Punishment and reward in children's instrumental learning¹

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Abstract

Kindergarten children were both punished and rewarded for performing a motor response, with no specific alternative response available. Punishment given early in training partially suppressed behavior, while punishment introduced later was ineffective. These results, which contradict comparable animal data, are explained in terms of differential orientation to the stimulus situation for children and rats.

Problem

Punishment is widely used as a matter of course in child training and socialization procedures and also throughout our educational system. However, the value of punishment in general has not been established, nor have specific varieties of punishment been adequately evaluated. Traumatic punishment is undoubtedly effective in suppressing behavior, but usually produces unfortunate side effects. Less severe levels of punishment might well be used effectively in actual learning situations, but little work has been done in this area, and much systematic investigation is needed.

The operation of punishment on learning is generally thought to be indirect, i. e., it suppresses an undesirable response so that a new response can occur, be rewarded, and replace the punished one. Most of the support for this view comes from animal experiments (e.g., Whiting & Mowrer, 1943). There are also studies of children's discrimination learning in a choice situation, which have indicated that punishment alone or a combination of reward for the correct response and punishment for the wrong one produces faster learning than reward alone (Brackbill & O'Hara, 1958; Penney & Lupton, 1961).

On the other hand, there are many training situations in which certain behavior is punished but no alternative course of action is explicitly designated. For example, a child may be reprimanded for handling attractive objects in a department store; or he may be punished for thumbsucking when he has no other outlet for the underlying impulses. The present experiment investigated the effect of punishment in such a situation, where the child was punished for performing a previously rewarded response but had no specific alternative response to be substituted for the punished one. This type of situation has been successfully used in animal experiments (Karsh, 1962) and was adopted to see whether similar results would be obtained with simple instrumental responding for children.

Method

The task was chosen both for similarity to other successful children's experiments (Rieber, 1961; Bruning, 1964; Cantor & Cantor, 1964) and also for comparability to animal studies. The apparatus was a 6-ft long box containing a weighted lever which could be moved

along a 5-ft slot in the front of the box. The child's task was to push this lever from the extreme left to the right end of the slot, using his left hand and walking alongside the apparatus. It was not a difficult task. Initially the experimenter showed each child how to start pushing the lever when a green light came on at the left and to continue pushing as far as the lever could go. When the lever reached the end of the slot, a red light came on, and an M & M candy was delivered through a chute into a cup. The child was allowed to eat the candy immediately, and then he returned to a chair on the side of the room to await the experimenter's signal to get ready for the next trial. At the ready signal ("Come and get ready") the child got up and stood in a prescribed spot, a circle on the floor, at the left side of the apparatus. When the green light appeared, the child operated the lever. Each child, tested individually, performed this simple task 10 times during a daily session, which lasted approximately 10 min. The time from the end of one lever response to the beginning of the next was about 30 sec.

The punishment was a short, loud tone (2500 cps at 125 db for 0.2 sec.) plus verbal disapproval by the experimenter ("What a bad noise! That noise means you did something wrong."). When punishment was given, the noise was delivered automatically when the lever reached the end of the slot.

Forty-four kindergarten participated in the experiment. The control group (14 children) was never punished; they had five days of training with reward (candy) and then two days with no reward (extinction). The late punishment group (19 children) had three days of rewarded training, two days with both punishment and reward, and two days of extinction (neither punishment nor reward). The early punishment group (11 children) received only one day of rewarded training followed by two days with punishment plus reward.

Results

The children learned the task quickly, within 2-3 days as shown in Fig. 1. The main response measure was the time from the onset of the green light until the lever reached the extreme right position (total time). Two subdivisions of total time were used: starting time (the time from the light signal to initial movement of the lever) and response time (the time from initial movement of the lever until it reached the end of the slot).

Fig. 1. Mean starting speed for the 3 experimental groups during 7 daily sessions of 10 trials each, plotted in blocks of 2 trials.

Fig. 2. Mean total speed for the 3 experimental groups during 7 daily sessions of 10 trials each, plotted in blocks of 2 trials.

