JOURNAL OF APPLIED BEHAVIOR ANALYSIS 1997, **30,** 279–298 NUMBER 2 (SUMMER 1997)

THE USE OF POSITIVE AND NEGATIVE REINFORCEMENT IN THE TREATMENT OF ESCAPE-MAINTAINED DESTRUCTIVE BEHAVIOR

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We identified 3 clients whose destructive behavior was sensitive to negative reinforcement (break from tasks) and positive reinforcement (access to tangible items, attention, or both). In an instructional context, we then evaluated the effects of reinforcing compliance with one, two, or all of these consequences (a break, tangible items, attention) when destructive behavior produced a break and when it did not (escape extinction). For 2 clients, destructive behavior decreased and compliance increased when compliance produced access to tangible items, even though destructive behavior resulted in a break. For 1 client, extinction was necessary to reduce destructive behavior and to increase compliance. Subsequently, when the schedule of reinforcement for compliance was faded for all clients, destructive behavior was lower and fading proceeded more rapidly when compliance produced multiple functional reinforcers (i.e., a break plus tangible items or attention) and destructive behavior was on extinction. The results are discussed in terms of the effects of relative reinforcement value and extinction on concurrent operants.

DESCRIPTORS: concurrent operants, developmental disabilities, negative reinforcement, positive reinforcement, functional analysis, escape, response covariation

Negative reinforcement plays a significant role in the maintenance of problematic behavior (Iwata, 1987). Iwata, Pace, et al. (1994) conducted 152 functional analyses and found that self-injurious behavior (SIB) was sensitive to social negative reinforcement in the form of escape from demands or other aversive stimulation for 38.1% of individuals. Derby et al. (1992) found that the destructive behavior (e.g., aggression, SIB) of 48% of clients seen in an outpatient clinic was sensitive to social negative reinforcement. Results of these epidemiological studies suggest that the development of treatments for behavior maintained by negative reinforcement would be beneficial for a large proportion of individuals who engage in destructive behaviors. Toward that end, a number of treatments, such as functional communication training (FCT; Carr & Durand, 1985; Fisher et al., 1993; Wacker et al., 1990), reinforcement of compliance (Carr, Newsom, & Binkoff, 1980; Steege, Wacker, Berg, Cigrand, & Cooper, 1989), instructional fading (Pace, Iwata, Cowdery, Andree, & McIntyre, 1993; Piazza, Moes, & Fisher, 1996; Zarcone et al., 1993), noncontingent escape (Vollmer, Marcus, & Ringdahl, 1995), and task alteration (Dunlap, Kern-Dunlap, Clarke, & Robbins, 1991; Mace et al., 1988; Weeks & Gaylord-Ross, 1981; Zarcone, Iwata, Mazaleski, & Smith, 1994), have been demonstrated to effectively reduce responding shown or hypothesized to be maintained by escape from demands. These treatments vary along a number of procedural dimensions; however, the studies all share one common element: the use of ex-

This investigation was supported in part by Grant MCJ249149-02 from the Maternal and Child Health Service of the U.S. Department of Health and Human Services. We thank Jennifer Zarcone for her helpful comments on this manuscript.

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tinction for escape-maintained aberrant behavior.

In fact, escape extinction alone has been demonstrated to be effective in reducing SIB independent of other treatment components. Iwata, Pace, Kalsher, Cowdery, and Cataldo (1990) demonstrated the effectiveness of an escape extinction procedure with 6 individuals whose SIB was sensitive to escape as reinforcement. The extinction procedure consisted of continuing the learning trial and physically guiding the individual to complete tasks contingent on SIB. Although escape extinction has been demonstrated to be effective in reducing aberrant behavior, the use of extinction may be associated with a number of problems, such as extinction bursts (Iwata et al., 1990), increases in behavioral variability (Goh & Iwata, 1994), or difficulties continuing tasks due to an individual's size or strength (Pace, Ivancic, & Jefferson, 1994; Piazza et al., 1996).

Despite the potential problems associated with escape extinction, it is unclear whether reductions in escape-maintained destructive behavior could be produced without it (i.e., when escape continues to be available for destructive behavior). Iwata (1987) suggested that analysis of behavior maintained by negative reinforcement should consider not only the activity that is terminated (negative reinforcement) but also the activity that is initiated (positive reinforcement) coincident with escape. Zarcone, Fisher, and Piazza (1996) examined the effects of "free time" contingencies and found that a break plus access to preferred items resulted in greater increases in compliance than a break alone. It is possible that similar manipulations could be used with differential reinforcement procedures to increase compliance and decrease problem behavior.

Thus, one potential approach to the treatment of behavior maintained by negative reinforcement may be to greatly increase reinforcement for compliance relative to the reinforcement associated with destructive behavior. Previous investigations on response covariation have shown that increasing compliance through reinforcement can result in concomitant decreases in problem behavior without manipulating the consequences for destructive behavior (Parrish, Cataldo, Kolko, Neef, & Egel, 1986; Russo, Cataldo, & Cushing, 1981). In other investigations, results of a functional analysis were used to determine the reinforcer for compliance. For example, Horner and Day (1991) demonstrated that task initiation was high and destructive behavior was low when escape was allowed contingent on task initiation, even when destructive behavior also resulted in escape. However, low levels of destructive behavior were not maintained when the schedule of reinforcement (escape) for compliance was thinned.

Lalli and Casey (1996) also evaluated the effects of escape as reinforcement for compliance and destructive behavior with 1 client. When compliance was reinforced on a fixed-ratio (FR) 1 schedule and destructive behavior was reinforced on a variable-ratio (VR) 5 schedule, compliance increased and destructive behavior decreased. As the schedule of reinforcement for compliance was thinned, destructive behavior increased and compliance decreased. However, when the authors reinforced compliance with both escape and adult attention, they were able to thin the schedule of reinforcement for compliance (i.e., to an FR 10) while maintaining low rates of destructive behavior and high levels of compliance, even though destructive behavior continued to produce escape on a VR 5 schedule. One potential explanation for these results may be that the client's aberrant behavior appeared to be sensitive to both escape and attention as reinforcement. During treatment, compliance produced both reinforcers, whereas destructive behavior produced escape only (atten-

tion was unavailable during the escape interval).

Results of the investigation by Lalli and Casey (1996) suggest that, for clients whose destructive behavior is multiply maintained, access to multiple functional reinforcers following compliance may increase compliance and decrease destructive behavior even when destructive behavior continues to produce escape. Such a finding is consistent with research on concurrent operants in that increasing the quality of reinforcement for one response (e.g., compliance) may increase the likelihood of that response relative to the other response (e.g., destructive behavior).

In the current investigation, we attempted to replicate and extend previous research on the effects of manipulating the consequences for compliance on destructive behavior. First, we identified 3 clients whose destructive behavior was sensitive to negative reinforcement (break from tasks) and positive reinforcement (access to tangible items, attention, or both). Next, we evaluated the effects of providing a break contingent on either compliance or destructive behavior during instructional tasks. We also compared the effects of a break for compliance to the effects of a break plus access to the tangible item that had been identified during the functional analysis. Finally, we evaluated the extent to which the schedule of reinforcement for compliance could be thinned using a break as reinforcement versus using a break plus social positive reinforcement (tangible items, attention, or both). These manipulations were conducted with and without extinction for destructive behavior.

