.32	1.24	1.28	1.16	3.67
15	1.40	1.16	1.32	1.28	1.16	1.32	1.24	1.88	1.36	1.28	3.21
$\overline{X}$	1.46	1.59	1.52	1.84	1.50	1.38	1.38	1.45	1.33	1.36	

0-SEC. DELAY, 0.8-ma. SHOCK

5-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10
1	0.40	0.40	0.40	0.40	1.00	5.72	1.36	1.84	1.40	1.56
2	25.84	5.92	1.96	1.48	1.24	1.28	2.92	2.28	1.36	1.24
3	6.12	8.24	5.32	1.40	1.52	1.52	1.52	1.80	1.36	1.60
4	3.44	9.36	3.16	2.48	1.20	1.40	3.04	1.56	2.72	2.04
5	10.00	4.16	5.48	2.40	2.36	2.00	1.80	2.36	1.36	1.60
6	9.56	3.28	5.00	4.92	1.64	1.36	2.08	1.80	1.84	2.48
7	11.32	2.52	1.28	0.88	1.36	1.04	1.40	1.36	1.44	1.28
8	14.84	1.84	1.36	1.44	1.48	1.36	1.20	1.36	1.36	1.40
9	6.40	3.28	1.56	2.36	1.12	1.32	1.36	1.36	1.20	1.40
10	6.84	6.24	2.16	1.28	1.52	1.60	1.40	1.40	1.28	1.24
11	20.40	9.24	6.16	1.68	1.56	1.88	1.52	3.32	1.52	1.40
12	28.96	18.28	2.00	1.88	8.28	2.48	1.92	7.76	1.84	1.68
13	6.52	12.76	5.04	2.48	1.44	1.60	2.36	1.36	1.32	2.24
14	11.92	6.40	2.96	3.60	1.48	1.84	1.56	2.40	1.76	1.52
15	14.04	1.76	1.64	1.88	1.36	1.40	1.20	1.32	1.56	1.40
$\overline{X}$	11.77	6.25	3.03	2.04	1.90	1.85	1.78	2.22	1.55	1.61

0-SEC. DELAY, 0.8-ma. SHOCK

5-trial blocks

Ss	11	12	13	14	15	16	17	18	19	20	$\overline{X}$
1	1.80	1.32	3.84	1.24	1.04	1.12	1.60	2.72	1.20	1.36	1.59
2	1.24	2.00	1.72	1.52	1.24	1.56	1.64	1.24	1.32	1.24	3.01
3	1.96	1.24	2.56	1.80	1.44	1.26	1.40	1.20	1.32	1.24	2.30
4	1.52	1.20	1.04	2.08	1.52	1.04	1.04	1.28	1.12	1.08	2.16
5	1.64	1.88	1.12	1.48	1.36	1.60	1.36	1.32	1.20	1.32	2.39
6	2.80	1.36	2.64	1.60	1.56	2.08	1.48	1.28	1.24	2.12	2.61
7	3.84	1.04	1.32	1.32	1.08	1.16	1.16	1.24	1.36	1.32	1.94
8	1.08	1.52	1.20	1.20	1.28	1.36	1.48	1.32	1.20	1.20	2.02
9	1.20	1.32	1.24	1.20	1.32	1.24	1.08	1.16	1.00	1.04	1.66
10	1.12	1.20	1.48	1.36	1.28	1.28	1.20	1.24	2.04	1.08	1.91
11	1.84	1.80	1.56	1.48	1.12	1.12	1.36	1.20	2.72	4.28	3.36
12	2.52	1.64	1.28	1.52	1.44	1.88	1.24	1.24	1.32	2.88	4.60
13	1.08	1.24	1.48	1.08	1.24	0.96	1.28	1.12	1.36	1.24	2.46
14	1.52	1.84	1.76	1.40	1.40	1.44	1.56	1.56	1.48	1.40	2.54
15	1.84	1.56	1.16	1.28	1.32	1.28	1.28	1.68	1.20	1.12	2.06
$\overline{X}$	1.80	1.48	1.79	1.44	1.31	1.37	1.39	1.39	1.45	1.59	

