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EMERGENCE OF INTRAVERBAL ANTONYMS IN CHILDREN WITH PERVASIVE DEVELOPMENTAL DISORDER

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In the type of intraverbal that consists of saying the opposite of a word, two intraverbals are related to one another because the response form of each intraverbal functions as part of a discriminative stimulus for the other (e.g., ''cold'' in response to ''name the opposite of hot,'' and vice versa). Moreover, the contextual cue ''Name the opposite of —'' is the same in the two intraverbals. The purpose of the present research was to explore a procedure designed to promote emergence of intraverbals of this type. Two children with pervasive developmental disorder learned pairs of intraverbals. Thereafter, they were tested for emergence of intraverbals with reversed stimulus–response functions. Results indicate that, although the participants did not initially show emergence of intraverbals with reversed stimulus–response functions, repeated cycles of probing and teaching facilitated emergence of these relations.

DESCRIPTORS: intraverbals, derived relations, emergent relations, social interaction, social skills, autism

After learning conditional discriminations, children with autism may show the emergence of novel conditional discriminations that result from combining stimuli from two or more taught discriminations (e.g., Eikeseth & Smith, 1992). Most studies on stimulus equivalence have used conditional discriminations with selection-based responses (e.g., match-to-sample procedures). There are, however, many everyday examples of topography-based conditional discriminations such as intraverbals, in which verbal stimuli evoke verbal responses of a different form. In addition, many intraverbal stimuli and responses may enter into relations that can be derived (i.e., can emerge), such as reversibility. For example, given the common contextual cue, ''Name the opposite of —,'' ''hot'' and ''cold'' are interchangeable, or reversible, as either verbal stimuli or responses. The few existing studies on emergent intraverbal relations suggest that extensive teaching may be required, even with typically developing children (Pérez-González, Herszlikowicz, & Williams, in press; Polson & Parsons, 2000).

Elucidation of variables involved in the emergence of intraverbals would be of theoretical interest and would have important implications for establishing derived verbal relations in children. The first goal of the present study was to explore whether children with pervasive developmental disorder (PDD) would show emergence of a reversible intraverbal relation. A

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second goal was to explore whether teaching the reverse of a previously taught relation would result in the subsequent emergence of intraverbals with the same contextual cue.

METHOD

Participants

The participants were 2 children who had been diagnosed with PDD and attended a behavior-analysis-based program. They were able to repeat almost all common words (generalized echoic repertoire), named more than 300 items (tacts), requested items (mands), answered several social questions such as ''what is your name?'' (intraverbals), and demonstrated some autoclitic responses (e.g., ''no more,'' ''this one''). Child A was 6 years old and had scored 2.92 years on the Peabody Picture Vocabulary Test administered 60 days before the experiment. Child B was 8 years 4 months old and had scored 6.0 years on the Peabody Picture Vocabulary Test administered 8 months before the experiment. Child B was able to read, write, and maintain simple conversations.

Stimuli and Relations

The stimuli were sentences spoken to the children. The responses were the words the children said. The stimuli and responses were presented as sets of intraverbals composed of two unrelated original intraverbals (e.g., ''Name the opposite of more''; ''less'') and two reverse intraverbals or two unrelated intraverbals. In each reverse intraverbal, terms from an original intraverbal were arrayed in reverse stimulus–response functions (e.g., from above, ''Name the opposite of less''; ''more''). In the unrelated intraverbals, the words were unrelated to either original intraverbal (e.g., ''Name the opposite of thin''; ''thick'').

Procedure

Sessions. The child's teacher conducted sessions. She asked questions aloud and waited for the child's response. Correct responses consisted of saying the word corresponding to the question within 5 s. In teaching trials, correct responses were followed by praise or a token that could be exchanged later for reinforcing items; incorrect responses were followed by the teacher stating the correct response, an intertrial interval, and the presentation of the next trial. In probe trials, there were no differential consequences. In all cases, intertrial intervals were about 5 s.

Pretest. Original and reverse intraverbals were probed to verify that the children had not previously acquired them. Three trials of each intraverbal were randomly presented with no differential consequences. To maintain an adequate level of motivation, intraverbal trials were interspersed with trials with verbal relations that the child already had acquired. Correct responses to previously acquired relations were followed by praise or tokens. Several sets of intraverbal relations were selected for intervention for each participant based on pretest outcomes showing low levels of correct responses. A detailed description of pretest outcomes for each participant is available from the corresponding author.