GENERAL METHOD

Participants

Three individuals with severe behavior problems were admitted to an inpatient unit specializing in the assessment and treatment of destructive behavior. Andy was a 7-year-old boy who had been diagnosed with mild mental retardation, mild cerebral palsy, and pervasive developmental disorder. His destructive behavior was aggression. Andy was ambulatory and could follow simple instructions (e.g., "Put the lotion in the basket"). He communicated using one- to three-word sentences and was often echolalic. Carly was an 8-year-old girl who had been diagnosed with mild mental retardation. Her destructive behavior included aggression and disruption. She could communicate verbally, but her communication was often unintelligible due to articulation problems. She was ambulatory and could follow simple one- and two-step instructions. Ben was a 9-year-old boy who had been diagnosed with a seizure disorder, oppositional defiant disorder, attention deficit hyperactivity disorder, and dysthymic disorder. His destructive behavior included aggression and disruption. Ben communicated in complete sentences, could follow complex instructions (e.g., "Go in your room and find your blue shoes"), and ambulated without assistance.

Data Collection and Interrater Agreement

During all sessions, trained observers used laptop computers to record each occurrence of destructive behavior. Andy's destructive behavior was defined as punching, slapping, pinching, kicking, pulling hair, scratching, and forcefully pulling on other's clothing. Carly's destructive behavior was aggression (hitting, kicking, scratching, pinching, hair pulling, headbutting, and throwing objects at people) and disruption (throwing objects, banging on surfaces, knocking objects off surfaces, and breaking objects). Ben's destructive behavior was defined as aggression (hitting, kicking, and scratching) and disruption (banging and kicking surfaces, throwing objects, and breaking objects). Observers also recorded occurrences of compliant behavior, which was defined as completion of an instruction following a verbal or

gestural prompt. Percentage compliance was calculated by dividing the number of compliant responses by the total number of demands and multiplying by 100%.

Two independent observers scored the target responses simultaneously but independently during 46%, 69%, and 42% of functional analysis sessions for Andy, Carly, and Ben, respectively. Interrater agreement was assessed during 79%, 55%, and 50% of demand analysis sessions and 41%, 66%, and 64% of fading sessions for Andy, Carly, and Ben, respectively. Agreement coefficients were calculated by partitioning each session into 10-s intervals and dividing the number of exact agreements on the frequency of behavior by the sum of agreements plus disagreements multiplied by 100%. Mean agreement was 96%, 97%, and 99% for destructive behavior for Andy, Carly, and Ben during the functional analysis. During the demand analysis, mean agreement was 99% for destructive behavior and 98% for compliance for Andy, 91% for destructive behavior and 98% for compliance for Carly, and 99% for destructive behavior and 99% for compliance for Ben. During fading, mean agreement was 99% for destructive behavior and 98% for compliance for Andy, 97% for destructive behavior and 97% for compliance for Carly, and 99% for destructive behavior and 97% for compliance for Ben.

Phase 1: Functional Analysis

Procedure

Functional analyses, using procedures similar to those described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994), were conducted with all clients. The 10-min conditions consisted of demand, social attention, toy play, and tangible. During demand sessions, the therapist used sequential verbal, gestural, and physical prompts every 10 s until the client either complied with the request or engaged in destructive behavior. If the client complied with the instruction following a verbal or gestural prompt, he or she received praise from the therapist. If the client displayed destructive behavior, the therapist removed the materials and ignored the client for 30 s (i.e., the client was permitted to escape the task). Both academic and self-care tasks were presented to all clients. During attention sessions, the client was given toys and was asked to play quietly. The therapist provided a reprimand contingent on each destructive behavior displayed by the client. All other responses were ignored. In the toy play sessions, the therapist played with the client and provided praise every 30 s contingent upon the first 5-s period in which no destructive behavior occurred. During tangible sessions, the client was allowed to play with preferred activities or items for 2 min prior to the start of the session. The activity and items were selected based on parental report that activity or item removal resulted in destructive behavior. Andy's preferred activity was to have the therapist swing him around, Carly's preferred object was access to television, and Ben's was a computer game. When the session began, the therapist terminated the activity (Andy) or withdrew the object (Carly and Ben). Following each occurrence of destructive behavior, the therapist engaged in the activity (Andy) or returned the item for 30 s (Carly and Ben).

Additional functional analysis sessions were conducted for Carly and Ben because the results of the multielement analyses were somewhat unclear. A sequential pairwise analysis was conducted with Carly in which each test condition was compared to the toy play condition (Iwata, Duncan, Zarcone, Lerman, & Shore, 1994). The conditions during the pairwise comparisons were similar to those of the multielement analysis except that different tangible items (books and photographs) were used. The tangible items

were changed because we observed that Carly engaged in destructive behavior on the living unit when these items were removed.

Rates of destructive behavior in the demand condition declined over the course of the analysis for Ben. However, we observed that he engaged in destructive behavior when he was instructed to complete his daily self-care tasks. Therefore, we used a reversal design (Vollmer, Marcus, Ringdahl, & Roane, 1995) to evaluate his sensitivity to escape as a reinforcer. Only self-care tasks were presented during these sessions.

Results

Results of the functional analyses appear in Figure 1. For Andy, rate (responses per minute) of destructive behavior was consistent during the demand ($M = 2.5$) and tangible ($M = 1.4$) conditions. In fact, Andy displayed the most efficient rates of responding in the tangible condition, contacting reinforcement almost immediately upon removal of the activity. Rates of responding were less efficient in the demand condition (i.e., he engaged in more destructive behavior than was necessary to escape each demand). However, he escaped almost every demand that was presented. Rates of destructive behavior were variable during the social attention condition ($M = 8.5$). In the toy play condition, rates of destructive behavior were initially high, but then decreased to near zero ($M = 1.2$). These results suggested that Andy's destructive behavior was maintained by escape from demands and access to an activity. His sensitivity to attention as reinforcement was less clear.

Carly's rates of destructive behavior were initially low during all conditions of the multielement functional analysis until Session 23. At that point, rates of destructive behavior increased in the social attention and demand conditions ($M = 4.5$ and 4.3 for social attention and demand, respectively). She engaged in some destructive behavior in the tangible condition ($M = 0.5$) and near-zero rates of destructive behavior during the toy play condition ($M = 0.1$). During the sequential pairwise analysis, she consistently engaged in destructive behavior during social attention ($M = 8.9$), tangible ($M = 2.1$), and demand ($M = 8.4$) conditions and engaged in low rates of behavior during the toy play condition. These results suggested that Carly's destructive behavior was maintained by escape from demands, attention, and access to tangible items.

During Ben's multielement functional analysis, destructive behavior occurred consistently during the tangible condition ($M =$ 1.9 responses per minute), at variable rates during the demand condition ($M = 0.4$), and not at all in social attention and toy play conditions. During the subsequent analysis using a reversal design, his mean rates of destructive behavior were 1.5 during the two demand phases and 0 during the toy play phase. These results suggested that Ben's destructive behavior was maintained by escape from self-care tasks and access to a tangible item.

