

EVALUATION AND TRAINING OF YES–NO RESPONDING ACROSS  
VERBAL OPERANTS

M. ALICE SHILLINGSBURG

MARCUS INSTITUTE AND EMORY UNIVERSITY SCHOOL OF MEDICINE

MICHAEL E. KELLEY

UNIVERSITY OF SOUTHERN MAINE AND PROVIDENCE'S ACHIEVE

HENRY S. ROANE

MUNROE-MEYER INSTITUTE AND UNIVERSITY OF NEBRASKA  
MEDICAL CENTER

AND

APRIL KISAMORE AND MELISSA R. BROWN

MARCUS INSTITUTE

Topographically similar verbal responses may be functionally independent forms of operant behavior. For example, saying yes or no may have different functions based on the environmental conditions in effect. The present study extends previous research on both the assessment and acquisition of yes and no responses across contexts in children with language deficits and further examined the functional independence of topographically similar responses. All participants in the present study acquired yes and no responses within verbal operants (e.g., mands). However, generalization of the responses across novel verbal operants (e.g., tacts to intraverbals) did not occur without additional training, thus supporting Skinner's (1957) assertion of functional independence of verbal operants.

DESCRIPTORS: functional independence, intraverbal, language acquisition, verbal operants, yes–no responding

Impairment in language development is a primary deficit in children diagnosed with autism and other developmental disabilities (American Psychiatric Association, 2000). Recently, research on language acquisition with this population has incorporated the theoretical framework of Skinner's *Verbal Behavior* (1957), in which he suggested that verbal behavior is governed by the same contingencies that influence the occurrence of other forms of operant behavior. According to Skinner, verbal

behavior should be characterized not by the response form but by the functional characteristics of the response. Specifically, he posited that topographically similar responses may be functionally independent, meaning that the occurrence of a response under the conditions of a specific social contingency does not automatically result in usage of that response under other social contingencies.

Skinner (1957) described four verbal operants that are directly applicable to the assessment and teaching of language to children with deficient language repertoires. The echoic is emitted in the presence of a verbal stimulus, has point-to-point correspondence with the occasioning response, and is maintained by generalized reinforcement. For example, following

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Address correspondence to Michael E. Kelley, 407 Bailey Hall, University of Southern Maine, Gorham, Maine 04038 (e-mail: mekelley@usm.maine.edu).

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presentation of the spoken word “truck,” the participant emits the word “truck,” which results in praise from the therapist. A mand is a verbal operant that is occasioned by a motivating operation (MO; Laraway, Snyckerski, Michael, & Poling, 2003) and is maintained by social reinforcement specific to the MO. For example, the response “truck” is emitted following a period of time without access to a child’s favorite toy truck and results in access to the truck. By contrast, a tact is a verbal operant that occurs in the presence of a nonverbal stimulus and is maintained by generalized reinforcement. For example, a child may see a truck and respond “truck,” which results in generalized reinforcement (e.g., the therapist saying, “that’s right!”). Finally, an intraverbal is occasioned by a verbal stimulus and is maintained by generalized reinforcement, but the response does not have point-to-point correspondence with the occasioning response. For example, following presentation of the phrase “what has wheels?” the participant may emit the word “truck,” resulting in praise from the therapist. In sum, the response “truck” may serve a variety of functions (i.e., mand, tact, or intraverbal), depending on the context.

Researchers and clinicians have applied Skinner’s (1957) analysis of verbal behavior to language programming for children with developmental disabilities (e.g., Kelley, Shillingsburg, Castro, Addison, & LaRue, 2007; Kelley, Shillingsburg, Castro, Addison, LaRue, & Martins, 2007; Lerman *et al.*, 2005; Sundberg & Michael, 2001; Sundberg & Partington, 1998). One area of research that has received attention is the evaluation of functional independence among topographically identical vocal responses (Hall & Sundberg, 1987; Reichle, Barrett, Tetlie, & McQuarter, 1987). Interestingly, this area has produced inconclusive outcomes, with some results providing support for the functional independence of verbal operants (Lamarre & Holland, 1985; Nuzzolo-Gomez & Greer, 2004; Twyman, 1996) and other results demonstrating

some transfer across operant conditions (Petursdottir, Carr, & Michael, 2005). Lerman *et al.* assessed the function of vocal responses in 4 children with developmental disabilities. Results for a majority of the vocal responses suggested that the responses were occasioned and maintained by specific antecedents and consequences. That is, these participants displayed various verbal operants that were topographically similar but were functionally independent. Given that much research shows functional independence of verbal operants, a relevant clinical goal is to design procedures to enhance generalization across verbal operants. Investigations into conditions that facilitate generalization across operants are beginning to emerge. Wallace, Iwata, and Hanley (2006) investigated the effects of the reinforcing quality of targeted items and found that items taught as tacts emerged under mand conditions and were maintained at higher rates when the items were highly preferred than when items were nonpreferred. In another study examining procedures to produce generalization from tacts to mands, Hernandez, Hanley, Ingvansson, and Tiger (2007) showed that differential reinforcement of mands within a sentence frame resulted in generalized use of novel framed mands. Specifically, these authors determined that the participants exhibited the correct tact for several highly preferred items but did not exhibit the target under mand conditions. Following the training of framed mands for a few items, framed mands emerged with other untrained items.

