EXTINCTION EFFECTS DURING ASSESSMENT AND TREATMENT OF BEHAVIOR DISORDERS IN APPLIED SETTINGS

THESIS

Presented to the Graduate Council of the University of North Texas in Partial Fulfillment of the Requirements For the Degree of

MASTER OF SCIENCE

By

Sandy K. Magee, B.A.
Denton, Texas
December, 1998

The main and side effects of extinction were evaluated in a multiple baseline design across the problem behaviors of two elementary school boys. For each subject, functional analysis procedures resulted in the occurrence and assessment of only one of several problem behaviors reported by teachers. Extinction treatment based on functional analysis outcomes was then applied to the assessed topography and resulted in the emergence of other inappropriate response forms. Each successive behavior was exposed to extinction and changes in previous and subsequent response forms were observed. Both main effects and indirect effects of extinction were examined. Findings are discussed regarding the covariation of responses and implications for the treatment of behavior disorders in applied settings.
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INTRODUCTION

Skinner (1938) described extinction of Type R responses (operant behavior) as occurring if "an operant already strengthened through conditioning is not followed by the reinforcing stimulus and the strength is decreased" (p. 21). Both basic and applied studies have demonstrated the powerful effects of extinction procedures. Although operant extinction has been used successfully in applied settings to reduce severe problem behaviors, extinction alone is rarely recommended. LaVigna and Donnellan (1986) suggested that, due to the potential occurrence of adverse indirect effects and the relatively gradual reduction in responding, extinction should not be used as treatment for severe behavior disorders. Weak or inefficient treatment effects may have resulted from topographical application of procedures (e.g., planned ignoring, time out) described as extinction. By contrast, data from early applied studies have shown that extinction as a treatment procedure produced rapid decreases in rate of problem behavior, when a functional analysis was conducted prior to implementation (Iwata, Pace, Kalsher, Cowdery, & Cataldo, 1990). Large, immediate, and durable reductions in problem behavior have been achieved when extinction procedures include withholding relevant maintaining reinforcers (Forehand, 1973; Pinkston, Reese, LeBlanc, & Baer, 1973; Repp, Felce, & Barton, 1988; Rincover, Cook, Peoples, & Packard, 1979).
Extinction as a Treatment Component

Many intervention procedures rely upon an extinction component for their effectiveness. Several studies (e.g., Iwata, Pace, Cowdery, & Miltenberger, 1994; Zarcone, Iwata, Mazaleski, & Smith, 1994) indicate that the effects of reinforcement-based interventions may be limited unless extinction is included as part of the treatment. Interventions based on the development of communicative responses and behavioral momentum produced either mixed results or no treatment effect when implemented without extinction (Carr & Durand, 1985; Mace & Belfiore, 1990; Wacker, et al. 1990; Zarcone, Iwata, Hughes & Vollmer, 1993). Mazaleski, Iwata, Vollmer, Zarcone, and Smith (1993) assessed both reinforcement and extinction components during implementation of a differential reinforcement of other behavior (DRO) procedure and suggested that extinction appeared to be the critical component in a DRO schedule.

Other studies have indicated that extinction procedures can increase behavioral variability, which occasionally results in the occurrence of more appropriate, reinforceable responses (Carr & Kologinsky, 1983; Duker & van Lent, 1991; Lalli, Zanoli, & Wohn, 1994). Duker and van Lent found that, by placing more frequently occurring request forms on extinction, the number and variability of appropriate gestured requests increased. Evidence indicating the potential benefits of extinction in treatment is, however, countered by a large body of literature describing weak or inefficient treatment effects and undesirable side effects.