0-SEC. DELAY, 1.3-ma. SHOCK

5-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10
1	14.44	5.88	3.52	2.80	1.60	2.56	1.29	1.32	1.68	1.40
2	5.84	4.16	3.52	1.88	1.92	1.72	2.60	2.04	1.40	2.16
3	19.92	4.92	2.32	1.32	1.32	1.40	1.12	1.92	1.16	1.28
4	2.12	10.84	3.24	2.32	3.04	2.00	2.12	1.52	2.12	1.80
5	21.40	6.16	2.32	2.40	1.12	2.08	1.36	2.64	1.36	1.80
6	2.84	3.28	1.64	1.44	1.52	1.28	1.20	1.24	1.64	1.40
7	8.04	4.96	2.32	1.36	4.12	3.72	1.40	1.68	2.64	1.72
8	6.96	3.56	2.12	4.60	5.64	4.92	4.24	2.48	1.76	1.72
9	29.20	1.64	1.20	2.52	1.24	1.40	1.44	1.56	1.16	1.68
10	13.56	10.56	4.00	1.60	1.56	1.32	1.08	1.76	0.88	1.00
11	13.96	5.12	1.68	1.52	1.84	1.16	2.16	1.56	1.44	4.92
12	18.44	2.52	2.24	1.68	1.80	2.32	1.36	1.76	1.28	1.68
13	12.68	24.88	8.80	3.08	1.72	2.35	1.32	1.80	2.72	1.56
14	2.60	2.60	3.64	1.88	1.40	1.28	3.28	1.48	1.92	1.72
15	19.60	2.68	1.32	2.00	1.40	1.48	1.72	1.48	1.40	1.20
$\overline{X}$	12.77	6.25	2.93	2.16	2.08	2.07	1.85	1.75	1.64	1.80

0-SEC. DELAY, 1.3-ma. SHOCK

5-trial blocks

Ss	11	12	13	14	15	16	17	18	19	20	$\overline{X}$
1	2.12	1.24	1.12	1.80	1.36	1.64	1.12	1.36	1.12	1.32	2.53
2	2.04	1.68	1.56	2.16	1.56	1.48	1.44	4.68	1.84	1.68	2.22
3	1.72	1.04	1.40	1.16	1.00	1.28	1.20	1.08	1.92	1.04	2.48
4	2.60	1.44	1.32	1.16	1.36	1.92	1.40	1.52	1.36	1.32	2.33
5	1.24	1.36	1.28	2.44	1.48	1.48	1.16	1.32	1.36	1.44	2.86
6	1.16	1.32	1.20	1.08	1.04	1.04	1.20	1.16	1.20	1.12	1.45
7	2.28	2.04	2.88	2.00	3.64	1.24	1.44	1.44	1.36	1.28	2.58
8	1.28	1.88	1.84	1.52	1.44	1.84	1.60	1.32	1.24	1.16	2.66
9	1.80	1.24	1.20	1.28	1.32	1.44	1.36	1.60	1.44	1.12	2.84
10	1.08	1.04	0.92	1.08	0.96	1.20	1.16	1.16	1.00	1.00	2.40
11	1.92	1.24	1.40	1.12	1.28	1.44	1.16	1.24	1.16	1.40	2.44
12	1.24	1.36	1.44	1.28	1.24	1.32	2.48	1.16	1.40	1.28	2.46
13	1.28	1.40	1.48	2.32	1.76	1.32	1.40	1.24	1.32	1.24	3.78
14	1.76	2.72	1.16	1.40	1.52	1.20	1.92	1.20	1.40	1.36	1.87
15	1.16	1.36	3.28	1.16	1.20	1.16	1.20	1.20	1.28	1.16	2.42
$\overline{X}$	1.65	1.49	1.57	1.52	1.48	1.40	1.41	1.51	1.36	1.26	

0-SEC. DELAY, 2.0-ma. SHOCK

5-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10
1	10.72	2.12	3.24	1.40	1.32	1.44	1.36	1.28	2.40	1.40
2	18.92	8.52	2.64	2.56	1.80	1.68	1.80	1.80	1.76	2.00
3	7.64	8.96	1.88	2.04	2.48	2.20	1.44	1.36	1.36	2.80
4	3.16	4.72	9.08	2.16	1.20	1.40	1.48	1.92	1.44	1.32
5	19.24	2.44	2.32	1.64	2.00	1.52	1.32	1.12	1.40	2.12
6	13.12	1.72	1.60	2.12	1.72	1.68	1.56	1.28	1.84	1.52
7	5.60	2.48	1.60	1.48	1.84	2.92	1.36	1.20	1.96	1.72
8	9.56	5.72	1.84	3.40	1.32	1.68	3.40	3.28	1.76	1.60
9	9.48	7.04	3.72	2.08	2.56	2.12	1.28	1.28	2.16	1.44
10	27.92	4.32	1.56	1.92	2.04	1.32	1.48	1.32	1.56	1.60
11	13.72	16.36	1.88	1.12	1.60	1.20	1.96	1.28	1.24	1.24
12	11.16	2.60	1.36	0.96	1.44	1.16	1.48	1.20	1.00	0.88
13	16.80	12.80	1.80	4.88	1.68	1.32	1.28	1.84	1.92	1.32
14	7.52	6.60	1.80	3.04	3.96	1.72	4.20	2.20	5.44	3.16
15	9.96	3.80	2.16	1.56	1.28	1.12	1.36	1.16	1.44	1.12
$\overline{X}$	12.30	6.01	2.57	2.16	1.88	1.63	1.78	1.58	1.44	1.68

