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Effects of a Differential Observing Response on Intraverbal Performance of Preschool Children: A Preliminary Investigation

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Axe (2008) speculated that some instances of intraverbal responding might be associated with limited or delayed acquisition because they require discrimination of multiple components of verbal stimuli. Past studies suggest that acquisition of responses under control of complex, multicomponent antecedent stimuli (e.g., conditional or compound stimulus control) can be facilitated with the introduction of a differential observing response (DOR; Dube & McIlvane, 1999; Gutowski, Geren, Stromer, & Mackay, 1995). The purpose of the current study was to evaluate the effects of a DOR (i.e., repeating the question) on intraverbal responding with six neurotypical preschool children. Findings included that (a) accuracy of intraverbal performance increased when the experimenter prompted a DOR; (b) 1 of 6 participants overtly emitted the DOR for a second relation in the absence of prompts, which was correlated with increased accuracy; and (c) following mastery, response accuracy was variable for 3 participants. Based on these findings, prompted DORs may offer an effective, if temporary, aid to intraverbal instruction for neurotypical preschool children.

Key words: differential observing response, discrimination training, intraverbal responses, preschool children, verbal behavior

A functional intraverbal repertoire appears critical for certain academic tasks (e.g., mathematics, reading comprehension) and participation in social activities such as conversation, singing songs, and telling stories (Partington & Bailey, 1993; Sundberg & Michael, 2001). Axe (2008) reported that some intraverbal behavior may be especially challenging to teach when responses must be evoked by complex (i.e., multicomponent) verbal stimuli, especially when individual components of the verbal stimuli overlap within a group of stimuli (e.g., ''opposite of tall'' vs. ''same as tall;'' see also Sundberg & Sundberg, 2011). Braam and Poling (1983) used differential reinforcement with error correction to teach two adults with developmental disabilities to manually sign the names of members of four categories with overlapping features (e.g., school things, home things, school people, and home people). Although the results of Braam and Poling are promising, some learners may require supplemental interventions to master intraverbal responses under the control of multiple overlapping stimuli.

The term *restricted stimulus control* has been used to describe situations in which only a limited range of the relevant antecedent stimuli (or stimulus components) gain control of responding, resulting in errors (Litrownik, McInnis, Wetzel-Pritchard, & Filipelli, 1978). For example, if a child responds ''hot'' when asked to ''Name the opposite of cold'' and also when asked to ''Name the same as cold'' it appears that the response is controlled only by the last word (cold).

Differential observing responses have also been used to overcome restricted stimulus control during conditional discrimination

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training (e.g., Dube & McIlvane, 1999; Gutowski et al., 1995). Saunders and Spradlin (1990) used differential reinforcement with error correction (for 1 participant) in combination with trial blocking to overcome restricted stimulus control in the context of conditional discrimination training. The DOR procedure is designed to require the learner to respond differentially to each relevant stimulus or stimulus component, thus increasing the probability of optimal stimulus control. Gutowski et al. (1995) overcame restricted stimulus control demonstrated by two young men with mental retardation (MR) by requiring them to tact the relevant visual stimuli (pictures) prior to a delayed matching-to-sample (DMTS) task. Similarly, Dube and McIlvane (1999) successfully reduced restricted stimulus control with three individuals with MR by requiring an identity matching response prior to a DMTS task. However, the effects of a DOR have not yet been evaluated in the context of intraverbal training. This procedure might prove useful for teaching intraverbal responses by enhancing the stimulus control of all relevant verbal stimuli (e.g., *opposite* of *cold—same* as *cold*) because the participant is required to make a different response to each stimulus. We chose the DOR topography of repeating the question because it does not depend on extra materials (e.g., pictures) and could therefore be used across a variety of settings and response opportunities. Thus, the purpose of this study was to evaluate the effects of a DOR on acquisition of intraverbal responses of preschoolers who failed to acquire intraverbals with differential reinforcement and error correction.