Criticisms of Extinction: Main Effects

Early basic research (Herrick, 1965; Hurwitz, 1962; Skinner, 1938; Warren & Brown, 1943) indicated that extinction produced only gradual decreases in responding
and effects were characterized by sporadic increases in response rate. Many texts and articles describe the effects of extinction as extremely gradual and recommended that extinction not be used if rapid treatment effects were desired (Favell et al., 1982; Horner & Barton, 1980; Muttar, Peck, Whitlow, & Fraser, 1975). Results of early applied studies supported the contention that extinction was a relatively inefficient treatment procedure (Duker, 1975; Wright, Brown & Andrews, 1978). Jones, Simmons, and Frankel (1974) found that extinction of an autistic girl's self-injurious behavior required more than 160 2-hr treatment sessions, during which thousands of nonreinforced responses occurred. Although the criticisms of extinction main effects are based on empirical evidence, the research findings may be questionable for several reasons.

Possible causes for criticisms of extinction: main effects. First, very little applied research has been conducted on extinction effects, per se and discrepancies exist in the results of that research (Iwata et al., 1994). Basic literature may not provide a sufficient basis for an applied technology without more thorough replication in applied settings. Although basic research has revealed a number of variables that influence the course of responding during extinction, most studies did not thoroughly examine variables relevant to clinical applications (Lerman & Iwata, 1996). Second, therapeutic techniques defined as extinction in early applied literature were often defined procedurally or applied on the basis of response topography and, thus, may not have been appropriately described as extinction. Procedures described as extinction (e.g., planned ignoring, time-out) were not implemented based on assessment of the contingency maintaining the target behavior and so may not have resulted in discontinuation of the specific source of reinforcement. Third, extinction may have been applied following exposure to intermittent or partial
reinforcement. These schedules have been demonstrated to increase resistance to extinction (Ferster & Skinner, 1957). When applied following exposure to intermittent reinforcement, extinction effects (i.e., decreases in response rate) are much more gradual than when applied following exposure to continuous reinforcement (Dubanoski & Weiner, 1978; Pittenger, Pavlik, Flora & Kontos, 1988). Given that, in most early research, reinforcement contingencies for problem behavior were usually unknown and uncontrolled, it is likely that intermittent reinforcement occurred during baseline conditions. In addition to the many descriptions of weak or inefficient main effects, extinction treatment procedures have long been associated with adverse indirect effects.

Criticisms of Extinction: Side Effects

Negative side effects are cited as reasons why extinction should not be used in clinical treatment applications. Indirect effects include bursts of responding (i.e., initial increase in the frequency, duration, and/or variability of the previously reinforced response) (Alessandri, Sullivan, & Lewis, 1990; Antonitis, 1951; Holton, 1961; Margulies, 1961), and increases in other inappropriate behaviors such as aggression (Azrin, et al., 1966). Extinction has also been associated with an increase in responses referred to as emotional behaviors. In humans, these behaviors include crying, pouting, fussing, and leaving or attempting to leave the experimental situation (Baumeister & Forehand, 1971; Rovee-Collier & Capatides, 1979; Sullivan, Lewis, & Alessandri, 1992). Goh and Iwata (1994) demonstrated that although bursts of targeted self-injurious-behavior (SIB) and nontargeted aggression occurred during initial extinction sessions, both SIB and aggression were reduced to zero by the 26th 15-min extinction session during initial treatment and by the 16th 15-min session following a brief reversal.
Possible causes for criticisms of extinction: side effects. First, the occurrence of side effects is more often emphasized in research publications than the nonoccurrence. Because side effects are reported frequently in experimental settings, clinicians are often warned of the potential problems associated with the use of extinction in clinical settings and may be especially sensitive to their occurrence. However, the prevalence and severity of these reported side effects has recently come into question. An analysis of studies using extinction treatment procedures (Lerman & Iwata, 1995) revealed that the extinction burst may not be as common as has been described. Lerman and Iwata reported that extinction bursts occurred in 36% of cases when extinction was implemented alone, but in only 12% of cases when extinction was combined with operant procedures that made reinforcement available for alternative responses. Furthermore, some of the applied studies in which extinction bursts occurred reported that bursts were brief and caused no notable problems (France & Hudson, 1990; Iwata et al., 1990).