0-SEC. DELAY, 2.0-ma. SHOCK

5-trial blocks

Ss	11	12	13	14	15	16	17	18	19	20	$\bar{X}$
1	1.72	1.24	1.20	1.76	1.12	1.36	1.24	1.24	1.24	1.60	2.02
2	1.40	1.96	2.68	1.32	1.40	1.64	2.00	1.72	1.76	1.52	3.05
3	0.96	1.16	1.28	1.08	1.16	1.08	1.40	1.36	1.68	1.08	2.22
4	1.60	2.12	1.60	4.20	1.40	1.28	1.24	1.24	1.40	1.80	2.29
5	1.40	2.88	1.32	1.16	1.72	1.88	1.20	1.20	1.68	1.40	2.55
6	3.04	1.64	2.76	1.72	1.36	1.56	1.36	1.44	1.52	1.20	2.29
7	1.24	1.28	1.24	2.16	1.32	1.20	1.64	1.40	1.20	1.32	1.81
8	3.29	2.20	2.36	1.36	1.80	1.84	1.60	1.40	1.72	1.44	2.63
9	1.28	1.32	1.40	1.32	1.28	1.36	1.28	1.32	1.08	1.04	2.29
10	1.72	1.36	1.48	1.08	1.36	1.28	1.60	1.28	1.28	1.26	2.93
11	2.68	1.20	1.20	1.12	1.20	1.20	1.32	1.36	1.44	1.12	2.77
12	1.04	1.08	1.20	1.16	1.24	1.20	1.32	1.32	1.28	1.36	1.77
13	1.28	1.28	1.40	1.28	1.44	1.36	1.08	2.64	1.44	1.36	3.01
14	1.76	2.20	1.32	1.44	2.72	2.64	2.72	1.36	1.48	1.84	2.96
15	1.24	1.76	1.16	1.20	1.04	1.12	1.04	1.80	1.24	1.08	1.88
$\bar{X}$	1.71	1.65	1.57	1.56	1.44	1.47	1.47	1.47	1.43	1.36	

Appendix B

Trials needed by each S to reach an extinction criterion of 5 consecutive failures to respond within 60 sec.

	0-SEC. DELAY					5-SEC. DELAY				
Ss	control	0.5-ma.	0.8-ma.	1.3-ma.	2.0-ma.	control	0.5-ma.	0.8-ma.	1.3-ma.	2.0-ma.
1	286	1	56	27	5	44	2	24	33	6
2	41	5	16	2	2	5	50	8	3	4
3	41	8	6	16	5	84	1	4	6	10
4	35	7	20	6	5	10	63	16	26	4
5	7	36	6	2	4	53	7	5	9	9
6	129	22	10	12	3	42	3	4	27	13
7	48	11	26	4	10	128	11	12	19	4
8	35	8	12	4	3	144	4	20	15	14
9	3	5	32	19	2	32	7	11	10	53
10	12	62	5	5	1	94	19	11	8	9
11	17	25	1	1	2	2	15	24	4	7
12	14	13	31	8	17	37	17	5	25	14
13	72	15	6	3	7	2	25	2	1	1
14	4	14	2	4	19	7	6	3	3	15
15	350	5	12	8	3	11	19	4	6	8
Md	35	11	12	5	4	37	7	8	9	9

Appendix C

Latencies of a wheel-turning response during extinction in seconds.

