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## Teaching intraverbal behavior to children with autism<sup>☆</sup>

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### Abstract

Skinner's conceptual analysis of language has influenced one model of early and intensive behavioral intervention with children, which incorporates verbal operants including mands, tacts, intraverbals, etc. Many studies have examined the mand and tact relations, with little focus on teaching intraverbal behavior. In the present experiment, children with autism were taught intraverbals using a transfer-of-stimulus-control procedure (i.e., tact to intraverbal) in combination with errorless learning (i.e., delayed prompting). Three children were successfully taught to name items associated with preselected categories (e.g., "What are some colors?") with limited generalization to a fourth, non-targeted category, and limited maintenance of skills.

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A number of studies have provided solid evidence that intensive early behavioral intervention can produce substantial increases in language skills for children with autism (Goldstein, 2002; Howard, Sparkman, Cohen, Green, & Stanislaw, 2005; Sallows & Graupner, 2005; Smith, 1999; Smith, Groen, & Wynn, 2000). One of the most socially valuable forms of language is the ability to respond meaningfully to the language of others. Bailey and Wallander (1999) and Sundberg and Michael (2001) suggest that when children with autism fail to acquire this type of language, it may dramatically impair their social development. Several studies have targeted social language that authors have referred to as social interaction skills (Krantz & McClannahan, 1998), conversational speech (Charlop &

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Milstein, 1989; Sherer et al., 2001), question-answering (Charlop-Christy & Kelso, 2003; Secan, Egel, & Tilley, 1989) and reciprocal social interactions (Odom & Strain, 1986). In addition to the social value of conversational skills, being able to answer questions and respond to statements can improve the accuracy and validity of tests used to assess academic performance and intellectual ability.

The intervention literature on social language in children with autism is substantial and stems from a variety of educational frameworks. One small but growing subset of this literature focuses on teaching language using Skinner's behavior analytic conceptualization of *verbal behavior* (Skinner, 1957). Skinner's theory of verbal behavior proposes several different verbal operants (e.g., mand, tact, intraverbal, echoic) defined by the unique antecedents and consequences that influence the use of language in a given context. Skinner's intraverbal relation subsumes what is termed by others as conversational language, question answering, and reciprocal language interactions. He defined the intraverbal as a verbal response that lacks point-to-point correspondence with an antecedent verbal stimulus. Intraverbal behavior can take the form of seemingly trivial social interchanges (e.g., "you too" when told "Have a nice day."), word associations (e.g., "short" when told "tall"), translations (e.g., "Buenos dias" when told "good day"), answering questions (e.g., "table, chair, desk" when asked "What are some types of furniture?"), and behavior chains (e.g., stating one's social security number).

All verbal operants are considered initially functionally independent during typical language development (Skinner, 1957). For example, a child might be able to request or "mand" for a ball, but not say "ball" when asked to label or "tact" one or when asked "what bounces" (i.e., intraverbal). Particularly in individuals still acquiring language, research has supported the functional independence of intraverbals from other verbal relations such as tacts (e.g., Braam & Poling, 1983; Luciano, 1986; Miguel, Petursdottir, & Carr, 2005; Partington & Bailey, 1993; Watkins, Pack-Texteria, & Howard, 1989; Twyman, 1995), suggesting that intraverbals must be targeted directly.

Growing interest in the clinical application of the verbal behavior approach to language instruction (Sundberg & Michael, 2001) has resulted in considerable dissemination efforts in recent years; however, research on the specific effects of instructional procedures for teaching elementary verbal operants to children with autism has lagged behind dissemination efforts (Carr & Firth, 2005; Sautter & LeBlanc, 2006). Additional studies are needed to evaluate all aspects of the use of this approach due to the limited experimental literature to support the current practice. Intraverbal repertoires, in particular, must be studied more closely because this literature lags substantially behind the literatures on mands and tacts (Oah & Dickinson, 1989; Sautter & LeBlanc, 2006).

Four studies have specifically targeted intraverbals with individuals with language problems due to mental retardation or brain injury. Braam and Poling (1983), Luciano (1986), Sundberg, San Juan, Dawdy and Arguelles (1990), and Watkins et al. (1989) each successfully used a transfer-of-stimulus-control procedure from either echoic or tact prompts to intraverbals. Additional manipulations involved either delayed prompting or errorless learning, with errorless learning procedures generally producing fewer errors than delayed prompting (Luciano).

