Response Persistence: The Effects of Stimulus Control on Negatively Reinforced Problem Behavior in a Concurrent Operant

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In the context of instructional demands, compliance and problem behavior can be considered concurrent operants. Of applied interest is increasing one response (i.e., compliance) while decreasing the other (i.e., problem behavior). Strategic arrangement of reinforcement can alter response allocation accordingly. Such schedules can also influence response persistence and generalization. A case study is used to illustrate the effects of stimulus–reinforcer relations in a concurrent-operants arrangement involving an adult with developmental disabilities and problem behavior. Results are discussed in the context of basic operant research findings in the areas of stimulus control and behavioral persistence.

Key words: persistence, negative reinforcement, problem behavior, stimulus control, resistance to change, concurrent operants, generalization, maintenance

When practitioners are faced with problem behavior, they often work to decrease problem behavior and to simultaneously increase an appropriate alternative response, setting up a concurrent operant. Further, it is not enough to produce initial behavior change; it is equally important to program maintenance of behavior change, or response persistence, and generalization of behavior to a variety of stimulus conditions. Thus, a complex situation is at hand, requiring careful consideration of the antecedent and consequent stimulus arrangements necessary to bias responding toward the appropriate alternative rather than the problem behavior and the implications of those arrangements for persistence and generalization.

One of the tactics used to increase one response relative to another in a concurrent-operants arrangement is to provide a relatively greater schedule of reinforcement associated with the desired response alternative than the undesired alternative (e.g., Horner & Day, 1991; McDowell, 1988).

For example, Peck, Wacker, Cooper, McComas, and Richman (1996) conducted a study to test the effects of relative reinforcement on response allocation across two responses in a concurrent-operants arrangement. All 5 participants, children under the age of 5 years who had been diagnosed with developmental disabilities, consistently allocated more responding to the response that produced the relatively greater reinforcement (duration or quality). Furthermore, subsequent treatment involving concurrent schedules of differentially greater reinforcement for appropriate behavior than for inappropriate behavior was effective at reducing inappropriate behavior and increasing mands for all 5 participants.

Another tactic that has been used to decrease one response relative to another is to provide noncontingent reinforcement (Marcus & Vollmer, 1996; McComas & Mace, 2000). In a study designed to systematically examine the influence of noncontingent and differential reinforcement on mands and aberrant behavior, Marcus and Vollmer demonstrated that mands were maintained and aberrant behavior was reduced in conditions in which both differential reinforcement for mands and noncontingent

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reinforcement were delivered. Similarly, Kennedy (1994) found with 3 subjects that when task requests were interspersed with a high rate of social comments, an increase in work productivity and a decrease in problem behavior were observed. Moreover, the effects persisted after treatment was withdrawn.

The persistence of treatment effects observed by Kennedy (1994) is consistent with a behavioral momentum account of response persistence whereby resistance to change depends on reinforcer rate, not response rate (Nevin et al., 1983). Unlike other applications of behavioral-momentum-like procedures for increasing compliance (e.g., Mace et al., 1990; McComas, Wacker, & Cooper, 1998; McComas et al., 2000) that provided additional reinforcement for compliance with high-probability requests prior to the target low-probability task, thereby increasing both the response and reinforcement rates, Kennedy obtained similar increases in target behavior with the addition of noncontingent rather than contingent reinforcement.

In a study designed to test the effects of noncontingent reinforcement on persistence, Tota-Faucette (1991) examined muscle relaxation via biofeedback with normal children. Two conditions were arranged, each with its own distinct signal. In both conditions, contingent on meeting the criteria for relaxation, the experimenter presented audible tones plus points exchangeable for toys. In one of the two conditions, the experimenter also provided noncontingent points or toys. During training, levels of relaxation were similar and significantly improved from preintervention levels. Following training, an extinction test was conducted in which all tones and points were discontinued. Relaxation was substantially more persistent in the condition with the signal that had been associated with additional noncontingent reinforcers. These find-

ings, together with those of Kennedy (1994), provide applied evidence that supports basic findings that resistance to change depends on the total reinforcers in the situation rather than the reinforcer rate for each operant (Nevin, Tota, Torquato, & Shull, 1990).

Few applied studies have been conducted on the effects of additional reinforcement on response persistence and generalization, or transfer of stimulus control. Based on Nevin et al.'s (1990) findings in the area of behavioral momentum, it would follow that the persistence of stimulus control could be related to the density of reinforcement associated with the discriminated operant, even when the overall density of reinforcement associated with the discriminated operant involves noncontingent reinforcement. If this is the case, stimulus control might be restricted and resistant to transfer to other stimuli, such as persons or tasks, in applied settings. Findings of a study conducted by Dube and McIlvane (2002) indicate that the global reinforcement density associated with the discriminated operant may result in persistent stimulus control and therefore hinder transfer of stimulus control.