METHOD

Participants, Setting, and Materials

Participants were 6 typically developing preschool children between 4 and 5 years old. Five of the 6 participants completed standardized expressive (Expressive One-Word Picture Vocabulary Test, Fourth Edition; Martin & Brownell, 2011) and receptive (Peabody Picture Vocabulary Test, Fourth Edition; Dunn & Dunn, 2007) language assessments prior to the investigation and tested in the average range (Adrian: 3 years, 10 months; Jessica: 4 years, 2 months; Lisa: 5 years, 1 month; Zeke: 4 years, 2 months) or slightly below average (Denise: 3 years, 2 months). Participants were recruited for this study if they showed signs of restricted stimulus control and delayed acquisition of one or two intraverbal responses when taught using differential reinforcement and error correction (as in Braam & Poling, 1983). We first attempted to reduce restricted stimulus control by introducing errorless teaching and trial blocking with 2 participants (Larry and Jessica); however, errors persisted for the initial set of relations across both participants and for Jessica's second set of relations. Larry's performance (data available upon request) improved following introduction of the errorless teaching package with a second set of relations; thus, Larry did not participate in the DOR phase of the current study.

Sessions were conducted 1–2 times per day, 3–4 days per week in a quiet room at the participants' preschool. Session materials included a child-sized table, a video camera, a token board, and a bin of toys and activities, which was presented at the end of each session.

Dependent Variables

Data were collected on correct, unprompted responses (i.e., participant said the target response within 5 s of the experimenter delivering the instruction) and incorrect responses (i.e., error response or no response within 5 s of the experimenter delivering the instruction) and summarized as percentage correct performance.

Interobserver Agreement

Two independent observers scored intraverbal performance live or from video for at least 56% of sessions for each participant distributed across all phases of the investigation. An agreement was scored for each trial in which the experimenter and the observer both recorded the same correct or incorrect response. Point-by-point interobserver agreement (IOA) was calculated for each session by dividing the number of agreements by the sum of agreements and disagreements and converting the resulting ratio to a percentage. Mean IOA was 99.4% (range, 90% to 100%) for Adrian, 100% for Denise, 98.0% (range, 90% to 100%) for Felix, 100% for Jessica, 99.7% (range, 90% to 100%) for Lisa, and 100% for Zeke.

Design and Procedures

Effects of the DOR requirement on intraverbal responses were tested in a nonconcurrent multiple-baseline design across five participants. A multiple-baseline design across behaviors was employed with Denise, the only participant whose data did not show signs of DOR generalization between antonym and synonym relations. Each participant received training on one pair of intraverbals (i.e., two overlapping instructions) including one antonym response (e.g., ''Short'' in response to ''Name the opposite of tall'') and one synonym response (e.g., ''Giant'' in response to ''Name the same as tall'').

Baseline (differential reinforcement with error correction). All baseline sessions consisted of 10 training trials (5 antonym trials and 5 synonym trials), which the experimenter presented in alternating fashion. In each trial, the experimenter presented an instruction (e.g., ''Name the same as tall'') and waited 5 s for the participant to respond. If the participant made an error or did not respond, the experimenter modeled the correct response (''Giant''), praised correct imitative responses, and presented a correction trial (''Good. Name the same as tall''). If the participant did not imitate the model in the first correction trial, the correct response was modeled a second time followed by a correction trial. Accurate responses in correction trials were praised. An incorrect response in the correction trial resulted in one additional model and praise for imitation. Thus, the experimenter presented the next training trial (i.e., ''Name the opposite of tall'') after a correct response to either the initial instruction or the correction trial, or following two consecutive nonresponses to the model prompt or the correction trial. A response was mastered if the participant independently emitted five out of five correct responses for both targets in a pair of responses across three consecutive sessions. If mastery level responding was observed for one of two responses, training continued across responses until both were mastered.

The experimenter delivered tokens for all unprompted, correct responses and praise for all prompted and unprompted responses. The participants had experience with token economies prior to participation in the study. Tokens were also provided on an intermittent schedule for general compliance (e.g., looking at the experimenter when asked, sitting up in the chair, hands in lap). After 10 intraverbal trials were administered and the participant earned 12 tokens, he or she was invited to select a toy from a bin, and was allowed access to the selected toy during a 5-min play break.