Phase 2: Demand Analysis

Procedure

The escape-maintained destructive behavior of all clients was assessed during a series of phases in which consequences for compliance and destructive behavior were manipulated. The conditions conducted with each client were specific to the client's response to each treatment. During all conditions, (a) sequential verbal, gestural, and physical prompts were used once every 10 s until the client complied with the demand or engaged in destructive behavior; (b) compliance resulted in praise from the therapist; and (c) destructive behavior that occurred during a 30-s break was ignored. The conditions are described below. Each condition (e.g., differential reinforcement of compli-

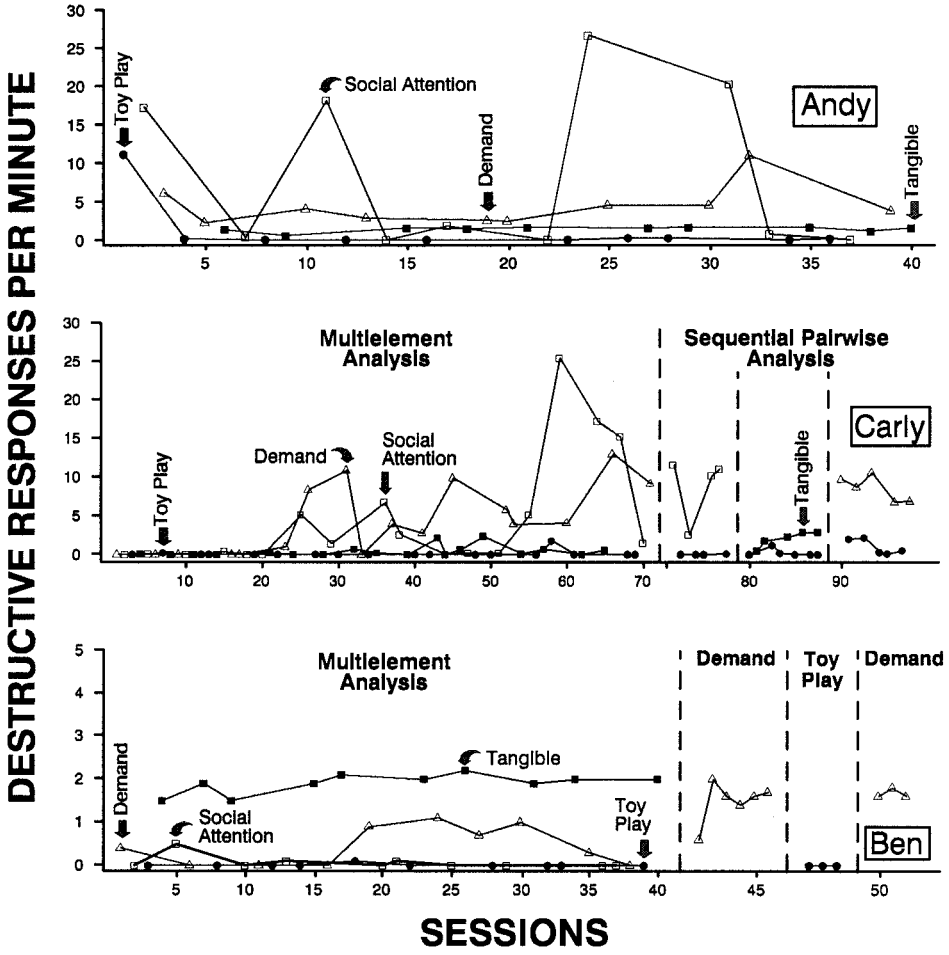

Figure 1. Number of destructive responses per minute during the analogue functional analyses for Andy (top panel), Carly (middle panel), and Ben (bottom panel).

ance without extinction) was given an abbreviated name (e.g., praise/break), in which the first word (e.g., praise) refers to the consequence for compliance, and the second word (e.g., break) refers to the consequence for destructive behavior.

Differential reinforcement of compliance (DRA) without extinction (praise/break). This condition was identical to the demand condition conducted during the functional analysis. Compliance resulted in praise from the therapist, and destructive behavior resulted in a 30-s break from the task (all task materials were removed, and the therapist did not interact with the client). Praise delivered for compliance did not appreciably alter the rate of demands (i.e., compliance did not result in a break from the tasks).

DRA without extinction (break/break). During this condition, compliance resulted in a 30-s break from the task. Destructive behavior also resulted in a 30-s break from the task.

DRA without extinction (tangible/break). In this condition, compliance resulted in 30 s of access to the tangible item used in the tangible condition of the functional analysis (books and photographs for Carly and a computer game for Ben). We were concerned that swinging Andy (the activity used

in the functional analysis) would not represent a long-term treatment option as he grew in size. Therefore, we substituted items that we believed had sensory properties similar to swinging (access to bouncing on a big therapy ball or to a sit-n-spin). It should be noted that providing access to the tangible item for 30 s also constituted a 30-s break from the task. Destructive behavior resulted only in a 30-s break from the task.

DRA with extinction (break/extinction). In this condition, compliance resulted in a 30-s break from tasks, and no differential consequence occurred for destructive behavior (extinction). If destructive behavior occurred during the instructional sequence, the three-step prompting procedure continued.

DRA with extinction (tangible/extinction). During this condition, compliance resulted in 30 s of access to the tangible item as described above, and no differential consequence occurred for destructive behavior (extinction).

During the demand analyses, a combination of multielement and reversal designs was used for Andy. The first phase consisted of a multielement analysis in which praise/break was compared to tangible/break. To isolate the effects of providing Andy with a break for compliance (independent of access to the activity), the multielement phase was then followed by a phase of break/break. Because destructive behavior decreased in the break/break condition, we reversed to praise/break and then returned to break/break to demonstrate functional control of the break/break treatment.

Two multielement phases were conducted for Carly. The first phase was a comparison of praise/break and break/break. Because destructive behavior did not decrease during the break/break condition, the second phase was a comparison of tangible/break and break/break.

A combination of multielement and reversal designs was used for Ben. The first phase consisted of a comparison of praise/break and break/break. Because destructive behavior did not decrease during the break/break condition, we then compared tangible/break with break/break. In the third phase, extinction was added to both conditions (tangible/extinction vs. break/extinction). In the next phase, extinction was withdrawn (tangible/break vs. break/break). Finally, extinction was reintroduced in both conditions (tangible/extinction vs. break/extinction) to demonstrate functional control of the extinction component.

