EVALUATION OF THE UTILITY OF A DISCRETE-TRIAL FUNCTIONAL ANALYSIS IN EARLY INTERVENTION CLASSROOMS

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We evaluated a discrete-trial functional analysis implemented by regular classroom staff in a classroom setting. The results suggest that the discrete-trial functional analysis identified a social function for each participant and may require fewer staff than standard functional analysis procedures.

Key words: autism, discrete trials, early intervention, functional analysis

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A functional analysis (FA) identifies specific environmental variables that maintain problem behavior. Interventions based on the results of an FA are more effective than arbitrarily selected treatments (Hanley, Iwata, & McCord, 2003). Despite the important contributions of FA to the identification of function-based interventions, FA procedures may be underused in a variety of natural settings (e.g., a classroom) because they typically require (a) at least two adults to conduct the procedures and collect data and (b) an extended period of time to complete the analysis.

To address these challenges, researchers have developed modified FA methods (e.g., Bloom, Iwata, Fritz, Roscoe, & Carreau, 2011). For example, Bloom et al. (2011) evaluated a trial-based FA (TBFA) during which the experimenters implemented test trials when the classroom activity closely matched the procedures associated with the trial. The results indicated that the outcomes of the TBFA matched the results of a standard FA for the majority of participants. Although the procedures developed by Bloom et al. have a number of advantages relative to a standard FA, potential disadvantages may limit the use of TBFA in naturalistic settings. For example, trial-based (and standard) FAs require two and sometimes three (when reliability is assessed) trained adults to be available simultaneously several times per day to conduct the procedures and collect data. For example, in Berg et al. (2007), teacher associates were required to assist with other students in the classroom while the teacher conducted a standard FA and experimenters collected data. In natural settings, the availability of highly trained people to conduct an assessment with one child may be rare. In addition, it may be challenging for classroom staff to identify appropriate instances in which test conditions fit into ongoing activities. Although TBFA may be conducted more easily in classroom settings because each trial is relatively brief (e.g., 2 min in Bloom et al., 2011), shortening the trials further may be advantageous. Therefore, additional research on the feasibility of implementing trial-based procedures to assess behavioral function in natural settings is warranted.

The purpose of the present study was to evaluate a discrete-trial FA procedure that (a) alternated between 30-s test and control trials within the same session, (b) required only one person to conduct the procedures and collect data on the target behavior (or two when reliability was assessed), and (c) was conducted in a classroom setting by routine staff who typically worked with the participants in that setting.

METHOD

Participants and Setting

Five children who had been diagnosed with autism participated. Wade was a 4-year-old boy who exhibited inappropriate vocalizations (i.e., screaming) that disrupted activities in the classroom. Jonah was a 7-year-old boy who exhibited hand-to-body contact that interfered with engagement in social and academic activities. Sebastian, Graham, and Hannah were 9, 5, and 5 years old, respectively; each engaged in aggression. Participants received services in a university-based early intervention program or elementary school setting. Sessions were conducted in either a large university-based classroom or a self-contained elementary school classroom 2 to 5 days per week. Items present in the classrooms during sessions included desks, chairs, relevant session materials, and a variety of academic and leisure materials typically found in classroom settings (e.g., books, toys). No programmed group-based instruction occurred during sessions, although other children were present in the classroom.

The classroom staff (hereafter referred to as therapists) consisted of individuals who delivered early intervention services to participants during scheduled appointments or provided instruction to students in a self-contained classroom. One therapist was enrolled at the time in an undergraduate training program, three therapists had obtained a bachelor's degree in psychology,

and one therapist had obtained a master's degree in behavior analysis. Two therapists had prior experience conducting analogue FAs. Prior to sessions, therapists reviewed protocols, asked questions, and received brief supervised practice implementing session procedures (for the therapists who did not have prior related experience).