Prompted differential observing response—all responses (DOR-All; Zeke and Jessica only). Teaching procedures were identical to baseline except that participants were prompted to repeat the instruction before providing an answer *to both* verbal antecedent stimuli. The experimenter presented the verbal antecedent (e.g., ''Name the opposite of tall'') and immediately asked the participant to repeat it by stating ''You say it.'' The participant was given 2 s to echo the verbal antecedent (i.e., emit the DOR) and an additional 5 s to emit the target intraverbal response (e.g., ''Short''). If the participant did not emit the DOR, but emitted the target intraverbal response within 2 s, the experimenter prompted the DOR again. If the participant made no response within 2 s (i.e., did not emit the DOR or give an answer), the experimenter repeated the instruction to emit the DOR by saying: ''Name the opposite of tall. You say it.'' None of the participants required a third prompt to emit the DOR. If the participant did not emit the correct intraverbal response after emitting the DOR, the experimenter repeated the verbal antecedent, modeled the correct response (e.g., ''Name the opposite of tall—it's short''), and prompted the participant to imitate (e.g., ''Say short''). If the participant did not imitate the first model, the experimenter prompted (''Say short'') one more time before advancing to the next trial.

Prompted DOR-single response (DOR-Single; Felix, Adrian, Lisa, and Denise). Teaching procedures were identical to DOR-All except that participants were prompted to emit the DOR for only *one of two* target intraverbal responses. The purpose of this modified evaluation was to assess DOR generalization across stimuli.

Procedural Integrity

A trained observer independently scored at least 56% of the sessions for each participant

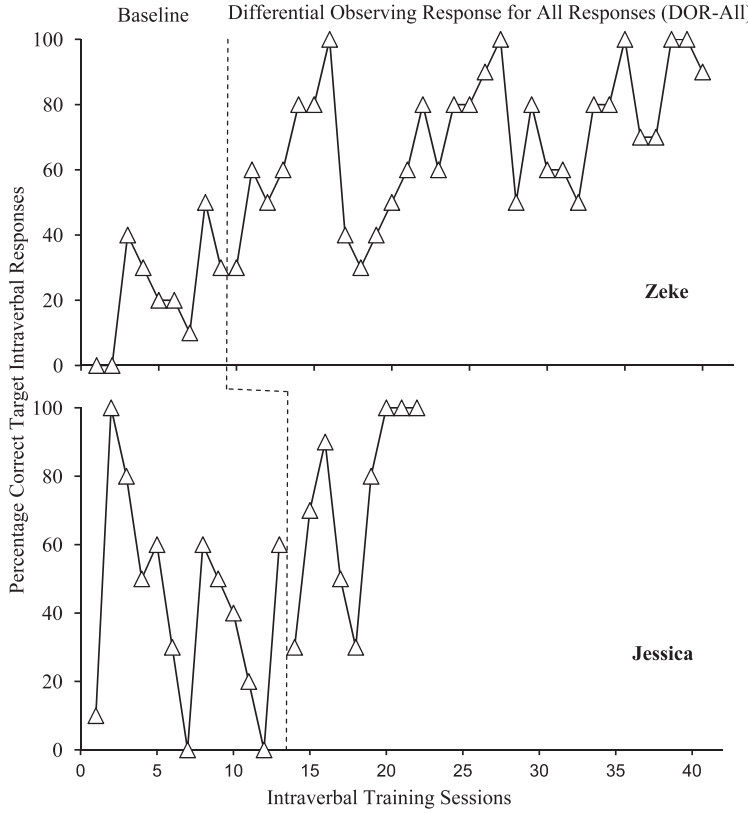

Figure 1. Percentage correct intraverbal responses for the across participants evaluation of the Differential Observing Response–All Responses (DOR–All) evaluation.

to assess procedural integrity. Each trial was evaluated according to a checklist of experimenter behaviors required for proper implementation. The behaviors on the checklist were providing (a) the correct instruction, (b) a prompt for the participant to emit the DOR (only relevant when the DOR condition was introduced for a particular question), (c) praise and tokens for correct responses, and (d) correct prompts. Incorrect implementation of any behavior from the checklist resulted in an implementation score of incorrect for that trial; otherwise the trial was scored as correctly implemented. Procedural integrity was calculated by dividing the number of correctly implemented trials by the total number of trials and multiplying by 100. Mean integrity scores were 99% (range, 90% to 100%) for Adrian, 100% for Denise, 95% (range, 90% to 100%) for Felix, 98% for Jessica (range, 90%–100%), 98% (range, 90% to 100%) for Lisa, and 99% (range, 90%–100%) for Zeke.

