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Evaluation of Mand-Reinforcer Relations Following Long-Term Functional Communication Training

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Abstract

The investigators evaluated the relation between mands and positive reinforcement in the form of parent attention following long-term in-home treatment with functional communication training (FCT) for destructive behavior. Participants were 3 five-year-old children (2 boys, 1 girl) with developmental disabilities who manded to obtain different levels of parent attention (Phase 1). To determine whether the children's rate of manding would vary based on the amount of reinforcement received, the investigators adjusted the duration of parent attention (12 s vs. 30 s) provided to each child for manding on an FR1 schedule (Phase 2) using a reversal design. All 3 children changed their rates of manding so that each child maintained consistent levels of reinforcement across Phase 2 conditions.

Keywords

destructive behavior; functional communication training; motivation operations

Introduction

Functional communication training (FCT) is a treatment for destructive (e.g., self-injurious, aggressive) and other problem behavior and is composed of two steps: (a) identifying the function (maintaining reinforcer) of destructive behavior via procedures such as a functional analysis (Iwata, Dorsey, Slifer Bauman, & Richman, 1982/1994), and (b) teaching the client to mand for (i.e., appropriately request) the same reinforcer that was identified in the functional analysis (Durand & Carr, 1985). If the client obtains reinforcement for manding but not for destructive behavior, manding should increase and destructive behavior should decrease over the course of treatment.

A number of investigators have reported FCT to be an effective treatment for destructive behavior (Arndorfer, Miltenberger, Woster, Rortvedt, & Gaffaney, 1994; Carr & Durand, 1985; Derby et al., 1997; Durand & Carr, 1992; Fisher et al., 1993; Wacker et al., 1990; Wacker et al., 1998; Wacker et al., 2005). Collectively, these and other studies have demonstrated that FCT can have both initial and long-term effects in reducing rates of destructive behavior.

Although several operant mechanisms likely underlie the success of FCT in reducing destructive behavior (e.g., Hanley, Piazza, Fisher, Contrucci, & Maglieri, 1997; Kahng, DeLeon, & Worsdell, 1997), one mechanism may be motivating operations. Motivating operations refer to conditions that influence the value of a reinforcer (Laraway, Syncerski, Michael, & Poling, 2003; Michael, 1982). For example, Berg et al. (2000) evaluated the effects of preceding a diverted attention condition with either high or low levels of adult attention with a young boy who engaged in self-injury. Results showed that the child engaged in low levels of self-injury when the diverted attention condition followed 5 min of free play with an adult. In contrast, self-injury increased when the diverted attention condition followed a 5-min alone condition in which an adult was not present. These results suggested that the absence of attention during the alone condition (adult absent) may have increased the value of attention during the subsequent diverted attention condition (adult present).

During FCT, if the client mands independently and manding is on an FR 1 schedule, then the client can respond quickly to momentary states of deprivation or satiation. Wacker et al. (1990) showed that more consistent reductions in destructive behavior occurred with FCT than with a differential reinforcement of other behavior (DRO) procedure that was matched to FCT relative to amounts of reinforcement. Even when comparable amounts of reinforcement were provided and punishment or extinction for destructive behavior was in place for both FCT and DRO, mild but persistent increases in destructive behavior emerged with DRO.

The probability that an individual will emit a manding response as an alternative to destructive behavior may be influenced by dimensions of reinforcement, which include amount of reinforcement, quality of reinforcement, immediacy of reinforcement, and relative response effort (Mace & Roberts, 1993). For example, Peck et al. (1996) trained children to emit two similar mands to gain reinforcement. Following training, the two manding responses received different amounts and quality of reinforcement within concurrent schedules and reversal designs. Allocation of responding to one mand over the other was shown to be related to the amount and quality of reinforcement produced by each mand. Thus, the children selected the mand that produced the greater amount and quality of reinforcement.

Although the results of Peck et al. (1996) and Wacker et al. (1990) suggested that mand selection or the frequency of manding was related to dimensions of reinforcement, neither study provided a direct analysis of whether children's rates of manding varied as a function of amount of reinforcement received. Wacker et al. showed that control over the delivery of reinforcement might be an important variable for reducing destructive behavior, and Peck et al. showed that amount and quality of reinforcement were related to mand selection. A next logical step is to show that (a) children's rates of manding would vary as a function of duration of reinforcement and (b) overall levels of reinforcement would be individualistic across children.