To date, much of the previous research on verbal behavior has focused on topographical responses that directly correspond to features of particular items (e.g., identifying items in a room; requesting desired items). However, correctly emitting a yes or no response has been described as a basic language skill (Carr, 1982) because of the potential for those responses to have multiple effects on the environment. The responses “yes” and “no” have been targeted for treatment in children and

adults with language deficits via vocalizations, manual signs, and augmentative communication (Barreca et al., 2003; Campbell & Stremel-Campbell, 1982; Duker & Jutten, 1997; Hung, 1980; Schepis, Reid, Behrmann, & Sutton, 1998; Sigelman, Budd, Spanhel, & Schoenrock, 1981). The majority of studies that have examined yes-no responses have focused on "no" responding (see Sigafoos, Drasgow, Reichle, O'Reilly, & Tait, 2004, for a review) and have predominantly examined these responses under mand contexts (Drasgow, Halle, Ostrosky, & Harbers, 1996; Duker, Dortmans, & Lodder, 1993; Reichle, Rogers, & Barrett, 1984; Sigafoos & Roberts-Pennell, 1999; Yamamoto & Mochizuki, 1988). In comparison, Neef, Walters, and Egel (1984) examined teaching and generalization of yes-no responses from mand to tact conditions. In that study, children's yes-no responses were recorded during tutoring (i.e., tact condition; "Is this a —?") and embedded instruction (i.e., mand condition; "Do you want a —?"). Results indicated that the participants acquired appropriate yes-no responses during embedded instruction (i.e., mands) but not during tutoring (i.e., tacts), suggesting functional independence of these responses. Furthermore, generalization of yes-no responses did not occur in the tact condition without specific programming, and the authors did not assess responses across other verbal operants (e.g., intraverbals).

In summary, much language research shows that responses of similar topography may be dissimilar in terms of operant function, and investigations to promote generalization across operant functions are beginning to emerge (Hernandez et al., 2007; Wallace et al., 2006). However, the former literature is characterized by mixed outcomes and has only been evaluated once with respect to yes-no responses (Neef et al., 1984), and the studies that have evaluated strategies to promote generalization have been limited to only two verbal operants (mand and tacts). Therefore, the purpose of the current

investigation was twofold. First, we attempted to further examine the functional use of yes-no responses across mands, tacts, and intraverbals. Second, in addition to the assessment of independence and generalization across verbal operants, we specifically assessed generalization to multiple untaught items within each verbal operant condition.

## METHOD

### *Participants, Settings, and Materials*

Three boys who had been diagnosed with autism and who were enrolled in a daily intervention program for children with developmental disabilities participated in this study. These participants were chosen for inclusion based on general language deficits identified by caregivers or teachers and on observations of infrequent and inconsistent functional use of the responses "yes" and "no." At the start of the study, Chuck was 2 years 10 months old, Jay was 3 years 4 months old, and Gary was 7 years 6 months old. All 3 participants were observed to reliably emit vocal verbal behavior under echoic, mand, tact, and intraverbal conditions using one- to four-word utterances.

Jay's and Chuck's sessions were conducted at their regular teaching tables in the classroom (20 m by 20 m). Gary's sessions were conducted in a self-contained room (3 m by 3 m). All participants were taught in a one-on-one format using discrete-trial instruction. During the sessions for Jay and Chuck, one to five other children and a similar number of therapists were also in the classroom. During Gary's session, only the participant, the research assistant conducting the session, and the research assistant collecting the data were in the room. Classrooms contained tables, chairs, bookshelves, toys, and other materials typically found in a classroom setting. The room for Gary's sessions contained a child-sized table, chairs, preferred toys, preferred food items, and teaching materials.

Sessions were conducted 2 to 5 days per week based on the individual schedule for each of the participants. One to five sessions within each category of verbal operants were conducted per day.

#### *Response Measurement and Interobserver Agreement*

Responses were recorded as correct if the participant vocalized the response “yes” or “no” under the appropriate conditions (e.g., responded “no” when asked if a dog says “moo”) within 5 s of the occasioning prompt. Responses were recorded as incorrect if the participant vocalized “yes” or “no” under inappropriate conditions (e.g., responded “yes” when asked if a dog says “moo”), gave another type of response (e.g., responded “woof” when asked if a dog says “moo”), or did not respond within 5 s. Data were collected on a specialized data-collection sheet and recorded with a pencil during all sessions.

A second observer independently collected data during a mean of 39% of sessions across all participants. We calculated interobserver agreement for each session by dividing the number of response intervals with an agreement on the occurrence and nonoccurrence of a response by the total number of response intervals (agreements and disagreements combined) in each session, and converting the resulting quotient to a percentage. An agreement was defined as both observers recording that a correct or incorrect response occurred on a given trial. A disagreement was defined as one observer recording a correct response and the other recording an incorrect response on a given trial. Mean interobserver agreement was 99.6% (range, 90% to 100%), 100%, and 97% (range, 65% to 100%) for Gary, Jay, and Chuck, respectively.

#### *Preteaching Procedure*

*Preference assessment.* Prior to baseline and teaching sessions, we conducted paired-item preference assessments (Fisher et al., 1992) to identify the participants’ highly preferred and less preferred food items for teaching “yes” and “no”

as mands. The four most highly preferred foods were selected for assessing and teaching the “yes” response. The four least preferred foods were selected for assessing and teaching the “no” response. Responses under mand “yes” conditions were assessed for all 3 participants. Responses under mand “no” conditions were assessed for only 1 participant (described below).

*Prerequisite skills assessment.* Prior to beginning teaching sessions of “yes” and “no,” the therapist conducted probes of specific mand, tact, and intraverbal repertoires to ensure that each category of verbal operant was present in the participants’ existing verbal repertoire and to select specific targets to be used during “yes” and “no” training. For example, the therapist presented a preferred item (e.g., a toy car) followed by the question, “what do you want?” to assess whether the participant engaged in the response (e.g., saying “car”) under mand conditions. To assess whether the participant engaged in the response under tact conditions, the therapist presented a picture card followed by the question, “What is it?” To assess whether the participant engaged in the response under intraverbal conditions, the therapist presented an intraverbal phrase (e.g., “What does a cow say?”). If the participant responded correctly on all five trials for each of the verbal operants, we considered the response to be in his repertoire. We selected targets for teaching sessions for the responses “yes” and “no” from this prerequisite skills assessment (data available from the second author). For example, if the participant correctly responded to the intraverbal “What does a cow say?” then the target, “Does a cow say moo?” could be included during teaching of the intraverbal “yes” response.

