

*EMERGENCE OF TACTS FOLLOWING MAND TRAINING IN YOUNG CHILDREN WITH AUTISM*

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This study sought to examine the effects of training mands on the emergence of tacts with the same response forms. Results indicated that training adjective sets as mands resulted in the emergence of adjective sets as tacts under modified, but not standard, antecedent conditions. The findings suggested that the apparent functional independence of mands and tacts may be explained by a lack of appropriate antecedent control over responding.

DESCRIPTORS: antecedent control, autism, functional independence, language, mand, tact

Skinner's analysis of verbal behavior (1957) classified human language into different types of verbal operants, each defined by their controlling antecedent and consequent variables. According to Skinner, *mands* are controlled by relevant establishing operations (EOs) and specific reinforcers, whereas *tacts* are controlled by nonverbal discriminative stimuli ( $S^D$ ) and generalized reinforcement.

Skinner (1957) suggested that the unique controlling variables defining mands and tacts resulted in two functionally independent behavioral classes. Thus, the acquisition of a particular response form under one set of controlling variables (e.g., an  $S^D$  for a tact) would not necessarily result in the emergence of that same response form under other controlling variables (e.g., reinforcer deprivation for a mand).

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The view of mands and tacts developing as functionally independent responses has informed professionals who design early language instruction based on Skinner's model of verbal behavior (Sundberg & Michael, 2001). Researchers in this area have often focused on establishing emergent verbal behavior, in which a response acquired under the controlling conditions of one verbal operant transfers to the conditions of another verbal operant without direct instruction (Hernandez, Hanley, Ingvarsson, & Tiger, 2007). For example, Nuzzolo-Gomez and Greer (2004) tested for emergence mands and tacts using adjective-object pairs (e.g., *big, medium, small bowl*). Results showed that training in one verbal operant (e.g., mand) did not result in the emergence of the other verbal operant (e.g., tact) until multiple-exemplar instruction (e.g., training mand and tact responses separately) was applied across one set of the adjective-object pairs. These researchers concluded that multiple-exemplar instruction provided a history of reinforcement for responding under various antecedent events for mands and tacts and thereby created contextual control over the different functions (i.e., participants learned to emit mands and tacts after instruction across multiple antecedent conditions). Based on this finding, the current study sought to examine the role of specific antecedents in establishing a context for the emergence of mands and tacts,

using mand training procedures outlined by Nuzzolo-Gomez and Greer (2004).

## METHOD

### *Participants, Settings, and Materials*

Participants were 4 boys, 5 years 7 months to 7 years 7 months old, who had been diagnosed with autism. During ongoing language training programs, the participants had learned to mand in the presence of objects following a period of deprivation and to tact when a teacher pointed to a target stimulus. All of the participants had learned vocal responses through the use of echoic modeling. Adjective sets for which the participants had no previous instruction were evaluated and included *left, middle, right* (Thomas); *first, second, last* (Leo); and *small, medium, big* (Ben and Sean).

Each participant sat at a table across from the experimenter. The materials used during all sessions were three clear plastic bowls of different sizes. The experimenter placed bowls on the table in front of the participant prior to each trial in random order.

### *Phase 1*

The experimental sequence involved preexperimental probes (mands and tacts), mand training, and postexperimental probes (tact and listener probes). Probe sessions consisted of 15 trials per session, with five opportunities to respond to each of the three target adjectives. During mand probe and mand training sessions, teacher-nominated preferred items and edible items (e.g., candy, toys) previously used to promote language acquisition were employed. To ensure that EOs were in effect during mand trials, preferred items were restricted outside the sessions on days when the experiment was conducted. Participants could select a preferred item on average every two trials by pointing, reaching, or vocally requesting from among three or four preferred items. During mand training, the opportunity to select a preferred item was contingent on correct responding.

*Preexperimental probes.* Prior to training, two probes were conducted, a 15-trial mand probe and a 15-trial tact probe. For mand probes, the experimenter placed a preferred item in one of the bowls to specify the target adjective, and no other prompts were delivered. Correct responses for mands were vocal forms that included the correct adjective, with the autoclitic frame "I want" (e.g., saying, "I want *small*"). Incorrect mands were defined as those mands that did not include the autoclitic frame "I want" or did not accurately specify the adjective (e.g., did not say "small").