In the current study, we replicated and extended previous findings by comparing the participants' rates of manding as a function of different durations of reinforcement and the levels of reinforcement obtained during baseline and analysis of attention sessions. All sessions were conducted following long-term treatment with FCT that reduced destructive behavior for 3 children. Because destructive behavior rarely occurred during follow-up treatment probes, we first conducted a functional analysis of manding to show that parent attention was a reinforcer for each child. We then altered the duration of reinforcement (12 s or 30 s) received via manding to determine whether rates of manding would change in relation to duration of reinforcement and whether the overall levels of reinforcement obtained via manding would remain relatively stable for each child across sessions but would vary across children. If the rate of manding changed to produce a stable level of reinforcement for each child, this would suggest that manding functioned to control the overall amount of reinforcement received and

would provide further support for the effectiveness of FCT in addressing momentary states of deprivation for a given reinforcer such as parent attention.

Method

Participants and Settings

Three children who participated in a federally funded research project (Wacker & Berg, 1992) were selected for this study. The children had been referred to the project for destructive behavior that occurred in the context of task demands. A minimum of 5 months of FCT to gain assistance with task demands (e.g., “Mom, help me”) had been provided to each child by their parents in their homes, with weekly follow-up treatment probes conducted by project staff. Follow-up probes had shown at least a 90% decrease in destructive behavior from baseline levels for all 3 children.

Rob was 5 years 2 months old at the beginning this study and was diagnosed with fragile X syndrome, pervasive developmental disorder, and mental retardation. Rob's vocal communication typically consisted of single words and two-word phrases that consisted of both tacts (labels) and mands. The current investigation was initiated with Rob after 5 months of follow-up treatment probes. The FCT treatment data for escape-maintained behavior for Rob were previously published in a book chapter (Wacker, Berg, & Harding, 2002).

Susan, who was 5 years 5 months old, was diagnosed with autism and developmental delays. The current investigation was initiated with Susan after 8 months of follow-up treatment probes. Kyle was 5 years 4 months old and was diagnosed with oppositional defiant disorder. The current investigation was initiated with Kyle after 5 months of follow-up treatment probes. Both Susan and Kyle could communicate vocally using complete sentences.

All 3 children attended early childhood special education programs in their respective communities. All procedures were conducted in the living rooms of the children's homes and were videotaped for subsequent data coding and analysis. The children's mothers conducted all procedures with coaching by an investigator.

Materials

All 3 children had access to preferred toys during all conditions based on both parent report and a preference assessment (Windsor, Piché, & Locke, 1994). Preferred items for Rob were books, a school bus, and toy figures. Preferred items for Susan were blocks, books, cards, and a board game. Preferred items for Kyle were markers, paper, and coloring/activity books.

Response Definitions

A 6-s partial-interval recording system was used to measure child and parent behaviors. Two categories of child behavior were recorded. *Destructive behaviors* were defined as self-injury (e.g., head biting, head banging), aggression (e.g., hitting, kicking), and property destruction (e.g., throwing toys). *Independent mands* were defined as appropriate vocal requests for parent attention and included the verbalizations “please” and “Mom.” One category of parent behavior, *parent attention*, was recorded and included verbalizations (e.g., praise), physical affection, and concurrent physical contact with an item (e.g., both parent and child holding a book).

Data Collection and Interobserver Agreement

Trained data collectors independently scored the occurrence of child destructive behavior and parent attention from videotapes using a 6-s partial-interval recording system. Interobserver agreement on the occurrence of behavior was calculated based on exact interval-by-interval

comparisons in which the number of agreements was divided by the number of agreements plus disagreements and multiplied by 100. Interobserver occurrence agreement data for child behavior was assessed for an average of 44% of sessions across all children (Rob, 43%; Susan, 50%; Kyle, 40%) and ranged from 90% to 100%, with a mean of 95%. Interobserver occurrence agreement for parent behavior was assessed for an average of 45% of sessions across all parents (Rob's, 46%; Susan's, 49%; Kyle's, 40%) and ranged from 91% to 100%, with a mean of 99%. Independent mands were recorded using an exact frequency count recorded within each 6-s interval. To calculate the rate of manding, we divided the total number of mands recorded in each interval by the number of minutes within a session. Interobserver agreement on the occurrence of manding was calculated based on exact interval-by-interval comparisons in which the number of agreements on the occurrence of manding within each interval was divided by the number of agreements plus disagreements and multiplied by 100. Interobserver occurrence agreement data for manding ranged from 50% (one session with a very low rate of mands) to 100%, with a mean of 97%.