O-SEC. DELAY NONPUNISHED

2-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10	Md
1	1.3	1.7	1.3	1.4	1.8	2.1	1.3	1.6	3.1	1.4	1.5
2	2.0	1.5	0.6	0.6	0.5	0.5	2.0	1.9	4.5	29.6	1.7
3	2.2	2.9	1.6	1.5	1.4	1.5	5.1	2.8	9.1	3.6	2.5
4	3.3	1.9	1.9	58.0	43.7	48.0	31.3	17.9	58.0	21.6	26.5
5	3.7	1.7	58.0	35.2	58.0	58.0	58.0	58.0	58.0	58.0	58.0
6	2.8	2.0	1.8	1.8	2.3	2.1	1.9	1.7	1.3	1.6	1.9
7	3.4	1.4	2.2	1.8	1.7	2.3	3.0	1.6	4.3	4.2	2.3
8	1.5	1.7	0.8	1.3	1.1	1.2	1.6	2.0	18.9	4.8	1.6
9	1.6	29.5	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
10	29.9	58.0	30.1	36.3	58.0	30.7	58.0	58.0	58.0	58.0	58.0
11	29.6	58.0	31.2	2.3	7.7	5.0	4.0	3.1	36.0	58.0	18.7
12	22.1	32.8	51.2	39.4	32.6	58.0	38.5	58.0	58.0	58.0	45.3
13	2.3	6.3	16.2	3.1	2.8	2.2	3.2	2.3	3.5	10.4	3.2
14	1.7	1.5	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
15	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Md	2.3	1.9	2.2	2.3	2.8	2.3	4.0	2.8	18.9	21.6	

O-SEC. DELAY, 0.5-ma. SHOCK

2-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10	Md
1	42.7	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
2	30.7	58.0	40.2	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
3	3.3	8.9	19.4	31.4	58.0	58.0	58.0	58.0	58.0	58.0	58.0
4	1.8	1.7	5.5	44.7	58.0	58.0	58.0	58.0	58.0	58.0	58.0
5	1.5	1.5	1.3	1.6	1.5	1.4	1.7	1.5	29.7	38.0	1.5
6	6.2	3.5	2.4	8.6	30.9	17.9	29.8	58.0	57.4	36.3	23.9
7	4.6	2.3	35.8	30.6	7.7	18.6	58.0	58.0	58.0	58.0	33.2
8	31.5	31.3	4.3	3.2	58.0	58.0	58.0	58.0	58.0	58.0	58.0
9	10.4	21.5	31.4	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
10	1.2	1.3	1.7	1.4	1.3	3.2	7.3	7.9	2.3	7.1	2.0
11	1.2	0.9	1.4	1.7	1.6	1.5	2.9	13.5	3.8	28.0	1.7
12	26.1	58.0	31.9	57.8	49.9	58.0	47.0	58.0	58.0	58.0	57.9
13	1.5	1.6	1.5	3.1	9.6	1.7	54.3	29.6	58.0	58.0	6.4
14	4.0	2.5	1.5	33.2	32.2	58.0	56.7	58.0	58.0	58.0	45.0
15	3.1	3.2	31.1	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
Md	4.0	3.2	5.5	31.4	49.9	58.0	58.0	58.0	58.0	58.0	

0-SEC. DELAY, 0.8-ma. SHOCK

2-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10	Md
1	1.3	1.2	1.4	1.1	1.4	1.5	1.5	1.5	1.6	3.0	1.5
2	1.6	1.8	1.8	29.8	4.2	31.5	29.8	9.8	58.0	58.0	18.8
3	11.3	29.8	25.8	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
4	1.1	1.2	1.7	1.2	1.3	1.6	2.0	2.4	3.4	3.7	1.7
5	4.1	1.8	1.6	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
6	1.3	1.2	2.2	2.6	6.0	58.0	58.0	58.0	58.0	58.0	32.0
7	2.6	6.7	1.7	9.7	2.3	3.7	2.9	1.5	2.4	21.3	3.3
8	1.5	1.4	1.3	3.4	1.3	3.0	58.0	58.0	58.0	58.0	3.2
9	2.4	2.0	2.6	3.6	2.3	3.0	2.6	3.6	1.8	2.0	2.5
10	10.7	1.6	30.7	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
11	3.2	1.9	2.2	3.2	1.8	2.4	1.6	35.0	2.7	58.0	2.6
12	30.3	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
13	0.6	1.2	1.6	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
14	10.3	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
15	9.3	3.0	31.1	58.0	43.4	58.0	58.0	58.0	58.0	58.0	58.0
Md	2.6	1.8	2.2	29.8	6.0	58.0	58.0	58.0	58.0	58.0	

