JOURNAL OF APPLIED BEHAVIOR ANALYSIS 1988, 21, 89–95 NUMBER 1 (SPRING 1988)

STIMULUS VARIATION AS A MEANS OF ENHANCING PUNISHMENT EFFECTS

MARJORIE H. CHARLOP
CLAREMONT MCKENNA COLLEGE AND CLAREMONT GRADUATE SCHOOL

LOUIS D. BURGIO
NATIONAL INSTITUTE ON AGING

BRIAN A. IWATA
UNIVERSITY OF FLORIDA

MARTIN T. IVANCIC
FLORIDA STATE UNIVERSITY

We compared the effects of varied punishers (presentation of one of three available punishers) with the single presentation of one of the punishers on the occurrence of inappropriate behaviors with three developmentally delayed children. Two children were presented with varied-punisher conditions in which either overcorrection, time-out, or a verbal "no" was presented contingent upon inappropiate behavior. A loud noise was substituted for overcorrection for a third child. Results of the multielement with reversal design indicated that both punishment formats produced a decrease in the target behaviors with the varied-punisher format slightly more effective than the single presentations of the punishers. The results suggest the use of varied punishers as a means of enhancing the effects of less intrusive procedures to effectively reduce inappropriate behaviors.

DESCRIPTORS: aggression, punishment, developmental disabilities, self-stimulatory behavior

Much research has demonstrated the efficacy of punishment procedures in reducing or eliminating children's inappropriate behaviors. This research has evaluated a wide variety of procedures (e.g., verbal reprimands, overcorrection, time-out, contingent slap, water mist, electric shock) that have been applied to an equally wide variety of behaviors (e.g., tantrums, aggression, self-injurious behavior, self-stimulation) in both normal and clinical populations (see Matson & DiLorenzo, 1984, for a review).

Although the therapeutic effectiveness of punishment has been clearly demonstrated, practical and logistical problems often preclude the use of certain procedures. For example, it is generally recommended that the least intrusive procedures be used. However, in certain cases, less intrusive procedures may not be effective because of previous inconsistent or incorrect use. Furthermore, when target behaviors are physically harmful (e.g., aggression, self-injurious behavior) the use of less intrusive procedures that require more time may be considered unethical (Repp & Deitz, 1978). Nevertheless, the use of intrusive procedures necessitates ethical concern and thus is seldom permitted in many settings (Matson & DiLorenzo, 1984). Researchers and practitioners are consequently faced with the dilemma of using less intrusive reductive procedures in a speedy and effective manner.

Recent research on positive reinforcement suggests one approach for enhancing the effects of "mild" punishing stimuli. Egel (1980, 1981) demonstrated with autistic children the superiority of reinforcement variation over the single presentation of one salient reinforcer. He compared conditions in which only one highly preferred food reinforcer was available to conditions in which a variety of highly preferred food reinforcers were available. Correct responding was highest during varied-reinforcement conditions. He explained these results in terms of lower satiation effects during varied conditions.

Reprints may be obtained from Marjorie H. Charlop, Psychology Department, Claremont McKenna College, Claremont, California 91711.

It seems feasible that children may "get used to" the presentation of one punisher and that it may in turn decrease in effectiveness. Thus, a varied-punisher format may enhance the effectiveness of "weak" punishers while maintaining the use of less intrusive procedures. The present study was designed to test this hypothesis by comparing the effects of varied versus constant punishers.

METHOD

Subjects

Three developmentally delayed children participated. Child 1 was referred to a hospital in-patient program for behavior problems for treatment of aggressive behavior. He was profoundly retarded with a CA of 5.2 years and an MA of 11 months. He displayed no speech and was not toilet trained. He was ambulatory, but his motor coordination was extremely poor. His aggressive behavior consisted of pinching, pulling hair, hitting, and object throwing (usually small objects such as blocks and plates that he threw either across the room or directly at someone).