Results

Results of Andy's demand analysis are shown in Figure 2. The top panel depicts number of destructive responses per minute, and the bottom panel depicts percentage of compliance. When compliance resulted in praise and destructive behavior resulted in a break (praise/break), rates of destructive behavior remained stable (M = 1.7 responses per minute) and compliance was low (M = 12.6%). However, rates of destructive behavior were near zero (M = 0.02 responses per minute) and compliance was higher (M = 84.5%) when compliance resulted in access to the tangible item, even though destructive behavior resulted in a break (tangible/break). To evaluate the effects of the break alone, independent of the tangible item, a phase was conducted in which destructive behavior and compliance both resulted in a break (break/break). Initially, rates of destructive behavior were at baseline levels but then dropped to near zero (M = 0.5 responses per minute). In addition, compliance was initially low but then increased (M = 51.3%). Rates of destructive behavior increased during the reversal to praise/break (M = 0.7 responses per minute), and compliance was variable (M = 50.1%). When we returned to the break/break condition, rates of destructive behavior dropped to near zero (M = 0.7 responses per minute), and

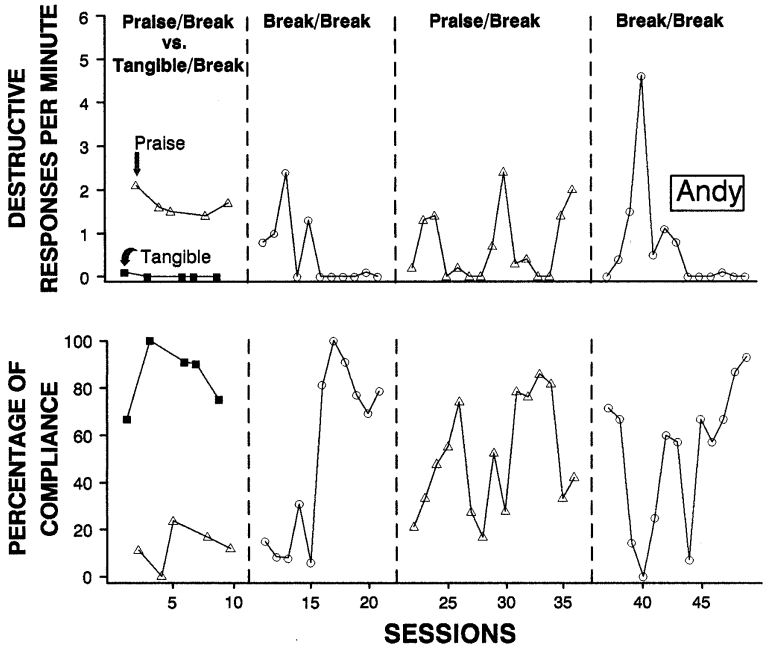

Figure 2. Number of destructive responses per minute (top panel) and percentage of compliance (bottom panel) during Andy's demand analysis.

compliance, although somewhat variable, increased (M = 51.7%).

The results of Carly's demand analysis are depicted in Figure 3. During the first phase, the effects of praise/break were compared with break/break. Rates of destructive behavior and compliance were similar across the two conditions. Mean rate of destructive behavior was 4.7 responses per minute for praise/break and 6.4 for break/break; mean percentages of compliance were 28.1 for praise/break and 17.6 for break/break. In the next phase, the effects of break/break were compared to tangible/break. The rates of destructive behavior (M = 3.4) were lower and compliance (M = 36.3%) was higher during the second phase of the break/break condition. Rates of destructive behavior (M = 0.4) were near zero and compliance was highest (M = 65.2%) during the tangible/break condition.

Results of Ben's demand analysis are depicted in Figure 4. During the first phase, praise/break was compared to break/break, and the rates of destructive behavior and compliance were similar (M = 1.8 and 1.0 for destructive behavior and M = 35.6% and 37.4% for compliance during the praise/break and break/break conditions, respectively). Adding a tangible item to the break for compliance during the next phase produced little change in behavior (M = 0.7 responses per minute and 53.4% for destructive behavior and compliance, respectively). When extinction was added to both conditions, destructive behavior decreased to zero across both conditions (M = 1.6 and 0.6 for break/extinction and tangible/extinction, respectively) and compliance increased (M = 90.4% and 90.4% for break/extinction and tangible/extinction, respectively). When the extinction component was withdrawn, destructive behavior occurred consistently in both conditions (M = 0.9 and 0.5 for break/break and tangible/break, respectively) and compliance decreased (M = 51.9% and 61.7% for break/break and tangible/break, respectively). Finally, when ex-

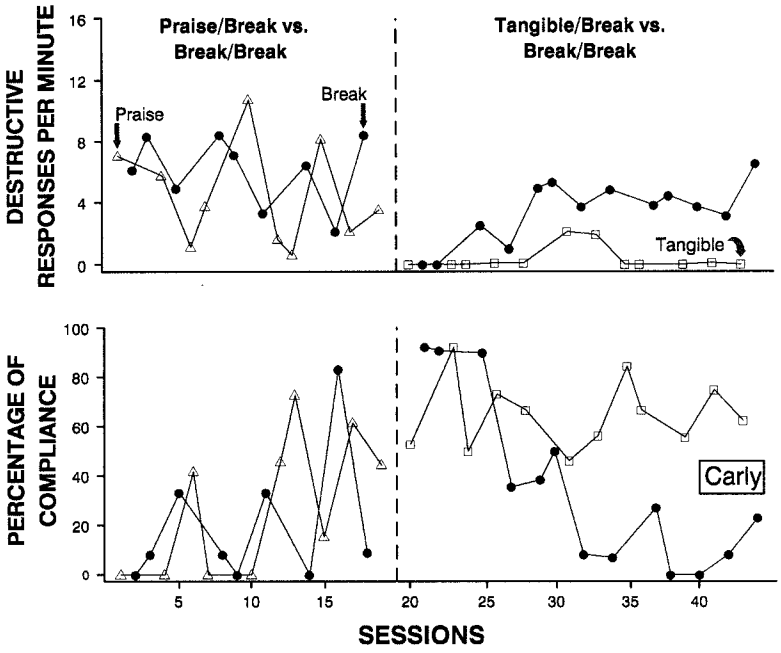

Figure 3. Number of destructive responses per minute (top panel) and percentage of compliance (bottom panel) during Carly's demand analysis.

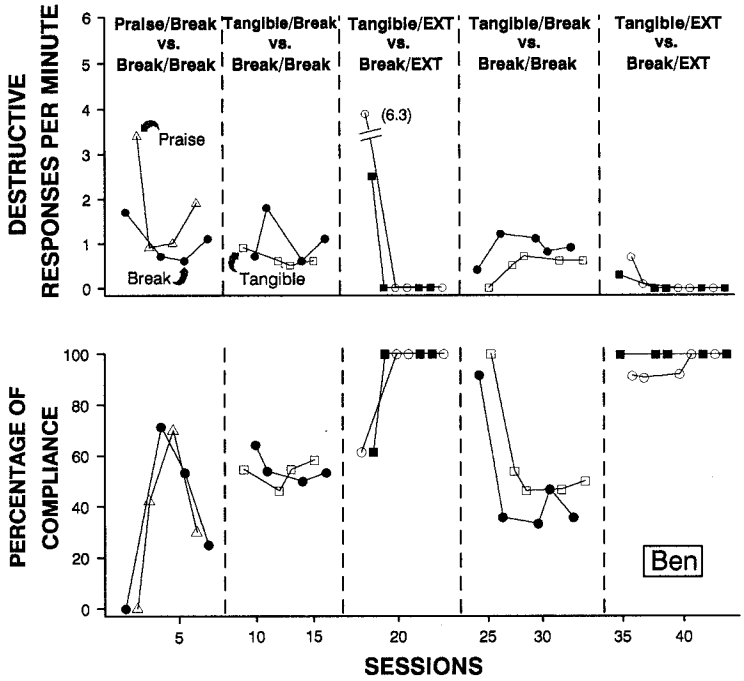

Figure 4. Number of destructive responses per minute (top panel) and percentage of compliance (bottom panel) during Ben's demand analysis (EXT = extinction).

