

*ESTABLISHMENT OF MANDS FOLLOWING TACT TRAINING
AS A FUNCTION OF REINFORCER STRENGTH*

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We examined some conditions under which a response acquired as a tact might facilitate the establishment of a mand. We taught 3 participants with developmental disabilities to tact the items ranked highest and lowest in a preference assessment and subsequently tested to see if the responses occurred as mands. All participants manded for the highly preferred item but rarely manded for the nonpreferred item. These results indicate that, although tact and mand functions are different, conditions can be created to facilitate transfer from the former to the latter. Implications for communication training are discussed.

DESCRIPTORS: communication, preference, mand, tact, verbal behavior

Skinner's (1957) theoretical analysis of verbal behavior described seven different functional relations in terms of their controlling antecedent and consequent events, the class of which is commonly referred to by linguists as *language*. This study examined two of these relations: the tact and the mand.

A tact is evoked by a nonverbal discriminative stimulus, such as an object or event, or the relation between objects or events, and is maintained by generalized or social reinforcers (Skinner, 1957). By contrast, a mand is evoked by an establishing operation (EO), such as deprivation or aversive stimulation, and is maintained by a specific consequence relevant to that EO (Michael, 1988). Although the functional properties of the tact and mand

differ, their form may be identical. A child might say "juice," for example, when a teacher points to a picture of a glass of juice, asks "What is it?," and responds "that's right" when the child gives the correct answer. In this example, saying "juice" is a tact. Alternatively, a thirsty child who says "juice" and receives a glass of juice from the teacher has emitted "juice" as a mand.

Skinner (1957) noted that the tact and the mand are independent response functions, such that the establishment of one does not automatically result in the appearance of the other. This notion of functional independence has both theoretical and practical implications. From a theoretical perspective, the distinction between the tact and the mand makes clear the importance of considering function in any treatment of language. In a more practical vein, it raises the question of whether instructional procedures designed to establish one relation (e.g., the tact) have any facilitative or inhibiting effect on emergence of the other (e.g., the mand), and several studies have addressed this

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question. Sundberg, San Juan, Dawdy, and Arguelles (1990) presented data indicating successful transfer from tact to mand functions; however, participants had previously demonstrated both tact and mand repertoires but had lost their ability to communicate due to brain injury. Similarly, Sigafoos, Reichle, and Doss (1990) demonstrated that 2 adults with developmental disabilities who had been taught to reliably point to the “want” symbol to mand for displayed food items could subsequently mand for the corresponding utensil used to consume the food item after successfully being taught to tact the utensil.

Results of other studies, in which tact and mand performance was examined in participants with developing repertoires, have shown less transfer across functions. Lamarre and Holland (1985) trained 5 participants to tact and subsequently tested their ability to mand. They trained 4 other participants to mand and then tested their ability to tact. A response was considered a tact if the child said “on the left” or “on the right” when asked “Where is object one compared to object two?” A response was considered a mand if the child said “on the left” or “on the right” when asked “Where do you want me to put this?” Results indicated that all participants acquired the verbal operant that was trained but did not exhibit the untrained operant.

In a related study, Hall and Sundberg (1987) trained 2 participants to tact each of several items used to complete a response chain (e.g., making instant soup: instant soup, hot water, a bowl, and a spoon) and then tested for manding by eliminating from the array an item necessary to complete the task. Results indicated that both participants learned to tact the items but did not mand for the missing item until they were explicitly trained to do so. Similar results were reported by Sigafoos, Doss, and Reichle (1989), who taught 3 participants to tact both a food item and the utensil required to consume the item (e.g., applesauce and spoon)

and tested for subsequent manding of the two items when the food item was placed on the table but the utensil was out of sight. Manding for the utensil emerged only when the experimenter prompted a tact response (e.g., asked “What is this?” while holding up the item) during the mand probes and delivered the item following a correct response (i.e., reinforced the response as if it were a mand).

Finally, Twyman (1995) attempted to teach preschool children with existing tact and mand repertoires (e.g., crayon) to tact and mand abstract stimulus properties (e.g., *whole* crayon). Results indicated that students emitted the trained response but did not emit the untrained operant until trained. In other words, after participants were trained to tact “whole crayon” when asked “What is this?” while the experimenter held up a whole crayon, they did not mand “whole crayon” when it was taken from them during the mand probes until they were trained to do so and vice versa.

