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ASSESSMENT OF THE FUNCTIONS OF VOCAL BEHAVIOR IN CHILDREN WITH DEVELOPMENTAL DISABILITIES: A REPLICATION

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Although experimental analysis methodologies have been useful for identifying the function of a wide variety of target behaviors (e.g., Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994), only recently have such procedures been applied to verbal operants (Lerman et al., 2005). In the current study, we conducted a systematic replication of the methodology developed by Lerman et al. Participants were 4 children who had been diagnosed with developmental disabilities and who engaged in limited vocal behavior. The function of vocal behavior was assessed by exposing target vocal responses to experimental analyses. Results showed that experimental analyses were generally useful for identifying the functions of vocal behavior across all participants.

DESCRIPTORS: autism, developmental disabilities, functional analysis, language, speech, verbal behavior

Children diagnosed with autism and other developmental delays often do not acquire language repertoires comparable to those of their same-aged peers (American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed. rev., 2003). Although little is known about why many children fail to acquire functional communication repertoires, much research has been devoted to the early identification and treatment of language delays (e.g., Lerman et al., 2005; Miguel, Carr, & Michael, 2002; Sundberg & Partington, 1998). Early identification and treatment of language delays are important because children who do not receive early intervention may be at risk for deficits in other adaptive areas and for developing significant problem behaviors (Lerman et al.). Therefore, developing effective assessment and training techniques for language acquisition appears to be an important part of early intervention services for children with autism and other developmental disabilities.

The conceptual basis for many effective language-training procedures is based on Skinner's (1957) analysis of verbal behavior (e.g., Sundberg & Partington, 1998). Lerman et al. (2005) suggested that four verbal operants described by Skinner are relevant for early language training: echoic, tact, mand, and intraverbal. Each of these verbal operants is occasioned and maintained by specific antecedent and consequence events. Thus, a vocal response (e.g., "book") may be functionally independent under different environmental conditions despite similarity in topography (e.g., Lamarre & Holland,

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1985). More recently, Lerman et al. assessed the function of six vocal responses across 4 individuals with disabilities. Each vocal response was exposed to both test and control conditions for four functional operant classes: tact, mand, intraverbal, and echoic. Results for five of six vocal operants suggested that the responses were occasioned and maintained by specific antecedent and consequence events.

One implication of the Lerman et al. (2005) study is that the results of experimental analyses of vocal behavior may allow for the selection of function-based treatments, which may increase the efficacy of interventions for language delays. However, because the Lerman et al. study was the first to apply functional analysis methodology to vocal behavior, additional research is warranted. The purpose of the current study was to replicate and extend the results of the Lerman et al. assessment with additional participants and several procedural modifications.

METHOD

Participants and Setting

Four boys who had been diagnosed with developmental disabilities participated (Steve, Ed, Jim, and Tyler). All participants were enrolled in language-training programs at centers for children with developmental disabilities and were taught in a one-on-one format using discrete-trial instruction. Steve (10 years 10 months) had been diagnosed with autism and was observed to occasionally emit one-word utterances in the presence of preferred items. However, caregiver report indicated that the function of many of his vocal responses remained unclear. Tyler (3 years 5 months) had been diagnosed with spina bifida, a seizure disorder, and general language delays. He was observed to approach therapists and emit one-word utterances, such as ''shoes,'' ''book,'' and ''cookie.'' He was selected for the study because it was unclear whether the responses functioned as mands, tacts, or echoics. Ed (3 years 2 months) had been diagnosed with apraxia. He occasionally emitted one-word utterances, but his vocalizations did not occur under any consistent conditions. Thus, he was selected to participate in the study to determine the conditions under which he was most likely to engage in vocal behavior. Jim (5 years 4 months) had been diagnosed with autism and was observed to emit one- to three-word utterances frequently throughout the day. He was selected for the study because his teachers reported that the function of his vocalizations was unclear.

Sessions were conducted in a session room (3.1 m by 2.7 m) 2 to 5 days per week, based on the individual schedule of each participant. Only the participant, the experimenter conducting the session, and the reliability data collector were in the session room during each assessment. The room contained a child-sized table and two or three chairs.