Second, the occurrence of prolonged or persistently recurring extinction bursts has been associated with the incomplete application of extinction (bursts of responding which culminate in access to reinforcement) (Vollmer, Ringdahl, Roane, & Marcus, 1997). In fact, these authors reported that noncontingent reinforcement could be more problematic than extinction alone because bursts of responding occasionally "culminate coincidentally with reinforcement" (p.164) and as a result become chronic.

Few applied studies have systematically examined general patterns of responding during extinction or extinction-produced phenomena such as bursts, spontaneous recovery, and resurgence. Extinction-induced aggression has rarely been reported in applied research. Goh and Iwata (1994) observed increases in aggression during
extinction; however, few applied studies have directly examined the link between
increases in aggression and other topographies of inappropriate behavior and extinction.
Increases in topographically different inappropriate responses have been noted
anecdotally to coincide with decreases in target responses when extinction procedures
were implemented (Fisher, 1979; Lambert, 1975; McDowell, Nunn, & McCutcheon,
1969), yet “few studies with nonhumans and no studies with humans have systematically
examined the resurgence of previously reinforced behavior during extinction” (Lerman
& Iwata, 1996, p. 349). Thus, the actual prevalence and severity of these putative side
effects is unknown.

Alternative Explanations for Side Effects of Extinction as a Treatment Procedure

The indirect adverse effects associated with extinction are often described as
extinction-induced phenomena, but possibly could be described as response covariation:
the interdependency among response probabilities (Parrish, Cataldo, Kolko, Neef, &
Egel, 1986). The matching law predicts the relative probability of multiple responses
based on the frequency of reinforcement associated with each response. The probability
of a target response extinction burst may be inversely related to the availability of
reinforcement for functionally equivalent responses in the subject’s repertoire (Schukla &
Albin, 1996). Baer (1982) states that topographically dissimilar responses that have a
common effect on the environment may substitute for each other. Also, the probability of
occurrence of functionally equivalent responses varies for each topography and is
influenced by factors such as rate of reinforcement, punishment history and response
effort. Lalli, Mace, Wohn, and Livezey (1995) evaluated the effects of extinction on
covariation of response-class members. A functional analysis showed that three
topographically dissimilar behaviors (screams, aggression and SIB) were maintained by escape from demands and, therefore, members of the same response class. These responses were found to occur in a predictable sequence dependent upon the escape contingency: escape contingent upon screams, escape contingent upon aggression, or escape contingent upon SIB and were described by the authors as being hierarchically related. Most response covariation research has examined the effects of reinforcement schedules, yet few applied studies have examined patterns of responding across response class members during exposure to extinction.

Lerman and Iwata (1996) call for the development of a “comprehensive general technology for the use of operant extinction” (p. 345). These authors maintain that warnings against using extinction as a treatment for severe behavior disorders may be premature in the absence of thorough investigations of the prevalence and severity of problems. Translation of basic research findings into an applied technology of extinction requires replication with human behavior in clinical settings (Lerman & Iwata, 1996). The purpose of the present study is to begin to address this reported gap in the applied literature by examining, in an applied setting, the direct and indirect effects of extinction procedures applied systematically across target behaviors. Questions addressed in this study include 1) What effect will continuous reinforcement of a primary (first occurring) target behavior have on various secondary teacher-identified target behaviors? 2) What main and indirect effects will extinction alone have on the primary and subsequently occurring secondary target behaviors?
METHOD

Subjects

Kyle, a 7-year-old boy, attended a social adjustment class as a first grader. Kyle was diagnosed with ADHD and took 10 mg of Ritalin® daily. He was referred for treatment of severe problem behavior in the classroom, which included unauthorized out-of-seat behavior, inappropriate language and gestures, yelling, destruction of classroom materials and aggression toward the teacher. He typically engaged in these problem behaviors when given academic assignments or following reprimands for minor infractions such as fidgeting, leaving his assigned seat or looking away from the teacher.