#### *Experimental Conditions*

“Yes” and “no” responses were assessed under mand, tact, and intraverbal conditions. Specific antecedent and consequence events for a representative participant (Jay) are presented in Table 1. All sessions began with the participant and therapist seated at the table.

Table 1

Vocal Response Targets, Antecedent Stimuli, and Consequences Presented Under Mand, Tact, and Intraverbal Conditions for a Representative Participant (Jay).

Vocal response targets	Antecedent verbal stimulus	Antecedent nonverbal stimulus	Consequence for correct response
Mand "yes"	"Do you want a chip?"	Chip	Chip and praise
	"Do you want a Roll-up?"	Roll-up	Roll-up and praise
	"Do you want a fruit cup?"	Fruit cup (peaches)	Fruit cup and praise
	"Do you want a cookie?"	Cookie	Cookie and praise
Mand "no"	"Do you want an apple?"	Apple	Praise
	"Do you want corn?"	Corn	Praise
	"Do you want ham?"	Ham	Praise
	"Do you want a strawberry?"	Strawberry	Praise
Tact "yes"	"Is this a cup?"	Picture of a cup	Praise
	"Is this a boat?"	Picture of a boat	Praise
	"Is this a bear?"	Picture of a bear	Praise
	"Is this a car?"	Picture of a car	Praise
Tact "no"	"Is this a shoe?"	Picture of a boat	Praise
	"Is this a pen?"	Picture of a bear	Praise
	"Is this a ball?"	Picture of a cup	Praise
	"Is this a duck?"	Picture of a pen	Praise
Intraverbal "yes"	"Does a cat say 'meow?'"	None	Praise
	"Does a dog say 'woof?'"	None	Praise
	"Does a cow say 'moo?'"	None	Praise
	"Does a sheep say 'baa?'"	None	Praise
Intraverbal "no"	"Does a cat say 'quack?'"	None	Praise
	"Does a dog say 'ribbett?'"	None	Praise
	"Does a cow say 'oink?'"	None	Praise
	"Does a sheep say 'tweet tweet?'"	None	Praise

Four targets for the response "yes" and four targets for the response "no" were selected for each verbal operant condition. Baseline probe sessions for each item in each verbal operant for "yes" and "no" responses were conducted. During baseline probe sessions, all targets were assessed five times. Each of the targets were interspersed randomly (including whether the correct response was "yes" or "no") until each target had been presented five times to increase the likelihood of discriminated responding and decrease the likelihood of rote responding. The trials for each target were then compiled into a five-trial session to yield a percentage correct. Baseline probe sessions conducted pre- and postteaching were identical. Teaching sessions, consisting of 10 trials, were initiated in a multiple baseline design across verbal operants for each participant. During teaching, the therapist taught only one target at a time, and "yes" and "no" targets were not interspersed. Once mastery

criteria were met during teaching sessions, baseline probe sessions were conducted to test for generalization of untaught items within and across the three categories of verbal operants. Baseline probe sessions of "yes" and "no" responses were conducted following mastery of both targeted "yes" and "no" responses. Typically, the targeted "yes" and "no" responses were mastered in close proximity.

*Mand baseline probe sessions.* In these sessions, each participant was presented with a food item and asked, "Do you want a —?" followed by a 5-s response interval. If the therapist presented a highly preferred food item, the correct response was "yes." If a less preferred food item was presented, the correct response was "no." Access to the food item and brief descriptive praise (e.g. "Good job saying yes. You can have a chip.") followed a correct "yes" response. Removal of the food item and brief descriptive praise followed a correct "no" response. An

incorrect “yes” response (e.g., saying “yes” when presented a nonpreferred food item) resulted in the prolonged presentation of the nonpreferred food approximately 5 to 15 cm from the participant’s lips for approximately 10 s. An incorrect “no” or other response (i.e., saying “no” or other response when presented a preferred food item) resulted in removal of the food item and the presentation of the next trial.

*Tact baseline probe sessions.* In these sessions, the participant was presented with a picture card and asked, “Is this a —?” followed by a 5-s response interval. If the picture matched the item stated in the question, the correct response was “yes.” If the picture did not match the item stated in the question, the correct response was “no.” For example, if the therapist presented a picture of a car with the question, “Is this a dog?” the correct response was “no.” A correct response produced approximately 10 s of social praise. No consequences were delivered contingent on incorrect responses and non-responses with the exception of the presentation of the next trial.

*Intraverbal baseline probe sessions.* In these sessions, the participant was asked a question regarding an animal sound (e.g., “Does a dog say ‘moo?’”) followed by a 5-s response interval. If the named animal matched the animal sound, the correct response was “yes.” If the named animal did not match the animal sound, the correct response was “no.” Correct responses produced approximately 10 s of social praise. No consequences were delivered contingent on incorrect responses and nonresponses, with the exception of the presentation of the next trial.

### *General Teaching Procedure*

Sessions consisted of 10 trials. The therapist used an echoic prompt sequence, which consisted of the therapist presenting the question and providing the most intrusive echoic prompt necessary to maximize the likelihood of correct responding, to teach “yes” and “no” responses. For all participants, the therapist provided immediate, full vocal prompts (i.e., “yes” or “no”) during the first three trials, followed by a

less intrusive phoneme prompt on the fourth trial. The phoneme prompt consisted of presenting the initial sound of the correct vocal response (i.e., “y” and “n”). The therapist provided an opportunity to respond independently on the next trial contingent on a correct response (i.e., the therapist did not provide a prompt). Unprompted trials continued until the 10th trial was completed or until the participant emitted an incorrect response. Following an incorrect response for any trial, the therapist presented the most intrusive (i.e., full vocal) prompt at the start of the next trial and continued through the prompt sequence until the 10th trial. Sessions ended on the 10th trial regardless of prompt level.