Table 1
The Schedule and Duration of Reinforcement at Each Step During Fading

Steps	Number of demands	Duration of reinforcement (s)
1	1	30
2	2	30
3	3	45
4	5	60
5	8	90
6	12	120
7	16	180
8	20	270

tinction was again added to the two conditions, destructive behavior decreased (M = 0.2 and 0.1 for break/extinction and tangible/extinction, respectively) and compliance increased in both conditions (M = 95% and 100% for break/extinction and tangible/extinction, respectively).

Phase 3: Fading

Procedure

After the demand analysis was completed with each client and destructive behavior had been reduced to near-zero levels, the schedule of reinforcement for compliance was thinned (see Table 1). Fading included increasing the number of demands the client needed to complete to obtain reinforcement when the client's rate of destructive behavior was at or below 10% of baseline levels for two consecutive sessions. If the criterion was exceeded for two consecutive sessions, the number of demands was decreased to the previous step. As the demand requirement was increased, the duration of access to reinforcement was also increased. The goal for all 3 clients was completion of 20 tasks (approximately the number of demands presented in baseline) followed by a 4- to 5-min reinforcement period (i.e., Step 8), which was a reasonable work/break schedule based on input from their school placements.

Fading was implemented simultaneously for Andy in the break/break and tangible/break conditions because both procedures had been effective in reducing destructive behavior, and we wanted to determine whether those effects would be maintained under both procedures during fading. Six sessions were conducted in each condition, break/break and tangible/break, with reinforcement for compliance on an FR 1 schedule (Step 1). As the schedule of reinforcement was thinned, extinction was added to both conditions. The fading goal was achieved in the tangible/extinction condition but not in the break/extinction condition. Therefore, the tangible reinforcer for compliance was added in the break/extinction condition.

Fading was implemented for Carly in the tangible/break condition because this treatment produced the greatest decreases in destructive behavior and the highest levels of compliance. Eight sessions were conducted in the tangible/break condition with reinforcement for compliance on an FR 1 schedule (Step 1). As fading progressed, her destructive behavior increased, and we added extinction for destructive behavior. When the schedule of reinforcement was thinned further, destructive behavior increased again, and we added attention (verbal praise, tickles, and pats on the back) to the break and tangible items (Lalli & Casey, 1996).

Fading was introduced for Ben simultaneously in the break/extinction and tangible/extinction conditions because both procedures had been effective in reducing destructive behavior. Five sessions were conducted in each condition, with reinforcement for compliance on an FR 1 schedule (Step 1). When destructive behavior increased in the break/extinction condition, the tangible item was added for compliance.

A combination of multielement and reversal designs was used during fading for Andy. The first multielement phase consisted of a comparison of fading during the

break/break and tangible/break conditions. In the next phase, extinction was added to both conditions (break/extinction vs. tangible/extinction). Extinction was withdrawn in the next phase, followed by a return to the break/extinction and tangible/extinction conditions to demonstrate functional control of the extinction component. Finally, when destructive behavior increased during the break/extinction condition, the tangible item was added to the break for compliance (tangible/extinction). An ABABCBC design was used during fading for Carly. Fading was introduced in the tangible/break condition (A). As fading progressed, extinction for destructive behavior was added (B). Extinction then was withdrawn (A) and reintroduced (B). Next, attention (C) was added to the tangible/extinction condition, withdrawn (B), and then reintroduced (C). A multielement design was used during fading for Ben, in which the effects of break/extinction were compared to tangible/extinction. When rates of destructive behavior increased during the break/extinction condition, the tangible item was added to the break for compliance (tangible/extinction).

Results

The data for destructive behavior and compliance when reinforcement for compliance was faded are depicted in Figures 5, 6, and 7. The first and second panels of Figure 5 depict the data for destructive behavior and compliance, respectively, when fading was initiated in the break/break condition. The third and fourth panels of Figure 5 depict the data for destructive behavior and compliance, respectively, when fading was initiated in the tangible/break condition. The data for each condition are depicted in separate panels to improve readability, although the analysis was conducted in a multielement design. Andy's destructive behavior remained low and compliance remained high as the number of demands was increased from one to three (Steps 1 to 3) during the break/break procedure. However, when he was required to complete five demands (Step 4) to receive reinforcement, destructive behavior increased dramatically and was maintained above the fading criteria even when the number of demands was decreased to one (Step 1). A similar pattern was observed during the tangible/break condition: Destructive behavior remained low and compliance remained high until the number of demands was increased to three (Step 3). Mean rate of destructive behavior during the first phase for break/break was 0.7 and mean percentage of compliance was 43.7. Mean rate of destructive behavior during the first phase for tangible/break was 0.6 and mean percentage of compliance was 62.9. Because fading under both conditions was unsuccessful, extinction was introduced for destructive behavior across both conditions. When compliance resulted in a break and destructive behavior was on extinction (break/extinction), destructive behavior initially increased, then decreased to near zero (first panel, $M = 1.0$) but compliance was unchanged (second panel, $M = 43.4\%$). When compliance resulted in the tangible item and destructive behavior was on extinction (tangible/extinction), destructive behavior decreased rapidly (third panel, $M = 0.1$) and compliance increased (fourth panel, $M = 80.3\%$). When extinction was withdrawn, destructive responses increased (first panel, $M = 2.0$) and compliance decreased (second panel, $M = 11.4\%$) in the break/break condition. Withdrawal of extinction in the tangible/break condition also resulted in an increase in destructive behavior (third panel, $M = 1.4$) and a decrease in compliance (fourth panel, $M = 20.2\%$). Extinction was then reintroduced, and destructive responses decreased in the tangible/extinction condition (third panel, $M = 0.4$) but remained variable in the break/extinction condition (first panel, $M = 1.1$). In ad-