Trey, an 8-year-old boy, attended an applied academics class as a third grader. He was diagnosed with mental retardation and profound hearing loss, wore a slow release Catapress® patch (1 mg per day) and took 25 mg of Mellaril® daily. Trey was referred for treatment of severe problem behavior which included head rocking, object mouthing, destruction of classroom materials, yelling, self-injurious head slapping and hand biting, aggression and inappropriate sexual touching of female teachers. These behaviors appeared to occur randomly throughout the day and across all settings.

Settings and Equipment

All sessions with Kyle were conducted at his elementary school in a vacant classroom (6.0 m by 5.0 m) equipped with chairs and tables, computer, teacher's desk with supplies, books, educational games, and file cabinets containing instructional materials. All sessions with Trey were conducted at his elementary school, in a vacant classroom (6.5 m by 4.5 m) equipped with chairs and tables, book shelves and books,
wastebaskets, pencil sharpeners and a chalkboard with chalk. A video camera, hidden in a modified cardboard box, was used to record sessions with both subjects.

Procedure

Both subjects were exposed to a series of functional analysis conditions in a multielement design as described by Iwata et. al. (1982/1994). Extinction procedures were then applied to target behaviors in a multiple baseline design and resulting changes in all subsequently occurring target behaviors (secondary targets) were recorded.

Functional analysis procedures. Three to five daily sessions, usually 5 days per week, were conducted with each subject. Sessions lasted 10-min and were separated by 5- to 10-min breaks. Except for the alone sessions, only the therapist assigned to the particular condition (i.e., separate attention, play, and demand therapists) was present with the subject. The assigned therapist presented antecedent stimuli, delivered or withheld consequences and recorded data. Except for the alone condition, toys, games and classroom materials were available during functional analysis and extinction procedures for both subjects.

During the alone condition, only the subject was present in the room, and sessions were recorded either by hidden camera or by observers standing outside a partially covered window. This condition tested the role of automatic or sensory reinforcement in maintaining target behavior.

During the attention condition, the attention therapist ignored the student but made statements describing the behavior to the student following each target behavior occurrence (i.e., "Kyle/ Trey, you are out of your seat", "____, you are yelling", "____, you are hitting me"). Statements lasted approximately 3-5s, after which attention was
again withdrawn. This condition tested the role of social positive reinforcement in maintaining target behaviors. For Trey, these statements were spoken and signed simultaneously.

The play condition served as a control/comparison condition and was used to minimize potential carryover between attention and escape conditions. During the play sessions, the therapist engaged in toy play with the subject but withdrew attention for 30s contingent on a target response occurrence.

During the escape condition, the therapist presented a variety of requests (i.e., "Kyle/Trey, stand up", "___, look at me", "___, sit down", "___ count from 1-5") once each 10s, but left the room for 30s contingent upon a target response occurrence. Modeling and physical guidance were not used to prompt compliance. Requests used in demand conditions were those regularly made of the students in their homeroom classes and were used only after each student had demonstrated at least one correct unprompted response in his classroom. This condition tested the role of social negative reinforcement, in the form of escape from task demands, in maintaining target behavior.

Extinction treatment procedures. Extinction procedures based on the functional analysis results (escape extinction and attention extinction) were applied to target behaviors (out-of-seat for Kyle and object mouthing for Trey). Secondary target behaviors, reported by teachers but not observed during functional analysis, were expected to occur when the maintaining reinforcement contingency was terminated for the primary response. Each successive target behavior was exposed to extinction in a multiple baseline design across behaviors. Based on prior research (Lalli et al., 1995), occurrence of target responses belonging to the same functional response class was
predicted to be influenced by changes in the frequency of reinforcement associated with 'substitutable' responses.

Data Collection and Analysis

Kyle's target behaviors were defined as (a) *out-of-seat*: buttocks out of contact with bottom of assigned chair  (b) *yelling*: vocalizations above normal conversational volume; (c) *inappropriate language or gestures*: verbalizations or signs that were threatening or derogatory in nature; (d) *destruction*: hitting, kicking, or throwing objects; and (e) *aggression*: hitting, kicking others or throwing objects so that they made physical contact with others.