Only one study has targeted intraverbals in children with autism. Finkel and Williams (2001) compared textual and echoic prompts for teaching intraverbals to a six-year-old boy

with autism. A multiple baseline design across three sets of personal questions was used to determine the effects of prompts on full-sentences and partial answers. Multiple questions were generated for each set and specific questions were assigned to either the textual prompt or echoic prompt condition. A stimulus fading procedure was conducted using either text scripts or echoic prompts to transfer stimulus control. Although both forms of prompting proved effective, textual prompts produced a more immediate and robust increase in correct full sentence responses than echoic prompts, which typically resulted in partial responses.

Two studies of intraverbals with typically developing preschool-age children are potentially pertinent to intervention with children with autism. Partington and Bailey (1993) taught four typically developing preschool children categorical intraverbals using transfer-of-stimulus-control procedures. All participants successfully acquired the intraverbals and improved on the Verbal Fluency subtest of the McCarthy Scales of Children's Ability (McCarthy, 1970). In the second part of their study, they examined the effects of multiple tact training of both item name and class (e.g., "banana", "fruit"), which resulted in the emergence of a few untrained intraverbal responses for only half of the participants. Miguel et al. (2005) have since studied the effects of multiple tact training with typical preschoolers and found even less robust effects for the procedure, though the transfer-of-stimulus-control procedures continued to prove effective in directly teaching intraverbal behavior (Partington & Bailey, 1993; Miguel et al., 2005).

To date, only one study has directly examined a procedure to teach intraverbals, as defined by Skinner, to children with autism. The current study was designed to replicate the methodology of Partington and Bailey (1993) using transfer-of-stimulus-control procedures with errorless learning to target categorical intraverbals with children diagnosed with autism. Though these procedures have been investigated with other populations, no studies have used this procedure with children with autism despite common clinical recommendations to do so (e.g., Sundberg & Partington, 1998).

## 1. Method

### 1.1. Screening procedures and participants

The present study targeted 4–12 year olds diagnosed with autism with minimal compliance problems and no sensory or motor impairments that would preclude participation. Overall language skills were evaluated using the Behavioral Language Assessment Form which screens for numerous functional language categories (Sundberg & Partington, 1998). Specific intraverbal skills were screened using the Verbal Fluency subtest of the McCarthy Scales of Children's Abilities, which samples categorical responses (e.g., what are some things you ride on; McCarthy, 1970). Based on the recommendations of the Sundberg and Partington curriculum, inclusion in the present study required a strong verbal imitative repertoire, approximately 50 mands and 50 tacts, and limited intraverbals.

Five children met the language criteria described above but two discontinued participation due to noncompliance and problem behavior. The remaining three

participants were males diagnosed with autism according to *DSM-IV* criteria or classified with Autism Spectrum Disorder according to Michigan educational guidelines. Confirmatory support for the diagnosis was obtained by parental report on the Gilliam autism rating scale (GARS; Gilliam, 1995). All three participants' GARS scores fell at the mean, indicating an average probability of autism for each (98 for Paul, 97 for Greg, and 102 for Chad).

Paul was a 7-year-old male with several requests or mands, frequent vocalizations, identification skills for over 100 items, tacts in the form of short sentences, and limited intraverbals (i.e., a few fill-ins and animal sounds). Greg was a 5-year-old male with several mands, frequent vocalizations, and many clearly understandable words. He could not identify 50 items and could not complete 10 intraverbal tasks in the form of fill-in-the-blanks or answering simple questions. Chad was a 4-year-old male with several mands and frequent vocalizations who could say many clearly understandable words, easily identify over 100 items, use tacts in short sentences, and fill in a few missing words and provide animal sounds.

### *1.2. Setting and duration*

Trials were conducted in a university research room for Paul, a school office for Greg, and both at home and at the university for Chad. Trials were conducted for no more than 1 h per visit with visits on 1 or 2 days per week. Five-minute breaks frequently occurred to decrease fatigue. Intraverbal training and follow-up data collection were conducted in eight visits for Paul, six visits for Chad, and 11 visits for Greg.