The tact conditions in all of the above studies seemed to closely resemble those under which a tact would occur because the antecedent event consisted of an instruction to identify an object (or the relation between objects), and the reinforcing consequence presumably was a generalized reinforcer (e.g., praise or access to other preferred items). It is unclear, however, whether the mand conditions were optimally designed to evaluate that response function. In the Lamarre and Holland (1985) study, the EO was never identified because the reinforcing capability of the experimenter placing an object on the left or right was unknown. In both the Hall and Sundberg (1987) and Sigafoos et al. (1989) studies, an item required to complete a response chain or to consume the food or beverage item was removed, but it is unknown whether completing the chain or obtaining the utensil *per se* functioned as a reinforcer. In the Twyman (1995) study, it is unclear whether the abstract property of an object functioned as a reinforcer. Thus, none of the studies provided evidence that the consequence delivered during

the mand condition served as a specific reinforcer for the target response. It is possible, therefore, that any potential influence of tact training on the emergence of mands went undetected because the test for mands did not contain the relevant EO and reinforcer.

When a response such as labeling an object is taught as a tact, its occurrence as a mand might be observed when access to the object functions as a reinforcer. We examined that possibility in the present study by teaching individuals to tact objects for which preference had been established previously through formal assessment. Results of a number of studies on the assessment of preference have shown that, when a preferred and a nonpreferred item are available in a free-operant concurrent arrangement, participants allocate responses toward the preferred item (Fisher et al., 1992; Roscoe, Iwata, & Kahng, 1999). Thus, we taught participants to tact preferred and nonpreferred items and predicted that, if mands emerged, they would favor the preferred items.

METHOD

Participants and Setting

Three adults with mental retardation participated. Jarred was a 35-year-old man who had been diagnosed with severe mental retardation and lived in a residential facility. Jay, a 33-year-old man who had been diagnosed with moderate mental retardation, and Claire, a 40-year-old woman who had been diagnosed with severe mental retardation, lived in group homes and attended a vocational day program. All participants could follow simple instructions and engaged in limited vocal behavior (they mostly repeated statements that were irrelevant to the current situation or context or emitted one-word utterances such as "no," "yes," etc.). In addition, they did not engage in verbal behavior (e.g., vocalizations or signs) to obtain desired items readily, although they occasionally used gestures. Moreover, all participants had language development as a goal in their

individualized plans. No participant used formal signs to communicate. Two to four sessions were conducted daily, 4 to 5 days per week, in a room that contained a table, chairs, and other materials relevant to the specific conditions.

Response Measurement and Interobserver Agreement

A tact was defined as emitting a correct response to the question "What is it?" while the experimenter held up an item. In other words, the actual item and the question "What is it?" served as the discriminative stimulus for engaging in the sign to obtain a nonrelated reinforcer (generalized in that both responses produced the same reinforcer). A mand was defined as emitting a response that corresponded to either of the two items available during the mand testing sessions. Responses produced access to the specified reinforcing stimulus, suggesting that access to the item was currently effective as reinforcement. The responses used for each participant were the signs (Riekehof, 1993) for music and bubbles (Jarred), the signs for horn and bee (Jay), and the signs for music and book (Claire). Signs were selected as the form of the response over vocal words because they were amenable to tact training (i.e., they could be physically guided). Observers scored the occurrence of tacts and mands on handheld computers (Assistant Model AST102) or laptops running Observe software. Interobserver agreement was assessed by having two observers collect data simultaneously but independently during 47% of the sessions. Exact agreement was calculated by summing agreements and dividing by agreements plus disagreements and then multiplying by 100%. Agreement averaged 98% across all participants (range, 93% to 100%).

Preference Assessments

Food assessment. Seven food items suggested to be reinforcers for each individual by their staff were presented in either a paired-stimulus

(Fisher *et al.*, 1992) or a multiple-stimulus (DeLeon & Iwata, 1996) assessment. The top-ranked item was used as the reinforcer during tact training. Although food is not typically conceptualized as a generalized reinforcer, both responses produced the same reinforcer and, therefore, one could argue that the reinforcer is generalized in the sense that it was used to maintain multiple behaviors.

Leisure assessment. Seven leisure items suggested to be reinforcers for each individual by their staff were presented in either a paired-stimulus or a multiple-stimulus assessment. A high-preference item (HP; selected on 80% or more of trials) and a low-preference item (LP; selected on 20% or fewer of trials) were used as the stimuli during both tact training and mand tests.

Experimental Sequence and Design

A series of mand tests was conducted for each participant to establish a baseline level of mand performance. Tact training was then initiated in a multiple baseline design across subjects. When a participant acquired the signs for both leisure items as tacts, mand tests were resumed.

