ESCAPE AND AVOIDANCE RESPONSE OF PRE-SCHOOL CHILDREN TO TWO SCHEDULES OF REINFORCEMENT WITHDRAWAL

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Recent demonstrations by Sidman (1953) and Brady (1958) show that aversive control can establish an operant response which is regular in rate, efficient in the avoidance of the aversive stimulus which controls it, and durable over long periods of time during which the aversive stimulus is perfectly avoided. These characteristics alone make avoidance schedules a logical tool to apply to the development of social behaviors in humans. A primary problem in any such attempt is the demonstration of avoidance responding under aversive control in the laboratory, especially with children as subjects. The present study represents a beginning at implementing avoidance techniques for children, and an exploration of possibly significant variations in the way an aversive event may be programmed by a response. The aversive event used is the temporary withdrawal of positive reinforcement.

SUBJECTS AND APPARATUS

The subjects were pre-school children, ranging in age from 4 to 6 years, in attendance at day-care schools during the course of the study. They represent low-income and student families.

The study was conducted in a mobile laboratory built into a 19-foot house trailer (Bijou, 1958), which was parked close to the nursery school. The interior of the laboratory included a one-way observation room for the experimenter and a playroom for the child. The playroom contained a small chair, two tables holding toys or apparatus, a movie screen mounted on a wall, and a partitioned corner in which an accompanying adult (*A*) could sit, out of the child's sight but still present.

The child was seated beside one table, facing the movie screen, with a bar to press located at his right hand such that he could respond to the bar while watching movies projected onto the screen. The bar was housed in a red box approximately 1 foot on a side. The movie screen was a 9- by 11-inch rectangle of translucent plastic, located in the wall separating child and experimenter. The movie projector, a Busch "Cinesalesman," operated from the experimenter's side. The projector contained as many as three cartoons on an "endless" reel of film, and could repeat these in an uninterrupted sequence for an indefinite number of cycles without rewinding or other adjustment. The cartoons were of the Castle Films' Woody Woodpecker series (Woody Plays Santa Claus, The Hollywood Matador, and The Dizzy Acrobats); each was in black and white, with sound, and lasted 7 minutes.

PROCEDURE

*S*s were dealt with entirely by young female adult, *A*. Before the experiment started, *A* had been a constant member of the play group for several days and was thoroughly

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familiar to the *S*s. In addition, she had told them that a trailer was coming, and that all the *S*s would be allowed to enter and see cartoons. This created a good deal of enthusiasm. Two *A*s were used in the course of the study, each seeing about half of the *S*s of each experimental group. Any *S* was dealt with always by the same *A*.

The *S*s were brought to the laboratory repeatedly by *A*, who told them on each occasion that it was "their turn to see the cartoons (again)." These occasions typically were spaced at 4- or 5-day intervals. When *S* entered with *A*, he was seated before the movie screen, the bar at his right hand, and *A* then retired to her corner (saying on *S*'s first visit, "I'll be right back here.") The cartoons started immediately and played through without interruption. Some *S*s saw two cartoons (14 minutes), and some saw three cartoons (21 minutes). The operant level of bar pressing was measured.

Procedure was similar for the second session, except that the cartoons played for only 1 minute before the first interruption. The cartoons were interrupted (i.e., positive reinforcement was withdrawn) by opening the voice coil of the projector's loud-speaker and flipping an opaque shield over the projector lens, operated by a small electric motor built into the projector. This procedure has been shown to constitute a punishing event in a previous study (Baer, 1960) with children of this age range. The cartoons stayed off (the projector running, nevertheless) until *S* responded to the bar. After this point, further withdrawals were programmed by *S*'s response according to one of two schedules.

Under one of these schedules, a response had these consequences: any response automatically programmed the next withdrawal for n seconds later. But if another response was made before n seconds elapsed, the withdrawal was re-programmed for n seconds after this last response. This is the avoidance schedule typical in Sidman's studies, except that the aversive event (the withdrawal of the cartoons) remains in effect until a response is made. It is precisely the schedule used by Hefferline (1959) to set up avoidance responding in adults, and will be referred to here as a Hefferline escape-avoidance schedule.

Under the other schedule, a response had somewhat different consequences: any response added n seconds to the interval between that response and the next programmed withdrawal of the cartoons. In effect, time could be "saved up." For example, if *S*, during an interruption, made one response, he received n seconds of cartoons, and then was interrupted again. If he had made 10 responses, however, then he would have been interrupted 10n seconds after his first response. If, before this programmed interruption, he again emitted 10 responses, the next interruption would be programmed another 10n seconds into the future, giving a total period of 20n seconds of uninterrupted cartoons. Because of the very precise similarity of this procedure to attempting to walk up an escalator going down, Sidman (1959) has called a schedule very similar to this an "escalator" schedule. It was implemented in this case by a modified Guardian add-subtract stepper[2], which was added one step towards a withdrawal every 3 seconds by a timer, and subtracted by *S*'s responses. In the event of a response and a timer impulse being fed to the stepper within 0.1 second of each other, the effect of the response was lost. This was rare.

During each subsequent visit to the laboratory, *S*s viewed the same cartoons under one of these schedules. At the conclusion of the last cartoon, the projector was turned off from the experimenter's room and *A* came out of her partitioned corner, telling the child, "That's all for today." She then took the child back to the play group.

A group of 16 children was observed under repeated applications of the Hefferline escape-

[2]This stepper had a capacity of 40 steps, thus allowing *S* to put off the next interruption a maximum of 40n seconds. This limit was rarely reached.

avoidance schedule. Some children were seen as many as 12 consecutive times. Response-interruption intervals (n) of 3, 5, and 10 seconds were used, always the same interval for a given *S*. Another group of 17 children was observed under repeated applications of the "escalator" schedule. Some were seen as many as eight consecutive times. The same intervals (3, 5, and 10 seconds) were used.