Behavioral momentum research suggests that increasing the overall density of reinforcement associated with a stimulus will enhance the persistence of the target response in the discriminated operant (Nevin, 1992; Nevin & Grace, 2000). However, Dube and McIlvane (2001) pointed out that behavior controlled by prompts may have substantial momentum due to the substantial stimulus-reinforcer relation incurred via dense schedules of reinforcement often used during acquisition. Put another way, providing additional reinforcement during prompted sequences will likely enhance persistence but have the undesirable side effect of increasing resistance to change for behavior controlled by

prompts and thus contribute to problems of stimulus control transfer. More research is needed to examine this potential problem.

The purpose of this case study was to examine the effects of increasing the overall density of reinforcement for both compliance and negatively reinforced verbal outbursts during intervention and subsequent intervention withdrawal as well as on the transfer of stimulus control to a novel instructor and a novel task. Instructors provided preferred stimuli both response independently and contingent on compliance while they continued to provide negative reinforcement contingent on verbal outbursts.

Case Study

Fionn was a 21-year-old man who had been diagnosed with autism, severe intellectual and developmental disorder, and a seizure disorder. He had a limited expressive language repertoire, rarely initiating social interactions but verbally responding to simple questions using one- to two-word utterances and following two-step directions. He was ambulatory, was 6 ft 3 in. tall, and weighed approximately 230 lb. The analysis was conducted in Fionn's vocational habilitation program, and tasks were selected from activities listed in his individual habilitative program that he was expected to engage in daily. Task requests included sweep the floor, say "hello," walk to and stand at the bus stop for at least 2 min, play a card game with a peer for at least 2 min, and play basketball with a peer for at least 2 min.

The target behaviors included compliance with task requests and destructive behavior in the form of verbal outbursts, self-injury, aggression, and noncompliance. When staff approached Fionn with a task request, he frequently responded with loud verbal outbursts that occasionally escalated to self-injury or aggression if the staff member persisted

with the request. The intensity and frequency of Fionn's destructive behavior precluded active involvement in the vocational training program and social activities and prohibited his inclusion in community-based training.

During the functional analysis, partial-interval data were collected on verbal outbursts using a 10-s sampling procedure during 10-min observation sessions. During the subsequent experimental analysis, event recording of compliance and verbal outbursts was conducted for each of the four trials during 60-min observation sessions, yielding a percentage of opportunities (trials) with verbal outbursts and compliance for each session. Interobserver agreement data were collected for 75% of all sessions across the functional analysis and the subsequent experimental analysis, and averaged 99% for verbal outbursts and 98% for compliance and independent variables across all sessions and all conditions of both analyses.

The study began with a functional analysis of destructive behavior. Procedures similar to those originally outlined by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) were used to test the effects of positive and negative reinforcement on destructive behavior. Three test conditions (attention, tangible, and escape) and a control condition were conducted three times each in random sequence across days. The results are displayed in Figure 1. The elevations in only the escape condition indicate that Fionn's verbal outbursts were maintained by negative reinforcement. Destructive behavior, aggression, and self-injury did not occur in any condition of the functional analysis. Therefore, the only behavior that was targeted during the intervention analysis was verbal outbursts.

Following the functional analysis, a forced-choice preference assessment (Fisher et al., 1992) was conducted to assess Fionn's relative preference

Figure 1. Results of Fionn’s functional analysis. Control, attention, tangible, and escape conditions are represented by open circles, open squares, open triangles, and filled triangles, respectively.

among four items, including candies, pretzels, magazines, and a set of watercolor paints. Fionn selected candies in 100% of the 24 trials. Next, the experimental analysis was conducted. One 60-min session was conducted per day, and in all sessions across all conditions, four tasks were delivered, one every 15 min. In all conditions, verbal outbursts produced negative reinforcement in the form of the instructor withdrawing the task materials, stepping back from Fionn, and seating herself at the table until the end of the 15-min interval. This was repeated four times, once every 15 min, during the 60-min session. Three different instructors conducted baseline sessions. All five tasks were presented during baseline, and no consequences were arranged for compliance. Verbal outbursts produced negative reinforcement in the form of escape from the task for 15 min until the instructor approached Fionn with another task instruction.

One of the instructors who conducted baseline sessions also conducted intervention sessions. The first

four tasks listed above were used during intervention. At the beginning of each 15 min, the instructor delivered three or four candies and social comments to Fionn response independently every minute (i.e., a fixed-time 1-min schedule). This was repeated three times. At the end of 3 min, the instructor presented Fionn with the task instruction. Contingent on compliance, the instructor gave him three or four candies and then told him he could take a break in the chair for a few minutes. Verbal outbursts resulted in negative reinforcement in the form of escape from the task for 15 min until the instructor approached Fionn with another task instruction. At the beginning of the next 15-min interval, the procedure was repeated.

The procedures for the intervention withdrawal were identical to baseline and were conducted by the instructor who conducted the intervention sessions. During the novel-task sessions, the intervention procedures were conducted, as described above, by the instructor who had conducted the intervention sessions.