*Mands.* Antecedent and consequence events were identical to the mand baseline condition, with the addition of the echoic prompt sequence described above.

*Tacts.* Antecedent and consequence events were identical to the tact baseline condition, with the addition of the echoic prompt sequence described above.

*Intraverbals.* Antecedent and consequence events were identical to the intraverbal baseline condition, with the addition of the echoic prompt sequence described above.

### *Experimental Design and Sequence*

We used a multiple baseline design across verbal operants to assess the effects of teaching. For each participant, probes for all four items in each verbal operant continued under baseline conditions (interspersing “yes” and “no” targets) until each was probed a total five times per session. Following baseline, the therapist implemented teaching sessions for one “yes” and one “no” item for one verbal operant. Prior to teaching sessions each day, the therapist collected one probe data point (consisting of one trial) for the target response being taught (i.e., one probe data point per day). The mastery criterion during teaching for each participant was three consecutive correct probe data points (i.e., three consecutive days with correct responding in the probe sessions).

Following mastery of the first target response, we probed all targets within the taught operant and each of the four targets within the other operants (i.e., the operants not taught) for generalization (i.e., assessment probes for generalization both within and across verbal operants). For example, following baseline in which no correct “yes” or “no” responses were emitted to any of the four targets in the mand, tact, or intraverbal conditions, the therapist selected one target from one verbal operant for treatment (i.e., mand “yes” when asked, “Do you want a Pringle?”). Following mastery of the response “yes” to this specific target, the therapist conducted baseline probe sessions (i.e., tests for generalization) for all remaining untaught mand “yes” targets (i.e., three targets), the four untaught tact “yes” targets, and the four untaught intraverbal “yes” targets. After all four targets within the first operant (e.g., mands) had been mastered, either via teaching or generalization, the therapist selected a target from another verbal operant (e.g., intraverbals) for teaching and conducted the probes for generalization following mastery of this operant in the manner described above.

If the targets within the same verbal operant as the mastered item did not generalize across baselines, either the initial target was retaught to mastery level, followed by generalization probes, or a second target within the same verbal operant was taught, followed by generalization probes. If generalization did not occur during the second generalization probe (in the case of a target that was retaught), a second target within the same verbal operant was taught, and generalization probes were conducted as previously described. The choice to reteach a target item prior to teaching a second target was made following success with the latter procedure with Gary. Because teaching a second exemplar successfully resulted in generalization to untaught targets with Gary, we were interested in examining a different procedure (i.e., reteaching the original target) and its effects on generalization.

## RESULTS

Figures 1 through 3 depict each participant’s responding within each verbal operant. (Data from the teaching sessions are not shown but are available from the second author.) Specific items that were targeted for instruction or mastered during baseline are depicted in individual panels of each figure. Untaught targets that were probed for generalization are depicted together in one panel immediately beneath the panel showing the trained target. For example, if one tact “yes” item was taught, it is shown individually in the top panel; the remaining untaught tact “yes” items are displayed together in the panel below the taught item to facilitate visual inspection of generalization. Data for all three verbal operants are shown in each figure to display generalization within and across verbal operants.

The left column of Figure 1 depicts Gary’s “yes” responses under mand (top two panels), tact (middle two panels), and intraverbal (bottom three panels) conditions. During baseline, Gary did not engage in mand, tact, or intraverbal “yes” responses. Panel 2 (left) shows generalization to the remaining three untaught mand “yes” items following teaching of one mand “yes” item (Panel 1). Following teaching of one mand “yes” item, probe sessions for tacts and intraverbals (left Panels 3 through 7) show that responding did not generalize across these verbal operants. That is, although he acquired a functional “yes” response under mand contexts, he did not display this behavior under tact or intraverbal contexts. Panel 3 (left) shows “yes” responding to the taught tact target, and Panel 4 (left) shows generalization to the remaining three untaught tact “yes” items following teaching of the one tact “yes” item. Baseline probe sessions show that responding did not generalize to intraverbal behavior (left Panels 5 through 7); thus, training was initiated for the intraverbal “yes” response. Panels 5 and 6 (left) show “yes” responding to the taught intraverbal targets.