### *1.3. Dependent variable and experimental design*

A target question related to object function (e.g., "What are some things you wear?") or class ("What are some colors?") was identified for each of four categories of familiar items. The dependent variable was the number of correct, non-repeated, independent responses to the question for a given category. Clothes, furniture, colors, and animals were initially targeted with two potential replacement categories (i.e., shapes, fruits) for participants who gave one or more correct responses per category during the first two baseline trials. Experimental control was demonstrated using a multiple probe design across three categories for each participant with a fourth category serving as a constant series control. Category order was determined by random selection for the first participant with counterbalancing for subsequent participants. When a criterion of three consecutive trials with four or more correct independent responses was met under a thinned schedule of reinforcement, the next category entered the intervention phase while follow-up probes continued for the original category.

### *1.4. Observer training and interobserver agreement*

Observers scored mock, videotaped sessions depicting trials from all phases of the study until they achieved 100% agreement with the scoring template for two videos. A second trained independent observer scored 100% of trials for Paul, 45% of trials for Greg, and

41% of trials for Chad distributed across categories and phases. A trial was scored as an agreement if the number of correct responses exactly matched between primary and secondary observers. Point-by-point agreement was calculated by dividing agreements by agreements plus disagreements and multiplying by 100%. Interobserver agreement for Paul was 93% for baseline, 97% for treatment, and 84% for follow-up and agreement for Greg and Chad were 100% across all phases.

### 1.5. Procedural integrity

Procedural integrity for intraverbal training trials was scored from video footage for 42% of trials for Paul, 19% of trials for Greg, and 40% of trials for Chad. To be scored correct, all procedural steps within the trial had to be implemented accurately. The percentage of correctly implemented trials for each participant was calculated by dividing the number of correct trials by the total number of trials within the intraverbal training phase and multiplying by 100%. The percentage of correctly implemented trials was 100% for all participants. Point-by-point interobserver agreement for procedural integrity data was collected for 46% of trials for Paul, 53% of trials for Greg, and 95% of trials for Chad, and agreement between observers was 100%.

### 1.6. Procedures

*Preference assessment:* Each child's parent was interviewed to identify preferred edibles. These items were then presented using a multiple-stimulus (without replacement) preference assessment (DeLeon & Iwata, 1996); however, each child repeatedly failed to select from the array. Next, items were presented in a paired-stimulus assessment (PS; Fisher et al., 1992), which resulted in clear preferences. Before each intraverbal training session, the three most highly preferred items from the PS assessment were presented for child selection unless the child independently nominated his preferred food, and the identified item was used during training.

*Baseline:* Baseline trials began with a question relevant to the first pre-selected category (e.g., "What are some things you wear?"). Participants were given 10 s to make an initial response. If no response occurred, the question for the next randomly selected category was presented. If the child responded within 10 s and was then quiet for at least 3 s, the researcher presented two additional prompts (i.e., "What else?" and "Tell me more."). All correct, non-repeated responses were recorded, and the process continued until all categories had been assessed.

*Tact assessment and training:* This phase assessed existing tacts for pictures of each category item. Any unknown tacts were trained and specific words used to tact known items (e.g., "pants" versus "jeans") were identified. Pictures were laminated, 4" × 4" color photographs for each of the five items for the four categories. All 20 pictures were shuffled. The researcher held up each picture and asked "What's this?" All correct responses resulted in brief verbal praise and progression to the next picture. After the first few trials, presentation of the next picture typically occasioned a response from the child without repetition of "What's this?", but if the child did not respond quickly the question was presented. No response within 3 s or an incorrect response resulted in an experimenter

prompt (e.g., “Say shoe.”). Echoed responses were praised and the picture was repeated until the child responded accurately and independently. Training continued until children responded quickly and accurately during three consecutive rapid presentations of the 20-picture set. Tact training occurred following the second baseline session for all participants, followed by immediate training in one category for Paul and continued baseline data collection for Greg and Chad’s four pre-selected categories.

*Intraverbal training:* The intraverbal training protocol involved tact prompts, errorless learning, and schedule thinning. Each trial began by shuffling the five picture cards for the training category and presenting the category-specific verbal stimulus (e.g., “What are some fruits?”). For the five initial trials, the first picture (i.e., tact prompt) was presented immediately after the question (i.e., errorless learning). Correct tacts resulted in praise, edible reinforcement, and immediate presentation of the next picture with an expectant look but no repetition of the initial question. Incorrect tacts or no response resulted in a correction sequence (e.g., “no, say ‘lemon’”), which was repeated until the child responded correctly and earned an edible and praise.