Child 2 was diagnosed as autistic according to the criteria of the DSM III (CA 6 years and IQ of 20). She was referred to the hospital for reduction of self-stimulation and destructive behavior. Her self-stimulation consisted of toe-walking, body-arching, hand-flapping, and flapping toys repetitively in front of her eyes, which interfered with her progresss in school and speech therapy. Her destructive behavior included object throwing, turning over furniture, and scraping furniture and walls with toys and other objects.

Child 3 was also diagnosed as autistic according the DSM III criteria (CA 6.5 years, MA 3.4 years). He was participating in an after-school behavior modification tutoring program that focused on teaching speech, language, and play and eliminating tantrums, self-stimulation, and aggression. His target behaviors were aggression, which consisted of pinching and biting, and out-of-seat behavior that was not only disruptive to his tutoring sessions but usually occurred immediately before an aggressive act.

Setting

Child 1 and Child 2 were presented with a free-play situation in a 1.5-m by 1.5-m room. The room was carpeted and contained a sofa, two child-sized chairs, and a large box of toys. While the child played with the toys, the experimenter sat on the sofa. The experimenter applied contingencies (depending on the experimental conditions) while observers watched through a large one-way mirror and recorded targeted behaviors. The experimenter was one of two psychologists working in the in-patient program.

Child 3 was presented with the procedures during his after-school tutoring sessions. Tutoring sessions took place in a small workroom. The room contained a table, two chairs on which the child and his tutor sat face-to-face, and educational stimuli and toys needed for his curriculum. A large one-way mirror separated the tutoring room from an observation room.

Design

A multielement design with reversals was used to compare the differential effectiveness of varied punishers to the single presentation of each of three punishers. After baseline, sessions in which varied punishment was in effect (the availability of all three punishers) were compared to the single presentation of one of the three punishers. Reversal to baseline was interspersed between each multielement comparison (e.g., varied vs. punisher 1, reversal, varied vs. punisher 2, reversal, etc.). The experiment was concluded with several sessions of the most effective procedure. The order of presentation of a specific punisher to be compared with varied-punisher sessions was different for each child to control for order effects. Each multielement comparison for Child 1 consisted of six sessions (six sessions of punisher 1 vs. six sessions of varied, etc.). Child 2 was presented with four sessions and Child 3 with five sessions.

Procedure

Baseline. During baseline (and reversals to baseline), the experimenter (tutor) sat in the room with the child and ignored all occurrences of the target

inappropriate behaviors. Additionally, on the average of once per minute, the child was praised for appropriate behavior (e.g., "good playing," "nice quiet"). This differential reinforcement of other behavior (DRO) was in effect during all conditions throughout the study in order for the children to experience positive consequences for appropriate behavior.

Varied punishers condition. During sessions with varied punishers, three punishers were available for the experimenter to use. Contingent upon the inappropriate target response, the experimenter administered one of the three punishers to the child. These specific punishers were used because they were commonly employed in the natural environment in a variety of settings (home, school), and were considered less intrusive than other procedures used with this population (e.g., contingent spank, water mist). The experimenter alternated the use of the punishers with no punisher presented more than twice consecutively to avoid a pattern of application. For Child 1 and Child 2, the three punishers were the same. The first punisher was a stern "no" spoken in a loud voice with the experimenter making eye contact approximately 8 in. away from the child's face. If eye contact was not provided by the child, no additional procedures were undertaken to occasion it, because we did not want to associate any other attention with the inappropriate behavior. The second punisher was an overcorrection procedure that consisted of 5 s of physically guiding the child through a stand-up and sit-down routine. During overcorrection, the experimenter stood behind the child and manually assisted under the arms. The third punisher was a 5-s chair time-out with the experimenter holding the child in the chair from behind while facing the wall. For Child 3, a loud noise was substituted for overcorrection. The loud noise consisted of hitting a large wooden block against the table top. Overcorrection was discontinued because (a) it seemed to be associated with an initial increase in the inappropriate behavior (see Figure 2) with the child laughing and seemingly enjoying it, (b) the child's mother thus requested that it be discontinued, and (c) the physical assistance required by the tutor was too tiring for the tutor. Time-out for Child 3 did not involve any restraint in the chair because the child stayed in his seat, facing the wall.