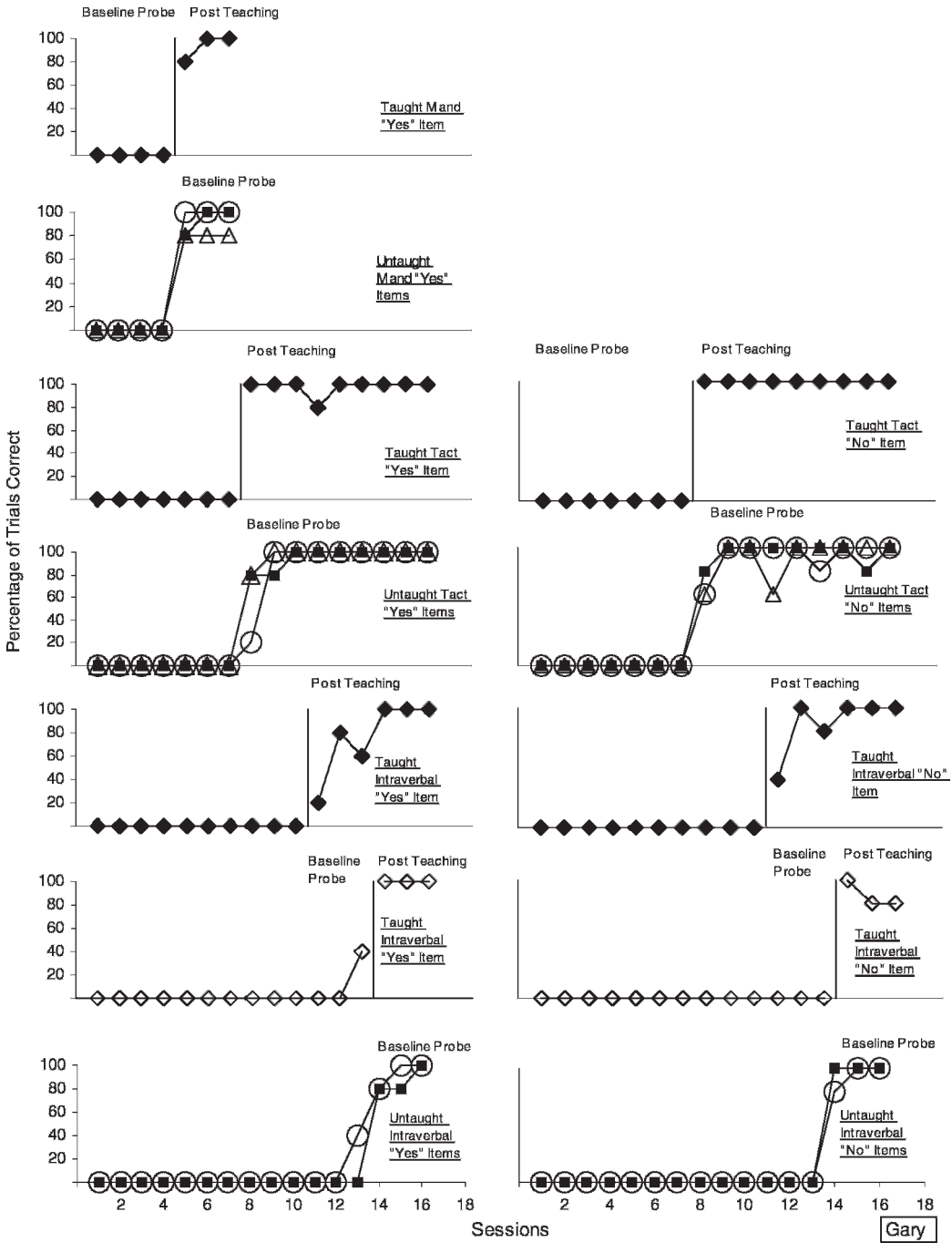


Figure 1. Gary’s mand, tact, and intraverbal baseline probe and postteaching sessions for the “yes” response and tact and intraverbal baseline probe and postteaching sessions for the “no” response are depicted. Untaught targets, in which baseline probes were conducted after mastery of a taught target, are depicted together in one panel immediately beneath the trained target. Solid phase lines indicate that the item was taught.