For tact probes the experimenter pointed to one of the bowls to specify the adjective the participant should tact. Correct responses were vocal forms that included the correct adjective, with the autoclitic frame "It is" (e.g., "It is *small*"). Incorrect responses were those that did not specify the accurate adjective or did not use the autoclitic frame "It is." No social consequences were delivered during probes.

*Mand training.* Participants were taught to respond to the mand conditions described above by vocally specifying the target adjective. For correct mands, the experimenter delivered the preferred item to the participant. For incorrect responses or if the participant did not respond, the experimenter presented the vocal model (e.g., "I want *small*"), and the participant echoed that model. If the participant did not echo the model within three opportunities, the experimenter put away the preferred item and discontinued training for that adjective on that trial. Mand training continued until participants achieved 14 of 15 correct responding across two successive sessions or 15 of 15 once.

*Postexperimental probes.* Following mand training, tact probes were conducted as described for the preexperimental probes. Previous research has demonstrated that listener or receptive language commonly develops before speaker or "expressive" language in young children (Wynn & Smith, 2003). Therefore,

probes (e.g., "Point to the big bowl.") were conducted to determine if listener responses were present, despite the absence of a tact response (e.g., "It's a big bowl.") of the same form. During listener probes, the experimenter presented a vocal instruction, "Point to —" (e.g., "Point to *small*") relevant to one of the three targets. A correct response was defined as the participant contacting the materials with any part of the fingers or hand. An incorrect response was recorded if the participant pointed to an incorrect item or more than one item. No differential consequences were delivered for correct or incorrect responses. Postexperimental probes consisted of no mand probes (as occurred during the preexperimental probes) because all participants had achieved mastery criteria during mand training.

### *Phase 2*

Phase 2 of the study replicated Phase 1 using identical procedures except for the addition of a modified tact condition during the postexperimental probes. Phase 2 was conducted 4 weeks after the conclusion of Phase 1.

*Modified tact probes.* The modified tact probes were identical to the tact probes described in Phase 1 except that the experimenter included a vocal antecedent (saying, "What is it?") while pointing to one of the bowls to specify the adjective the participant should tact.

### *Interobserver Agreement*

Interobserver agreement was collected for 29% of all sessions and was 100% for all participants. It was calculated by dividing the total number of agreements on the occurrence of correct and incorrect responses by the total number of agreements plus disagreements, and converting this ratio to a percentage.

## RESULTS AND DISCUSSION

*Phase 1.* Prior to mand training none of the participants displayed correct responses during

mand or tact probes. Following mand training, Thomas, Ben, and Sean displayed no correct responses on tact probes, whereas Leo scored 5 of 15 (Figure 1). All participants displayed some correct responding on listener probes, although only Thomas displayed correct listener responses at a relatively high level.

*Phase 2 (modified tact).* Thomas, Ben, and Sean did not demonstrate an emergence of untaught tact responses during standard tact conditions. However, when the antecedent was modified, the correct tact responses emerged (Figure 2). By contrast, Leo demonstrated an emergence of untaught tact responses during preexperimental standard tact probes and postexperimental modified tact probes.

In summary, following mand training, 3 of the 4 participants displayed emergence of untaught tact responses during modified, but not standard, tact conditions. These results suggest that modifying the antecedent stimulus influenced the emergence of untaught tact responses.

It is possible that the vocal stimulus presented in the modified tact probes (i.e., the experimenter saying, "What is it?") cued participants to the change from mand to tact contingencies. Thus, the lack of tact emergence under standard tact conditions may be explained by ambiguous antecedent control in Phase 1, rather than functional independence per se (because the modified antecedent produced emergent responding). The expected performance for two functionally independent verbal operants would be that training one operant (e.g., the mand) would not result in the emergence of the other verbal operant (i.e., the tact) without direct instruction, which suggests that modifying the antecedent conditions alone should not produce emergent responding. Nevertheless, untaught tacts emerged when the vocal antecedent was added during Phase 2. Future research should evaluate the functional independence of mands and tacts under a variety of antecedent conditions.