Single presentation. During sessions of single presentation, only one of the three punishers was applied contingent upon the target behavior. Thus, sessions of varied punishers (presentation of punisher 1, 2, or 3) were compared with sessions of the single presentation of only overcorrection (or loud noise), sessions of chair time-out, and sessions of "no."

Observations and Reliability

Each session lasted 15 min. Observers watched through a one-way mirror and recorded the occurrence of the target behavior using a 10-s continuous partial-interval scoring procedure. During the 5 s of time-out and overcorrection, the observers temporarily switched off the tape recorder to control for the fact that the child was prevented from engaging in the target response during those 5 s. Thus, each session lasted 15 min as indicated by the interval tape. Two sessions every day were presented to Child 1 and Child 2 during their inpatient stay at the institute. Child 3 was presented with three sessions per tutoring session, which occurred once or twice a week. All observations occurred in the experimental setting, and the observers were not informed about the purpose of the study.

Interobserver reliability was calculated on an interval-by-interval basis by dividing the total number of agreements between the two observers for occurrence and nonoccurrence of the target behaviors by the number of agreements plus disagreements and multiplying by 100. Overall interobserver reliability was measured for 50% of all sessions and was calculated at 92%. Reliability for Child 1 had a range of 80% to 100%, with a mean of 95%. Reliability for Child 2 ranged from 70% to 100%, with a mean of 85%. Child 3's reliability observers agreed 95% of the time, with a range of 80% to 100%.

To ascertain that the procedures were delivered in a consistent manner, additional observers recorded the occurrence of the independent variable for Child 3. These observers were instructed on the