The sixth trial included a 3 s delay before the prompt sequence was initiated to allow the opportunity for independent responses. If at least one independent response occurred, the delay remained in place for subsequent trials regardless of performance. If no independent response occurred during the delay, the next five trials were conducted using the errorless learning procedure followed by a probe trial with a 3-s delay. Each correct response resulted in praise and an edible with up to a 3-s pause (following consumption of the reinforcer) for continued responding until all five members were named. If the child failed to provide all five intraverbals, the remainder of the trial entailed immediate prompts (e.g., picture, echoic) for the remaining category items.

After three trials with one or more correct intraverbals, differential reinforcement of independent responses was initiated. Independent responses resulted in praise and edibles while prompted responses resulted in praise only. When four or more independent responses occurred for three consecutive trials, schedule thinning was initiated. The first step of schedule thinning was an FR-2 schedule. The second step was an FR-4 schedule and the third step was no specific reinforcement with periodic general praise for “nice work”. Schedule thinning progressed following three consecutive trials with four correct responses. For Paul and Greg, edibles and praise were thinned simultaneously. For Chad, the schedule for edibles was thinned but verbal praise was retained to facilitate maintenance.

*Follow-up:* Follow-up trials were identical to the baseline trials. They were conducted periodically for each category until training was completed for the first three categories. The first participant, Paul, performed poorly during initial follow-up so immediate booster training trials were added for all participants if one or fewer correct responses occurred during a follow-up trial. Booster trials included tact prompts, but no differential reinforcement. Training was interspersed across categories for the final participant, Chad, in hopes of further facilitating maintenance. Every sixth trial after schedule thinning was immediately followed by a single training trial for each previously mastered category. Additional follow-up data were collected 9 weeks after the completion of training for Paul and 7 weeks after training for Greg. Unfortunately, Chad was unavailable for collection of final follow-up data.

## 2. Results

Correct intraverbal responses for each participant are graphically depicted in Figs. 1–3. No correct responses occurred during baseline trials despite the fact that each participant subsequently responded correctly to most of the items during the first tact assessment trial. Paul responded correctly to 19 of the 20 pictures in the first presentation, but exhibited significant attending and compliance issues across presentations. Seven presentations over 2 days were required to meet the mastery criterion of three perfect sets ( $M = 17.7$  correct; range = 13–20). Chad responded correctly to 15 of 20 pictures in the first presentation and required 26 presentations of the 20-picture set across 3 days to acquire the tact for pear and clearer articulation for yellow and desk ( $M = 18.8$  correct; range = 15–20). Greg initially responded correctly to 18 of the 20 pictures and required 13 presentations across 3 days to meet the criterion and acquire the remaining items ( $M = 19$  correct; range = 18–20). Following mastery of all tacts, baseline levels of intraverbal responding remained at zero for all categories for Greg and Chad and for the three categories with a return to baseline for Paul. This pattern of poor intraverbals despite a robust tact repertoire is notable.

During training, Paul (Fig. 1) did not respond independently until trial 44 for the first category despite probes on every sixth trial (top panel). The first category required over 100

