JOURNAL OF APPLIED BEHAVIOR ANALYSIS 2004, **37,** 239–242 NUMBER 2 (SUMMER 2004)

# *OBTAINED VERSUS PROGRAMMED REINFORCEMENT: PRACTICAL CONSIDERATIONS IN THE TREATMENT OF ESCAPE-REINFORCED AGGRESSION*

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This investigation provides a preliminary examination of the difference between programmed and obtained reinforcement rates and its potential influence during treatment of aggression in a natural setting. Following a functional analysis that suggested that the aggression of a boy with autism was negatively reinforced, intervention was implemented by the boy's mother. Concurrent fixed-ratio (FR) 1 FR 1 schedules of escape were arranged for manding and aggression. When mands failed to compete effectively with aggression, obtained reinforcement ratios were calculated; these indicated that obtained reinforcement varied from the programmed schedule for aggression but not for mands. Increasing the rate of prompts for mands resulted in an increase in mands and a decrease in aggression to near-zero levels.

DESCRIPTORS: concurrent schedules, functional communication training, obtained reinforcement, response allocation

One issue applied researchers face in conducting experimental analyses is the difference between the level of experimental control achievable in the laboratory and natural settings. To illustrate, in an operant chamber, given a simple fixed-ratio (FR) schedule of reinforcement, the rates of programmed and obtained reinforcement coincide. By contrast, applied researchers frequently report a specific programmed reinforcement schedule (e.g., FR 1), but the actual ratio of obtained reinforcement is most often unknown. Undetected differences between programmed and obtained rates of reinforcement could potentially introduce unexpected variability in the data or unexplained effects. For example, the findings of a number of applied studies suggest that when concurrent FR 1 FR 1 reinforcement schedules are arranged, problem behavior is more likely to occur than an appropriate alternative response (DeLeon, Fisher, Herman, & Crosland, 2000; Shirley, Iwata, Kahng, Mazaleski, & Lerman, 1997; Worsdell, Iwata, Hanley, Thompson, & Kahng, 2000). This apparent response bias might be accounted for by reinforcement history (DeLeon et al., 2000). Another plausible explanation is that the obtained rates of reinforcement in these studies did not match the programmed schedules. Only a small handful of applied studies have reported the percentage of reinforcement obtained (e.g., Hanley, Iwata, & Thompson, 2001; Neef, Mace, Shea, & Shade, 1992), and none have examined the correspondence between programmed and obtained ratios of reinforcement. In this study we inspected differences between programmed and obtained reinforcement for aggression and an appropriate alternative response (manding) when concurrent FR 1 FR 1 schedules were arranged for the two responses.

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## METHOD

### *Participant and Setting*

Abe was an 11-year-old boy with autism and no vocal speech who displayed aggres-

sion toward his mother and infant brother. Abe's mother conducted two to four sessions per day (2 days per week) in the living room of their home.

*Data Collection*

All sessions were videotaped and lasted 5 min. Event data were recorded using a frequency-within-10-s-interval system for aggression and mands. *Aggression* was defined as hitting with an open hand or fist, kicking, pinching, biting, or pulling hair. *Mands* were defined as picking up a picture card with the word "break" written on it (the break card) and placing it in his mother's hand. Rates of aggression and mands were calculated separately by dividing the number of occurrences by 5 min. Data on independent variables including prompts to use the break card (mand prompts), and the presence or absence of Abe's mother and brother were also recorded within the 10-s intervals. The ratio of obtained reinforcement was calculated for each session by dividing the number of Abe's responses by the number of times reinforcement was delivered for that response. A second observer independently scored 11 (33%) of the sessions. Exact agreement within 10-s intervals was calculated for all dependent and independent variables across all sessions and averaged of 92% (range, 67% to 100%) across all variables.

*Experimental Design and Conditions*

A functional analysis was first conducted to evaluate the influence of positive and negative reinforcement on aggression (data available from the first author on request). Results indicated that Abe's aggression was maintained by negative reinforcement in the form of his mother picking up Abe's infant brother and leaving the living room (the typical consequence during nonexperimental time). Following the functional analysis, a functional communication training intervention was designed to teach Abe to request a break from his mother and brother. Due to the danger of injury to the infant, extinction was not a viable treatment component. Instead, a concurrent FR 1 FR 1 schedule was arranged to produce 30 s of negative reinforcement for aggression or mands. Treatment effects were evaluated in an ABCACAC reversal design.

In Phase A, negative reinforcement was arranged on an FR 1 30-s schedule for aggression. In Phase B, the break card was introduced and concurrent FR 1 FR 1 schedules of 30-s escape were programmed for aggression and mands. In each session of Phase B, experimenters instructed Abe's mother to deliver a verbal prompt to Abe (e.g., "Give me the break card if you want us to leave") at the beginning of the session and then about once per minute during the 5 min session. Analysis of the data indicated that she prompted Abe approximately every 75 s (variable-time 75 s) in Phase B. Phase C was identical to B except that Abe's mother was instructed to deliver prompts more frequently (FT 10 s). Following the conclusion of this investigation, Abe participated in a published project designed to increase the amount of time he would spend near his mother and brother (Hoch, McComas, Johnson, Faranda, & Guenther, 2002).

## RESULTS AND DISCUSSION

Figure 1 shows the rates of aggression and mands across phases. In Phase A, aggression occurred at variable rates ($M$ = 0.7 responses per minute). In Phase B, when mand prompts were delivered approximately every 75 s, aggression continued to occur at variable rates ($M$ = 1.1) and mands occurred at a relatively lower rate ($M$ = 0.3). In Phase C, when a denser schedule of prompts was introduced (FT 10 s), aggression dropped ($M$ = 0.1) and mands increased ($M$ = 1.2). This pattern was replicated in the subsequent ACAC reversal.