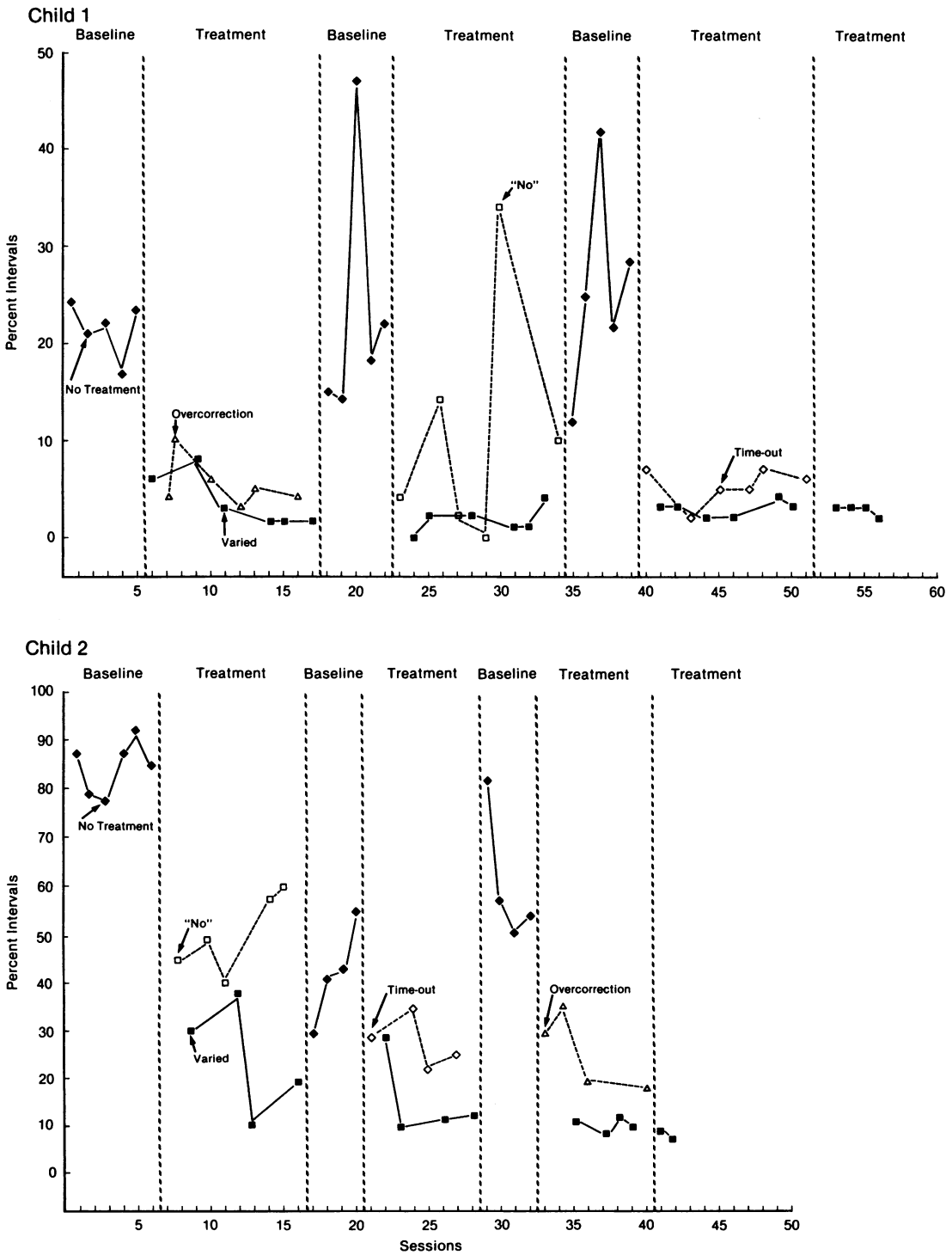

Figure 1. Percentage of intervals of occurrence of aggressive behavior for Child 1 and self-stimulation and destructive behavior for Child 2.

