A COMPARISON OF PROMPTING TACTICS TO ESTABLISH INTRAVERBALS IN CHILDREN WITH AUTISM

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We compared the efficacy of tact-to-intraverbal (i.e., using picture prompts) and echoic-to-intraverbal transfer-of-stimulus-control procedures to establish intraverbal responding in 3 boys (4 years old) with autism. For all 3 participants, the picture prompts resulted in fewer trials to criterion, but both prompting tactics were eventually effective.

Key words: autism, intraverbal responding, transfer of stimulus control, verbal behavior

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Early and intensive behavioral intervention curricula (e.g., Taylor & McDonough, 1996) often include programs to teach young children with autism to answer questions. Question answering can be characterized as intraverbal responding according to Skinner's (1957) taxonomy of verbal behavior. Intraverbal responding plays an important role in typical social and academic functioning, and is therefore an important educational goal for children with autism and other developmental disabilities (Partington & Bailey, 1993). Previous research has shown that transfer-of-stimulus-control procedures are frequently an effective and efficient way to teach intraverbals (e.g., Miguel, Petursdottir, & Carr, 2005). These procedures involve the presentation of a stimulus that evokes the target response and thus serves as a prompt. The prompt is then faded (e.g., systematically delayed) with the goal of transferring stimulus control to the appropriate antecedent verbal stimulus, in this case the question.

Only two published studies have directly compared the use of prompt modalities within a transfer-of-control procedure for teaching intraverbals (Finkel & Williams, 2001; Vedora, Meunier, & Mackay, 2009). Both studies compared textual prompts (i.e., the presentation of the target answer as printed words) and vocal (i.e., echoic) prompts, and found that both prompting tactics were effective. However, textual prompts resulted in quicker mastery. Previous research has also demonstrated the effectiveness of picture prompts (i.e., tact-to-intraverbal transfer) in intraverbal training (e.g., Goldsmith, LeBlanc, & Sautter, 2007). However, no research has compared picture prompts to other prompt modalities in the context of intraverbal training. In the current study, we compared the efficiency of picture and vocal prompts in establishing intraverbals (question answering) with three boys with autism.

METHOD

Participants and Setting

Three 4-year-old boys with autism participated. Aaron, Billy, and Noah attended a

Table 1
Question Sets for All Participants

Participants	Question sets	
	Picture prompt set	Vocal prompt set
Aaron	What do you use to tell time?	What coin is worth 25 cents?
	What do you use to paint with?	What is ice made of?
	What do you hear with?	What do you sweep with?
	What do apples grow on?	What do you wear on your hands?
	What shines in the sky during the day?	What do you see with?
Noah	What do you hear with?	What do apples grow on?
	What do you wear on your feet?	What do you talk with?
	What do you use to cut paper?	What do you use to brush your teeth?
	What do you use to tell time?	What do you sweep with?
	What do you take pictures with?	What do you use to call people?
Billy	What do you use to tell time?	What do you wear on your hands?
	What animal says moo?	What animal says oink?
	What do you walk with?	What do you hear with?
	What do you write with?	What do you color with?
	What do you sleep in?	What do you read stories from?

university-based center for the study and treatment of autism. The participants attended the center each weekday and received a variety of special education services in a variety of teaching formats, including both one-to-one and group instruction. However, the participants had not received early and intensive behavioral intervention services. A speech-language pathologist employed by the center nominated these participants for the study because of delays in the development of question answering and conversational skills.

All sessions were conducted in a small classroom (the training room), with the participants and the experimenter seated in child-sized chairs and one or two observers sitting in close proximity. We conducted three to six sessions per day, with 1- to 2-min breaks between sessions.

Response Measurement and Interobserver Agreement

Observers scored prompted and unprompted correct answers on a trial-by-trial basis using pencil and paper. A second observer independently collected data for 68% of sessions with Aaron, 59% of sessions with Noah, and 65% of sessions with Billy. To calculate interobserver agreement, the number of trials with agreement was divided by the total number of trials for each session. Mean interobserver agreement was 100% for Aaron, 100% for Noah, and 99.8% for Billy (range, 89% to 100%).

Procedure

Preexperimental assessments. We identified 32 questions with answers that could be prompted vocally or with pictures. We then conducted an intraverbal pretest to identify unknown questions for each participant. Each question was presented three times over the course of 5 days; correct answers were praised, but incorrect answers were ignored. The questions that were answered incorrectly on all three assessment trials were considered unknown for that participant. Sets of unknown questions were assigned to the picture or vocal prompt conditions only if the participants were able to tact or echo the relevant answers (see Table 1). A brief pretest was implemented to ensure that the participants could echo the words to be used as vocal prompts and tact the pictures to be used as picture prompts. Each set consisted of five questions, and the participants' teachers agreed to refrain from targeting these questions during the study.