Response Measurement

The responses chosen for each child were words previously emitted by the participant, as reported by therapists and parents. At least two target responses were chosen for each participant. The responses were ''book'' and ''tune'' for Steve; ''bubbles'' and ''book'' for Ed; ''chip,'' ''cookie,'' ''chocolate milk,'' and ''phone'' for Tyler; and ''water'' and ''music'' for Jim. Correct emission (i.e., correct English pronunciation) of the target vocalization was required for all participants. A correct response was defined as emission of a target vocalization within 5 s of an occasioning stimulus or a prompt. Data were collected using paper-and-pencil recording by the therapist who conducted the session. A second independent observer also collected data either simultaneously or via videotape during at least 37% of sessions. Interobserver agreement was calculated for each session by dividing the number of agreements by the number of agreements and disagreements and multiplying by 100%. An agreement was defined as both the primary and reliability data collectors recording that a response either occurred or did not occur during a trial. Mean

Table 1
Prompt Sequence per Trial in Each Test Condition

Condition	Prompt sequence per trial				Approximate trial length (approximate session length)
Mand test	EO	Vocal prompt ("What do you want?")	Sight of item	Sight + vocal prompt ("What do you want?")	20 to 35 s (200 to 350 s)
Tact test	Sight of item	Sight + vocal prompt ("What is it?")			20 to 25 s (200 to 250 s)
Intraverbal test	Vocal prompt (relevant phrase)	Vocal prompt (relevant phrase)			20 to 40 s (200 to 400 s)
Echoic test	Vocal prompt (target word)	Vocal prompt (target word)			5 to 10 s (50 to 100 s)

interobserver agreement was 100% for Steve and Ed, 99% (range, 90% to 100%) for Tyler, and 99% (range, 90% to 100%) for Jim.

Verbal Behavior Assessment

The verbal behavior assessment consisted of sessions in which the controlling variables of four verbal operants (i.e., echoic, mand, tact, and intraverbal) were manipulated. Each targeted vocal response was assessed by alternating test and control conditions for each verbal operant in a multielement design. Each vocal response was determined to function as a mand, tact, intraverbal, or echoic if the response was emitted during a higher percentage of trials in the test condition than in the control condition. The echoic test and control conditions were conducted only if the target vocal response did not occur during the other test conditions (with the exception of one vocal response for Ed).

Similar to the procedures described by Lerman et al. (2005), specific antecedent and consequence events were manipulated to determine the function of the participants' vocal behavior. In the mand test condition, access to the relevant item was restricted prior to the session, the item was present during the session, and access was provided contingent on the relevant vocalization. In the tact test condition, access was not restricted prior to the session, the item was present during the session, and a generalized consequence (e.g., praise or an edible item) was provided contingent on the relevant vocalization. In the intraverbal test condition, access was not restricted prior to the session, the item was not present during the session, and a generalized consequence was provided contingent on the relevant vocalization. In the echoic test condition, access was not restricted prior to the session, the item was not present during the session, and a generalized consequence was provided contingent on the relevant vocalization (see Lerman et al. for specific procedural details). Each of the control conditions was arranged such that the likelihood of the occurrence of the relevant verbal operant was minimized.

In addition, several modifications to the procedures described by Lerman et al. (2005) were incorporated to establish more clinically practical methods. First, all sessions consisted of 10 trials (to approximate the discrete-trial format to which the participants were typically exposed), and responding was expressed as a percentage of trials with correct responding. Each trial consisted of several prompts, which varied depending on the type of test condition (see Table 1 for a description of prompts and approximate session length). The length of control sessions was yoked to the corresponding test session. Second, two test conditions were conducted for every one control condition. Finally, we restricted (mand test condition) or provided access (echoic test, echoic control, tact test, tact control, intraverbal test, intraverbal control, and mand control conditions) to preferred items for 5 min rather than 60 min as in the Lerman et al. study. Otherwise, procedures were identical to those described by Lerman et al.