Trey’s target behaviors were defined as (a) *object mouthing*: insertion of any inedible item into his mouth; (b) *yelling*; (c) *destruction*; (d) *aggression*; and (e) *inappropriate physical contact*: touching others within 3 in of a genital zone.

During each 10-min session, data were collected using 10-s partial interval recording procedures. The percentage of intervals containing target behaviors was then calculated by dividing the number of intervals during which the particular behavior occurred by the total number of intervals in the session. For interobserver agreement, sessions were either recorded by a hidden video camera or a second observer recorded data through blinds drawn on a large classroom window. Interobserver agreement data were collected for 30% of sessions and interval-by-interval occurrence agreement was calculated by dividing the number of agreements by the total number of agreements plus disagreements and then multiplying by 100. Interobserver agreement averaged 88% overall for Kyle (range 76%-100%), and 91% overall for Trey (range 77%-100%).
RESULTS

Functional Analysis

The results of Kyle’s functional analysis are shown in Figure 1. Out-of-seat behavior occurred almost exclusively during the demand condition. The percentage of intervals in which out of seat behavior occurred increased in during the 4th session and maintained during the final 2 sessions. These results suggest that Kyle’s out-of-seat behavior was maintained by escape from task demands (negative reinforcement). None of the other target topographies occurred during functional analysis conditions.

The results of Trey’s functional analysis are shown in Figure 2. The percentage of intervals during which object mouthing occurred was highest during the attention condition with no overlap in the data between this and other conditions. These results suggest that Trey’s object mouthing was maintained by positive social reinforcement. With the exception of a few instances of destruction and yelling, only object mouthing occurred during the functional analysis conditions.

Extinction Treatment

Kyle. Figure 3 shows results obtained during continued reinforcement and extinction conditions. After 9 sessions of contingent escape (of which the first 6 occurred during functional analysis procedures), out-of-seat behavior was placed on escape extinction (continued delivery of demands every 10s without the use of modeling or physical guidance). An immediate decrease in out-of-seat behavior (from 19.8% of intervals over the last 7 reinforced sessions to 3.4% percent of intervals across the first 7 extinction sessions) was observed and response bursts did not occur. This effect was accompanied by an increase in yelling (from a mean of 0% of intervals over the last 7
sessions during which out-of-seat was reinforced to a mean of 26.1% of intervals over the first 7 sessions of out-of-seat extinction). Additionally, increases in the percentage of intervals containing inappropriate language, gestures, and destruction coincided with the implementation of extinction procedures to the primary target behavior. Yelling was placed on escape extinction after 7 sessions and an immediate decrease in the percentage of intervals containing yelling was noted (from a mean of 26.1% of intervals to a mean of 9.9% of intervals). Further increases in inappropriate language and gestures coincided with this decrease in yelling. Destruction occurred at slightly higher percentages and aggression occurred for the first time in session 18. Following 7 sessions of escape extinction for yelling, the escape contingency for inappropriate language and gestures was discontinued. Due to the potentially dangerous outcomes of destructive and aggressive behavior, the escape contingency for these two target behaviors was also discontinued. According to Lerman and Iwata's (1995) definition of an extinction burst (an "increase in responding during any of the first three treatment sessions above that observed during all of the last five baseline sessions" [p. 93]), implementation of extinction to inappropriate language/gestures and aggression resulted in bursts of these behaviors during the first 2 extinction treatment sessions. Percentage of intervals containing inappropriate language/gestures and aggression rapidly declined to zero levels following the second session. Although yelling had decreased when extinction was initially implemented, it did not reach zero levels until the last three secondary target behaviors were exposed to extinction. Out-of-seat behavior was significantly reduced by extinction, but never decreased to zero levels. No other inappropriate responses were observed to occur during the last 4 sessions of extinction (30-33).
Trey. Figure 4 shows results obtained during reinforcement and extinction conditions for Trey. After 6 sessions of contingent attention, extinction was implemented for object mouthing. As with Kyle, an immediate decrease in object mouthing (from a mean of 55.8% of intervals over the last 5 sessions of baseline to a mean of 6.5% of intervals over the first 5 treatment sessions) was observed and response bursts did not occur. This effect was accompanied by an increase in destructive behavior (from a mean of 8.4% of intervals over the first 5 sessions to a mean of 65.8% of intervals during the first 5 sessions of object mouthing extinction). No other target behaviors occurred. Destructive responses were then placed on extinction and decreased dramatically during the first 3 sessions of extinction. The decreasing trend in destruction from session 15 to 22 was accompanied by sporadic increases in destruction and slight increases in yelling and aggression. The attention contingency was discontinued for yelling beginning with session 23. Decreases in yelling (from a mean of 2% of intervals during the last 5 reinforcement sessions to a mean of .6% of intervals over the first 5 extinction sessions) were accompanied by further increases in aggression through session 25. The first occurrence of inappropriate touching also occurred in session 23 and coincided with the implementation of extinction for yelling. Attention contingent upon aggression was discontinued in session 26 and aggressive responding decreased from a mean of 24% of intervals over the last 3 reinforcement sessions to a mean of 4% of intervals over the first 3 extinction sessions. Further increases in inappropriate touching followed discontinuation of attention contingent upon aggression (from a mean of .6% of intervals over sessions 23-25 to a mean of 9% over sessions 26-28). A burst of inappropriate touching responses occurred during session 29, following the introduction of extinction,
and was accompanied by resurgence of aggression and yelling. These effects lasted only 1 session and were followed by immediate decreases to zero occurrences.
DISCUSSION