Mand test. Prior to and following tact training, sessions were conducted to determine whether participants exhibited target responses as mands. Each session lasted for 10 min. The experimenter simultaneously placed the HP and LP items on a table in front of the participant (as in a paired-stimulus assessment) but did not otherwise deliver any prompts or instructions. If the participant correctly signed either item, the experimenter gave that item to the participant for 30 s, after which it was replaced on the table next to the other item.

Pure mand test. Given the absence of instructions during the mand test, it was unlikely that target responses would occur as tacts. Nevertheless, it was possible that the mere presence of the object would occasion tacting responses (akin to saying "What a lovely sunset" while looking at the sky). Therefore, a secondary (pure) mand test was conducted for

Jay under conditions that were identical to those during mand testing, except that the items were not in Jay's visual field (*i.e.*, they were hidden in a box under the table). This test reduced further the probability that responses would be emitted as tacts.

Tact training. During each training session, the experimenter presented trials designed to teach participants how to tact the HP and LP leisure items from their preference assessments. Items were presented one at a time in a semirandom order until both items were presented 10 times in any given session (*i.e.*, a total of 20 trials). New trials were initiated every 30 s. On each trial, the experimenter held up either an HP or LP item in front of the participant and asked "What is it?" If the participant emitted the correct sign, the experimenter delivered a piece of the individual's preferred food item. If the participant emitted an incorrect response (*i.e.*, the sign did not match the item), the experimenter modeled the correct sign and waited for the next scheduled trial. If the participant did not respond within 5 s, the experimenter physically guided the participant to emit the correct sign. A correct tact was scored only if the participant signed the correct item after the verbal prompt ("What is it?") but prior to any subsequent prompting. Training was completed when the participant correctly tacted both items on 100% of the trials over two consecutive sessions.

RESULTS

Figure 1 shows results of the food and leisure preference assessments. Participants' most highly ranked foods were M&Ms[®] (Jarred, selected on 100% of trials), Doritos[®] (Jay, selected on 80% of trials), and Reese's[®] cups (Claire, selected on 100% of trials). These items were used as reinforcers during tact training. Jarred's HP and LP leisure items were a music toy and bubbles (selected on 100% and 20% of trials, respectively), Jay's were a toy horn and toy bee (selected on 80% and 20% of trials, respective-

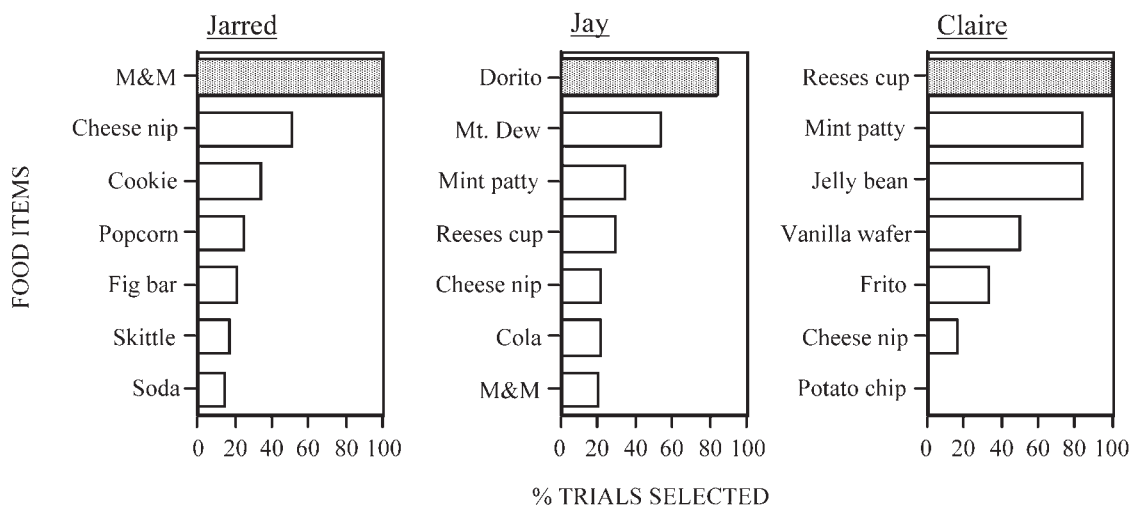
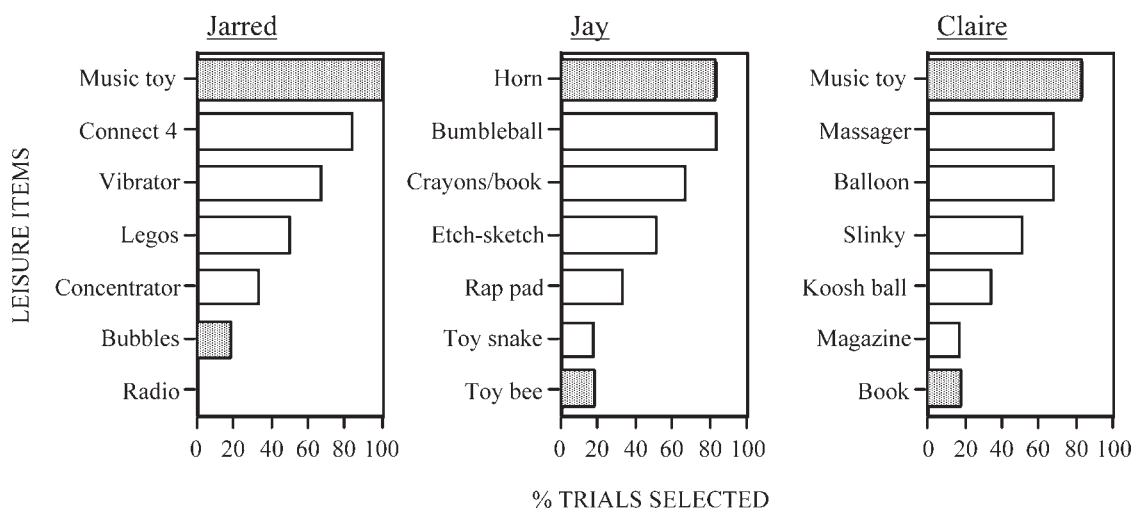
Food Preference AssessmentLeisure Preference Assessment