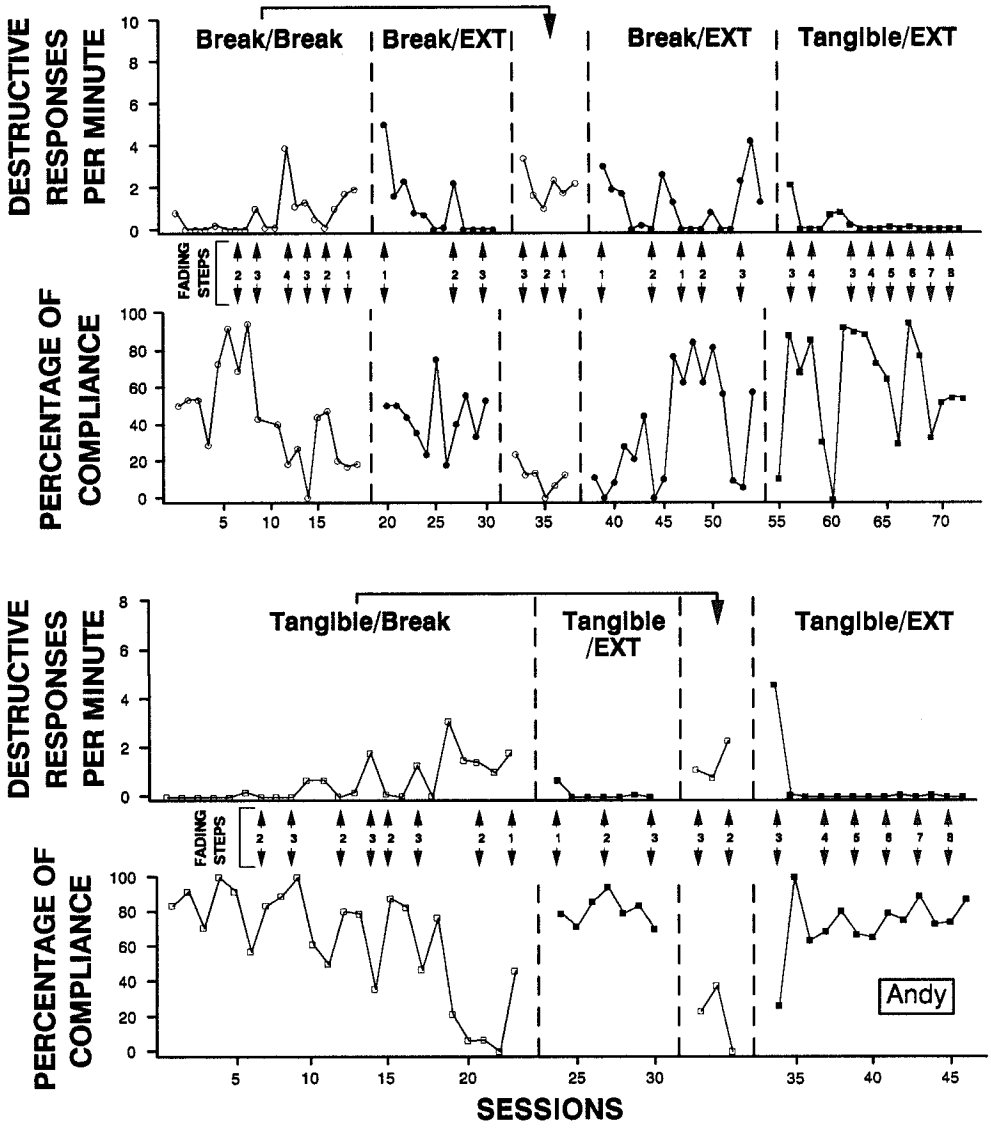

Figure 5. Number of destructive responses per minute (first panel) and percentage of compliance (second panel) when fading of the schedule of reinforcement was initiated in the break/break condition with Andy, and number of destructive responses per minute (third panel) and percentage of compliance (fourth panel) when fading of the schedule of reinforcement was initiated in the tangible/break condition with Andy. The numbers and arrows between the graphs for destructive behavior and compliance indicate the fading steps (EXT = extinction).

dition, compliance increased in the tangible/extinction condition (fourth panel, M = 72.8%) but was more variable in the break/extinction condition (second panel, M = 36.3%). The tangible item was then added as a reinforcer for compliance during the break/extinction condition, and destructive behavior decreased rapidly to near-zero levels (first panel, M = 0.2), and overall levels of compliance were slightly higher than in the previous phase (second panel, M = 60.5%).

Figure 6 shows treatment effects during fading for Carly's destructive behavior and compliance. We were able to increase the

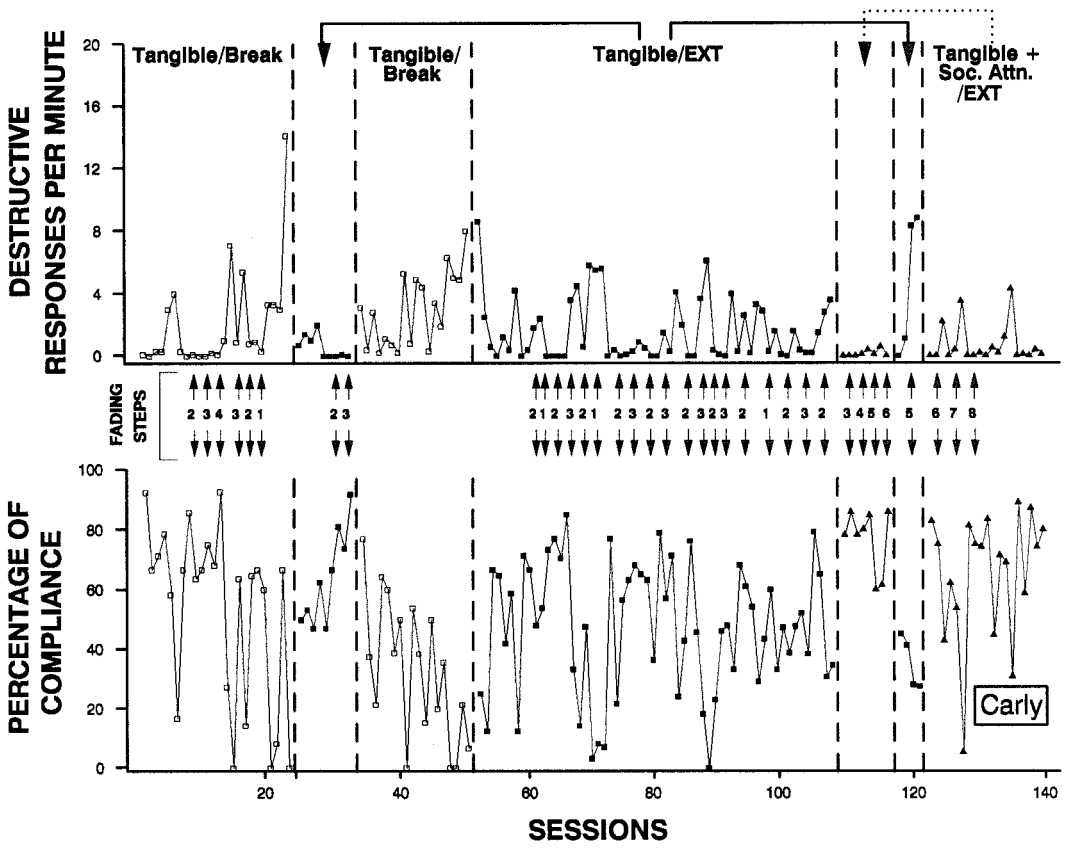

Figure 6. Number of destructive responses per minute (top panel) and percentage of compliance (bottom panel) when fading of the schedule of reinforcement was initiated in the tangible/break condition with Carly. The numbers and arrows between the graphs for destructive behavior and compliance indicate the fading steps (EXT = extinction; Soc Attn = social attention).

number of demands to three (Step 3) during the tangible/break procedure while maintaining low levels of destructive behavior. However, destructive behavior increased in the second session in which Carly was required to complete five demands (Step 4) to receive reinforcement. Mean rate of destructive behavior was 2.0 and mean percentage of compliance was 53.1 during the tangible/break phase. When we added extinction, destructive behavior decreased (M = 0.6) and compliance increased (M = 64.4%). When extinction was withdrawn, destructive behavior again increased (M = 3.0) and compliance decreased (M = 32.8%). When extinction was again implemented, destructive behavior was maintained (M = 1.6) and compliance increased slightly (M = 47.3%). When attention was added for compliance, destructive behavior decreased (M = 0.2) and compliance increased (M = 76.8%). When attention was withdrawn, destructive behavior increased (M = 4.6) and compliance decreased (M = 35.6%). Finally, when attention was added, destructive behavior decreased (M = 0.7), compliance increased (M = 64.5%), and the fading goal was achieved.