Teaching. With Child A, for each set of intraverbals, the teacher followed a cycle with the following steps: In Step 1, the teacher presented six trials with original intraverbals and six trials with reverse intraverbals selected for intervention. All other procedures were identical to the pretest. In Step 2, the teacher taught two original intraverbals. First, she presented two trials with one original intraverbal relation in which she prompted the response using a verbal model. After three consecutive correct responses with no prompt, she taught the other original intraverbal of the set using the same procedure. She then presented randomly ordered trials with the two original intraverbals with no prompts. If the child made four consecutive incorrect responses or made fewer than 18 correct responses in 24 trials, Step 2 was repeated. After reaching a criterion of 12

consecutive correct responses, the teacher initiated Step 3. In Step 3, the teacher conducted 12 probe trials with the two original intraverbals taught in Step 2 and 12 trials with the two reverse intraverbals. For data analysis, the probes were divided into two clusters of six trials of each type. If the child made four or fewer correct responses during either cluster of six trials with reverse intraverbals, the child went to Step 4. If the child made five correct responses in each cluster of six trials with both reverse intraverbals, Steps 2 and 3 were repeated. If six correct responses were made with all reverse intraverbals, Step 1 was initiated with a new intraverbal set or the study finished. In Step 4, the reverse intraverbals were directly taught using procedures identical to Step 2. Thereafter, trials with the original and the reverse relations were randomly intermixed. When the child emitted 12 consecutive correct responses, Step 1 was initiated with a new intraverbal set.

To determine whether learning intraverbals per se would suffice to facilitate the emergence of novel intraverbals of this type, Child B did not receive trials with reverse intraverbals during Step 4 for the first two sets of original intraverbals. Instead, Child B learned unrelated intraverbals with these two sets. Starting after the probes with Set 3, he learned pairs of related (reverse) intraverbals. This arrangement worked as a multiple baseline design across children such that the effects of teaching pairs of related intraverbals could be contrasted with the effects of simply learning the same number of unrelated intraverbals. In addition, because Child B had difficulties producing 12 consecutive correct responses in Step 2, the criterion for that step was decreased to six consecutive correct responses.

Interobserver agreement. The experimenter and an independent observer recorded 658 of 777 verbal responses uttered by Child A and 2,346 of 5,486 responses uttered by Child B. Only words clearly spoken by the child were accepted as correct responses. The experimenter and the observer agreed on 3,000 of the 3,004 responses; thus, interobserver agreement (number of agreements divided by the number of agreements plus disagreements multiplied by 100%) was 99.8%.

RESULTS AND DISCUSSION

Pretest. Child A responded correctly in only one trial. Child B responded correctly in four or more trials with six of eight pairs; thus, these intraverbals were replaced by other intraverbals with less frequently used antonyms.

Acquisition of directly taught relations. Child A learned each pair of the taught intraverbals within 105 trials on average (range, 31 to 269 trials). Child B learned each pair of intraverbals in 306 trials on average (range, 37 to 1,107 trials). No clear trend was observed in the number of trials needed to master a pair of intraverbals; instead, the number seemed to depend on the difficulty of pronunciation of the words. Typical forms of incorrect responses were that the child remained silent or repeated the last word of the question or a word from previous questions (i.e., immediate or delayed echolalia).

Probes. The outcomes of probes are shown in Figure 1. After failing to show emergence of reverse intraverbals with Stimulus Set 1, the reverse intraverbals for that set were directly taught. Reverse intraverbals also did not emerge during probes with Stimulus Set 2. Following direct teaching with reverse intraverbals for Stimulus Set 2, however, Child A scored correct responses on five of six trials with each cluster of reverse intraverbals for Stimulus Set 3; after a review of original relations, the child responded correctly to five of six and six of six reverse intraverbals. All probe trials with reverse intraverbals in Stimulus Set 4 were correct. Interestingly, probes revealed variability in the original relations, with perfect responding observed during only two clusters of trials.