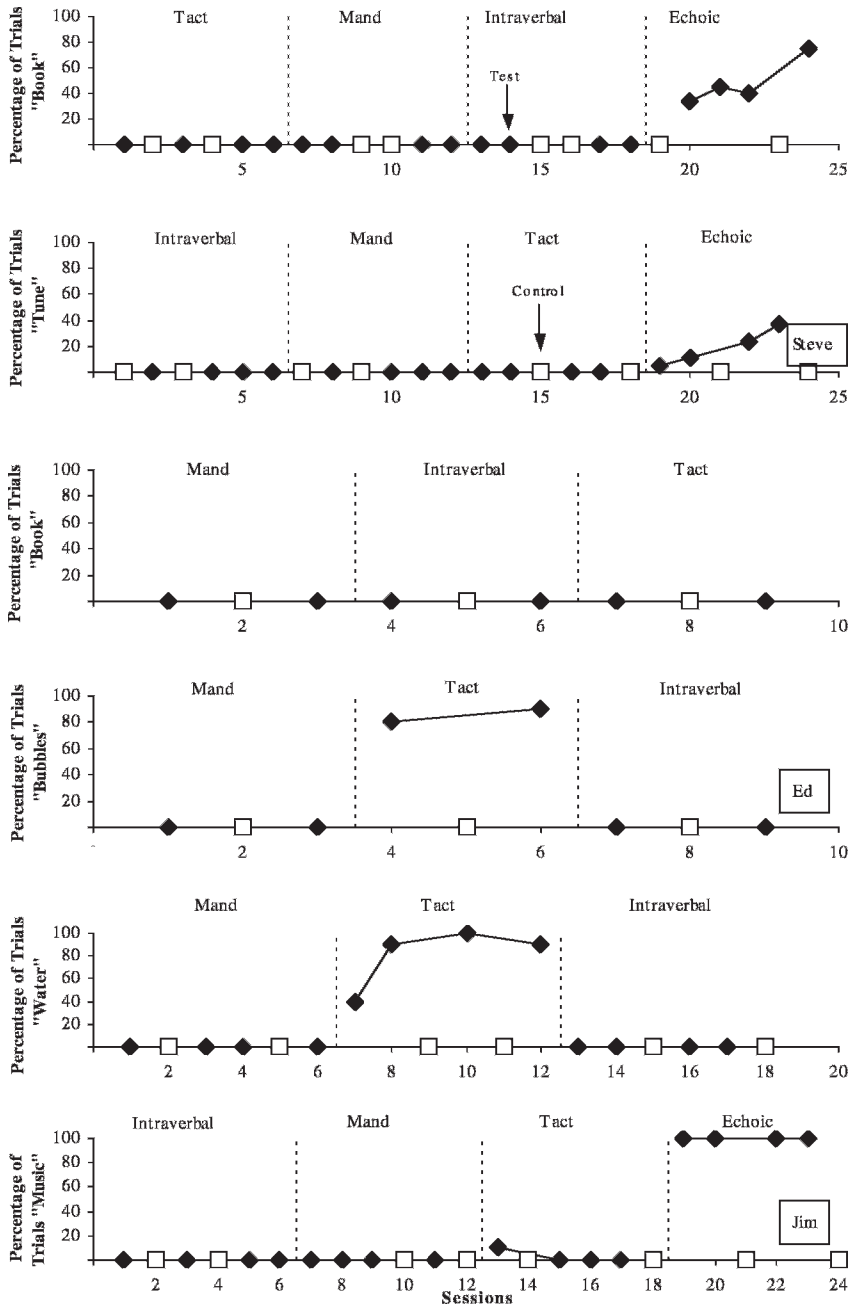

Figure 1. Percentage of trials with engagement in the target vocalizations for Steve, Ed, and Jim during test and control conditions for each verbal operant.

RESULTS AND DISCUSSION

Steve engaged in neither response ("book" and "tune") during the tact, mand, and intraverbal assessments (Figure 1). However, he engaged in moderate to high levels of responding during the echoic test conditions for both responses. Ed did not engage in vocal responses during either the mand or intraverbal