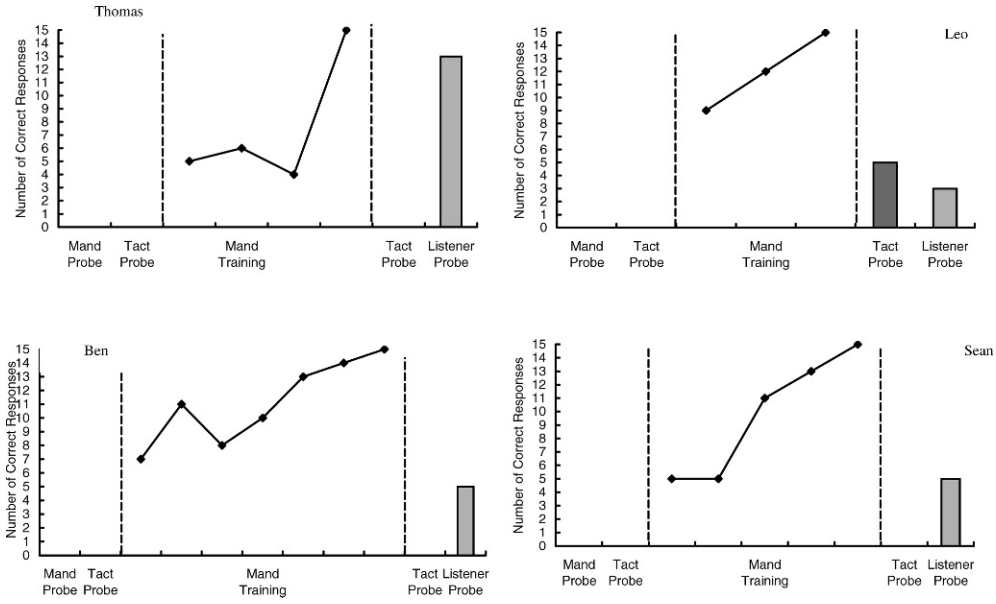


Figure 1. Responses to probes during mand probes, tact probes, and listener probes, and scores during mand training trials for Thomas, Leo, Ben, and Sean.

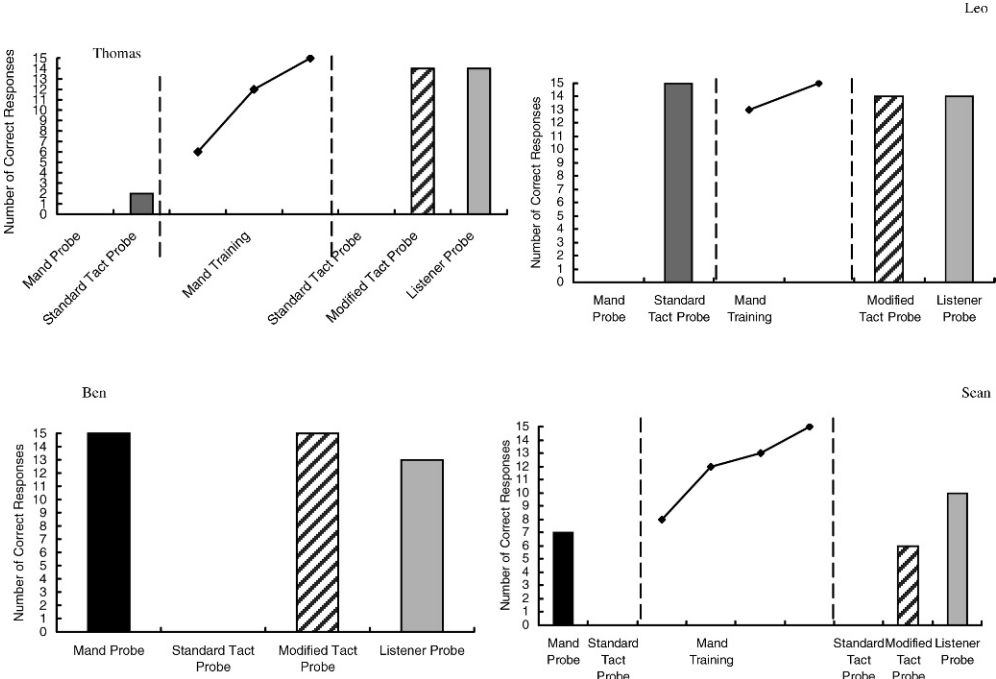


Figure 2. Responses to probes during mand probes, standard tact probes, modified tact probes, and listener probes, and scores during mand training trials for Thomas, Leo, Ben, and Sean. (Mand training data are not depicted for Ben.)