This study first attempted to identify contingencies maintaining inappropriate behaviors described by the subjects' teachers. Functional analysis procedures, however, resulted in the occurrence and assessment of only one of the behaviors described for each student. Apparently, continuous reinforcement of the primary target behavior reduced the probability of secondary target behavior and, therefore, precluded assessment of secondary target behaviors during functional analysis procedures. Discontinuation of the reinforcement contingency maintaining the primary target behavior, however, resulted in the occurrence of one or more secondary target behaviors. Furthermore, secondary target behavior increased when followed by the reinforcer identified as maintaining the primary target behavior. This suggests that both primary and secondary target behaviors were members of the same response class.

Several problem behaviors may belong to the same response class and be hierarchically related so that the occurrence and reinforcement of one precludes or greatly reduces the probability of occurrence of another. Lalli et al., (1995) found that, when escape was contingent upon SIB, other response class members (screams and aggression) were observed to occur. However, when escape was delivered contingent upon screams, neither SIB nor aggression was observed to occur. As Baer (1982) stated, the probability of occurrence of functionally equivalent responses varies for each topography and is influenced by factors such as response effort, rate of reinforcement and history of reinforcement and punishment. Extinction procedures may be essential when problem behaviors are not produced during analog functional analysis procedures. Applying extinction to one or more topographies of problem behavior may result in the occurrence
of other response class members and allow assessment of reinforcers maintaining previously elusive response forms.

**Extinction Treatment: Main Effects**

The main effects of extinction were immediate decreases in the percentage of intervals per session during which that target behavior occurred. The decreases in out-of-seat and yelling for Kyle and destruction for Trey were characterized by the "wave-like" pattern described in the typical extinction curves observed in early research (Skinner, 1938). This pattern is most pronounced in Trey's destructive behavior and resembles the wave-like response curves obtained when the runway responses of rats were exposed to extinction (Miller & Stevenson, 1936).

