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A clinical application of procedures to promote the emergence of untrained intraverbal relations with children with autism☆

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ABSTRACT

Strategies to promote the emergence of untrained verbal relations are of critical importance for learners with autism spectrum disorder (ASD). The current study examined the effects of systematically training new relations on the emergence of intraverbal relations within the same set and across untrained sets using a multiple probe across behaviors design. Three sets consisting of three classes of stimuli were developed for each of the six participants with ASD. Training was sequentially introduced within set 1 for listener feature/function, tact feature/function, and bi-directional intraverbals. Following mastery of one relation within the set, probes were conducted to assess emergence of all untrained relations within set 1. Once mastery criteria were met through direct training or emergence for all intraverbal relations in set 1, probes were conducted to evaluate relations across all sets (1–3). The procedures were repeated with the remaining sets. Results indicated that some participants showed emergence of untrained intraverbal relations following training of the listener and tact responses, consistent with prior research. Some participants required training across multiple relations and classes before emergence of intraverbals was observed. These results highlight the importance of evaluating performance over multiple sets and the benefits of systematically programming for emergence within clinical work.

1. Introduction

Children with autism spectrum disorder (ASD) can have significant challenges to learning compared to their typical peers (Mody & Belliveau, 2013), particularly in the area of vocal communication (Thurm, Lord, Lee, & Newschaffer, 2007). Considering the breadth of areas requiring intervention and the limited resources available to families of individuals with ASD, procedures with maximum efficiency should be highly prioritized. One way to identify the efficiency of an intervention approach is to examine the likelihood of producing learning beyond the instructional context (Wolery, Ault, & Doyle, 1992). Essentially, does the intervention approach lead to untrained behavior? Several possible avenues of producing untrained

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behavior have been suggested including: behavioral cusps (e.g., Rosales-Ruiz & Baer, 1997), generalization (e.g., Stokes & Baer, 1977), and emergence (e.g., Grow & Kodak, 2010). The latter, particularly as it relates to the emergence of untrained vocal language, is the focus of the current paper.

Researchers and practitioners alike have prioritized strategies to produce untrained, emergent vocal language and have predominantly done so using Skinner's (1957) taxonomy of verbal behavior. Skinner's analysis examines each vocal utterance as a unique instance of behavior with specific antecedent and consequent stimuli that can be analyzed. These *operants* are classified according to their function, and include echoics, intraverbals, tacts, and mands. Echoics are vocal behavior that share point-to-point correspondence with the vocal antecedent stimulus that evokes the response (e.g., "Cup" and child says "cup"). Intraverbals are vocal behavior that do not share point-to-point correspondence with the vocal antecedent stimuli that evokes the response (e.g., "What do you drink with?" and child says "cup"). Tacts are vocal behavior that are evoked by non-verbal antecedent stimuli (e.g., teacher shows the child a cup and the child says "cup"). These three operants are maintained by generalized conditioned reinforcement provided by the verbal community. In contrast, mands are vocal behavior evoked by a motivating operation that is maintained by a specific reinforcer (e.g., child needs a cup, child says "cup"). A rich body of literature has examined instructional strategies that promote the emergence of verbal operants trained in one functional arrangement to another (see Grow & Kodak, 2010). Recent studies have focused specifically on strategies that produce the emergence of intraverbal responses without direct teaching with individuals with ASD (e.g., Allan, Vladescu, Kisamore, Reeve, & Sidener, 2015; Grannan & Rehfeldt, 2012; May, Hawkins, & Dymond, 2013; Perez-Gonzalez, Garcia-Asenjo, Williams, & Carnerero, 2007; Smith et al., 2016; Vallinger-Brown & Rosales, 2014).