RESULTS AND DISCUSSION

The DOR requirement was sufficient for 4 of 6 participants to achieve mastery of a pair of intraverbal responses. Participation for Felix and Zeke (see Figure 1) was terminated before full mastery was reached on both responses in the targeted response pairs. Felix's participation was terminated because he refused to attend three consecutive sessions and Zeke's participation was terminated because he was absent from school for an extended period of time due to illness. For 3 of 4 participants who experienced the DOR-Single condition, performance accuracy also improved on the second target (see Figure 2). For Denise, correct responses to the second question

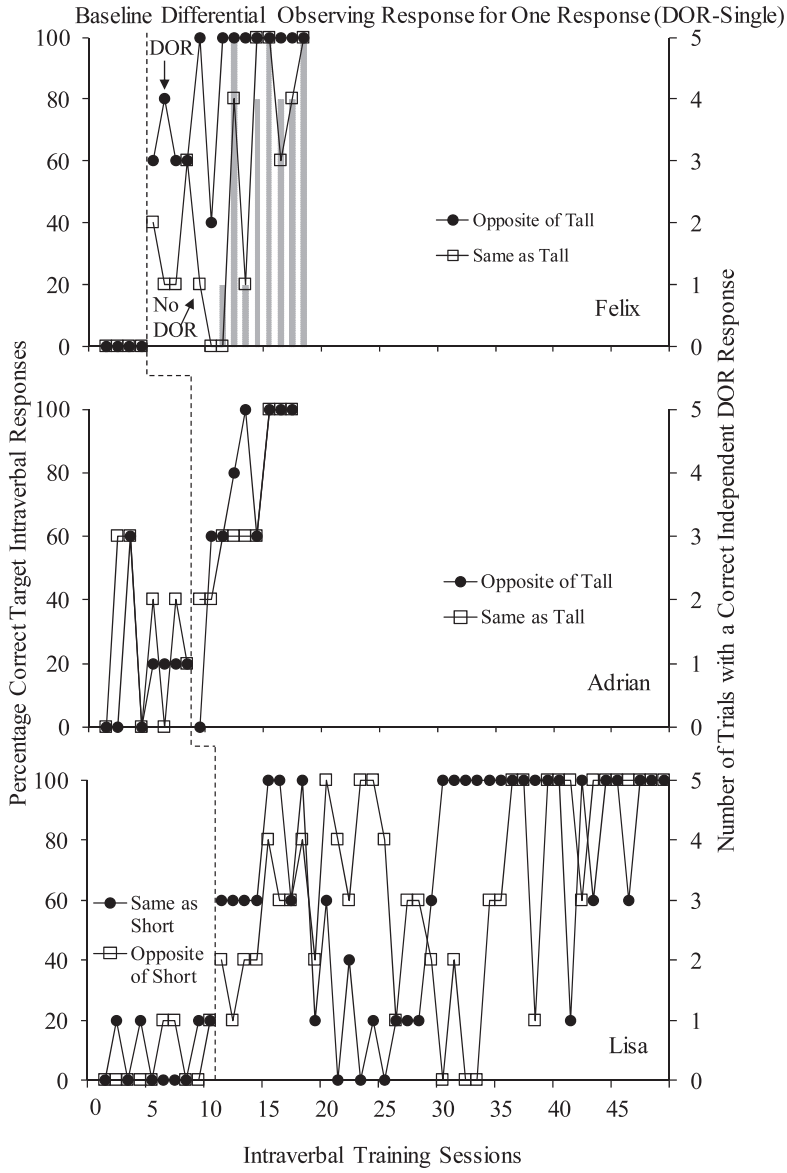

Figure 2. Percentage correct intraverbal responses for the across participants evaluation of the Differential Observing Response–Single Response (DOR–Single) condition. Note: Shaded bars = number of trials the participants emitted the DOR independently for the untaught response.

occurred only when the DOR was required after both ''opposite'' and ''same'' questions (see Figure 3).