Figure 1. Top: selection percentages during food assessment (shaded bars represent items used as reinforcers during tact training). Bottom: selection percentages during leisure assessment (shaded bars represent items taught as tacts).

ly), and Claire's were a music toy and a book (selected on 80% and 20% of trials, respectively). Signs corresponding to these items were taught during tact training and probed during mand tests.

Figure 2 shows results of the mand tests and tact training for all participants. None of the participants emitted any signs during the baseline mand test for the leisure items.

Moreover, none of the participants emitted other signs or vocal behavior during this condition. During tact training, all participants acquired the signs for HP and LP leisure items within 12 sessions. When the mand tests were resumed, participants initially emitted signs for both HP and LP items. In every case, however, the rate of HP signs increased across sessions, and the rate of LP signs decreased to

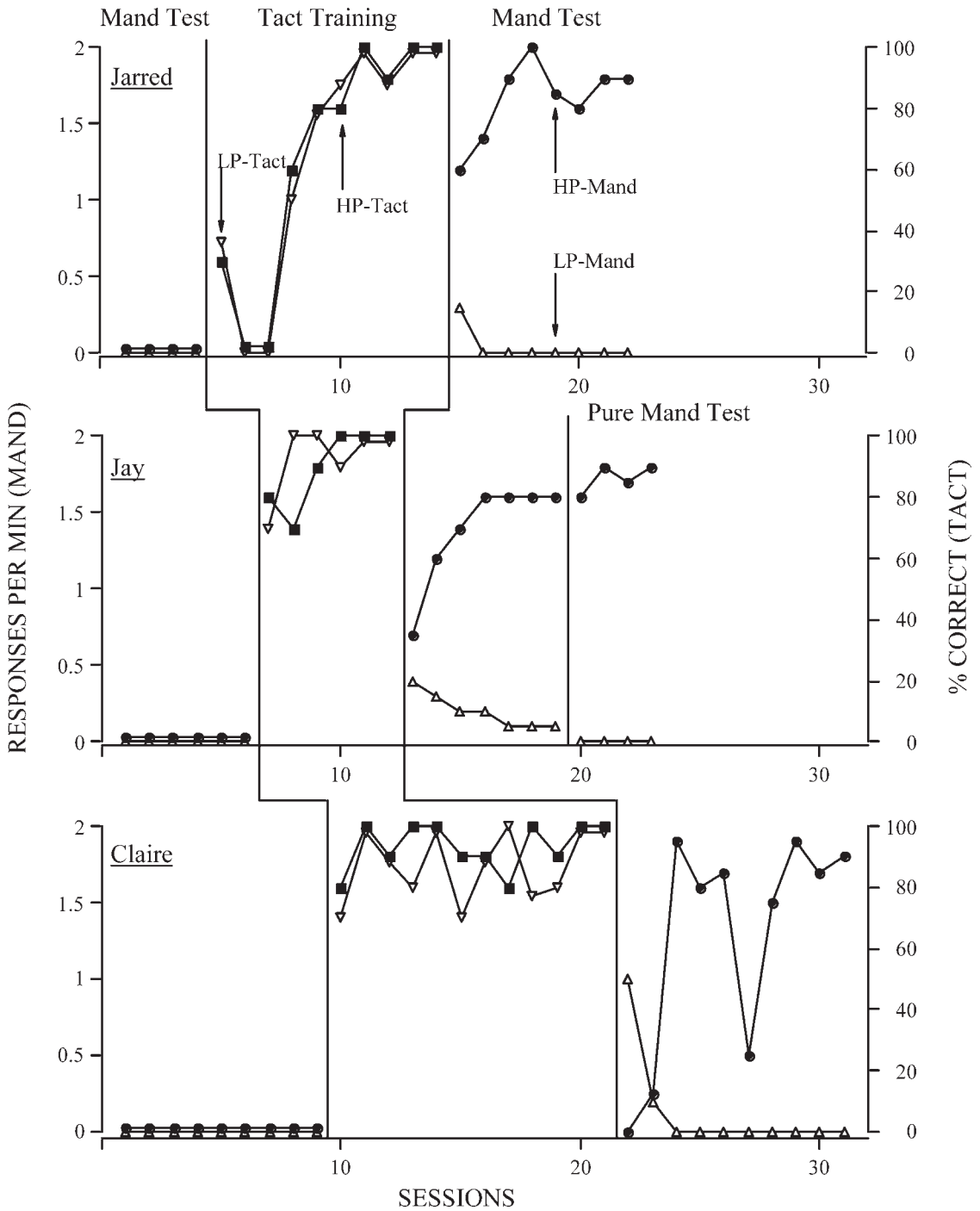


Figure 2. Mand for HP and LP items during mand tests (left scale) and tacts for HP and LP items during tact training (right scale).

zero (Jarred and Claire) or near zero (Jay). Finally, when HP and LP items were removed from Jay's view (pure mand test), he continued to emit the HP sign but never emitted the LP sign.

DISCUSSION

All of the participants acquired signs for HP and LP items when the responses were taught as tacts (the same reinforcer, a preferred food, was used to establish both responses). Following tact training, participants initially emitted both HP and LP signs during the mand test. However, responding that produced LP items quickly decreased to zero or near-zero rates. By contrast, responses for HP items increased and were maintained at high rates during the mand tests. Thus, results of the present study identified conditions under which responses taught as tacts facilitate the establishment of mands (HP responses).

