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Further evaluation of blocked trials to teach intraverbal responses under complex stimulus control: Effects of criterion-level probes☆

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ABSTRACT

Individuals with autism spectrum disorder (ASD) often have deficient intraverbal repertoires. Ingvarsson, Kramer, Carp, Petursdottir, and Macias (2016) evaluated the use of a blocked-trial procedure to establish complex stimulus control over the intraverbal behavior of children with ASD. In the current study, we replicated the procedures of Ingvarsson et al. (2016) and added criterion-level probes. Three children with ASD, ages 7–13, participated. We targeted discriminations between questions that differed in subtle ways. The questions were initially presented in trial blocks. Contingent on accuracy criteria the size of the trial blocks was gradually reduced until the questions were presented in quasi-random order. We conducted criterion-level probes (quasi-random presentation) following each step. The blocked-trials procedure was effective with two participants, and probe performance showed that the full set of blocked-trials instructional steps was rarely needed following acquisition of the first discrimination. Hence, the efficiency of the procedure was significantly enhanced for these two participants relative to the previous study. The procedure was not effective for the third participant. These results suggest that the blocked-trials procedure can be an effective and efficient way to teach intraverbals that require conditional discriminations to children with ASD.

1. Introduction

One of the verbal operants introduced in B.F. Skinner' *Verbal Behavior* (1957) was the *intraverbal.* The intraverbal relation involves a response that is evoked by a verbal antecedent, is maintained by generalized reinforcement, and has no formal similarity or point-to-point correspondence with the verbal stimuli that evoked it. Intraverbal control is involved in common behavior such as answering questions and conversational exchanges. Simple examples include answering "Four" when asked, "How old are you?", and saying "I'm doing well" when asked, "How are you?" However, intraverbal control is involved in a multitude of more complex social and verbal interactions (Palmer, 2016). Acquisition of a functional intraverbal repertoire is necessary to benefit from classroom instruction and to fully participate in everyday social interactions.

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Individuals with autism spectrum disorder (ASD) and other developmental disabilities often have deficient intraverbal repertoires. Sundberg and Sundberg (2011) suggested that this might in part be due to lack of conditional stimulus control over intraverbal behavior. In conditional discriminations, the discriminative function of stimuli depends upon other stimuli (Catania, 1998). Tasks requiring conditional discriminations can be presented in various forms. They can be visual-visual, as in identity matching-to-sample, or auditory-visual, as in receptive labeling. Axe (2008) and Sundberg and Sundberg (2011) suggested that conditional discriminations also can take the form of one auditory stimulus modifying the effect of another auditory stimulus (i.e., auditory–auditory conditional discriminations). According to these authors, this is what occurs when multiple components of a verbal antecedent gain stimulus control over intraverbal responses.

An example of an auditory–auditory conditional discrimination was provided in a study by Braam and Poling (1983). In their third experiment, they taught two participants with hearing impairments and mental retardation (a 17-year-old girl and 23-year-old man) intraverbal responses under conditional stimulus control. The stimuli included overlapping components (e.g., "home things", "school things", "home people", "school people"). The overlap is important because control by both components of the antecedent (e.g., home vs. school; things vs. people) is necessary for the behavior to come under conditional stimulus control. If components did not overlap (e.g., "home things" vs. "school people"), stimulus control by both words would not be necessary for correct responding to occur.

When a conditional discrimination is required, the listener has to attend to more than one stimulus or stimulus component in order to respond correctly. This can be challenging for individuals with ASD, even when they are able to acquire simple discriminations (Ingvarsson, Kramer, Carp, Petursdottir, & Macias, 2016; Sundberg & Sundberg, 2011). For instance, a child might learn to answer the question, "What is your mother's name" by responding to "name" only. However, accurate responding decreases when an attempt is made to teach the discrimination between "What is your mother's name?" and "What is your father's name?" These kinds of error patterns suggest lack of stimulus control by all relevant components of the verbal antecedent (i.e., the question). The failure to respond to all relevant stimuli or parts of stimuli has been referred to as stimulus overselectivity (Lovaas, Koegel, & Schreibman, 1979). It should be noted that this kind of complex stimulus control also can be conceptualized as convergent multiple control by stimulus compounds (i.e., multiple stimulus components controlling a single response; Eikeseth & Smith, 2013; Michael et al., 2011). Regardless of the conceptualization, carefully designed teaching procedures may be needed to establish complex stimulus control over intraverbal responses.