A post-hoc analysis of within-session responding was completed to determine (a) types of errors made, and (b) if participants emitted unprompted DORs for the second target response. Participant response patterns were assessed by reviewing trial-by-trial notes on verbatim responses. Results of the post-hoc within-session analysis suggested that 84% of overall participant errors were consistent with restricted stimulus control (e.g., saying ''Giant'' in response to both ''Name the opposite of tall'' and ''Name the same as tall''). This finding suggests that the DOR requirement facilitated acquisition by requiring successive discriminations between

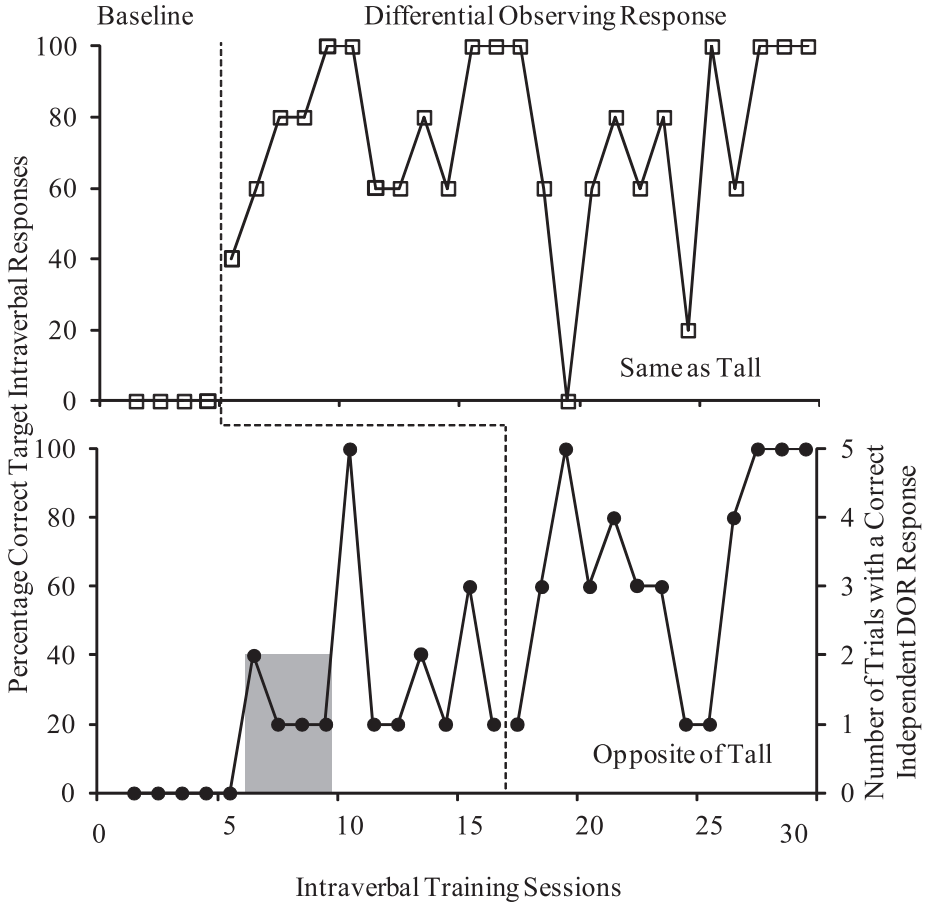

Figure 3. Percentage correct intraverbal responding for the across behaviors evaluation of the Differential Observing Response–Single (DOR–Single) condition with Denise. Note: Shaded bars = number of trials the participant emitted the DOR independently for the untaught response.

antecedent stimuli. Results of the post-hoc within-session analysis (results indicated by bars in the figures) indicated that only Felix overtly emitted the DOR response for the second target response on the majority of trials without prompts from the experimenter. Lisa, by contrast, emitted a DOR for the second target response on just one trial in session 23. Despite this, the accuracy of Lisa's intraverbal responding for the second target increased during the intervention phase.