Experimental Design

The study was conducted in two phases. During Phase 1, analysis of manding, we assessed the children's rate of independent manding per minute across two conditions: (a) free play (control), in which parent attention was continuous and not contingent on manding; and (b) attention, in which the child was required to mand to obtain 30 s (continuous attention across five intervals) of parent attention. The purposes of this analysis were to determine whether parent attention functioned as a reinforcer for manding and to evaluate the overall levels of attention obtained via manding. A multielement design was used to evaluate child responding across conditions. Conditions were counterbalanced across assessment sessions.

During Phase 2, analysis of attention, we assessed the rate of independent manding per minute across two conditions that altered the duration of parent attention provided for manding. The purpose of this analysis was to evaluate the relation of rate of manding to overall amount of reinforcement for each child. During Condition 1 (FCT 30), the child received 30 s of parent attention contingent on appropriate manding. During Condition 2 (FCT 12), the child received 12 s (continuous attention across two intervals or approximately 33% of the attention received in Condition 1) of parent attention contingent on appropriate manding. A reversal design was used to evaluate child responding across these two conditions.

Procedure

Phase 1: Analysis of manding—During the free-play (control) condition, the parent gave the child noncontingent access to preferred toys, provided continuous attention, ignored minor inappropriate behavior, and blocked any potentially destructive behavior. During the attention condition, the child was given noncontingent access to preferred toys and activities, and parent attention was contingent on manding. The parent ignored minor inappropriate behavior and blocked any potentially destructive behavior. At the beginning of each attention session, the parent told the child, “If you want me to play, say ____” (“Please” for Rob and “Mom” for Susan and Kyle). Each time the child emitted the appropriate mand, the parent interacted with the child for 30 s. The investigator timed the length of parent interaction using a digital timer on the video camera view screen and cued the parent when 30 s had elapsed. If the child emitted an additional mand before the 30-s period had elapsed, the investigator started timing a new 30-s interval, and parent attention continued until the new 30-s period had elapsed. If the child did not mand after 1 min had elapsed, the child was reminded by the parent how to obtain attention. Conditions during the analysis were counterbalanced across sessions. Sessions for each child lasted for 5 min and were conducted across 2 or 3 days.

Phase 2: Analysis of attention—Two duration of attention conditions, FCT 30 and FCT 12, were evaluated within a reversal design. Both conditions were conducted in a manner similar to the attention condition described for Phase 1 except for the duration of parent attention during the FCT 12 condition. In this condition, the parent was cued by the investigator to provide 12 s of attention for appropriate manding. All sessions lasted 5 min and were conducted over 3 to 9 days.

Results

Individual results are displayed in Figures 1 (Rob), 2 (Susan), and 3 (Kyle). The top left panel of each figure shows the rate of independent manding per minute during the analysis of manding (Phase 1). The remaining top panels show the rate of independent manding per minute (Phase 2) during the FCT 30-s and FCT 12-s analysis of attention conditions. The bottom panels of each figure show the percentage of intervals of parent attention delivered (shaded bars) and the percentage of intervals of child destructive behavior (open diamonds) displayed during each session.

Rob

Figure 1 shows the results of Rob's analysis. The analysis of manding (top left panel) shows that Rob manded during the contingent attention condition only. The bottom left panel shows that Rob requested less parent attention during the attention condition (range = 76% to 78%; $M = 77\%$) than he received during the free-play condition ($M = 96\%$ across sessions) in which parent attention was noncontingent. These results show that Rob's manding was sensitive to the presence or absence of parent attention. Destructive behavior during this analysis consisted of finger biting. The relatively high percentage of finger biting that occurred during the first free-play session was unexpected and decreased to zero or near-zero occurrences during the remaining sessions.

The duration of attention analysis (top panel) shows that Rob's rate of manding increased substantially during the FCT 12 condition relative to the FCT 30 condition. The bottom panel shows that parent attention ranged from 73% to 100% during the FCT 12 condition ($M = 92\%$) and 62% to 94% during the FCT 30 condition ($M = 81\%$). These results show that Rob maintained similar levels of parent attention across the two conditions by adjusting his rate of manding. Low levels of destructive behavior occurred during Sessions 17 (2%) and 19 (6%).

Susan

Figure 2 shows the results of Susan's analysis. The analysis of manding (top left panel) shows that Susan manded across both conditions, but her rate of manding was higher during the attention condition. The bottom left panel shows that Susan requested less parent attention during the attention condition (range = 58% to 94%; $M = 79\%$) than she received during the free-play condition (range = 96% to 100%; $M = 96\%$) in which attention was noncontingent. These results show that Susan's manding was sensitive to the presence or absence of parent attention. No destructive behavior occurred during this analysis.