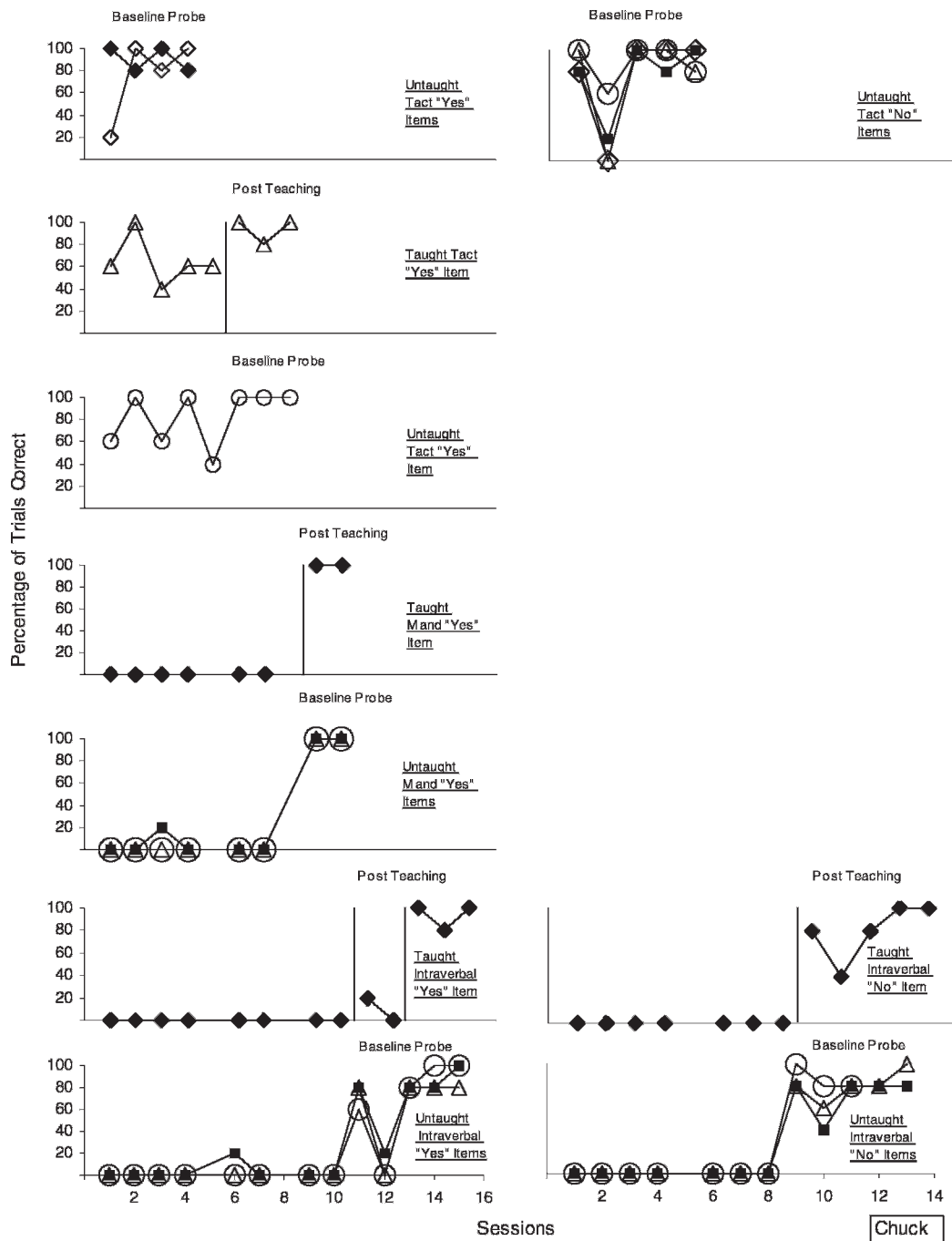


Figure 2. Chuck's tact, mand, and intraverbal baseline probe and postteaching sessions for the "yes" response and tact and intraverbal baseline probe and postteaching sessions for the "no" response are depicted. Untaught targets, in which baseline probes were conducted after mastery of a taught target, are depicted together in one panel immediately beneath the trained target. Solid phase lines indicate that the item was taught.

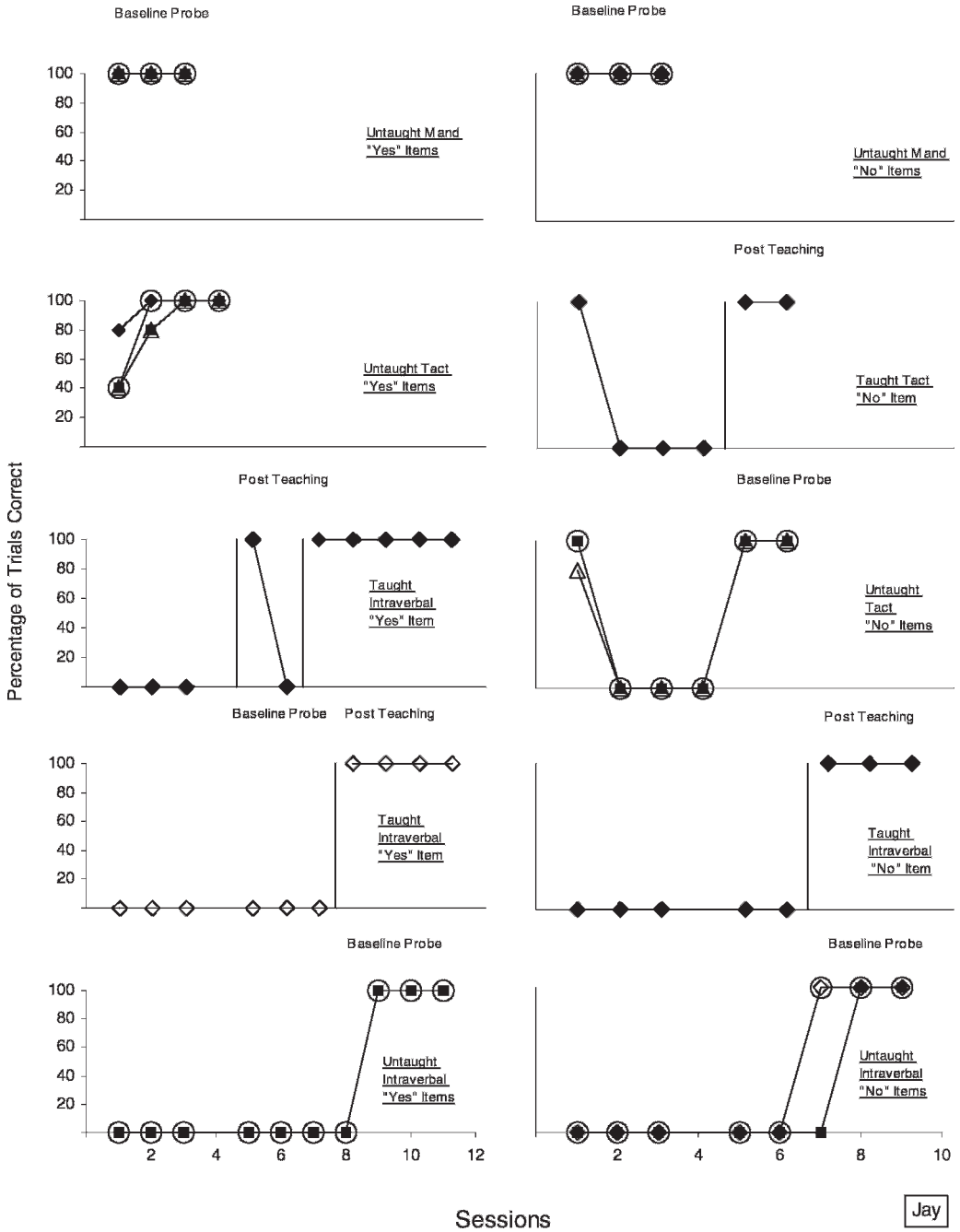


Figure 3. Jay's mand, tact, and intraverbal baseline probe and postteaching sessions for the "yes" response and "no" response are depicted. Untaught targets, in which baseline probes were conducted after mastery of a taught target, are depicted together in one panel immediately beneath the trained target. Solid phase lines indicate that the item was taught.

Weak generalization to the remaining intraverbal targets was observed following intraverbal training with one item, whereas the two untaught intraverbal “yes” items (left Panel 7) occurred at high levels when two intraverbal “yes” items were taught.