Contrary to La Vigna and Donnellan's (1986) description of extinction effects as very gradual, decreases in both primary and secondary target responses occurred for both subjects in this study within the first 2 sessions of exposure to extinction. All observed target behaviors were reduced to zero or near zero levels in fewer than 15 10-min sessions. These outcomes are consistent with those reported by Repp et al. (1988) and Iwata et al. (1990). Therapeutic techniques described as extinction in early research were often applied topographically, without first assessing reinforcement contingencies. Our extinction treatment may have been more efficient than previous procedures because the maintaining contingency was first identified and then discontinued. Furthermore, extinction effects may have been enhanced by prior sessions of continuous reinforcement (Dubanoski & Weiner, 1978; Pittenger, Pavlik, Flora & Kontos, 1988). Ferster and Skinner (1957) found that exposure to intermittent schedules of reinforcement increased resistance to extinction and that extinction effects occurred much more rapidly following
a period of continuous reinforcement. The contrasting descriptions of extinction effects as gradual and ineffective or rapid and efficient may be the result of treatment applications following periods of exposure to very different schedules of reinforcement.

**Extinction Treatment: Side Effects**

Previous research has described extinction as being associated with an increase in emotional responses such as crying, pouting, fussing and complaining (Baumeister & Forehand, 1971; Rovee-Collier & Capatides, 1979; Sullivan et al., 1992). Although these behaviors did not occur in this study, Kyle did attempt to leave the classroom during both functional analysis (3 times) and extinction treatment procedures (2 times). Smith and Iwata (1997) suggested that emotional behaviors such as these are primarily operant in nature, and that certain stimuli (e.g., extinction of one response form) may evoke other response forms that belong to the same functional class. Attempting to leave the room may be a response that belongs to the class of escape behavior for Kyle. Crying, pouting, fussing, and complaining, however, may not have belonged to the class of escape-maintained behavior for Kyle and may not have belonged to the class of attention-maintained behavior for Trey.

The extinction burst has been described frequently as a common undesirable side effect of extinction procedures; however, target response bursts, as operationally defined by Lerman and Iwata (1995), occurred with only 3 of the 10 target behaviors. For both subjects, bursts occurred with the target behavior that was last to appear and be placed on extinction: aggression for Kyle and inappropriate touching for Trey. This finding may suggest that *all* members of the response class were undergoing extinction, and the lack of an alternative, substitutable response may have occasioned the burst. This contention
is supported by Lerman and Iwata's (1995) finding that the occurrence of bursts can be reduced substantially by implementing extinction in combination with other treatments such as differential reinforcement. This suggests that when the relevant reinforcer is available for alternate forms of responding, bursts are less likely. However, in this study, using extinction alone, bursts occurred during 2 or fewer sessions, caused no notable problems and occurrences immediately decreased to zero.

Increases in topographically dissimilar inappropriate responses have been referred to as extinction bursts. As previously noted, withholding reinforcement for each successively occurring target behavior was accompanied by increases in other (previous and subsequent) target behaviors. However, the increased occurrence of other topographies might be described more accurately as response covariation. Shukla and Albin (1996) state that behavioral escalation to more severe responses is common in clinical settings when less severe responses are placed on extinction, and they suggest that, "response covariation may account for at least some forms of behavioral escalation" (p. 568). In this study, secondary target behaviors (topographically dissimilar inappropriate responses) emerging subsequent to extinction treatment were maintained by the contingent delivery of escape (in Kyle's case) and attention (in Trey's case). Secondary target behavior occurrence decreased when contingent reinforcement delivery was discontinued. Again, this suggests that the variable response forms that occur during extinction may be members of an operant response class and that referring to the occurrence of topographically dissimilar responses as extinction induced variability may be an incomplete description.
Aggressive responding that occurs during extinction has been described as extinction-induced or elicited aggression (Ulrich & Azrin, 1962). Researchers have proposed that withholding reinforcement is aversive, and organisms tend to respond as if a painful or punishing stimulus had been delivered (Azrin et al., 1966). Extinction-induced aggression has been described by researchers as being most frequent at the beginning of extinction treatment (Thompson & Bloom, 1966; Todd et al., 1989). However, in the present study, aggression did not occur when extinction was initially introduced. In fact, for both subjects, aggressive responding occurred only after 10 successive sessions of primary target behavior extinction and then only after extinction had been applied to at least one secondary target behavior as well. Again, the increase in aggressive responding might be better described in terms of response-covariation. As a functionally equivalent response, the occurrence of aggression may be influenced by its history of reinforcement and associated response effort (Horner & Day, 1991; Horner, Sprague, O'Brien & Heathfield, 1990).

