EMERGENT INTRAVERBAL RESPONSES VIA TACT AND MATCH-TO-SAMPLE INSTRUCTION

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The present investigation evaluated the effectiveness of category tact and match-to-sample instruction in facilitating the emergence of intraverbal responses (i.e., naming several items belonging to a specific category) for 2 children with autism. Results demonstrated the emergence of untaught responses, suggesting an effective instructional protocol for establishing intraverbal responses without direct instruction.

Key words: verbal behavior, intraverbals, autism

Skinner's (1957) taxonomy of verbal behavior has increased in popularity as a curricular approach for children with autism (e.g., Sundberg, 2008). Although based on a strong conceptual framework, continued research is necessary to verify the efficacy of programming based on verbal behavior concepts (Carr & Firth, 2005). Few studies have investigated the intraverbal relative to the mand, tact, and echoic (Sautter & LeBlanc, 2006). Intraverbal categorization (e.g., answering "dog, cow, pig" when asked, "What are some animals?") is a skill commonly targeted in intervention (Sundberg, 2008). Prior investigations have demonstrated intraverbal categorization skills via transfer-of-stimulus-control procedures (e.g., Goldsmith, LeBlanc, & Sautter, 2007; Luciano, 1986). For example, Luciano (1986) taught participants to list the names of some foods via tact-to-intraverbal transfer of stimulus control, in which vocal responses originally were brought under control of visual stimuli (tact-

ing), and stimulus control was transferred gradually to the experimenter's verbal stimuli (intraverbal behavior). Likewise, multiple-tact instruction, or teaching item and category names for stimuli (e.g., "It's a dog and an animal"), and listener instruction both have been investigated, but transfer-of-stimulus-control procedures were necessary to produce intraverbal responding for many participants (Miguel, Petursdottir, & Carr, 2005; Petursdottir, Carr, Lechago, & Almason, 2008). The purpose of the present investigation was to explore the role of category tact instruction in facilitating the emergence of intraverbals, with the addition of match-to-sample instruction, a procedural sequence suggested by Miguel and Petursdottir (2009) to be of potential value in engendering untaught verbal skills.

METHOD

Participants, Sessions, and Stimulus Materials

Two 5-year old children who had been diagnosed with autism served as participants. Michael's age equivalent on the Preschool Language Scale (4th ed.; PLS-4) was 3 years 7 months, and Richard's age equivalent was 3 years 6 months. Based on the Verbal Behavior Milestones Assessment and Placement Program (Sundberg, 2008), individual instruction goals for both boys were derived from the Level 3 curriculum. The participants were recruited from Southern Illinois University Carbondale's

This project was supported by funding from The Autism Program of Illinois and the Illinois Leadership Education in Neurodevelopmental and Related Disabilities Training Program. We thank Tracy Tufenk, Jessica Loverude, Christina Racz, Hamilton Rech, Fiorella Scaglia, and Andresa De Souza for assistance in sessions and with data collection.

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doi: 10.1901/jaba.2012.45-601

Center for Autism Spectrum Disorders. Families were compensated with gift cards to local convenience stores. Sessions were conducted in a clinic setting two to three times per week. Session duration was approximately 60 min (instructional sessions) or less than 10 min (test probe sessions). Stimulus materials consisted of nine picture cards for each of four categories (a total of 36 cards) for each participant. Category cards for Michael were pictures of things that take you places (e.g., car, train, airplane), things in the bathroom (e.g., mirror, toilet paper, toothpaste), body parts (e.g., leg, ear, foot), and musical instruments (e.g., piano, drums, guitar). Richard's category cards included furniture (e.g., bed, chair, table), vehicles (e.g., bus, car, truck), clothing (e.g., shoes, pants, shorts), and body parts.

Design and Measurement

A concurrent multiple probe design across participants was employed. The dependent variable during intraverbal probes was the number of correct answers to questions about items in a category. Questions for Michael included "What are four things in the bathroom?," "What are four body parts?," "What are four things that take you places?," and "What are four musical instruments?" Questions for Richard included "What are four body parts?," "What are four vehicles?," "What are four kinds of furniture?," and "What are four kinds of clothing?" The experimenter scored a correct intraverbal response when the participant emitted an answer that was appropriate for the category (e.g., saying "car" for the vehicle category). Intraverbal responses were scored as correct only if they occurred within 5 s of the verbal antecedent stimulus. All other responses (or absence of responding) were scored as incorrect, as were responses that occurred after 5 s, but this rarely happened. The dependent variable during simple tact instruction, category tact instruction, and match-to-sample instruction was the percentage of correct responses per trial block. In all of these conditions, responses were scored as correct only if they occurred within 5 s of the presentation of the stimuli and the corresponding vocal instruction. For sim-

ple-tact instruction, a correct response was scored if the participant stated the name of the item depicted in the picture card (e.g., "toothpaste," "airplane"). For category tacting, a correct response was scored if the participant named the category associated with the item depicted in the picture card, and for match-to-sample instruction, a correct response was scored if the participant placed the picture card in the corresponding category pile. For simple tacting and category tacting, responses were scored as incorrect if the participant did not respond within 5 s or stated something other than the target response. During match-to-sample instruction, incorrect responses were scored if the participant placed the card in an incorrect pile or failed to respond.