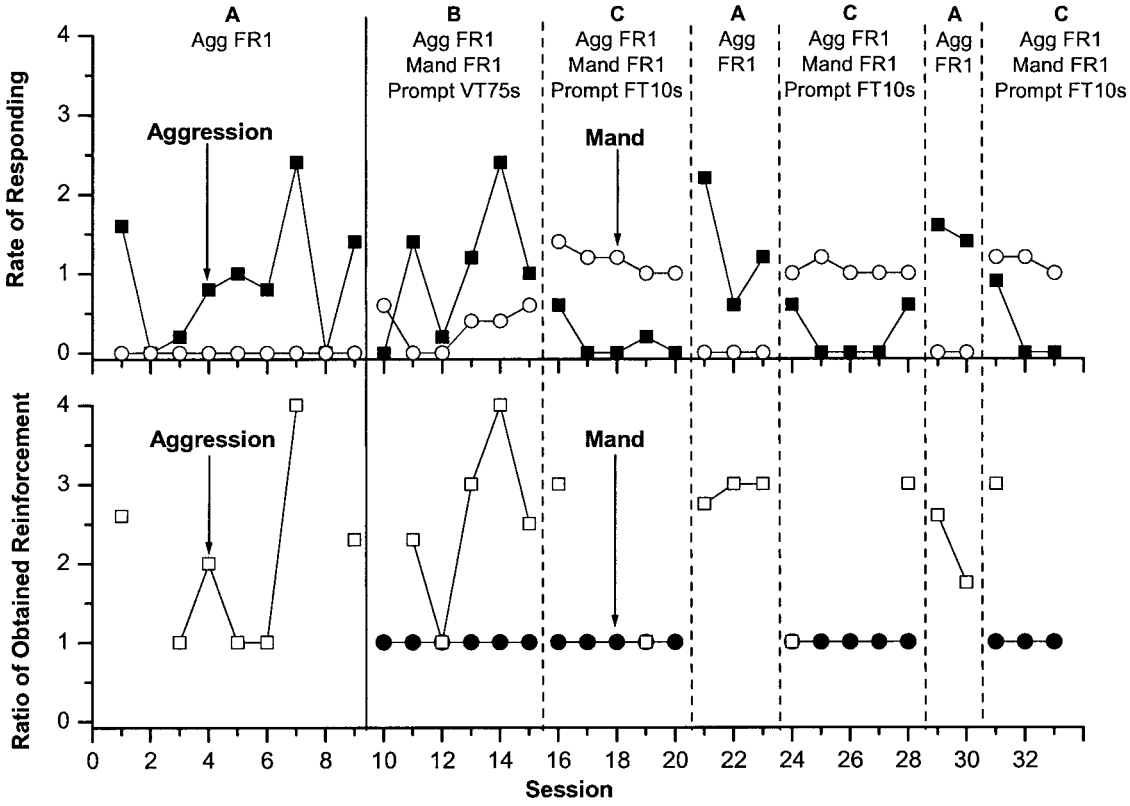


Figure 1. Responses per minute of aggression (filled squares) and mands (open circles) in the top panel and ratio of obtained reinforcers for aggression (open squares) and mands (filled circles) in the bottom panel. In Sessions 18, 20, 25, 26, 28, and 32, following the first mand prompt, virtually all of the mands were independent. Ratio of obtained reinforcement was calculated by dividing the number of responses (aggression or mands) by the number of times reinforcement was delivered for that response in each session. For sessions in which no responses occurred (e.g., no aggression occurred in Session 2), no data point is presented for obtained reinforcement in the bottom panel.

Figure 1 also shows the ratios of obtained reinforcement for aggression and mands. In the first Phase A, the ratio of obtained reinforcement for aggression was variable-ratio (VR) 2.0. In Phase B, obtained reinforcement rates for aggression and mands were VR 2.6 and FR 1, respectively. In Phase C the obtained reinforcement rates for aggression and mands were VR 2.0 and FR 1, respectively. This pattern was replicated in the subsequent ACAC reversal.

The observed differences between the rates of programmed and obtained reinforcement for the two responses were probably due to the fact that aggression was a free operant whereas the topography of mands in Abe's repertoire was not a free operant. Specifically, after Abe handed his mother the card, mands could not occur again (because his mother was holding the communication card) until after the reinforcer (30 s of escape) was delivered. By contrast, Abe frequently displayed multiple aggressive responses (until his mother was out of reach), even though only one response was necessary to produce 30 s of escape. Increasing the rate of prompts for manding increased that response and decreased aggression. It should be noted that in Phase C sessions in which aggression occurred (Sessions 16, 19, 24, 28, and 31), the obtained reinforcement ratios remained higher for aggression than for

manding. That is, the treatment reduced aggression to zero in most sessions, but when aggression occurred, several aggressive responses often occurred for each reinforcement delivery, indicating that the discrepancy between programmed and obtained reinforcement remained despite the apparent treatment fidelity and effectiveness of the intervention.

These data provide a preliminary indication that in natural settings, despite programming for equivalent schedules of reinforcement, there may be differences in actual obtained rates of reinforcement that may influence the occurrence of behavior. In addition, manipulation of antecedents, such as frequency of prompts, may hold promise for biasing responding when the complexities of the natural setting preclude obtained reinforcement from matching the programmed schedule.

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*Received June 13, 2003*
*Final acceptance February 18, 2004*
*Action Editor, Wayne Fisher*