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A further evaluation of the effects of listener training on derived categorization and speaker behavior in children with autism☆

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ABSTRACT

Previous research has shown that children with autism may accurately categorize visual stimuli after learning to both tact (i.e., speaker behavior) and receptively discriminate (i.e., listener behavior) them using common category names. The purpose of the current study was to further evaluate the effects of category listener training alone on the development of Visual Categorization and Category Tacts with four children diagnosed with autism. We administered standardized language assessments to evaluate participants' skills prior to beginning the study and used a non-concurrent multiple-baseline design across participants. Two of the participants whose language assessments identified both speaker and listener scores greater than 36 months, passed Visual Categorization and Category Tact testing with previously unfamiliar stimuli following Category Listener training. The two participants whose language assessments identified a deficit in either speaker or listener scores failed Visual Categorization and Category Tact testing following Category Listener training. These results suggest that both speaker and listener behavior may be required for the emergence of untrained categorization and tacting following listener training.

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Categorization plays an important role in a wide variety of skills, including identifying objects and their similarities, recalling and learning new information, and problem-solving skills. Thus, much of our understanding of human cognition depends on our understanding of categorization (Markman, 1989). One way of sorting or classifying objects is based on shared similarities, whether these are physical or functional. Behavior analysts have investigated taxonomical categorization for years without the need for relying on *concepts* as the mental representations of categories (e.g., Hernstein & Loveland, 1964; Lowe, Horne, Harris, & Randle, 2002; Miguel, Petursdottir, & Carr, 2005; Petursdottir, Carr, Lechago, & Almason, 2008). A concept could be easily defined as a group of objects (stimuli, actions, etc.) that control similar responses. When an individual behaves similarly in response to a group of objects, these objects are said to form a class that can be called a

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concept. As a result, concepts may be equated to stimulus classes. The concept of "bird," for example, involves stimulus generalization among all stimuli we label as birds. The same concept involves discriminating between these stimuli and others we do not call birds (Keller & Schoenfeld, 1950). Most of these concepts are acquired through formal or informal education, when the same response (e.g., saying "bird") is reinforced in the presence of several different stimuli (e.g., birds), but not in the presence of other animals or objects. Over time, the verbal topography "bird" comes under control of the physical characteristics common to all of these stimuli. When a new stimulus that shares the same or some of these characteristics is presented, induction is observed when the novel stimulus evokes the same behavior as the other birds. In behavior analysis, this form of induction is referred to as stimulus generalization or in the case of verbal induction, generic extension (Skinner, 1957).

Some classes or categories are comprised of objects or events that although topographically distinct, may share the same *name*. Having the same name means these objects occasion the same listener and speaker behavior (Horne & Lowe, 1996). Apples, bananas, and oranges, for instance, all evoke the vocal topography, "fruit" (i.e., speaker behavior) and can all be selected when someone asks for "fruits" (i.e., listener behavior). When encountering a new item (e.g., a pineapple) also labeled as a "fruit," a child may respond to it the same way as the other fruits, including placing it in the fruit basket and not placing it in some other basket, for example, containing utensils (i.e., categorization). This form of taxonomical induction or categorization can be considered a novel behavior since it has not been directly reinforced. Moreover, this form of induction may depend on the child's verbal behavior, more specifically, her listener and speaker repertories. Sorting or relating visually dissimilar objects for the first time could emerge as a function of the child's ability to label or tact the pineapple as a "fruit" and respond to her (sub) vocalizations as a discriminative stimulus. The discriminative stimulus would evoke the (listener) behavior of searching for other fruits or the fruit basket that, of course, she had already learned to identify. In other words, apples, bananas, oranges, and pineapples may become related to one another simply because they have the same name (Horne & Lowe, 1996; Miguel & Petursdottir, 2009).

Naming itself can be described as a higher-order operant acquired through a history of multiple exemplar instruction in which words and their referents are related by cues of sameness (e.g., "this is a cup," "this object is called a brush,"). In Relational Frame Theory (RFT) literature, naming is conceptualized as a generalized operant class of deriving mutually entailed relations of coordination between two stimuli (Hayes, Barnes-Holmes, & Roche, 2001; Miguel & Petursdottir, 2009). This is a complicated way of simply saying that the ability to derive either object-name or name-object relations is a generalized operant. This generalized operant is thought to be acquired through a history of reinforcement for multiple exemplars of responding bidirectionally between an object and its name (Greer, Stolfi, & Pistoljevic, 2007). Despite its origin,[1] naming has been shown to be a fundamental (verbal) skill responsible for facilitating the incidental learning of words (i.e., language explosion), as well as reading, writing and, of course, categorization (Greer & Longano, 2010).

A series of studies with typically developing children have found that participants could only sort new objects and pictures into categories (i.e., visual categorization) when they could name them as defined by the bidirectional relation between categorical listener and speaker behaviors (i.e., tact the category name of an object and receptively identify the object when given the category name). So far, a number of studies have shown that in the absence of this skill, Visual Categorization does not occur (Horne, Hughes, & Lowe, 2006; Horne, Lowe, & Harris, 2007; Horne, Lowe, & Randle, 2004; Lowe et al., 2002; Lowe, Horne, & Hughes, 2005; Miguel, Petursdottir, Carr, & Michael, 2008). These studies' typical preparation involved teaching participants to either tact novel stimuli by their category name (e.g., calling all stimuli in Class A as "VEK" and in Class B as "ZOG"), or receptively discriminate them by category (e.g., selecting stimuli from Class A when hearing "VEK" and selecting stimuli from Class B when hearing "ZOG"), with subsequent tests to see if participants would sort these stimuli into classes/groups (i.e., Visual Categorization). Findings have consistently shown that when participants name the stimuli by category, they also sort them accurately. In other words, equivalence classes or frames of coordination can be established via verbal behavior training (i.e., category tact training) alone, as long as participants respond as both speaker and listener.

Until recently, this preparation had not been used with children with disabilities. Instead, many of these children have been taught to categorize objects directly, one by one, as opposed to being taught the pre-requisite skills for novel or derived categorization (Miguel & Petursdottir, 2009). In the first assessment of this preparation with children with autism, Miguel and Kobari-Wright (2013) evaluated whether two preschool-aged children would categorize pictures after learning how to tact them with a common category name. Visual Categorization was measured via a visual–visual matching-to-sample task. Each participant learned to tact nine pictures belonging to three unfamiliar categories with their common category name (e.g., hound dog, work dog, and toy dog). Each participant received Visual Categorization and Category Listener pretests prior to Category Tact training. In Visual Categorization testing, the experimenter presented a sample stimulus (e.g., card), prompted or asked for an observing response (e.g., looking at, and touching the card), and then presented an array of three comparisons paired with the instruction, "Match." A correct response was recorded if the participant matched the sample to the correct corresponding stimulus. During Category Listener testing, the experimenter dictated the sample (e.g., "toy dog") and presented three visual comparisons. A correct response was recorded if the participant selected the positive comparison out of the three-stimulus array. Following Category Tact training, one participant successfully passed both Visual Categorization and Category Listener tests. The other participant initially failed Visual Categorization posttests despite

[1] See Horne and Lowe (1996) for a detailed description of how naming is acquired in typically developing children.

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