Measures were recorded automatically, and reciprocal transformations (speed scores) were used for figures and analyses. Figure 1 shows starting speed and Fig. 2 shows total speed (which includes both starting time and response time). Response speed, which is not shown, looks very much like total speed.

Children who were rewarded and not punished (the control group) increased their total speed during the first three days of training and then stabilized, showing a typical, negatively-accelerated learning curve. Starting speed showed the most obvious increase from the first to the third day ($t = 3.47$; $p < .005$) but changes in response speed ($t = 2.68$; $p < .02$) and total speed ($t = 3.72$; $p < .005$) were also significant. There were no reliable changes from day three to day five. The late punishment group (after three days of training) did not respond differently from the unpunished control group on any measure (e. g. total speed on second day of punishment: $F = 1.42$; $df = 1/41$). There was no response suppression caused by punishment, even though the noise appeared aversive (the children showed visible reactions like covering their ears and wincing afterwards). However, the early punishment group showed a definite, persistent decline in total speed throughout the two days of punishment, compared to the late punishment and control groups (second day of punishment: $F = 12.14$; $df = 1/41$; $p < .005$). This decrease in total speed was reflected both in starting speed and in response speed. The suppression of response speed was significant ($F = 10.70$; $df = 1/41$; $p < .005$) while starting speed was not, due to greater variability in the latter measure.

Discussion

These results, which indicate that increased training (30 trials versus 10 trials) produced complete resistance to punishment, contradict those of comparable studies with rats, which show that increased training does not increase resistance to punishment; in fact, overtraining tends to decrease resistance to punishment (Karsh, 1962). According to the simplest theoretical formulation, increasing the number of rewarded trials should increase habit strength and lead to increased resistance to punishment. It is interesting that this prediction has been confirmed with children as subjects but not with rats.

The disruptive effect of punishment for rats is probably determined by two factors, habit strength and stimulus change, which are both

affected by number of rewarded trials, but, in turn, affect resistance to punishment differently. With an increasing number of rewarded trials, habit strength increases and at the same time the stimulus situation becomes better established, so that any change in conditions has a greater effect. An increment in habit strength acts to increase resistance to punishment while an increase in stimulus change (due to late introduction of shock) decreases resistance to punishment. Thus, the net effect for rats may be no change in resistance to punishment with increased training or may indeed be the paradoxical effect of decreasing resistance to punishment following overtraining, depending on the relative strengths of the two factors and the shape of the functions.

Whereas the rat is stimulus bound, i. e., controlled to a large extent by the stimulus situation, the child's field is less determined by the experimental apparatus. The child works outside the apparatus, exposed to stimulation of the experimental room. Therefore, it is likely that the stimulus change factor is much weaker for the child than for the rat. For children, the simple original prediction, which was based on only one factor, habit strength, was confirmed.

Another interesting finding here was the resistance to extinction shown by the control and late punishment groups. (The early punishment group did not go through extinction.) Removal of reward had very little effect on behavior during the two days of extinction. There was no decline in respond speed at all. The only indication of decreased responding was on the starting speed measure, where the second day of extinction showed a decrement, compared to the last day of training for the control and late punishment groups (trials 41-50 vs. 61-70: $t = 2.29$; $df = 32$; $p < .05$). In a similar situation, Bruning (1964) found that children actually increased their response speed during 12 extinction trials. It would be interesting, in further work, to see whether there is a direct relationship between resistance to punishment and resistance to extinction in children's learning.

It seems clear that the suppressive effects of punishment for children can be either completely or partially mitigated by giving a sufficient amount of training beforehand. Other learning variables might also be effective in this situation. For example, training with mild punishment increases resistance to strong punishment for rats (Karsh, 1963); would this finding hold also for children? In any event, it is obvious that the results of animal learning studies are not completely applicable, even to simple learning situations for children. Instead of extrapolating from animal experiments, empirical evidence must be gathered using children as subjects in order to assess the effects of punishment on children's learning.

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Note

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