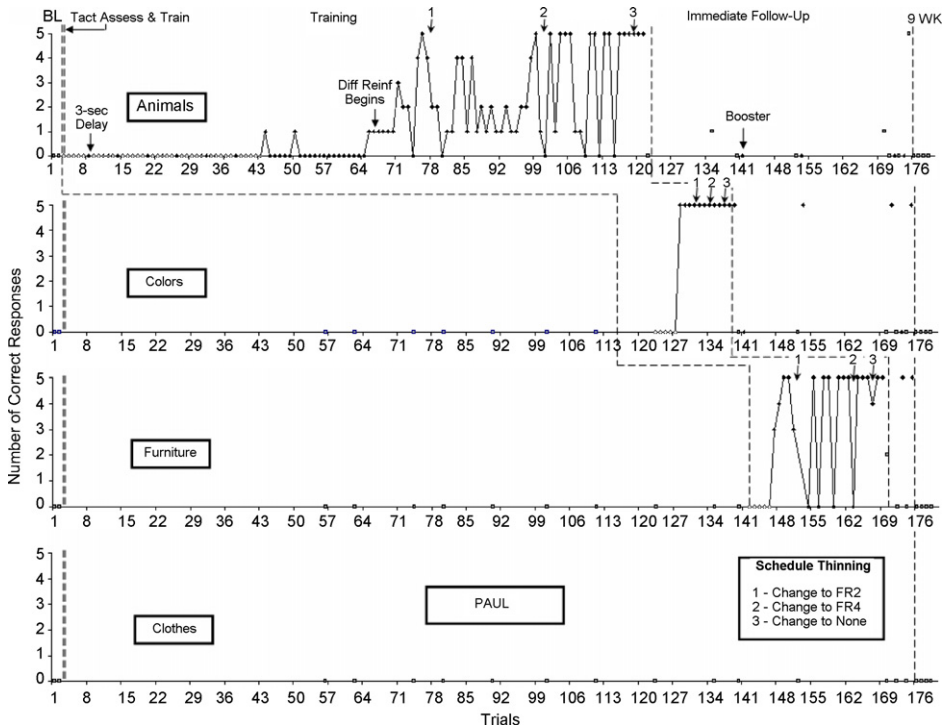


Fig. 1. Number of categorical intraverbals per trial emitted by Paul during baseline, treatment, and follow-up.

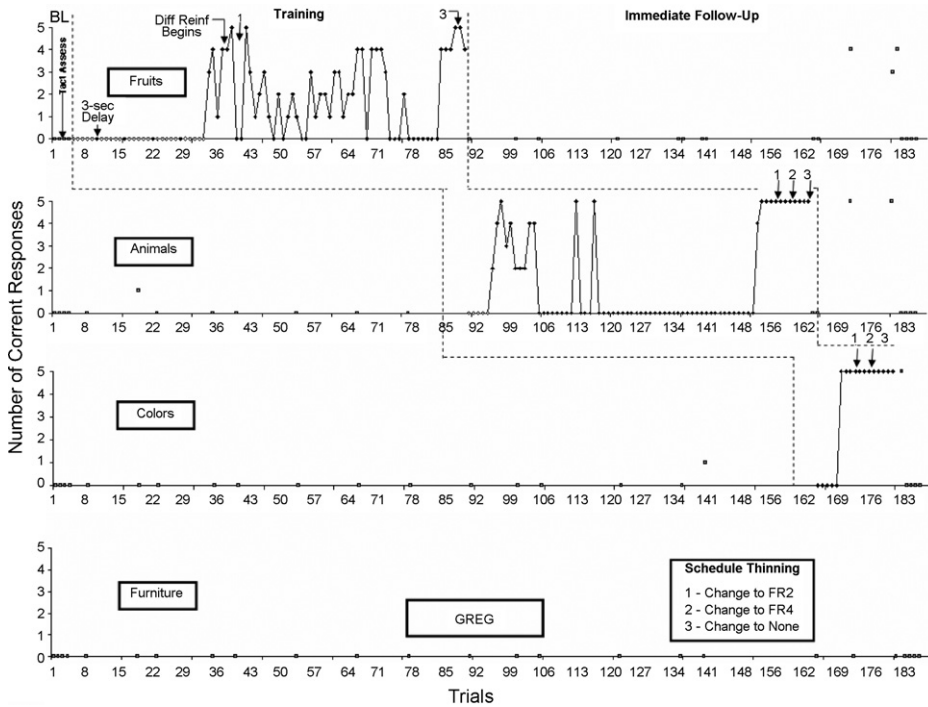


Fig. 2. Number of categorical intraverbals per trial emitted by Greg during baseline, treatment, and follow-up.

trials to mastery and completion of schedule thinning, while subsequent categories took fewer than 30 trials each (second and third panels). Performance in initial follow-up trials was poor, resulting in booster training trials, and performance remained poor at 9 weeks post-treatment. No generalization to the untrained constant series control category was observed (bottom panel).