The duration of attention analysis results (top panel) were similar to those obtained for Rob and show that Susan's rate of manding increased during the FCT 12 condition relative to the FCT 30 condition. The bottom panel shows that parent attention ranged from 42% to 76% during the FCT 12 condition ($M = 62\%$) and from 62% to 96% during the FCT 30 condition ($M = 75\%$). These results show that Susan maintained similar levels of parent attention across both conditions by adjusting her rate of manding and that she requested lower levels of attention than Rob. Destructive behavior remained at 0% across all sessions.

Kyle

Figure 3 shows the results of Kyle's analyses. The analysis of manding (top left panel) shows that Kyle manded across both conditions, but his rate of manding was slightly higher during the attention condition. Kyle manded at a relatively low rate during the attention condition because he often engaged in independent play before he manded for his mother's attention. The bottom left panel shows that Kyle requested substantially less parent attention during the attention condition (range = 14% to 40%; $M = 28\%$) than he received during the free-play condition (range = 86% to 96%; $M = 91\%$). These results show that Kyle's manding was sensitive to the presence or absence of parent attention. No destructive behavior occurred during this analysis.

The duration of attention analysis (top panel) shows that Kyle's rate of manding increased during the FCT 12 condition relative to the FCT 30 condition. The bottom panel shows that parent attention ranged from 22% to 38% during the FCT 12 condition ($M = 30\%$) and from 8% to 28% during the FCT 30 condition ($M = 18\%$). These results show that Kyle maintained similar levels of parent attention across both conditions by adjusting his rate of manding. In addition, Kyle requested substantially lower levels of attention than either Rob or Susan. Destructive behavior remained at 0% across all sessions.

The results show that all 3 children adjusted their rates of manding relative to the amount of reinforcement they received. Rob requested high levels of attention, Susan requested moderate levels of attention, and Kyle requested low levels of attention. The levels of attention obtained via manding by each child remained relatively stable throughout the evaluation. These results appear to support the supposition that independent manding functioned, at least in part, to regulate the amount of attention received, which was individualized across the 3 children.

Discussion

If the motivation to emit mands during FCT is related to momentary states of deprivation, then rates of manding should vary based on the amount of reinforcement received. We tested this supposition with 3 children who displayed different rates of manding for attention during Phase 1. All 3 children showed changes in their rates of manding when reinforcement was received for 12 s versus 30 s. Of equal importance, changes in rates of manding resulted in relatively stable amounts of attention for each child. These results support a motivating operations hypothesis (Laraway et al., 2003; Michael, 1983), given that each child obtained individualized levels of attention that were maintained by changes in their rates of manding.

The results of the current study showed that the participants did not mand at rates that resulted in the maximum amount of attention that was available to them but instead manded at rates that resulted in comparable levels of attention across the two attention conditions (FCT 12-s vs. FCT 30-s). These results suggested that preferred levels of reinforcement during maintenance may vary individually and be lower than the maximum amount available.

Future researchers may wish to establish baseline levels of consumption of reinforcement when the reinforcer is freely available prior to evaluating the effects of different schedule arrangements. In the current study, we used the occurrence of independent mands to establish baseline levels of reinforcement consumption and conducted free-play conditions with continuous attention as a control condition. Each participant manded at rates that resulted in less adult attention than the amount received during the free-play condition. Of interest was that the participants consumed similar amounts of reinforcement during the subsequent 12-s and 30-s duration of attention conditions even though this required changes in their rates of manding.

Although studies such as Wacker et al. (1998) showed the long-term effectiveness of treatment, they did not increase our understanding of why maintenance occurs during FCT. Methodologies are needed that isolate the active variables responsible for maintenance of FCT. Evaluations of the interaction of treatment components and amounts of reinforcement may further our understanding of how treatments produce durable effects. Future researchers may wish to establish the average (baseline) rate of manding following treatment on a fixed-time reinforcement schedule and then provide reinforcement on parametrically defined lean or dense schedules to more directly test the relation between amounts of reinforcement and displays of problem behavior.

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Figure 1. Top panel shows rate of manding and bottom panel shows percentage of intervals of destructive behavior (open diamond) and parent attention (shaded bars) across duration of attention conditions for Rob

Figure 2. Top panel shows rate of manding and bottom panel shows percentage of intervals of destructive behavior (open diamond) and parent attention (shaded bars) across duration of attention conditions for Susan

Figure 3. Top panel shows rate of manding and bottom panel shows percentage of intervals of destructive behavior (open diamond) and parent attention (shaded bars) across duration of attention conditions for Kyle