Response Measurement and Interobserver Agreement

The primary dependent measure was the percentage of 30-s trials during which participants engaged in problem behavior. Problem behavior included aggression (Sebastian, Graham, and Hannah; defined as an open hand, closed fist, or foot making contact with another person's body from a distance of 6 in. or more), inappropriate vocalizations (Wade; defined as any vocalization that was not associated with the activity and above conversational level), hand-to-body contact (Jonah; defined as contact between an open hand or closed fist and any part of the body from a distance of 1 in. or more, excluding functional contact such as covering the mouth while coughing), or disruption (defined as swiping or throwing materials off a surface without being instructed to do so). We converted problem behavior to a percentage measure (i.e., percentage of trials) by dividing the number of trials in a session in which problem behavior occurred by the total number of trials in the session, and then converting the proportion to a percentage.

A second observer collected interobserver agreement during at least 25% (range, 28% to 100%) of all sessions across conditions of the discrete-trial FA. We calculated interobserver agreement using the trial-by-trial method (i.e., the number of trials with an agreement divided by the total number of trials, converted to a percentage). Mean agreement scores for Wade, Jonah, Sebastian, Graham, and Hannah were 100%, 96% (range, 85% to 100%), 100%, 100%, and 96% (range, 80% to 100%), respectively.

Preference Assessment

The therapist conducted a multiple-stimulus-without-replacement (MSWO) preference assessment prior to the discrete-trial FA (Carr, Nicolson, & Higbee, 2000). We included the most preferred item from the MSWO in tangible test trials, the second most preferred items in the control trials, and the item selected last during the MSWO in the attention test trials.

Discrete-Trial Functional Analysis

All sessions lasted approximately 10 min. Sessions including brief pretrial access to a tangible item or attention resulted in slightly longer session durations. Sessions included 20 30-s trials (10 test trials and 10 control trials). The therapist semirandomly rotated between test and control trials in each session, with no more than two trials of the same type conducted consecutively. A pairwise design was used to evaluate the effects of each condition of the discrete-trial FA on problem behavior. However, instead of alternating between test and control sessions within a phase, each session included both test and control trials, which were graphed separately for each session. We also conducted reversals of selected conditions with several of our participants to verify the results of the discrete-trial FA.

The criterion for moving to the next phase in the assessment was either (a) differentiation in levels of problem behavior between test and control trials during the last two sessions of the phase or (b) at least three sessions with similar levels of problem behavior across test and control trials. The staff supervisor assisted therapists in determining whether a participant's data met the criterion for advancing to the next phase of the assessment. The therapist conducted demand and attention test trials with each participant. We included tangible trials in the discrete-trial FA only if the participant's parents or teacher reported that problem behavior occurred following restriction of preferred items.

Attention test trials. The participant had access to a low-preference toy, and the therapist provided 5 s of attention prior to each attention trial. After 5 s elapsed, the therapist withdrew attention and told the participant that he or she was busy. Contingent on the occurrence of problem behavior, the therapist delivered attention (e.g., statements of concern and reprimands) for the remainder of the 30-s trial. For example, if problem behavior occurred in the first 25 s of the trial, the therapist delivered attention for the remaining 5 s of the 30-s trial.

Demand test trials. The therapist delivered an instruction (e.g., point to the animal) at the beginning of the 30-s trial. Iinstructions were selected based on the participant's current academic treatment goals; a least-to-most prompting hierarchy (i.e., verbal, model, physical prompt) was used during trials. Contingent on compliance during the prompting sequence, the therapist delivered praise and presented the next instruction. The therapist continued to present instructions until either the 30-s trial elapsed or problem behavior occurred. Contingent on problem behavior during the prompting sequence, the therapist withdrew materials and provided a break for the remainder of the 30-s trial. The trial ended after 30 s, regardless of whether the child complied with a demand or the therapist completed the prompting hierarchy.

Tangible test trials (Wade, Jonah, Sebastian, and Hannah). The participant had access to his or her most preferred toy for 5 s prior to the test trial. The therapist initiated the trial by removing the toy and turning away from the participant. Contingent on problem behavior, the therapist returned the toy to the participant for the remainder of the trial but did not interact with him or her during the reinforcement interval.