Greg (Fig. 2) also required many training trials with immediate picture prompts before responding independently at trial 36 (top panel). Independent responding remained variable under differential reinforcement. The first category was completed in 84 trials with subsequent categories taking 75 trials (second panel) and 16 trials (third panel). Like Paul, Greg's immediate follow-up data for the first two categories was poor and booster sessions were required; however, performance for all three categories improved once he began consistently responding to the third category. Despite promising immediate follow-up data, maintenance at 7 weeks was poor and no generalization occurred to the untrained category (bottom panel).

Chad's (Fig. 3) evaluation required the most time due to long delays between sessions and an attempt to relocate sessions to his home (trials 25–90) to accommodate the family's scheduling problems. A regular training schedule was resumed at the research site at trial 91 with a collateral increase in independent responding and decreasing trials to criterion across categories: first category – 109 trials (top panel), second category – 28 trials (second panel), third category – 23 trials (third panel). Concurrent training across

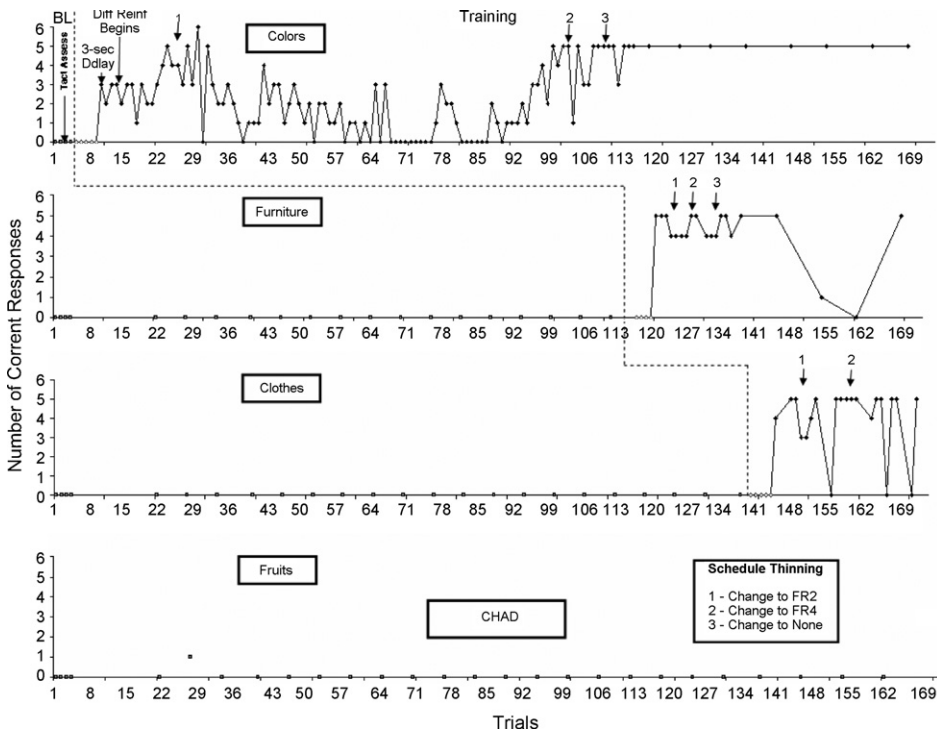


Fig. 3. Number of categorical intraverbals per trial emitted by Chad during baseline, treatment, and follow-up.

categories was implemented with Chad resulting in better response maintenance for all categories during ongoing training and follow up. Unfortunately, Chad was not available for the 2-month follow-up. Accurate responses to the fourth, untrained category (fruits) were observed in trials 27 (orange) and 169 (grapes and banana). One completely novel response was observed for the colors category (top panel) when Chad responded by providing all five targeted colors plus one that had not been included in tact training.

### 3. Discussion

Intraverbals are an important aspect of language for children with autism because they are critical to everyday interpersonal interactions and contribute substantially to measured intelligence (Sundberg & Michael, 2001). The current study replicated the methodology of Partington and Bailey (1993) using transfer-of-stimulus-control procedures with errorless learning to target categorical intraverbals with children with autism. This represents only the second study specifically evaluating procedures for teaching intraverbals to this population (Finkel & Williams, 2001) and the first to examine categorical intraverbals. All three participants acquired the targeted intraverbal repertoires with varying trials to

criterion. Acquisition occurred more quickly for subsequently trained categories than for the first category for all participants, suggesting that training may become more efficient across targets.