Figure 2. Results of Fionn's experimental analysis. Open circles represent verbal outbursts, and filled circles represent compliance. Open squares represent verbal outbursts, and shaded squares represent compliance with a novel task. Open triangles represent verbal outbursts, and filled triangles represent compliance with a novel therapist.

However, the task that had not been presented during intervention (play basketball with a peer for at least 2 min) was presented four times during each 60-min session. Finally, during the novel-instructor sessions, the intervention procedures were conducted as described above, with the four tasks that were conducted during intervention. However, one of the instructors who had conducted baseline sessions but had not conducted intervention sessions presented the task instructions.

The results of the intervention analysis appear in Figure 2. During baseline, Fionn engaged in verbal outbursts during 75% or more of the four trials in each of the four sessions. Compliance was not observed in any baseline session. During

intervention sessions, compliance increased to 75% of the trials in six of the eight sessions. Verbal outbursts were observed during only two of the eight sessions. During intervention withdrawal, when baseline conditions were reinstated, compliance was maintained at between 75% and 100% of the trials of all nine sessions, and verbal outbursts were observed in only one session. During Sessions 17, 18, and 21, the instructor who had conducted intervention sessions presented novel task instructions. Although Fionn did not engage in verbal outbursts in response to the novel task instruction, he never complied with the novel task instruction. During Sessions 23 through 26, a novel instructor, who had conducted baseline sessions but had not con-

ducted intervention sessions, presented the same tasks that Fionn complied with during intervention. Fionn engaged in verbal outbursts during 50% to 75% of task trials during those four sessions, and complied with the task instructions during 25% to 50% of the trials. The results suggest that delivery of preferred items and social interaction prior to task instructions and delivery of preferred items contingent on compliance effectively competed with negative reinforcement contingent on verbal outbursts and resulted in a near elimination of verbal outbursts and an increase in compliance. Further, in the subsequent return to baseline, in the absence of intervention, compliance with task demands persisted, as did the near elimination of verbal outbursts in sessions conducted by the instructor who had previously implemented intervention. Stimulus control of verbal outbursts appeared to transfer to a novel task, but stimulus control of compliance did not. Transfer of stimulus control to a novel instructor appeared incomplete; compliance exceeded baseline levels but did not reach intervention levels, and verbal outbursts occurred at slightly lower levels than during baseline but at higher levels than during intervention.

Conclusion

The findings of this case study suggest that the addition of both contingent and noncontingent reinforcement increased compliance and decreased the occurrence of negatively reinforced verbal outbursts. These effects persisted during intervention withdrawal, suggesting stimulus control by the instructor over tasks presented during intervention. The purpose of the novel-task and novel-instructor sessions was to evaluate whether treatment effects generalized across untrained stimulus conditions. Findings indicated that the intervention effects only partially generalized

across tasks and persons; we observed reductions but not elimination of verbal outbursts and modest levels of compliance with a novel task and instructor.

These results appear to have both practical and conceptual implications. On a practical level, this intervention represents an effective, feasible, safe, and apparently durable alternative to common extinction-based interventions for negatively reinforced problem behavior. These findings are consistent with patterns of behavior found by Kennedy (1994) with a similar intervention and are also consistent with findings by Wacker et al. (2005), in which intervention effects partially generalized across persons and tasks.

On a conceptual level, the data provide preliminary support to the concern expressed by McIlvane and Dube (2000) regarding the undesirable side effect of increased persistence contributing to problems with transfer of stimulus control. Specifically, the results demonstrate poor transfer of stimulus control to an untrained response topography (task) and untrained therapist attributable to the density of reinforcement associated with the discriminated operant established during intervention.

Overall, the findings suggest that these procedures led to persistent behavior change, or maintenance of treatment effects. Behavioral momentum research predicts that both problem behavior and compliance would have persisted in the presence of the therapist associated with intervention (Dube & McIlvane, 2001), but instead, it was the behavior change that persisted: elevated compliance and reduced verbal outbursts. One hypothesis is that the schedules for problem behavior and compliance were discriminable enough to disrupt the persistence of verbal outbursts. This would be consistent with Dube and McIlvane's contention that behavior that has substantial momentum might be countered by arranging

exceptionally discriminable and reinforcing teaching contingencies.

Further, stimulus control appears to have developed, but was restricted to intervention therapists and tasks. These findings suggest the need for future investigations into the possibility that more successful transfer might be obtained by (a) reducing the reinforcement to the leanest schedule that will maintain stimulus control once the discriminated operant has been established, (b) using a dense schedule of reinforcement with target generalization stimuli (e.g., sufficient exemplars of instructors, tasks), and (c) interspersing the generalization stimuli with the training stimuli on a lean schedule (McIlvane & Dube, 2000). Systematic testing, in basic and applied preparations, of procedures that incorporate these three elements for promoting transfer of stimulus control is needed to enhance our understanding of these complex applied situations.

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