Control trials. The therapist provided continuous attention, did not place any demands on the participant, and provided the participant with access to his or her second most preferred toy. No differential consequences were provided for problem behavior.
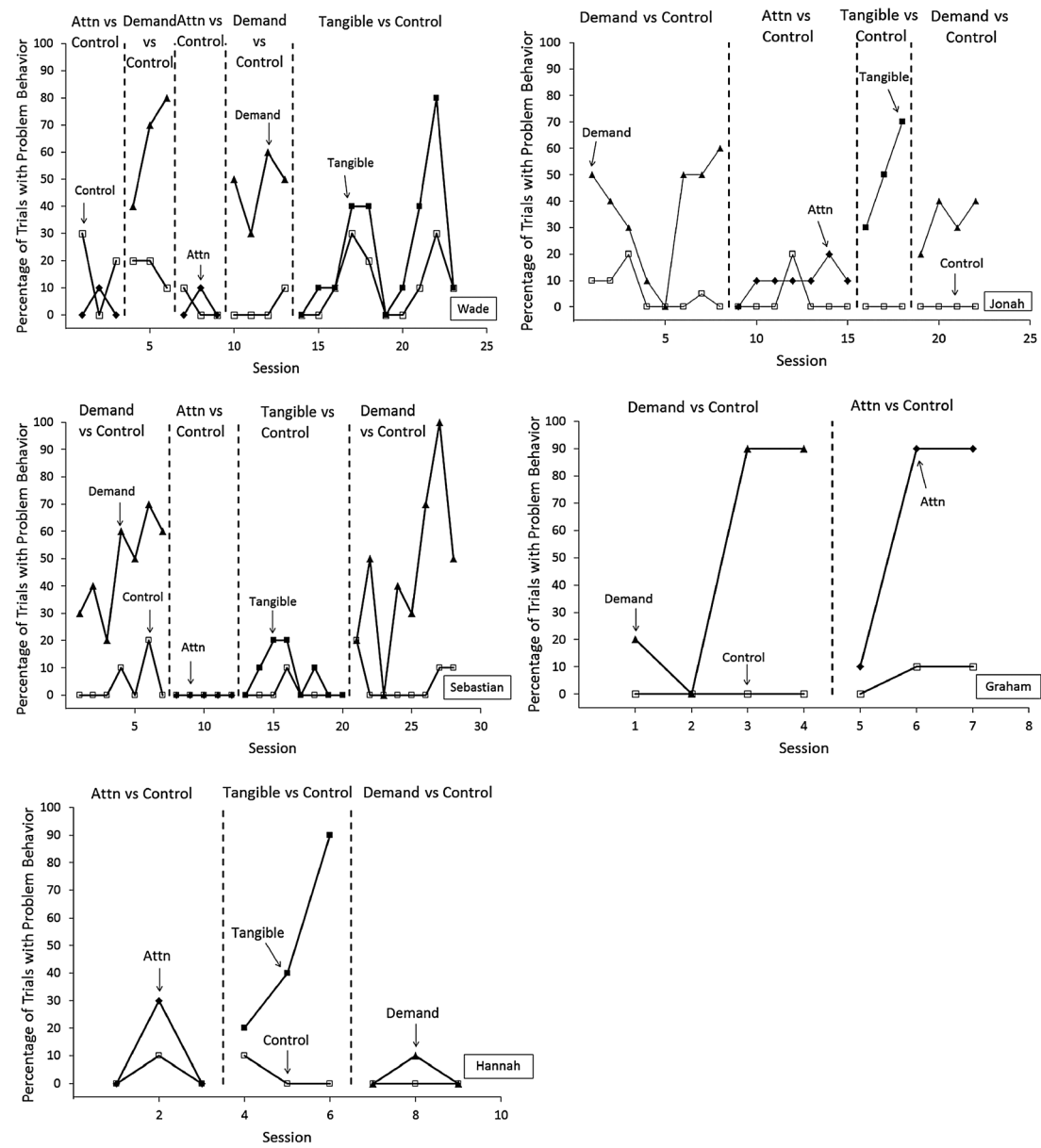
Figure 1.   Percentage of trials with problem behavior during the functional analysis for Wade (left top), Sebastian (left middle), Hannah (left bottom), Jonah (right top), and Graham (right bottom). Attn = attention.