Baseline. The experimenter asked each question in a given set once per session, praised

correct answers emitted within 5 s, and ignored incorrect answers. Questions were intitially presented in a fixed order from session to session, but random question order was implemented in later sessions of the prompt-comparison training phase (see below).

Prompt comparison. In the first session of the prompt-comparison phase for each set, the experimenter presented each question followed by an immediate prompt for three trials. In each subsequent session, one trial with a 5-s constant prompt delay (these trials will henceforth be referred to as *training probe trials*) was implemented for each of the five questions. If a correct answer occurred within 5 s of the question on a training probe trial, the experimenter provided descriptive praise (e.g., ''that's right, a cow says moo''), and presented the training probe trial for the next question. If a correct answer did not occur (i.e., the participant answered incorrectly or did not respond), the experimenter delivered the vocal or picture prompt. In the vocal prompt condition, the experimenter said ''say —.'' In the picture prompt condition, the experimenter presented the picture (while remaining silent) directly in front of the participant's face. Pictures were presented on laminated stimulus cards made of white paper (approximately 13 cm by 18 cm). If a correct answer occurred within 5 s of the initial prompt, the experimenter provided descriptive praise and the trial ended. If the participant did not respond, the experimenter repeated the vocal prompt or pointed to the picture a second time.

If a correct unprompted answer did not occur on a training probe trial, we immediately conducted two *teaching trials* for that question. The procedures for teaching trials were identical to the training probe trials except that the first teaching trial always included an immediate prompt (0-s delay). If a correct response to the immediate prompt occurred, the second teaching trial was conducted using 5-s constant prompt delay, but otherwise an immediate prompt was used again in the second teaching trial. Thus, the number of teaching trials in a session during the prompt-comparison phase could range from 0 (if all questions were answered correctly in the five training probe trials) to 10 (if no correct answers occurred in the five training probe trials).

The mastery criterion for each prompt condition was defined as three consecutive sessions with at least 80% correct answers on the training probe trials. If the mastery criterion was reached earlier in one condition compared to the other, alternating sessions continued until the mastery criterion was reached in both conditions, and until three sessions with random question order had been conducted with each set. The point at which random question order was introduced with each question set relative to when the mastery criterion was reached varied somewhat across participants and question sets, but the last three sessions in each condition were always conducted with a random question order.

Generalization. A generalization probe was implemented with each question set immediately prior to and immediately following the prompt-comparison phase. Procedures during the generalization probes were identical to baseline, except that the participants' regular teachers conducted the probes in their everyday classrooms with other children present. One of the experimenters supervised each generalization probe session to ensure procedural integrity.

Design

We compared vocal and picture prompts for each participant in an adapted alternating treatment design (Sindelar, Rosenberg, & Wilson, 1985). The effectiveness of both prompting tactics was assessed using a nonconcurrent multiple baseline design across participants.