0-SEC. DELAY, 1.3-ma. SHOCK

2-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10	Md
1	1.6	2.1	1.9	1.7	1.3	1.2	2.8	2.1	1.5	1.7	1.7
2	1.7	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
3	1.2	1.5	1.8	1.4	1.9	1.7	1.3	1.5	58.0	58.0	1.6
4	2.4	1.7	1.5	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
5	2.2	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
6	1.0	0.9	1.4	29.6	58.0	57.3	58.0	58.0	58.0	58.0	57.7
7	30.0	33.7	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
8	18.3	3.7	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
9	1.3	1.2	1.5	2.8	1.8	1.3	1.5	2.1	5.8	34.2	1.7
10	6.7	4.2	30.2	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
11	49.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
12	30.6	30.8	36.0	45.5	58.0	58.0	58.0	58.0	58.0	58.0	58.0
13	2.1	29.8	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
14	3.1	9.5	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
15	1.7	3.0	2.8	2.1	58.0	58.0	58.0	58.0	58.0	58.0	58.0
Md	2.4	3.7	36.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	

O-SEC. DELAY, 2.0-ma. SHOCK

2-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10	Md
1	1.7	1.8	30.1	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
2	1.6	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
3	1.5	1.8	38.5	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
4	1.8	4.4	29.6	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
5	1.5	11.4	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
6	29.7	42.1	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
7	5.8	1.7	32.4	58.0	50.4	58.0	58.0	58.0	58.0	58.0	58.0
8	2.2	29.9	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
9	1.4	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
10	49.2	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
11	16.2	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
12	1.7	1.5	4.0	30.8	30.9	32.9	58.0	58.0	55.0	58.0	31.9
13	58.0	56.4	58.0	39.7	58.0	58.0	58.0	58.0	58.0	58.0	58.0
14	12.5	1.5	1.8	1.7	7.1	10.0	36.8	58.0	18.2	51.5	11.3
15	4.6	32.4	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
Md	2.2	29.9	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	

5-SEC. DELAY NONPUNISHED

2-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10	Md
1	29.8	1.4	2.9	4.2	2.7	15.9	1.3	17.4	2.5	6.3	3.6
2	58.0	47.7	47.6	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
3	1.6	2.2	1.7	4.8	4.0	2.1	2.6	9.4	9.9	14.6	3.3
4	1.7	1.6	6.0	29.8	50.0	58.0	58.0	58.0	58.0	58.0	54.0
5	3.7	0.4	0.5	1.4	0.8	0.4	0.8	0.8	1.4	1.6	0.8
6	2.1	1.5	1.9	1.8	1.3	1.5	2.2	1.9	1.8	2.6	1.9
7	1.5	1.9	2.0	1.6	1.8	1.7	1.3	1.3	1.8	1.4	1.7
8	1.3	2.1	2.0	5.6	6.3	2.0	1.5	1.4	18.9	2.8	2.1
9	2.4	25.5	1.9	2.0	7.5	1.5	10.1	4.0	19.2	30.8	5.8
10	5.4	8.2	12.4	7.2	17.4	33.6	19.7	31.3	34.5	2.0	14.9
11	1.6	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
12	1.5	1.3	1.4	0.5	1.2	1.4	1.8	3.2	3.7	48.6	1.5
13	2.3	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
14	2.3	1.8	55.8	30.3	58.0	58.0	58.0	58.0	58.0	58.0	58.0
15	5.6	3.9	6.4	2.5	6.0	49.2	58.0	58.0	58.0	58.0	27.8
Md	2.3	2.1	2.7	4.8	6.3	15.9	19.7	17.4	19.2	30.8	

5-SEC. DELAY, 0.5-ma. SHOCK

2-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10	Md
1	10.2	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
2	1.5	1.1	1.4	1.1	1.4	1.2	1.6	6.6	4.2	1.8	1.5
3	24.1	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
4	3.0	1.3	0.8	1.1	1.5	1.6	2.8	14.3	1.3	2.8	1.6
5	30.7	2.3	58.0	32.4	58.0	58.0	58.0	58.0	58.0	58.0	58.0
6	3.3	29.6	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
7	3.7	6.5	29.8	58.0	46.2	58.0	58.0	58.0	58.0	58.0	58.0
8	2.1	1.7	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
9	3.4	58.0	5.8	33.9	58.0	58.0	58.0	58.0	58.0	58.0	58.0
10	3.2	1.8	3.4	2.5	8.4	3.9	3.6	2.7	2.0	38.4	3.3
11	1.0	1.3	32.2	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
12	1.4	0.9	1.1	1.8	2.0	1.9	1.4	5.2	30.4	58.0	1.9
13	3.3	2.5	2.5	2.9	2.4	2.5	2.6	3.2	3.0	6.7	2.8
14	1.4	29.5	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
15	2.0	2.2	3.5	1.3	1.7	2.5	4.5	1.6	22.7	58.0	2.4
Md	3.2	2.3	29.8	33.9	58.0	58.0	58.0	58.0	58.0	58.0	