The right panels of Figure 1 depict Gary’s “no” responses under tact (top two panels) and intraverbal (bottom three panels) conditions (the mand “no” condition was not conducted with Gary for reasons described below). During baseline, he did not engage in any tact or intraverbal “no” responses. The top right panel shows “no” responding to the first targeted tact item. Panel 2 (right) shows generalization to the remaining untaught tact “no” items following mastery of one tact “no” item. Baseline probe sessions of the untaught targets (right Panels 3 through 5) show that responding did not generalize to intraverbal behavior. That is, although he acquired a functional “no” response under tact contexts, he did not display this behavior under intraverbal contexts. Panels 3 and 4 (right) show “no” responding to the two targeted intraverbal items. Generalization to the remaining two untaught intraverbal “no” items (right Panel 5) did not occur until mastery of two intraverbal “no” items (right Panels 3 and 4).

Chuck’s results are depicted in Figure 2. The left side of Figure 2 depicts Chuck’s “yes” responses under tact (top three panels), mand (middle two panels), and intraverbal (bottom two panels) conditions. Chuck mastered two tact “yes” items under baseline conditions (left Panel 1) and displayed generalization to the remaining one untaught tact “yes” item (left Panel 3) following mastery of one additional tact “yes” item (left Panel 2). By contrast, he did not engage in mand “yes” or intraverbal “yes” responses during baseline (bottom three panels, left). Following mastery of one tact item, probe sessions (left Panels 4 through 7) show that responding did not generalize across verbal operants (to mand or intraverbal behavior). That

is, although he displayed a functional “yes” response under tact contexts, he did not display this behavior under mand or intraverbal contexts. Panel 4 (left) shows mand “yes” responding to the first targeted mand item. Panel 5 (left) shows generalization to the remaining three untaught mand “yes” items following teaching of one mand “yes” item. Baseline probe sessions (left Panels 6 and 7) show that responding did not generalize to intraverbal behavior. Panel 6 (left) shows “yes” responding to the first targeted intraverbal item, which required two exposures to the training condition. Generalization to the remaining untaught intraverbal “yes” items (left Panel 7) did not occur until the first intraverbal “yes” item was mastered.

The right column of Figure 2 depicts Chuck’s “no” responses under tact (top) and intraverbal (Panels 2 and 3) conditions. As shown in the top panel, he demonstrated mastery of all tact “no” items without teaching. However, he did not engage in the “no” response under intraverbal conditions, suggesting these responses were topographically similar but functionally independent. Following mastery of one intraverbal “no” item, generalization to the remaining untaught intraverbal “no” items occurred. It should be noted that mand “no” sessions were not conducted with Chuck because we did not identify foods that he would not consume. That is, although the foods chosen were identified as nonpreferred and were never consumed during the preteaching preference assessment, he began to consume the food during the mand “no” sessions.

Jay’s results are shown in Figure 3. As shown in the left column, Jay exhibited the “yes” response under both mand and tact conditions during baseline (top two panels). He did not, however, exhibit the response “yes” under intraverbal conditions until instruction occurred (left Panels 3 and 4). Generalization within the verbal operant to the remaining untaught intraverbal “yes” items (Panel 5) did not occur until two phases of teaching “yes” to

the first targeted intraverbal item and one phase of teaching “yes” to the second targeted intraverbal item were completed.

The right column of Figure 3 depicts Jay’s “no” responses under mand (top panel), tact (middle two panels), and intraverbal (bottom two panels) conditions. As shown in the top panel, Jay demonstrated mastery of all mand “no” items without instruction. However, he did not consistently emit the “no” response under tact or intraverbal conditions. Following mastery of one tact “no” item, responding generalized to the remaining untaught tact “no” items but did not generalize to intraverbal “no” items (i.e., supporting independence across operants). Following mastery of one intraverbal “no” item, generalization occurred with the remaining untaught intraverbal “no” items.

## DISCUSSION

We evaluated the functional independence of “yes” and “no” responses across verbal operants. The results for all participants suggested that the topographically similar responses (“yes” and “no”) were functionally independent across mand, tact, and intraverbal operants. Mastery of “yes” or “no” responses resulted in generalization to other untaught items within the same verbal operant class, but did not result in generalization across other verbal operants. The results of the present study are consistent with previous studies that have examined functional independence of vocal responses (Lamarre & Holland, 1985; Nuzzolo-Gomez & Greer, 2004; Twyman, 1996) and support Skinner’s (1957) hypothesis of functional independence among verbal operants. Similar to findings by Neef *et al.* (1984), the participants in the current investigation did not demonstrate correct use of the “yes” or “no” responses under conditions that deviated in a functional sense from training conditions (i.e., across verbal operants). However, participants in the present study engaged in correct responding within each verbal operant to items that were not specifically trained.

The current results support previous research findings that suggest that the assessment of verbal behavior across verbal operants is critical when assessing an individual’s verbal repertoire and implementing appropriate language programming (Kelley, Shillingsburg, Castro, Addison, & LaRue, 2007; Kelley, Shillingsburg, Castro, Addison, LaRue, & Martins, 2007; Lerman *et al.*, 2005). Incomplete information regarding an individual’s functional vocal repertoire may result in fractured language training. For example, Jay exhibited functional use of the response “yes” under mand and tact conditions and use of the response “no” under mand conditions. If his language assessment had been based solely on the form of the response, one may have assumed that his vocal repertoire included the use of those responses under all conditions and may have failed to implement programs to teach “yes” under intraverbal conditions and “no” under tact and intraverbal conditions. Likewise, Chuck and Jay demonstrated some consistent use of the responses under one or two verbal operants. That is, although these participants had already acquired the responses “yes” and “no” under specific stimulus conditions (e.g., tact), they did not emit these responses under other conditions (e.g., intraverbal). In sum, the current results were consistent with past research suggesting that assessment of individuals’ functional vocal repertoires is critical prior to initiating treatment for language deficits.