In general, two types of errors were made during tact probes. Leo and Sean consistently responded without the target adjective (e.g., saying, "It is a bowl" rather than "It is a medium bowl"). All participants had extensive extraexperimental training to tact objects using the autoclitic frame "It is —." Thus, this type of error may have resulted from a history of reinforcement for an alternate response form.

Thomas and Ben consistently responded to tact probes by saying, "I want [target autoclitic]" rather than "It is [target autoclitic]." These participants appeared to respond with the response form that had been most recently reinforced (i.e., the autoclitic frame "I want" that was reinforced during mand training prior to the tact probe sessions). A second explanation for this type of error might be that the participants continued to request preferred items due to reinforcer deprivation that had been established during earlier mand training (i.e., the relevant EO was still in place).

Whereas Skinner (1957) defined pure tact responses as having nonverbal antecedent controls, he also characterized tact responses evoked by both nonverbal and verbal stimuli as having impure or multiple antecedent controls. During the modified tact probes, the emergent tacts may be more accurately classified as impure tacts, due to the presence of an additional (vocal) stimulus. To date, all studies that have examined tact emergence following mand training have employed vocal (e.g., Lamarre & Holland, 1985) or nonvocal (e.g., Nuzzolo-Gomez & Greer, 2004) verbal antecedents during tact testing and may thus have employed impure antecedent controls. Future research might differentiate emergent performances for tacts under pure (nonverbal) versus impure (verbal and nonverbal) antecedent conditions.

In the present study, participants were taught to mand by specifying the bowl containing the preferred item (e.g., "I want big bowl") rather than directly specifying the reinforcer (e.g., "I

want candy"). According to Skinner (1957), no specified relation exists between a mand response and a prior stimulus; rather, the relevant EOs and specific reinforcement define the mand. Thus, based on the occurrence of these responses under specific evocative conditions, they may be characterized as mands.

An unexpected performance was observed for Leo across Phases 1 and 2. In Phase 1, he had been trained on mand responses but not standard tacts. However, during Phase 2 he emitted 15 of 15 (100%) correct responses to standard tact conditions during preexperimental probes and 0 of 15 in the mand probes. Although the reasons behind this unexpected outcome remain unclear, it may be that the experimental procedures in Phase 1 provided ambiguous antecedent control for the standard tact probes. Likewise, Thomas and Leo both scored 0 of 15 on preexperimental mand probes in Phase 2, despite reaching criterion during mand training in Phase 1. It may be that the training criterion of 15 of 15 once was insufficient to ensure that the mand response would be maintained over the 4 weeks between Phases 1 and 2.

It is notable that scores for the listener probes across Phases 1 and 2 increased for 3 of the 4 participants, despite the absence of direct training. The 4th participant, Sean, maintained high scores across both experiments. These data suggest that relations existed among mand, tact, and listener responses despite initial evidence that they were functionally independent. However, the nature of these relations remains unexplained. It may be the case that the introduction of the modified tact probes clarified the stimulus conditions in the listener probes. It is also possible that the additional mand training provided in Phase 2 contributed to the emergence of the listener behavior.

One limitation to the present study was that the two phases employed the same participants and training stimuli. It could be argued that

the effectiveness of the modified antecedent in evoking tact responses in Phase 2 was, in part, a result of the testing conditions in Phase 1. A second limitation to the current study was the single pre- and posttest probe design employed, which limits the demonstration of functional control. Further, a preexperimental assessment of modified tacts was not conducted. Consequently, it is unclear what effect mand training had on the performance of the participants in the modified tact condition. Thus, the current results should be viewed as preliminary, and future studies should address these procedural issues by including preexperimental measures of modified tacts and by employing an experimental design that allows evaluation of the variables responsible for performance under modified and standard tact conditions.

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