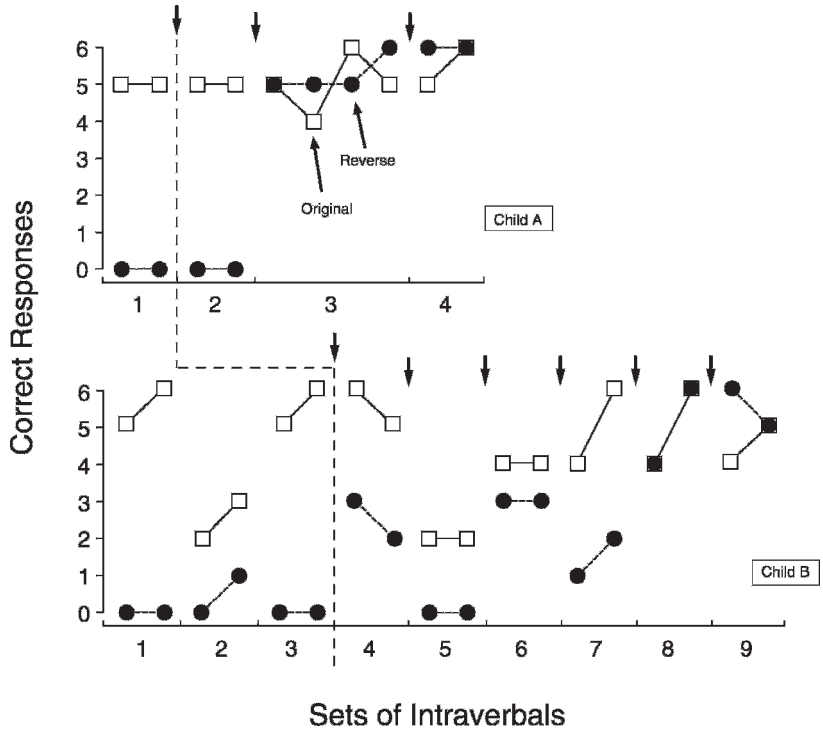

Figure 1. Results of the probes with the original and reverse intraverbals (Step 3). Correct responses during probes of original and reverse relations are displayed across consecutive presentations of clusters of intraverbals. The vertical arrows indicate that the reverse intraverbals of the set on the left emerged or were taught.

No reverse intraverbal relations were taught for the first two stimulus sets for Child B; thus, probes of Sets 1 to 3 showed the effects of teaching unrelated intraverbals on acquisition of directly taught relations and emergence of reverse intraverbals. Directly taught relations showed variability, and only one correct trial with reverse intraverbals was observed across sets. Following direct teaching with reverse intraverbals (starting with Set 3), probes of reverse intraverbals initially showed three of six and two of six correct responses (Set 4). Although no reverse intraverbals were scored correct with Set 5, Child B made increasing numbers of correct responses on reverse intraverbal trials with Sets 6 through 9.

The outcomes show that neither child responded correctly to probes of reverse intraverbal relations until direct teaching was initiated with those relations. After teaching sets of reverse intraverbals, subsequent emergence of those types of relations, without directly teaching the specific relations, was observed with both children.

The first goal of the present study was to explore whether children with PDD would show emergence of an intraverbal of the type "Name the opposite of —" after learning original intraverbal relations. Neither child showed emergence of the novel intraverbals prior to the explicit teaching of both original and reverse intraverbals. Moreover, Child B did not show emergence even after having demonstrated some intraverbals of this type (during the first baseline probes) and after learning 10 additional operants of this type (original relations and unrelated intraverbals with Sets 1 to 3). These results indicate that learning

intraverbals of the type "Name the opposite of —" was not enough to produce emergence of novel intraverbals of this type.

The second goal of the present study was to explore whether teaching reverse intraverbals would result in the subsequent emergence of intraverbals. Child A demonstrated emergent relations after learning four pairs of related intraverbals; Child B began to correctly reverse some stimulus–response functions after learning two related pairs and showed emergence of the two reverse intraverbals from Sets 8 and 9 after learning related pairs of each set from Set 3. These data suggest that learning pairs of related intraverbals facilitates the emergence of this type of intraverbal.

Outcomes for Child B, who had extensive language skills and was in his first year of full-time integration in a regular school, are particularly interesting. This child demonstrated an enormous number of intraverbals of the type "Name the opposite of —" prior to the study; however, he was not able to demonstrate emergence of novel intraverbals of this type, either prior to or following initial teaching with original relations. Thus, the outcomes for this child suggest that learning intraverbals of this type (either through informal or formal teaching) does not guarantee emergence. The results of reverse intraverbal teaching for both participants suggest that these procedures can promote the emergence of novel language and may play a key role in the acquisition of generative language skills in children with PDD and other learning disabilities.

Of theoretical interest is whether these children's performances reflect the acquisition of a relational frame consisting of the two related intraverbals (e.g., Hayes, Barnes-Holmes, & Roche, 2001). The development of such a relational frame was not necessary for the emergence of similar intraverbals in typically developing children (Pérez-González & Salameh, 2003). The present data suggest that development of this specific type of relational frame may have been necessary to establish emergent relations for the current participants; it is possible that the typically developing children in the previous study by Pérez-González and Salameh had previous experience with similar frames. Future research should investigate the role of relational framing, if any, in the emergence of reverse intraverbal operants.

The present study should be replicated with additional children to determine the generality of the current outcomes. It is notable that the child who received direct teaching with more pairs of unrelated intraverbals before initiating teaching with reverse intraverbals (Child B) had more difficulty demonstrating emergence of these relations. Thus, it is possible that extensive teaching with original relations prior to teaching with related intraverbals may impede emergence. Perhaps subsequent replications using similar multiple baseline designs would allow a more definitive account of the relation, if any, between extensive teaching with original intraverbal relations and the emergence of related intraverbal operants.

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