RESULTS AND DISCUSSION

Figure 1 displays the results of each participant's discrete-trial FA. Wade engaged in high levels of problem behavior during demand and tangible trials, although there was a high degree of overlap in problem behavior during tangible and control trials in the last phase. Thus, results suggested that Wade's inappropriate vocalizations were maintained by escape from demands. Jonah displayed the highest levels of hand-to-body contact in the demand and tangible trials, with

low levels of problem behavior in attention and control trials. These results indicated that Jonah's problem behavior was maintained by escape from demands and access to tangible items. Sebastian's aggression occurred most often during demand trials and rarely occurred in other types of trials. Thus, results suggested that Sebastian's aggression was maintained by escape from demands. Graham's aggression occurred most often during demand and attention test trials, suggesting that his problem behavior was maintained by escape from demands and access to adult attention. Hannah displayed high levels of aggression during the tangible trials, with low levels of problem behavior in other types of trials. These results indicated that Hannah's problem behavior was maintained by access to tangible items.

The current study extends the literature on FA by evaluating a discrete-trial FA procedure that can be implemented in a classroom setting by routine classroom staff. During the discrete-trial FA, only one therapist was present for about three quarters of the sessions (a second therapist was present only when reliability was assessed), resulting in an average of 3.5 hr of therapist time (i.e., 126 min with one therapist present plus 42 min with two therapists present). Previous studies on standard and trial-based FA in classroom settings required several adults to be present to conduct sessions, collect data, or maintain ongoing classroom activities during sessions (e.g., Berg et al., 2007; Bloom et al., 2011). In addition, conducting 30-s test and control trials resulted in a relatively brief FA ($M = 168$ min; range, 70 min to 280 min). Therefore, our procedures minimized disruption to the classroom setting and staff. However, more research is needed to evaluate whether these procedures are feasible for regular classroom teachers or other school personnel to implement independently.

Several limitations of the investigation warrant consideration. First, unlike Bloom et al. (2011), we did not compare the results of our discrete-trial FA to a standard FA or evaluate the effectiveness of treatment based on the results.

Thus, it remains unclear whether our discrete-trial FA would show concordance rates with a standard FA, similar to those observed by Bloom et al., or lead to effective treatments. In addition, we collected procedural integrity for only one of the five therapists (mean integrity during 16% of sessions was 97.5%). Additional data on procedural integrity would strengthen the conclusions drawn from the FA results.

Another limitation of the current investigation is the lack of an alone or ignore condition in the discrete-trial FA. It is noteworthy that social functions were identified for each of the participants in this study; nevertheless, this finding does not preclude the possibility that one or more of the behaviors were maintained by automatic reinforcement. Future investigators may wish to include an extended ignore condition to rule in or rule out an automatic reinforcement function for problem behavior. Furthermore, the identification of attention-maintained problem behavior may be affected by limited exposure to relevant motivating operations (MO) during trials. That is, rapidly alternating trials in which the therapist provides (i.e., control trials) or withholds (i.e., attention trials) 30 s of attention may not be sufficient to establish the momentary value of attention as a reinforcer during test trials. Nevertheless, Graham engaged in high levels of problem behavior during attention test trials, suggesting that an MO was in place during his discrete-trial FA. Additional research could compare different trial durations to evaluate whether shorter durations (e.g., 30 s) hinder a determination of behavioral function during trial-based FA. Such evaluations may help determine the most efficient and accurate discrete-trial FA procedures.

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