RESULTS AND DISCUSSION

Cumulative-response curves representative of developing response under the Hefferline escape-avoidance schedule are shown in Fig. 1. These represent Sessions 2 through 12 of a

Figure 1. Developing response under the Hefferline escape-avoidance schedule of reinforcement withdrawal.

single *S* seeing the same two cartoons each session. The response-interruption interval (n) shown is 5 seconds. (Operant level is not shown, since it was a precise–and typical– zero.) Each curve represents a single session. Interruptions are indicated by the usual vertical blip. The horizontal extent of the blip indicates the time *S* allowed the interruption to continue.

Clearly enough, response comes increasingly under control of the escape contingency of the schedule, and shows a decreasing (if any) sensitivity to the avoidance contingency also programmed. Performance during the final session is an extremely regular escape response, very closely discriminated to the interruption and much like *S*'s initial performance on this schedule. Many *S*s returned to this response pattern somewhat earlier, and then maintained it consistently throughout the tenure of the study.

Failure to evoke avoidance responding with this schedule hardly removes the schedule from consideration as a significant variable in child behavior. It must be emphasized that the interruption itself is a very mild event, the prospect of viewing the same three cartoons again not constituting an extremely powerful reinforcer for this population. (However, several *S*s were observed under a schedule in which an interruption could not be escaped until 5 seconds has passed. Response was not essentially different from that shown in Fig. 1.) And there is reason to assume that further hours of experience with this schedule eventually would produce avoidance responding.

Cumulative-response curves indicating a quickly developing avoidance response under the "escalator" schedule are shown in Fig. 2. These represent Sessions 2 through 6 of a single *S* seeing the same three cartoons each session. In this case, the response-interruption interval (n) is 3 seconds.[3] (Again, operant level is not shown, being zero.) Each curve represents a single session.

[3]The response-interruption intervals used in this study did not prove to be a significant variable in predicting the development of avoidance responding.

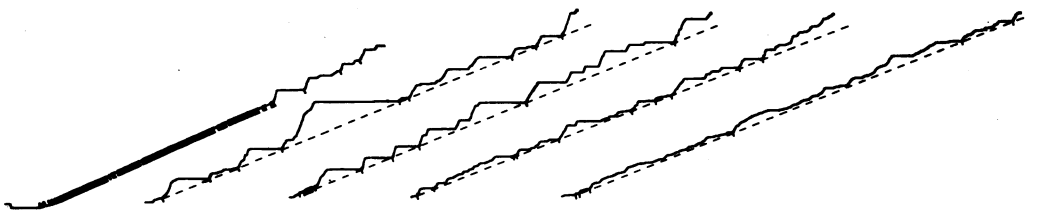

Figure 2. Developing response under the "escalator" schedule of reinforcement withdrawal.

Initial response is exclusively to the escape contingency of the schedule, as was the case of *S*s under the escape-avoidance schedule (Fig. 1). And, as was the case for *S*s under the escape-avoidance schedule, before the session ends, a burst of responses appears. But under this schedule, the consequence of such a burst is to give *S* a relatively long period of uninterrupted cartoons. Subsequent response develops then to be primarily of an avoidance character, rather than of an escape character: the response pattern is one in which rapid bursts of response alternate with plateaus which typically end in reinforcement withdrawals. As the sessions proceed, this pattern shifts such that plateaus tend to end in renewed bursts of response just prior to the next scheduled reinforcement withdrawal. By the sixth session, response rate has fallen to the point where it is reasonably smooth, plateaus are rare and short, and the reinforcement is rarely withdrawn (although the withdrawal often is potentially only a few seconds away).

Most *S*s are slower to come to this pattern, but clearly are developing toward it in the course of eight sessions. In these cases, it is typical to find a relatively longer phase in which plateaus following response bursts end in reinforcement withdrawals, rather than renewed bursts of responding.

In Fig. 2, the dotted lines indicate a minimal rate for keeping just ahead of the next interruption (i.e., one response per 3 seconds). With this schedule and cumulative recording, the response curve will intersect this projected line exactly at the time of the next programmed interruption, as long as *S* responds almost instantaneously to any interruption (which is invariably the case).

The difference in avoidance behavior observed in response to these schedules may be a function of the discriminative stimuli each schedule allows the subject—if the avoidance response is viewed essentially as a temporally discriminated operant. Under the Hefferline escape-avoidance schedule, the essential S^D for avoidance responding may be simply time since the last response, independent of the rate or extent of recent responding. Under the "escalator" schedule, possible S^Ds may include time since the last response, and the rate and extent of recent responding. However, to imply that the subject will discriminate his response to the latter two of these three variables will involve an assumption that a response is reinforced in proportion to the length of time it delays the next reinforcement withdrawal, or, alternatively, that it is punished in inverse proportion to the length of time it delays the next reinforcement withdrawal. Clearly, the present study does not contain data in direct support of these assumptions. It is probably best simply to point to the variables which program the next reinforcement withdrawal (time since last response, in the Hefferline escape-avoidance schedule; time since last response, rate and extent of responding, in the "escalator" schedule) as a target for explanatory research.

Conceivably, the "escalator" schedule of reinforcement withdrawal (or of other aversive events) is a typical and important schedule in the developing child's reinforcement history. It seems reasonable that when a human is absentmindedly programming punishment for "bad" behavior, he is likely to be placated longer by an intensive burst of "good" responses than by only one or two. At any rate, the "escalator" schedule seems to have certain advantages in promoting the rapid development of avoidance responding, and deserves attention.

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