A second observer collected interobserver agreement and procedural fidelity data for 58% of Michael's sessions and 59% of Richard's sessions. Interobserver agreement was calculated per phase on a trial-by-trial basis by dividing agreements by disagreements plus agreements and converting that number to a percentage. Mean agreement was 99% for both participants. Procedural fidelity indexes were calculated by dividing the number of steps performed correctly by the investigator (according to a checklist specifically prepared for this study) by the total number of steps, and converting this number to a percentage. The mean percentage of steps performed correctly was 100% for Michael and 99% for Richard. Interobserver agreement and procedural fidelity data were collected in every condition.

Procedure

Intraverbal probes. The purpose of the intraverbal probes was to determine if the participants would respond correctly to category questions before and after intervention. A single intraverbal probe session consisted of 12 intraverbal probe trials (i.e., one question for each of the four categories presented three times), with questions presented in a semirandom order. Three pretest probe sessions were conducted with Michael and four with Richard. One

posttest probe session was conducted with each participant following all instruction phases. The onset of an intraverbal probe trial was marked by the investigator asking a question about items included in one of the target categories (e.g., "What are four body parts?"). We required the participants to name four items, a level of difficulty that is considered age appropriate according to the PLS-4. (However, they were taught category names for nine total items per category during subsequent instruction.) There were no programmed consequences for correct or incorrect responses. A maintenance-task trial that consisted of a previously learned skill (e.g., following simple instructions and counting) was interspersed approximately every fifth probe trial. The investigator delivered descriptive praise for all correct maintenance responses, and participants were given a break and access to preferred items after completing each session.

Simple tact instruction. Prior to teaching category tacts, participants were taught to tact items depicted in the 36 picture cards to a criterion of 100% accuracy over two consecutive 36-trial blocks, presented in a semirandom order. A trial began when the investigator presented a picture card and asked "What is it?" As in the intraverbal probes, the investigator presented a maintenance-task trial after approximately every fifth teaching trial. Descriptive praise was delivered for every correct response, and a token was delivered after every sixth or seventh correct response on maintenance and instruction trials. Prior to beginning each session, the participant selected reinforcers from a toy closet or told the instructor what he would like to earn. Michael frequently chose playing basketball or playing a game on the computer. Richard's selections varied across sessions and included playing with cars or a train set. After earning 10 tokens, the participants received access to the activities for approximately 5 min.

When an incorrect response (or no response) occurred, the investigator used a two-step

prompt hierarchy consisting of a partial verbal prompt (e.g., "too" for toothpaste) and then a full verbal prompt (e.g., "toothpaste") if the participant did not respond to the partial verbal prompt. The trial then was repeated, using 3-s constant prompt delay, until the participant responded correctly in the absence of the prompt.

Category tact instruction. Following mastery of simple tacts, participants were taught to emit the appropriate category name when shown each of the 36 picture cards. Thus, they were taught to emit category names in the presence of nine stimuli that belonged to four categories. The onset of a trial occurred when the investigator presented a picture card and asked "What is a [name of item]?" For example, the investigator presented a picture of an ear and asked, "What is an ear?" Positive reinforcement, prompting, and prompt-delay procedures were identical to the simple-tact instruction phase. Instruction began with one category. Following mastery, a second category was added and category cards were intermixed. The mastery criterion was set at 89% correct for two consecutive trial blocks, and the number of trials per block increased as category pictures were added. Therefore, the mastery criterion was eight of nine trials correct on two consecutive trial blocks for the first category, 16 of 18 trials for two categories, 24 of 27 trials for three categories, and 34 of 36 trials for all four categories.

Match-to-sample instruction. Following mastery of the multiple tacts, the participants were taught to match the cards according to category. The picture cards were shuffled and presented in random order. Comparison stimuli (one per category) were presented in an array of four on a table. A trial commenced when the investigator presented a picture card and instructed the participant to "match." Reinforcement procedures were identical to the previous training phases. A two-step prompt hierarchy was used as needed; we first provided a partial physical prompt and then a full

Figure 1. Number of correct intraverbal categorization responses during pre- and posttest probes for both participants.

physical prompt if the participant did not respond to the partial physical prompt. Trials were repeated until the child responded independently. Mastery criterion was 34 of 36 (94%) correct trials for two consecutive trial blocks.