Tact training has been successfully implemented to promote the emergence of untrained intraverbal relations with individuals with ASD. May et al. (2013) taught two adolescents with ASD to tact pictures of monsters (e.g., "What is the name of this monster?" and individual says "Simon") and to tact what the monster liked to eat (e.g., "What food does this monster eat?" and individual says "Chips") then tested for the emergence of intraverbals related to the monsters' food preferences (e.g., "What does Simon like to eat?" without any pictures present). Results showed that both adolescents demonstrated the emergence of the untrained intraverbal relations. Grannan and Rehfeldt (2012) reported similar success using multiple tact training (e.g., tacting name and category of an item) and matching-to-sample to establish untrained category intraverbals for two five-year-olds with ASD.

Intraverbal training has also successfully led to the emergence of other, untrained intraverbal relations. Allan et al. (2015) taught four individuals with ASD to emit a trained intraverbal response (e.g., "Florida" and individual says "Miami") then probed for the emergence of the reverse of that intraverbal (e.g., "Miami" and individual says "Florida"). Results indicated that for three of the four participants, reverse intraverbals emerged without additional intervention. Perez-Gonzalez et al. (2007) reported similar results with two individuals with pervasive development disorder; however, emergence only occurred after multiple pairs of intraverbals had been trained.

Finally, listener training may also promote the emergence of untrained intraverbal relations with individuals with ASD. Smith et al. (2016) provided listener training related to features or functions of nouns (e.g., "What's an animal that flies?" and child points to bird) that were already mastered in listener by name and tact name training then tested for emergence of intraverbals (e.g., "What's an animal that flies?" and child says "bird" without picture present). Intraverbals emerged for four of the five participants with ASD. Similar results were reported by Vallinger-Brown and Rosales (2014), though not all targeted intraverbals emerged for two of the three participants with ASD.

Taken together, these findings suggest that for some individuals with ASD, the emergence of untrained intraverbals can occur. Two important commonalities stand out across all of these previous studies. First, studies that report successful emergence of untrained intraverbal responses often include the same verbal discriminative stimuli (S^Ds) for the trained and untrained relations. For example, May et al. (2013) trained the response "Chips" in relation to the verbal S^D "*What food does* this monster *eat*?" with a picture of the monster present. The S^D for the intraverbal included similar components (e.g., "*What food does* Simon *eat*?'), but with no picture present, and same response (e.g., 'Chips') was correct. Similarly, Smith et al. (2016) trained the selection of a picture in the presence of the verbal S^D "What flies?" and found the emergence of the intraverbal response "Bird" in response to the same verbal S^D (e.g., "What flies?" and child says "Bird"). It has been posited that the occurrence of overt or covert verbal behavior may explain why this particular tactic effectively produces untrained intraverbal relations (Petursdottir, Olafsdottir, & Aradottir, 2008). During tact training with the monsters and listener training with bird, if the participant were to covertly or overtly tact "Simon" or "bird" when the picture was presented, then the reinforcement provided by the experimenter would simultaneously strengthen the explicitly trained response and the occurrence of the intraverbal response. Though the mechanisms involved in the success of this tactic are unclear, the overlap of S^Ds between training and emergent relations may play a critical role for intraverbals.

The second important commonality of previous research on emergence is the strategic arrangement of trained stimulus-stimulus relations. May et al. (2013) trained a tact which could be thought of as a relation between the A and B stimuli (A as the picture, B as the vocalization "*Monster Name*") and a tact related to a feature which could be thought of as a relation between the A and C stimuli (A as the picture, C as the vocalization "*Food Preference*"). They tested for the emergence of the intraverbals which could be thought of as the relations between the B and C stimuli (e.g., "*Monster Name*" to "*Food Preference*" and "*Food Preference*" to "*Monster Name*"). The emergence of these BC and CB relations could be predicted based on their shared relation with the A stimulus, consistent with equivalence relations (Sidman & Tailby, 1982) and combinatorial entailment (Hayes et al., 2001). The same could be true of the relations established in the Allan et al. (2015) study, though the authors did not use this terminology. The listener response trained in the study could be thought of as a relation between

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