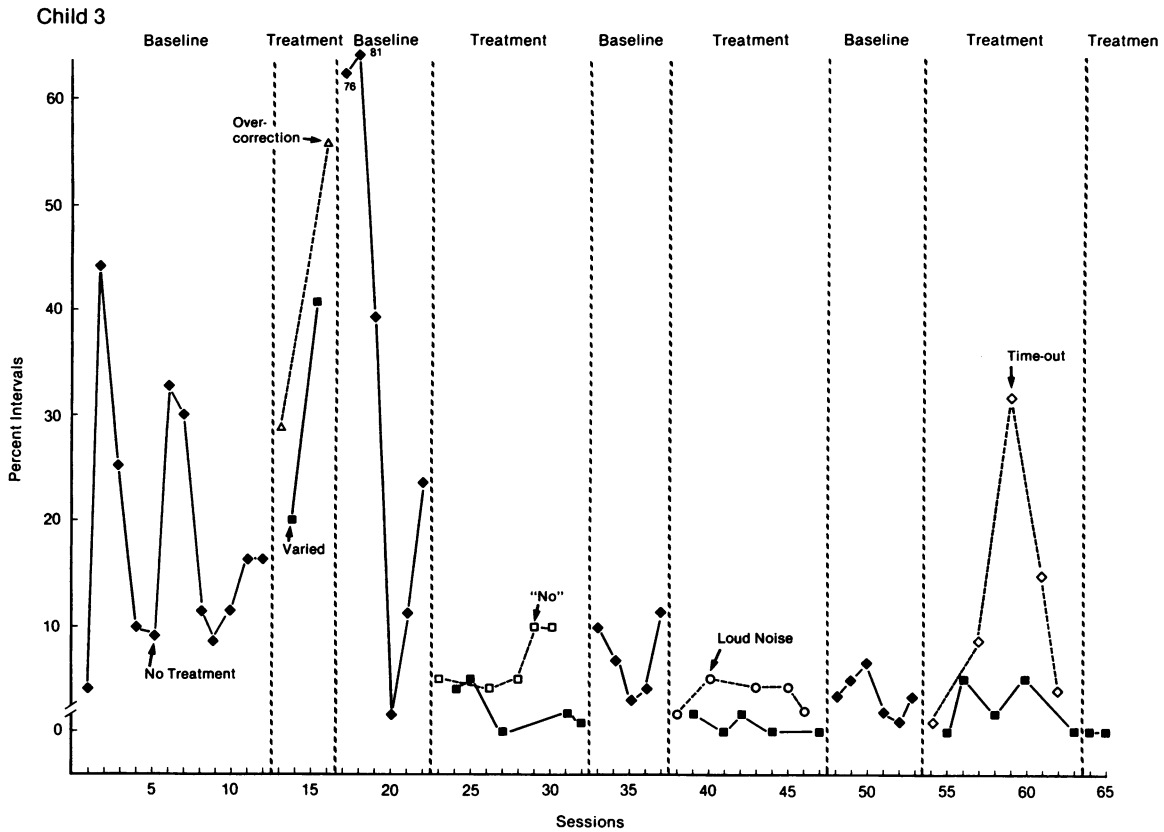

Figure 2. Percentage of intervals of occurrence of aggression and out-of-seat behavior for Child 3.

manner in which each of the punishers were to be delivered. The observers were instructed to record the occurrence of the independent variable only if presented appropriately. Thus, we could compare this with the occurrence of the child's behavior. Interobserver reliability for this was obtained for 95% of Child 3's sessions and was 100%. Furthermore, the independent variable was presented 100% of the time the primary observer recorded an occurrence of the child's target behavior.

RESULTS

The results for Child 1 and Child 2 are shown in Figure 1, and Child 3's data are shown in Figure 2. Child 1 engaged in aggression and object throwing for an average of 21% of the intervals during baseline. In the first multielement comparison (overcorrection vs. varied punishers), the inappropriate behavior decreased to an average of 5% of the intervals during sessions of single presentation and 4% during varied-punisher sessions. After a sharp increase in the response during reversal, the inappropriate behavior decreased during sessions of punisher 2 ("no") to an average of 11% of the intervals, and even further to an average of 2% of the intervals during varied-punisher sessions. After another increase in the response during a return to baseline, the inappropriate behavior once again occurred less often during varied-punisher sessions (M = 3%) than during the single presentation of time-out (M = 6%). The inappropriate behavior was then maintained at a lower level (M = 3%) than during baseline and reversal conditions as well as single presentation of a punisher.

The data for Child 2, whose self-stimulation and destructive behavior averaged 86% of the intervals during baseline, also demonstrated the superiority of varied punishers over single presentation. The inappropriate behavior occurred more often during

sessions of "no" (M = 51%) compared with varied punishers (M = 24%); time-out (M = 31%) compared with varied punishers (M = 16%); and overcorrection (M = 28%) compared with varied sessions (M = 11%). Finally, the inappropriate behavior demonstrated a continued decrease (M = 10%) at the conclusion of study when varied punisher conditions were maintained for two additional sessions.

During baseline, Child 3 engaged in aggression and out-of-seat behavior during an average of 18% of the intervals. The first comparison of overcorrection with varied punishers yielded a high percentage of occurrences (M = 42% during overcorrection and M = 30% during varied conditions). After a reversal to baseline, varied punishers (M = 2%), with the loud noise substituted for overcorrection, were superior to sessions of "no" (M = 7%). After another return to baseline the target behaviors occurred less often with varied punishers (M = 0.8%) compared with a loud noise (M = 4%), and finally less often with varied punishers (M = 3%) compared with time-out (M = 13%). Aggression and out-of-seat behaviors did not occur during the final sessions.