Ben's data for destructive behavior and compliance are depicted in Figure 7. Fading proceeded rapidly when compliance resulted in the tangible item and extinction was implemented for destructive behavior (M = 0 for destructive behavior, M = 98.2% for

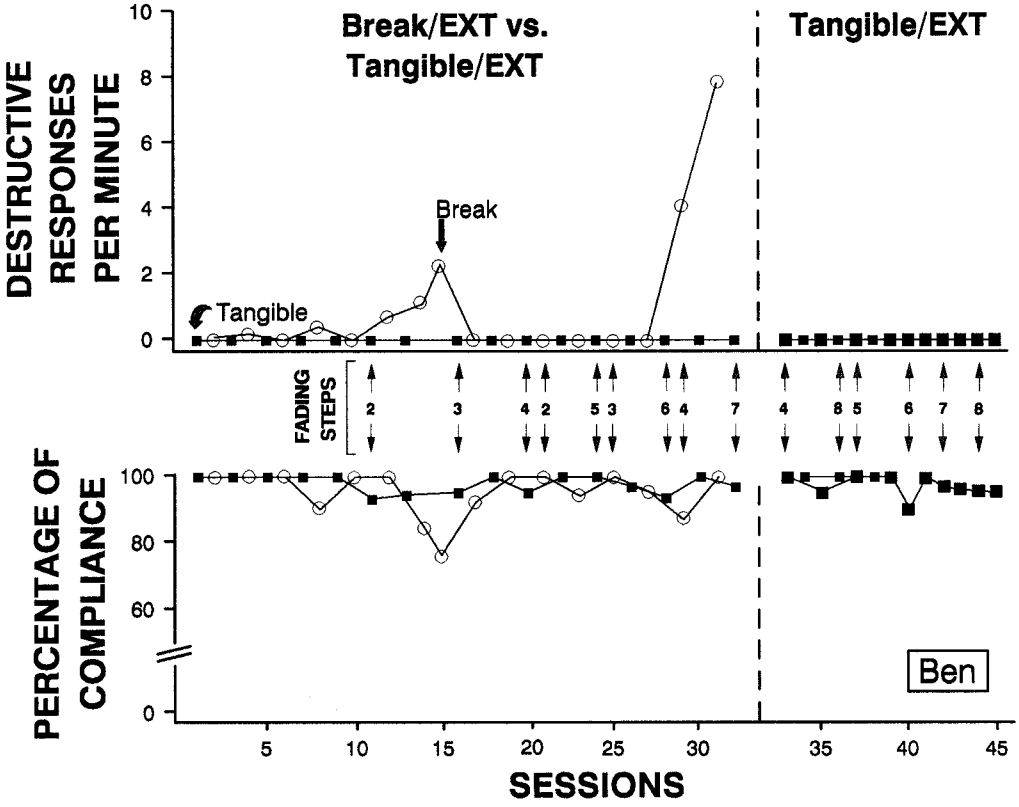

Figure 7. Number of destructive responses per minute (top panel) and percentage of compliance (bottom panel) when fading of the schedule of reinforcement was initiated in the break/extinction and tangible/extinction conditions with Ben. The numbers and arrows between the graphs for destructive behavior and compliance indicate the fading steps (EXT = extinction).

compliance). However, when compliance resulted in a break and extinction was implemented for destructive behavior, destructive behavior increased (M = 1.3) when he was required to complete five demands (Step 4) to receive reinforcement, although his compliance remained high (M = 95%). At that point, the tangible item was added for compliance, and Ben's destructive behavior decreased (M = 0) and compliance remained high (M = 97%).

DISCUSSION

In the current investigation, the functional analyses of 3 clients indicated that their destructive behavior was maintained by multiple sources of reinforcement. Andy's destructive behavior was maintained by escape from demands and access to an activity. Carly's destructive behavior was maintained by escape from demands, access to tangible items, and attention. Ben's destructive behavior was maintained by escape from demands and access to tangible items. Therefore, we examined the effects of providing these reinforcers for destructive and compliant behavior during instructional situations with and without extinction. For Andy, but not for Carly or Ben, compliance increased and destructive behavior gradually decreased to near-zero levels when compliance was reinforced with a break, even though destructive behavior also continued to produce a break. The combination of a break and access to tangible items contingent upon com-

pliance produced immediate behavioral change (decreases in destructive behavior and increases in compliance) for Andy and Carly. However, for Andy and Carly, it was necessary to add extinction to the treatment as the schedule of reinforcement for compliance was thinned. For Ben, destructive behavior was maintained until it was placed on extinction, regardless of whether compliance resulted in a break or a break plus access to the tangible item.

This investigation replicates and extends the literature on the relation between compliance and problem behavior in several ways. First, the results for Andy and Carly are consistent with previous findings showing that reinforcement of compliance can produce concomitant decreases in destructive behavior (Horner & Day, 1991; Lalli & Casey, 1996), even when destructive behavior continues to produce reinforcement in the form of a break. When compliance produced a break (Andy) or a break plus a tangible item (Carly), destructive behavior decreased even though it continued to produce a break. In addition, during fading for Andy and Carly and during the demand analysis for Ben, applying extinction to destructive behavior resulted in increases in compliance, even when the consequence for compliance remained unchanged.

One potential explanation of these findings is that the relative rates of compliance and destructive behavior were a function of the relative value of the reinforcement produced by each response (Catania, 1992). In a concurrent operants arrangement, two or more responses, each correlated with a schedule of reinforcement, are available at the same time. Variables that affect relative response rates in such arrangements include response effort or difficulty as well as reinforcement rate, delay, amount, and type (Mazur, 1994). When each response is reinforced on a ratio schedule, as in the current investigation, individuals often display one response almost exclusively if it results in (a) a higher rate or amount of reinforcement (Catania, 1963), (b) more immediate reinforcement (Chung & Herrnstein, 1967), or (c) higher quality reinforcement (Miller, 1976).

When compliance or destructive behavior resulted in a 30-s break (break/break), the destructive behavior for 2 of 3 clients (Carly and Ben) did not decrease. One reason may have been that even though reinforcement for the two responses (destructive behavior and compliance) was the same (a 30-s break from work), there may have been differences between the two conditions that favored destructive behavior. The criterion for reinforcement of compliance was task completion, which produced a break (i.e., postponement of the next task). Destructive behavior, on the other hand, produced a break in the absence of task completion. This could help to explain the results for Carly and Ben, whose destructive behavior did not decrease when both compliance and destructive behavior produced a break from work, but not those for Andy, whose destructive behavior decreased to near-zero levels under this schedule arrangement.

The results of the demand analysis for Andy were consistent with those of Horner and Day (1991), who found that task initiation was high and destructive behavior was low when both behaviors resulted in a break (break/break condition). It is possible that Andy's preference for compliance over destructive behavior when each produced a 30-s break was due to other reasons, such as the amount of physical effort required for each response. However, the effort for the two responses did not appear to be different; no attempt was made to measure the relative effort associated with these responses, so this explanation remains speculative.