Felix emitted the DOR for the second target response, despite not being directly prompted to do so. This might be described as a problem-solving strategy that facilitated his rapid acquisition of the second intraverbal response. Problem solving occurs when an individual is presented with a problem for which he has no immediately available solution, thus, he or she must engage in a series of precurrent behaviors (Palmer, 1991; Skinner, 1968) that increase the likelihood of emitting a successful response. When presented with a multicomponent question, a child might not have an immediate response. Repeating the question enhances the salience of the S^D and may increase the likelihood of a correct response (i.e., solution).

Denise occasionally emitted a DOR for the second target response (once in session 6, twice in session 7, once in session 8, once in session 9) following introduction of the DOR for the first response. Denise only emitted a correct intraverbal response 1 out of the 5 times that she emitted the DOR for the second target intraverbal response.

None of the participants consistently emitted the wrong DOR for either intraverbal response. However, Felix said the wrong DOR on one occasion in session 12 (i.e., ''Name the opposite of tall'' when the question was ''Name the same as tall''), followed by a correct response (''Giant'').

One analysis that might shed light on whether Adrian and Lisa were emitting an unprompted DOR covertly would be to assess changes in response latency from baseline sessions for the second relation before and after the DOR was introduced for the first relation. Unfortunately, an adequate number of video samples were not available for this analysis.

With the exception of Lisa, no participant experienced training for antonym-synonym responses prior to this study. Lisa successfully learned one set of responses (i.e., opposite of tall, same as tall) as a participant in a previous study, but she did not acquire the reverse responses (i.e., opposite of short, same as short). Twenty percent of Lisa's errors in the first 10 sessions of training in the current study (data presented in Figure 2) were responses from the set she had learned previously (i.e., ''short'' for ''opposite of short'' and ''giant'' for ''same as short''). This indicates Lisa's responses were initially under simple stimulus control of words in the middle of each question (i.e., opposite and same), but that introduction of the DOR might have resulted in control by all relevant stimuli (i.e., opposite – short and same – short).

The results of the current study should be interpreted in light of at least four limitations. First, it is possible that the training in the current study resulted in simple stimulus control, rather than the desired conditional or compound stimulus control. In other words, the stimulus arrangements might have established simple stimulus control by the words ''same'' and ''opposite.'' This could be avoided in future studies by teaching multiple exemplars concurrently, for example the four overlapping stimuli of opposite-tall, opposite-soft, same-tall, and same-soft. Second, we did not evaluate whether the children could respond accurately to the concepts ''opposite'' and ''same.'' Future researchers should evaluate the extent to which participants can respond to the words ''opposite'' and ''same'' as speakers and listeners. Third, overtly repeating a question as a form of DOR may not be socially acceptable to parents and teachers, particularly those who serve people with autism spectrum disorders or other developmental disabilities. To avoid stigmatization, future research should systematically fade the volume at which participants repeat the question until they emit the DOR covertly (Fjellstrom, Born, & Baer, 1988). Fourth, the DOR did not produce stable changes in performance for 3 participants. The post-mastery increase in variability of responding observed for Denise, Lisa, and Zeke might have occurred because the DORs in this study shared overlapping features (e.g., ''opposite of tall'' and ''same as tall'') and, therefore, were not sufficiently different or unique. Future research should evaluate maintenance of intraverbals trained with a DOR.

Results of this preliminary study suggest that DORs may offer a useful, if temporary, means for facilitating acquisition of intraverbal responses. Based on these data and the practical importance of intraverbal repertoires, researchers should continue to examine the utility of DORs and the extent to which a history of teaching with DORs prepares learners with and without disabilities to acquire subsequent responses. Other DORs that could be evaluated include making different hand gestures for each relevant stimulus, repeating only the most relevant stimuli (e.g., ''opposite-tall'' and ''same-tall''), or including an MTS task (e.g., match opposite of tall prior to presentation of intraverbal instruction).

Finally, results of studies conducted by Sautter, LeBlanc, Jay, Goldsmith, and Carr (2011) and Kisamore, Carr, and LeBlanc (2011) indicate that teaching problem-solving strategies to typically developing children aids in the acquisition of intraverbals. The role of problem solving in the acquisition of intraverbal responses warrants further investigation. Future researchers might examine the effects of other problem-solving strategies, such as searching the environment for answers to questions like, ''Name a blue animal.''

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