Although good acquisition effects were achieved, maintenance and generalization effects were limited. For Paul and Greg, training ceased for mastered categories when another target was begun and booster trials were needed to produce any maintenance. Maintenance was better for Chad with modified schedule thinning procedures and concurrent training across categories to ensure more frequent exposure to mastered categories. As a result, the training trials became progressively more similar to baseline probes with all categorical questions presented consecutively as opposed to early training trials where one question was repeated across consecutive training trials. Thus, future studies and clinical application should involve simultaneous training across categories and schedule thinning procedures to enhance maintenance of learned responses. Generalization to novel responses might require targeting an additional problem-solving response on the part of the child with autism such that the child learns to behavior (overtly or covertly) to occasion correct responding. For example, children might ask themselves covertly “What kind of furniture is in my room?” in response to the question “What are some pieces of furniture?”

The present findings provide support for Skinner’s conceptual premise of functional independence. Previous research has investigated the functional independence of mands and tacts with some studies indicating independence and some studies indicating partial interdependence (Sautter & LeBlanc, 2006). Very few studies have examined functional independence of other taxonomic categories. All three participants demonstrated good tact repertoires at initial assessment ( $M = 86.67\%$  correct) in spite of their poor baseline performance of intraverbals with the same items. Baseline data collection resumed for intraverbal categories once tacts were mastered, with no effects on intraverbal responding, replicating the findings of Braam and Poling (1983) and Miguel et al. (2005). Strong tact repertoires existed while intraverbal repertoires were absent suggesting complete functional dependence in every instance as compared to the mixed results that have been obtained with mands and tacts.

With evidence that teaching intraverbal behavior to children with autism is a realistic goal, researchers’ next efforts must concentrate on determining which treatment strategies are most effective. Finkel and Williams (2001) used textual and echoic prompts with one child while the current study employed pictorial tact prompts and echoic prompts. Each study employed transfer of stimulus control from one established verbal operant to another. These findings support other studies that have incorporated transfer of stimulus control from one verbal operant to another with positive results (e.g., Luciano, 1986), but additional research is needed to determine if certain prompts generally result in faster acquisition and stimulus transfer or if response patterns are unique to individual learners. Additionally, our data suggest that follow-up assessment and continuing practice should be a high priority when targeting intraverbals because of the likelihood of poor maintenance.

The current study used errorless learning, which has been advocated by behavioral researchers and clinicians (e.g., Green, 2001) and supported in previous studies on verbal behavior (e.g., Luciano, 1986). The procedure was associated with positive effects on

acquisition and resulted in minimal noncompliant or other disruptive behavior (e.g., inattention, not staying in seat) throughout intraverbal training for all three participants, though two of those children exhibited some noncompliance during screening. In contrast, two other participants were discontinued from the study during tact training, which did not include errorless learning procedures, due to escalating noncompliance and problem behavior.

Several limitations of the present study are noteworthy. Procedural modifications (e.g., training across categories) were made for the final participant in order to achieve better outcomes, but the effects of these modifications were not replicated with other participants. This participant also lacks follow-up data resulting in an incomplete data set. Additionally, several components are included in the intervention (e.g., differential reinforcement, schedule thinning) as part of best clinical practice; however, multi-component interventions make it difficult to determine which components of the intervention were crucial for acquisition. The personnel resources (e.g., therapist and assistant/data collector) required to accurately implement this multi-component procedure might not be available in all settings. Though schedule thinning, differential reinforcement, and errorless learning with transfer of stimulus control (i.e., prompt fading) are based on best practice guidelines, this intervention might need to be simplified for parental or general staff implementation.

Caution should also be exercised with respect to application of these results to general early and intensive behavioral interventions in common practice because this intraverbal behavior occurred as isolated skill development rather than as part of a larger program targeting multiple skills simultaneously. Sporadic attendance often resulted in lengthy delays between training sessions, which may have negatively affected the participants' performance. Thus, the current results may represent an underestimate of the speed of acquisition that might be observed if training were conducted on a daily basis in the context of an in-home intensive early intervention program.

In conclusion, the present study provides additional support for the use of Skinner's taxonomy and behavioral teaching strategies to teach language to children with autism. Future research should continue to determine which treatment components facilitate efficient learning that maintains and, ideally, generalizes to other targets within the same training program.

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