During the demand analysis, when compliance resulted in a 30-s break and access to tangible reinforcement but destructive be-

havior resulted in a break only (tangible/break), compliance was associated with higher quality reinforcement (multiple functional reinforcers) than destructive behavior was. Under this arrangement, Andy and Carly, but not Ben, preferred compliance over destructive behavior. These idiosyncratic results are consistent with those reported by Neef, Mace, Shea, and Shade (1992), who examined the effects of reinforcer rate and quality on time allocation to arithmetic problems during concurrent variable-interval schedules. Neef et al. found that 2 students generally responded for the higher quality reinforcer, even when that high-quality alternative was associated with leaner schedules of reinforcement. However, the 3rd student demonstrated a highly variable pattern of responding, sometimes allocating responses to the higher quality reinforcer and at other times responding on the richer schedule of reinforcement. Thus, when quality of reinforcement is manipulated, it may be difficult to predict how a given individual will allocate responding, perhaps because quality of reinforcement is more difficult to quantify than other parameters such as rate.

As the density of reinforcement for compliance was thinned during fading for Andy (break/break and tangible/break conditions) and for Carly (tangible/break condition), destructive behavior increased and compliance decreased. This may have occurred because destructive behavior continued to result in a break on an FR 1 schedule, and the differences between the rates of reinforcement for the two responses increased as the schedule for compliance was faded. Under this schedule arrangement, quality of reinforcement was higher for compliance, but rate of reinforcement was greater for destructive behavior. However, the schedule of reinforcement may not fully explain these results because control over destructive behavior was not regained when the schedule was returned to an FR 1 for compliance and destructive behavior.

During fading, the schedule of reinforcement for compliance was decreased rapidly during the tangible/extinction condition for Ben due to low rates of destructive behavior. However, similar to the results for Andy, destructive behavior increased as the schedule of reinforcement for compliance was thinned during fading in the break/extinction condition. As with Andy, we added the higher quality reinforcer (i.e., the tangible item) and maintained zero levels of destructive behavior. Thus, the results during fading suggest that for clients whose destructive behavior is multiply controlled, providing access to multiple functional reinforcers for compliance may improve treatment outcome.

There are several clinical implications of these findings. First, the primary goals of treatment for these 3 clients were (a) low rates of destructive behavior, (b) high levels of compliance, and (c) a reasonable schedule of demands and reinforcement (i.e., 20 demands followed by 4 to 5 min of reinforcement). For all 3 clients, these goals were met only when compliance produced multiple functional reinforcers (a break plus tangible reinforcers, attention, or both) in combination with extinction (i.e., discontinuation of reinforcement for destructive behavior). Placing destructive behavior on extinction and reinforcing compliance with the consequence that had previously maintained destructive behavior (i.e., escape) were not sufficient to meet our final treatment goal (20 demands and 4 to 5 min of reinforcement) for these 3 clients. Thibault et al. (1995) treated the severe behavior problems of 30 clients using differential reinforcement of an alternative (DRA) response (communication) and extinction. Even though the investigators reinforced communication with the reinforcer that had previously maintained destructive behavior, they successfully

faded the schedule of reinforcement for the alternative response in only 5 of 30 applications. By contrast, when communication was reinforced and a punishment procedure was added, they were able to fade the schedule of reinforcement in 100% of the cases. One potentially important clinical implication of the current results is that reinforcement of an alternative response with multiple functional reinforcers and extinction for destructive behavior may provide an effective alternative to punishment when DRA with a single functional reinforcer proves to be ineffective.

Second, we evaluated the individual contribution of reinforcement to treatment effectiveness because each reinforcement component (i.e., the break, the tangible item, and attention) was introduced separately. For 2 clients (Andy and Carly), reinforcement for compliance (with a break for Andy and a break plus a tangible item for Carly) on an FR 1 schedule without extinction for destructive behavior resulted in decreases in destructive behavior and increases in compliance. For all clients, extinction for destructive behavior and access to higher quality reinforcement (break plus social positive reinforcement) for compliance resulted in the greatest increases in compliance when the schedule of reinforcement for compliance was thinned.

In the natural environment, reinforcement for compliance and extinction for destructive behavior may not occur consistently (e.g., teachers or caregivers may allow escape for some destructive behavior or may not provide reinforcement for every compliant behavior). If teachers or caregivers cannot withhold reinforcement for destructive behavior, the findings from the demand analysis of the current investigation suggest that, for some clients (in this case, Andy and Carly), providing access to higher quality reinforcement on a dense schedule can result in decreases in destructive behavior even when extinction is not implemented for destructive behavior. In addition, if teachers or caregivers cannot provide reinforcement for compliance consistently, access to higher quality reinforcement and extinction for destructive behavior may be effective in reducing destructive behavior even when reinforcement is not provided on a continuous schedule.

Finally, in the current investigation, functional reinforcers that maintained destructive behavior in other social contexts (attention, tangible items) were added to the reinforcer that maintained destructive behavior in the instructional context (i.e., escape). However, most individuals with escape-maintained destructive behavior do not also display destructive behavior maintained by other tangible reinforcers or attention (i.e., they do not display multiply controlled destructive behavior). For individuals with destructive behavior that is maintained by a single consequence (e.g., escape), future research might be directed toward determining whether it is possible to increase the effectiveness of a DRA procedure by incorporating multiple alternative reinforcers that are identified on the basis of a reinforcer assessment, such as the one described by Fisher et al. (1992). Steege et al. (1989) used reinforcers that had been identified through a preference assessment and obtained increases in compliance and decreases in destructive behavior comparable to those in the current investigation. However, the procedure used by Steege et al. involved extinction for destructive behavior in addition to reinforcement for compliance on an FR 1 schedule. Thus, future investigators may wish to examine the extent to which reinforcers identified via preference (Pace, Ivancic, Edwards, Iwata, & Page, 1985) and choice (Fisher et al., 1992) assessments might also be effective for (a) achieving increases in compliance and decreases in destructive behavior without the use of extinction and (b) increasing the like-

lihood that destructive behavior will remain low as reinforcement for compliance is faded.

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Received August 26, 1996
Initial editorial decision November 4, 1996
Final acceptance January 31, 1997
Action Editor, Brian A. Iwata

STUDY QUESTIONS

1. What were the general purposes of the study?

2. Why were additional functional analyses conducted with Carly andBen, and what did these analyses entail?

3. Describe the consequences delivered (but not their various combinations) for compliance and destructive behavior across the various treatment and fading conditions.

4. How were demand frequencies and reinforcement interval lengths modified during the fading phase?

5. The participants were exposed to a variety of different arrangements during the demand analysis and fading phases. Below is a table indicating these various combinations. Complete the table by indicating for each paticipant whether a given condition produced a therapeutic effect (+), did not produce such an effect (−), or was not experienced by the individual (n/a).

	Andy		Carly		Ben	
	Demand analysis	Fading	Demand analysis	Fading	Demand analysis	Fading
Praise/break						
Break/break						
Tangible/break						
Break/EXT						
Tangible/EXT						
Tangible+praise/EXT						

6. Based on the above, which single component seemed to have the greatest therapeutic effect?

7. Across participants, the praise/break condition seemed to be uniformly ineffecive, whereas both the break/break and the tangible/break conditions were effective for at least 1 participant. Based on the contingencies in effect during these three conditions, why might one expect the praise/break condition to be the least effective?

8. What do the authors describe as two important clinical implications of their results?

Questions prepared by Iser DeLeon and Michele Wallace, University of Florida