DISCUSSION

The results demonstrated that all punisher conditions decreased the occurrence of the target inappropriate behaviors. More important, the data indicated that all children engaged in the inappropriate behaviors less often during sessions of varied punishers as opposed to sessions of single-punisher presentation, although these differences were not large. It appears that, by presenting a varied format of commonly used punishers, inappropriate behaviors may further decrease without the use of more intrusive punishment procedures. Thus, this study presents a method for reducing inappropriate behavior that incorporates punishers that are ethically more desirable and legally more pragmatic (Matson & DiLorenzo, 1984).

These results complement those obtained by Egel (1980, 1981), who demonstrated that autistic children gave more correct answers when reinforcers were presented in a varied format as opposed to a single-presentation format. He explained that the children may have had less opportunity to satiate on the reinforcers during varied conditions; thus, their motivation for providing correct answers was higher. Perhaps the use of multiple punishers increased the saliency of the consequences; thus the children were more motivated to avoid punishers under varied conditions in a similar manner to Egel's (1980, 1981) participants who were more motivated to obtain varied reinforcers. It is also possible that the varied conditions lessened any effects of habituation to punishment (e.g., Hutchinson, 1977). Additionally, some of the punishing properties of the stimuli during the varied presentation format might not have extinguished as rapidly as single punishers, because each punisher was presented without a primary aversive stimulus less often than in the single-presentation format (Azrin & Holz, 1966).

It is also feasible that the varied punisher procedure may have been more effective than single-punisher presentation in that the children were less likely to predict the specific consequences. Research on unpredictability of contingencies may be relevant here. For example, Dunlap and Johnson (1985) demonstrated that autistic children engaged in appropriate behavior more often and inappropriate behavior less often when contingencies for such behaviors were not predictable (intermittent supervision) compared with conditions of predictable contingencies (constant supervision). They proposed that the chldren's performance was analogous to the literature on avoidance behavior (Sidman, 1953) in that unpredictable contingencies promote a more steady rate of avoidance behavior. The unpredictability of the consequences in the present study may have enhanced the effect of the varied punishment.

It is, however, important to emphasize that in the varied-punisher condition it was the consequences (punishers), not the contingency, that may have been unpredictable. The children could predict that their behavior would be followed by some type of punishing consequence, but not the specific punisher. Thus, there was a continuous schedule of

punishment with each specific punisher on an intermittent schedule. Indeed, past literature suggests that the most effective use of punishment is its delivery on a continuous schedule (see Azrin & Holz, 1966). The varied-punisher condition may be viewed as a combination of a continuous schedule of punishment with the unpredictability of specific punishers, thus maximizing the effect. This suggests that one may use one strong punisher less often (one third of the time) with weaker varied punishers to obtain an effect. Indeed, this may have occurred in the present study. For Child 1, it is possible that the efficacy of the varied conditions was due to the use of overcorrection. Thus, varied-punisher procedures may be a less intrusive alternative to constant presentation of strong punishers.

It is interesting that certain punishers seemed to exacerbate the occurrence of the target behaviors. Child 1 escalated his aggression during conditions of "no" as a punisher, whereas Child 3 escalated during conditions of overcorrection alone and overcorrection within a varied format, as well as demonstrating a brief escalation during time-out. Interestingly, "no" was not associated with an escalation when presented in the varied format for Child 1. Unfortunately, due to logistical concerns, overcorrection could not be carefully studied within a varied-punisher format for Child 3. Future research should address the feasibility of using ineffective punishers (e.g., "no" for Child 1) effectively within a varied format.

It is important to note that for Child 1 and Child 2 the behaviors were not eliminated completely. It is also important to note that each of the punishers, when used alone, did reduce the target behavior, and in some cases, there was not a large difference between varied and single-presentation formats. Thus, we report the enhancing effect of combining several punishers over the single presentation of somewhat effective stimuli. Further research might explore the feasibility of combining two or more weaker stimuli that are commonly used and ethically acceptable to determine whether such a combination would require punishing properties.

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Received October 8, 1986
Initial editorial decision December 10, 1986
Revision received May 16, 1987
Final acceptance July 6, 1987
Action editor, Ron Van Houten