Finally, for Trey, what might be described as resurgence occurred for both yelling and aggression in session 29 of the extinction treatment phase. This side effect lasted only 1 session and occurrence (in percentage of intervals per session) returned to zero for the remaining sessions. Resurgence effects were not observed to occur with Kyle during extinction of any of the target behaviors.

Previous research has described the use of extinction in treating problem behavior in applied settings as inefficient and problematic with respect to side effects. The present study addresses some of these criticisms and concerns involving extinction-alone treatment and supports the results of previous studies of covariation within functional
response classes. Parrish et al. (1986) demonstrated changes in a variety of behaviors when one behavior was manipulated experimentally. As in the present study, results indicated that occurrences of the nontargeted behaviors varied inversely with the occurrences of the targeted behaviors when both reinforcement and extinction were applied. Sprague and Horner (1992) examined covariation of problem behaviors within a response class and found that when one response form was blocked one or more other problem behaviors increased. Response blocking has been used previously as an extinction treatment procedure and the results of its use in the Sprague and Horner experiment are similar to those in the present study. Lalli et al. (1995) used extinction to alter the order of occurrence of hierarchically related response class members. As in the present study, these authors found that applying the reinforcement contingency to earlier occurring topographies resulted in the nonoccurrence of subsequent topographies. Unlike the present study, however, these authors found that applying the reinforcement contingency to later responses resulted in the occurrence of all target topographies.

Results of the present study may have implications for the analysis of appropriate behavior. The current outcomes suggest that functionally equivalent inappropriate responses may occur when reinforcement is withheld for appropriate responses. That is, if appropriate behavior fails to produce reinforcement or does so only intermittently, maladaptive behavior may emerge. Behavioral escalation, the occurrence of more severe topographies such as destruction and aggression, may be hierarchically ordered, predictable and preventable by reinforcing appropriate or less severe target responses either continuously or intermittently. Outcomes of this study suggest areas for future
research identifying relationships between schedules of reinforcement, response cost, and punishment history and the emergence of topographically dissimilar responses.
APPENDIX A

INFORMED CONSENT FORM AND

APPROVAL OF THE INSTITUTIONAL REVIEW BOARD
CONSENT FORM

I hereby give consent for __________________________ to participate in the intervention program conducted by BATSS in a public elementary school in the Independent School District. No planned interventions are experimental in nature; all are based on empirically demonstrated and validated intervention procedures.

I give consent for the student to be videotaped to document any progress that occurs, and all documentation will be kept confidential and will be used solely for teacher training, data scoring, and progress tracking purposes. Video tapes remain the property of the __________________ Independent School District upon completion of the project.

The possible benefits of participation in the project include successful treatment of the student's problem behavior, learning new behavior, and placement in or being allowed to remain in a least restrictive learning environment. There are no anticipated risks to the student resulting from participation in the project.

I understand that I am free to ask any questions or express any concerns that I have about the intervention. I am free to withdraw consent, and this will have no effect on other services provided to this student.

This project has been reviewed and approved by the UNT Committee for The Protection of Human Subjects.

Signature of Legal Surrogate/Guardian (Date) Signature of Witness (Date)

Questions May Be Directed To:

Janet Ellis, Director-BATSS
Department of Behavior Analysis
University of North Texas
(940) 565-3318
APPENDIX B

FIGURES
Figure 1. Functional analysis results for each behavioral topography: Kyle. Blocks of four sessions include alone, attention, play, and demand conditions.
Figure 2. Functional analysis results for each behavioral topography: Trey. Blocks of four sessions include alone, attention, play and demand conditions.
Figure 3. Results of multiple baseline extinction treatment across behaviors: Kyle
Figure 4. Results of multiple baseline extinction treatment across behaviors: Trey
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