RESULTS AND DISCUSSION

Figure 1 (top three panels) shows training probe and generalization probe trial results
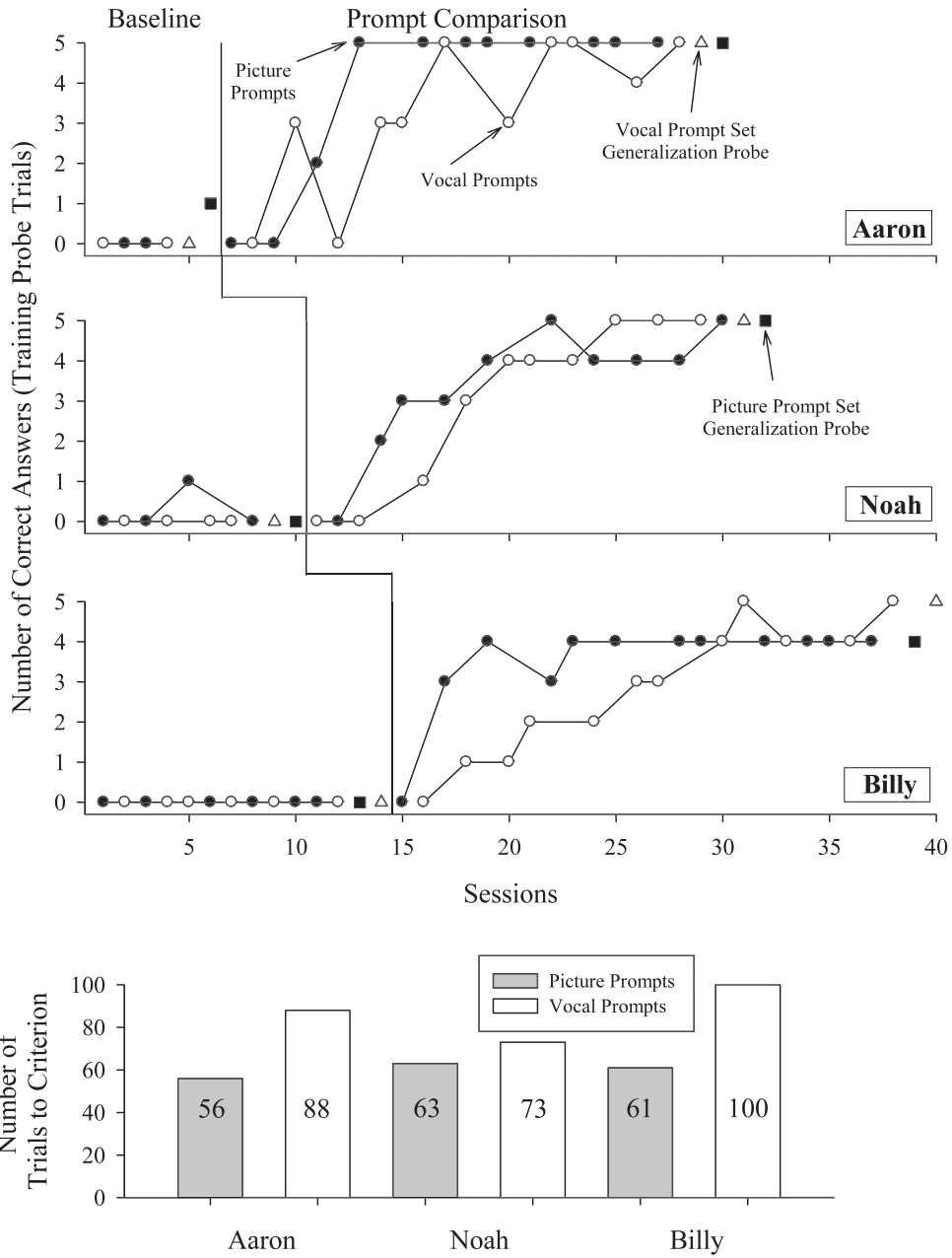
Figure 1.   The top three panels show the number of correct, unprompted intraverbal responses in training probes and generalization probes for Aaron, Noah, and Billy. The bottom panel shows the number of trials to criterion (including both training probe and teaching trials) during the intervention phase of the prompt comparison.

(teaching trial data are available from the first author). In baseline, none of the participants answered any questions correctly (with the exception of Noah, who answered one question correctly). Participants also did not answer any

questions correctly during preintervention classroom generalization probes (shown as the last two data points in baseline), with the exception of Aaron, who answered one question correctly. During the prompt-comparison phase, acquisi-

tion was evident for all participants in both conditions, but performance was slightly faster to improve and more stable in the picture prompt condition. All three participants answered four or five questions correctly in each generalization posttest. Figure 1 (bottom) shows the number of trials to criterion, which were calculated by adding up the total number of training probe and teaching trials from the first trial of the prompt-comparison phase to the last trial of the session in which the mastery criterion was reached. All three participants reached the mastery criterion in fewer trials in the picture prompt condition.

The current study extends previous research on transfer-of-control procedures in intraverbal training (Finkel & Williams, 2001; Goldsmith et al., 2007; Vedora et al., 2009) by directly comparing picture prompts (i.e., tact to intraverbal transfer) and vocal prompts (i.e., echoic to intraverbal transfer). Notably, picture prompts resulted in fewer trials to criterion for all three participants. It is possible that the success of prompt fading depends in part on the interaction between prompt modality (auditory or visual) and individual learning histories. For instance, children with an extensive history of vocal prompting and fading might show quicker echoic-to-intraverbal transfer than occurred in the current study. With repeated trials of vocal prompting and fading, self-echoic behavior (Esch, Esch, McCart, & Petursdottir, 2010; Schlinger, 2008) might develop, in which the child repeats the previously prompted answer to themselves until the verbal antecedent (i.e., the question) is presented again. In a similar fashion, tacting a picture prompt might set the occasion for visual imagining (i.e., seeing in the absence of the thing seen; Skinner, 1974, p. 91) among children who lack a history of vocal prompting and fading. It is possible that children who engage in visual imagining as a mediating response (Kisamore, Carr, & LeBlanc, 2011) may respond more effectively to the tact-to-intraverbal transfer procedure. Fu-

ture research should evaluate the role of mediating behavior on the effectiveness of transfer-of-control procedures. To advance the comparative studies of prompting tactics, future studies should also attempt to equate prompting conditions by eliminating the word "say" from the vocal prompt condition, or including "say" in both vocal and picture prompt conditions.

Based on results from the current group of participants, picture prompts are indicated as the most efficient prompting tactic. The generality of these findings for other children with autism is unknown. However, efficiency is only one consideration when choosing among prompting tactics. In some cases, vocal prompts might be indicated because they are relatively easy to implement. In addition, picture prompts are not applicable to some intraverbal targets (e.g., "What sound does a cow make?"). For these targets, vocal or textual prompts are indicated.

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