5-SEC. DELAY, 0.8-ma. SHOCK

2-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10	Md
1	0.9	1.1	1.5	1.3	1.0	6.5	1.0	2.3	4.6	25.0	1.4
2	1.5	1.1	2.8	5.4	58.0	58.0	58.0	58.0	58.0	58.0	58.0
3	1.2	2.6	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
4	2.0	1.2	1.5	1.2	1.3	1.4	2.3	3.0	58.0	58.0	1.9
5	29.7	51.6	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
6	4.4	1.9	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
7	1.4	1.4	1.4	1.7	1.5	1.3	58.0	58.0	58.0	58.0	1.6
8	1.5	1.9	1.6	7.5	8.9	1.0	1.7	2.8	58.0	52.5	2.3
9	5.2	1.8	1.6	1.5	1.7	29.8	58.0	58.0	58.0	58.0	17.5
10	15.4	1.4	1.6	2.4	2.1	29.8	58.0	58.0	58.0	58.0	22.6
11	3.0	1.7	1.5	1.7	1.6	1.6	5.9	1.8	1.5	1.4	1.7
12	29.9	58.0	31.4	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
13	2.6	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
14	41.7	40.2	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
15	29.7	51.6	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
Md	3.0	1.9	2.8	7.5	58.0	58.0	58.0	58.0	58.0	58.0	

5-SEC. DELAY, 1.3-ma. SHOCK

2-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10	Md
1	1.4	1.7	12.4	8.9	10.8	1.4	3.1	14.7	15.6	2.9	6.0
2	2.5	4.1	4.5	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
3	1.2	30.1	16.9	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
4	2.5	19.7	1.5	2.1	34.5	30.0	5.1	2.1	58.0	44.3	12.4
5	2.0	1.3	1.4	1.7	29.8	58.0	58.0	58.0	58.0	58.0	43.9
6	2.0	2.9	14.7	3.1	4.3	7.9	30.2	58.0	20.8	30.0	13.0
7	17.4	4.8	2.9	2.2	2.4	11.7	30.0	1.6	58.0	55.3	7.3
8	58.0	58.0	8.7	58.0	45.1	1.4	1.5	29.9	58.0	58.0	51.6
9	30.5	58.0	30.5	3.3	22.8	58.0	58.0	58.0	58.0	58.0	58.0
10	1.8	2.1	2.4	3.8	58.0	58.0	58.0	58.0	58.0	58.0	58.0
11	3.8	1.3	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
12	1.2	1.4	1.4	4.6	1.7	6.5	9.1	2.6	3.5	14.9	3.1
13	31.8	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
14	2.2	29.7	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
15	1.9	5.5	1.8	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
Md	2.2	4.8	8.1	8.9	45.1	58.0	58.0	58.0	58.0	58.0	

5-SEC. DELAY, 2.0-ma. SHOCK

2-trial blocks

Ss	1	2	3	4	5	6	7	8	9	10	Md
1	3.8	3.2	2.7	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
2	30.4	31.8	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
3	5.4	3.8	33.3	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
4	2.0	1.8	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
5	30.0	14.0	30.9	1.0	29.7	58.0	58.0	58.0	58.0	58.0	44.5
6	1.0	0.4	0.9	1.1	34.8	58.0	30.8	58.0	58.0	58.0	32.8
7	1.8	31.7	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
8	2.4	58.0	41.6	25.1	32.4	58.0	11.9	58.0	58.0	58.0	49.8
9	2.6	2.1	8.1	6.3	1.8	2.3	1.7	45.4	1.6	58.0	2.5
10	7.6	1.7	1.3	1.4	30.1	58.0	58.0	58.0	58.0	58.0	44.1
11	1.6	1.7	2.5	29.9	58.0	58.0	58.0	58.0	58.0	58.0	58.0
12	2.2	2.0	1.6	1.9	2.0	6.2	33.5	58.0	58.0	58.0	4.2
13	40.4	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
14	1.4	2.3	3.6	7.6	1.6	44.2	1.5	30.2	58.0	58.0	5.6
15	10.0	29.8	3.5	4.3	58.0	58.0	58.0	58.0	58.0	58.0	58.0
Md	2.6	3.2	8.1	25.1	58.0	58.0	58.0	58.0	58.0	58.0	