There were two major findings of the training of “yes” and “no” across baselines and across verbal operants. First, generalization of responses following mastery of a taught item to untaught items occurred for all 3 participants within the same verbal operant, but did not occur across verbal operants. Gary’s data provide a representative example. Although generalization to untaught mand items occurred following mastery of a mand “yes” item (i.e., generalization within the operant), generalization to tact and intraverbal “yes” items did not occur (i.e., showing independence across oper-

ants). Similarly, although generalization to untaught tact items occurred following mastery of a tact “yes” item (i.e., generalization within the operant), generalization to intraverbal “yes” items did not occur (i.e., showing independence across operants). Thus, these results suggested that the topographical responses were functionally independent, and that generalization within operants was likely relative to generalization across verbal operants.

The discovery of conditions to facilitate generalization across verbal operants is becoming an important area of research (Hernandez et al., 2007; Wallace et al., 2006). One might expect that generalization across verbal operants may be more likely to occur when overlapping (i.e., common) antecedents are present. Antecedents common across verbal operants that may promote generalization include the mere presence of verbal and nonverbal stimuli. For example, the presence of the verbal stimulus “What do you want?” under mand conditions and the presence of the verbal stimulus “What is it?” under tact conditions show an overlap of general conditions in that the antecedents of both operants involve the presence of a verbal stimulus, albeit of different forms. The lack of generalization across verbal operants in the present study is interesting in light of the fact that the antecedents included in each condition showed some overlap of general conditions (e.g., verbal and nonverbal stimuli were present in both mand and tact conditions; see Table 1). A potentially worthwhile area for future research includes a more thorough investigation of the specific variables that affect generalization across verbal operants, including the analysis of assessment and treatment conditions that involve impure mand, tact, and intraverbal antecedent conditions. Including similar antecedent conditions may result in generalized responding due to poor discrimination of relevant antecedent stimuli. This is one potential explanation for the generalization that occurred within the verbal operants. Although the antecedent conditions across verbal operants

showed some overlap, the antecedent conditions within each verbal operant were more similar than the antecedent conditions across verbal operants. For example, the same autoclitic frames were used within each operant class (e.g., “Do you want a —?” in all mand conditions, and “Is this a —?” in all tact conditions).

Second, generalization across baselines required more training for the intraverbal baselines than for the tact and mand baselines. Specifically, generalization across baselines occurred after treating just one baseline on 10 of the 10 opportunities for tacts, six of the six opportunities for mands, and 6 of the 18 opportunities for intraverbals. Generalization to untaught intraverbal items did not occur until the first item was retaught or an additional item was also mastered on 12 of the 18 opportunities. These results yield some potential information about the developmental progression and relative complexity of the distinct verbal operants. These results are also consistent with previous research that has demonstrated the benefit of training a sufficient number of exemplars to promote generalization of the response to untaught targets (Hernandez et al., 2007; Stokes & Baer, 1977). Although our study was not designed to provide definitive information regarding the relative ease with which the different verbal operants could be acquired, our results suggest that the tact and mand verbal operants may be more easily acquired than intraverbal responding; several reasons may account for this. First, relative to tacts and intraverbals, mands directly benefit the speaker (Sundberg & Michael, 2001). That is, access to the preferred item temporarily reduces a state of deprivation. Thus, motivation to engage in the mand may be relatively higher than during training of other verbal operants. Second, tact training is likely to include both the defining antecedent condition (i.e., the presence of a nonverbal stimulus) and a vocal prompt (e.g., a therapist may say, “What is it? It’s a tree,” while holding up a picture of a tree). On the other hand, intraverbal training would likely include

only verbal antecedents, such as those described in the current study. Future research is warranted to discover if intraverbal training may be improved by including components other than those that define the verbal operant (e.g., holding up a picture of a cat while saying, "What does a cat say? A cat says 'meow'").

There are limitations to the present study that warrant discussion. First, we were unable to assess or teach the response "no" under mand conditions for Gary and Chuck, because Gary continued to say "yes" in the presence of the less preferred foods, and Chuck attempted to eat the less preferred foods. These difficulties were probably occasioned by including less and not necessarily nonpreferred items in the mand assessment for these participants. Due to time constraints, the mand "no" condition was omitted from the training for both participants, and this omission limits the assessment of their acquisition of the "yes" response under mand conditions, given that discrimination between "yes" and "no" responding could not be completed. Thus, future research should assess the conditions under which "no" may be reliably taught as a mand, the success of which partly depends on identifying nonpreferred items to include in the "no" training context.

A second limitation involves the conditions present in the sessions conducted to assess for generalization. The primary difference between the teaching and baseline sessions was the use of the prompt procedure. The consequences for correct responding in both conditions were identical. Thus, in the baseline probe sessions conducted with the untaught targets, differential consequences were provided contingent on the correct response. Although no teaching procedures were present, if the participant emitted the correct response, the relevant consequence was delivered. It is possible that the differential consequence delivered during these sessions resulted in acquisition. Therefore, only the first trial of the probe sessions represents a true test of generalization.

A third limitation of the current study is that generalization of responses to the natural environment was not assessed. Although generalization to untaught items occurred, it would have been useful to assess spontaneous use of "yes" and "no" responses using different stimuli and in a variety of settings. For example, all of the participants were taught to emit "yes" and "no" responses under intraverbal conditions in the form of "wh—" questions using animal sounds. It is possible that the participants may not have emitted the appropriate response if presented with varying intraverbal prompts such as "Do you live in Maine?" or "Does a car have wheels?" A focus on functional use of these responses in the natural environment is another important area of future research.

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