Recently, Kisamore, Karsten, and Mann (2016) evaluated the effects of various teaching procedures on the acquisition of intraverbal responses that required conditional discrimination. Seven children and adolescents diagnosed with ASD participated. A prompt delay with error correction (similar to Braam & Poling, 1983) was used with all participants initially. If acquisition failed to occur, other procedures were introduced, including a differential observing response (DOR; Dube & McIlvane, 1999; Kisamore, Karsten, Mann, & Conde, 2013) and a DOR plus blocked trials (Saunders & Spradlin, 1989, 1990, 1993). Although prompt delay with error correction was successful with some participants, four participants required the addition of DOR procedures. Of these participants, two further required the addition of blocked trials; one participant also required the addition of a progressive prompt delay.

In another recent study, Ingvarsson et al. (2016) further explored the use of a blocked-trials procedure to teach complex intraverbal discriminations to four children diagnosed with ASD. In general terms, the blocked-trials approach involves presenting individual stimuli in alternating trial blocks until highly accurate performance and minimal errors occur when switching from one block to the next. The size of the trial blocks is then gradually reduced contingent on accuracy criteria until the stimuli (e.g., two similar questions) are presented in quasi-random sequence. Prior to the Kisamore et al. (2016) and Ingvarsson et al. (2016) studies, the blocked trials approach had primarily been applied to teaching auditory-visual and visual–visual conditional discriminations (Perez-Gonzalez & Williams, 2002; Saunders & Spradlin, 1989, 1990, 1993; Slocum, Miller, & Tiger, 2012; Smeets & Striefel, 1994; Williams, Perez-Gonzalez, & Queiroz, 2005).

Ingvarsson et al. (2016) used constant prompt delay and error correction as the basic teaching procedure, but arranged the presentation of trials in a blocked-trials format similar to that evaluated by Perez-Gonzalez and Williams (2002). Initially, questions pairs (e.g., "What do you wash?" vs. "What do you wash with?") were presented in alternating trial blocks. In the first step, each question was presented until five consecutive correct answers occurred, at which point the other question was presented in the same manner. Contingent on accuracy criteria, the participants proceeded to the next teaching step, which involved the presentation of alternating 2-trial and 3-trial blocks. The final step involved quasi-random presentation of the questions. If participants were not successful at the first step, longer trial blocks were implemented (10 consecutive correct answers, followed by 8 consecutive correct answers). This procedure was effective with all four participants, although two participants needed additional error correction to acquire the first discrimination. Towards the end of the study, one participant acquired two discriminations in intraverbal probes. Two other participants acquired a novel discrimination in a random-presentation posttest, which involved quasi-random sequence, delayed prompting, and error correction. These participants had not been able to acquire discriminations in a pretest using the same procedures. Thus, three of the participants acquired new intraverbal discrimination at the end of the study without use of the blocked-trials procedure. However, it is unknown whether it was necessary to implement all steps of the blocked-trials procedure with multiple question pairs to reach that goal. Conducting criterion-level probes (Etzel & LeBlanc, 1979) after each step of the blocked-trials procedure might have increased instructional efficiency. In this case, criterion-level probes would be similar to the final step of the blocked-trials procedure: Quasi-random presentation of the questions.

The current study replicated and extended Ingvarsson et al. (2016) by conducting criterion-level probes after the completion of each step of the blocked-trials procedure. Our purpose was to evaluate whether all steps of the blocked-trials

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