RESULTS AND DISCUSSION

Results of the intraverbal probes for both participants are presented in Figure 1. Pretest probe results indicated that neither participant could list any members of the four categories.

Following pretest probes, Michael required seven trial blocks to attain mastery for simple tacting and 18 trial blocks for category tacting. Richard required 25 trial blocks to attain mastery for simple tacting and 105 trial blocks to attain mastery for category tacting. With Richard, extensive instruction was necessary each time a new category was intermixed with a previously taught one. Both participants required only two trial blocks to master the match-to-sample task.

Following simple tact, category tact, and match-to-sample instruction trials, both Mi-

chael and Richard emitted multiple correct intraverbal responses during posttest probes, listing members of all categories. No incorrect category members were named, and no irrelevant responses were emitted. Participants often stated, "I'm done," or "that's it," after listing items. An upward trend for some categories can be observed for both participants.

The request to list four items did not necessarily exert stimulus control because on some test probes, participants listed more or fewer items. Michael listed six different items for vehicles, seven different body parts, six different things in the bathroom, and seven different musical instruments, and Richard listed six different clothing items, five different furniture items, six different vehicles, and three different body parts.

Our results lend support to the teaching of tacting and categorization skills to facilitate emergent intraverbals (Miguel & Petursdottir, 2009) and have implications for an approach to teaching children with autism this commonly targeted skill. The present approach stands in contrast to more common instructional approaches that use transfer-of-stimulus-control procedures to establish intraverbal responses (Goldsmith et al., 2007; Luciano, 1986). In our study, intraverbals were shown to emerge exclusively from tact and match-to-sample instruction. However, the design of the current study does not allow us to determine whether tact and match-to-sample instruction were both necessary for emergence of intraverbal responses. Future research should explore the facilitative role of match-to-sample instruction in promoting emergent intraverbals. One possibility is that multiple-tact instruction (i.e., the combination of simple and category tact instruction) resulted in the stimuli within each category becoming functionally equivalent, in which case match-to-sample instruction might not have been necessary. Indeed, this is one of the predictions of Horne and Lowe's (1996) naming hypothesis, which also delineates a process by which intraverbal naming is acquired

in the absence of direct instruction. It is also possible that multiple-tact and match-to-sample instruction could have produced derived stimulus relations between items in the same category (see Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000).

REFERENCES

- Barnes-Holmes, D., Barnes-Holmes, Y., & Cullinan, V. (2000). Relational frame theory and Skinner's *Verbal Behavior*: A possible synthesis. *The Behavior Analyst*, 23, 69–84.
- Carr, J. E., & Firth, A. M. (2005). The verbal behavior approach to early and intensive behavioral intervention for autism: A call for additional empirical support. *Journal of Early and Intensive Behavioral Intervention*, 2, 18–27.
- Goldsmith, T. R., LeBlanc, L. A., & Sautter, R. A. (2007). Teaching intraverbal behavior to children with autism. *Research in Autism Spectrum Disorders*, 1, 1–13.
- Horne, P. J., & Lowe, C. F. (1996). On the origins of naming and other symbolic behavior. *Journal of the Experimental Analysis of Behavior*, 65, 185–241.
- Luciano, M. C. (1986). Acquisition, maintenance, and generalization of productive intraverbal behavior through transfer of stimulus control procedures. *Applied Research in Mental Retardation*, 7, 1–20.
- Miguel, C. F., & Petursdottir, A. I. (2009). Naming and frames of coordination. In R. A. Rehfeldt & Y. Barnes-Holmes (Eds.), *Derived relational responding: Applications for learners with autism and other developmental disabilities* (pp. 129–144). Oakland, CA: New Harbinger.
- Miguel, C. F., Petursdottir, A. I., & Carr, J. E. (2005). The effects of multiple-tact and receptive-discrimination instruction on the acquisition of intraverbal behavior. *The Analysis of Verbal Behavior*, 21, 27–41.
- Petursdottir, A. I., Carr, J. E., Lechago, S. A., & Almason, S. M. (2008). An evaluation of intraverbal instruction and listener instruction for teaching categorization skills. *Journal of Applied Behavior Analysis*, 41, 53–68.
- Sautter, R. A., & LeBlanc, L. A. (2006). Empirical applications of Skinner's analysis of verbal behavior with humans. *The Analysis of Verbal Behavior*, 22, 35–48.
- Skinner, B. F. (1957). *Verbal behavior*. Acton, MA: Copley.
- Sundberg, M. L. (2008). *Verbal behavior milestones assessment and placement program*. Concord, CA: AVB Press.

Received June 20, 2011

Final acceptance January 16, 2012

Action Editor, Einar Ingvarsson