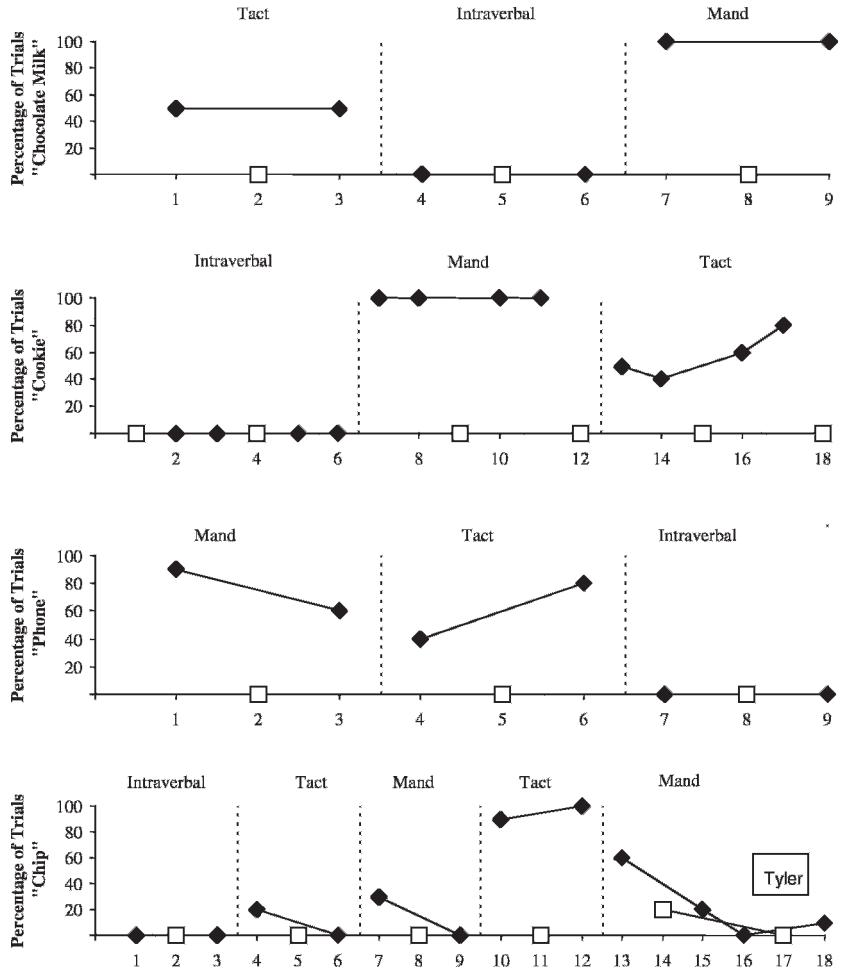

Figure 2. Percentage of trials with engagement in the target vocalizations for Tyler during test and control conditions for each verbal operant.

conditions (Figure 1). In contrast, he engaged in high levels of responding during the tact test condition for one vocal response (“bubbles”), suggesting that this response functioned as a tact. Like Ed, Jim did not engage in either vocal response during the mand or intraverbal conditions (Figure 1). However, he exhibited one of the two vocal responses (“water”) during the tact test condition. The other response, “music,” occurred only during the echoic test condition. These results suggested that one response functioned as a tact and the other response functioned as an echoic. Finally, for Tyler, results indicated that three of the vocal responses (“chocolate milk,” “cookie,” and “phone”) functioned as both mands and tacts, whereas none of the responses functioned as an intraverbal (Figure 2). Results for “chip” were less clear. In the first tact and mand phases, he engaged in some responding in one session for each verbal operant. In the reversal to the tact phase, responding during the test conditions increased to high levels. During a reversal to the mand condition, he engaged in moderate levels of manding, but responding was on a downward trend. These results suggested that Tyler could

engage in tact and mand responses for some stimuli, but that he was unlikely to engage in intraverbal behavior.

Overall, the results replicated the findings of Lerman et al. (2005), despite some procedural modifications, in that the function of at least one vocal response was identified for each participant. All of the participants except Steve engaged in either tacting or manding, but none engaged in responding on 100% of trials across verbal operants. Together, results of these studies suggest that experimental analyses of the verbal operants described by Skinner (1957) are useful for identifying the conditions under which individuals with disabilities engage in various topographies of vocal behavior. Nonetheless, results did differ from those in Lerman et al. in at least one important way. Three of the 4 participants engaged in mand responses in the Lerman et al. study, whereas only 1 of the 4 participants did so in the current study. These results may reflect the relative differences in the strength of the establishing operation (EO; Michael, 2000) or in the participants' existing vocal repertoires. Future research should evaluate this discrepancy to determine the specific effects of presession deprivation on mand behavior. Another area for future research includes evaluating the occasioning prompts used in this and the Lerman et al. studies. For example, the mand test condition included both verbal and nonverbal stimuli in addition to the EO manipulation. The necessary and sufficient conditions for evoking vocal responses should be evaluated. Finally, results of this study demonstrate and support the utility of conducting experimental analyses of vocal behavior prior to initiating training. Future researchers may wish to extend these results by specifically basing training on the results of the experimental analyses.

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