The data on LP responses during the mand tests require further elaboration. First, these data are consistent with those reported in previous studies in which tact-to-mand transfer was not observed (Hall & Sundberg, 1987; Lamarre & Holland, 1985; Sigafoos et al., 1989; Twyman, 1995). In each of those studies, it was unclear whether the consequence for emitting a putative mand actually functioned as a specific reinforcer for the target response. In the present study, results of the preference assessments predicted that LP items would not function as reinforcers (relative to HP items), and the data supported this prediction. Second, it is possible that the LP responses that occurred initially during the mand test following training functioned as tacts (labeling items), as had been taught during tact training. Tacting apparently was extinguished, however, when it no longer produced a reinforcing consequence (food), and tacting was not replaced by manding because access to the LP item was not a reinforcer. Third, although LP responses were not maintained, it is quite possible that they would have

been if (a) items that were less preferred than the LP items were available concurrently or (b) the LP item was the only available item.

HP responses during mand tests following tact training also may have initially functioned as tacts. It is extremely unlikely, however, that all of the participants would continue to tact one item (HP) consistently but not the other (LP). In other words, if responding during the mand tests was due to discriminative control established during tact training, one would not predict bias in responding when both stimuli are presented simultaneously. Instead, the maintenance of HP responses seemed to reflect a transfer of reinforcement function from food (during tact training) to access to the item (during the mand test). To reduce further the possibility that HP responses contained any tact-like characteristics, we conducted an additional (pure) mand test with Jay, in which HP and LP items were out of view. If the presence of an item were sufficient to occasion a tact, responding should have decreased during this condition, but Jay's HP responses continued to occur at high rates, as they had when items were visible, and LP responses decreased to zero.

A potential account for divergent outcomes of the current and previous research is that previous studies did not specifically establish or take advantage of a naturally occurring EO, and therefore, did not evoke mands. Although the current study did not manipulate EOs per se, it is reasonable to conclude that access to HP items were more reinforcing than access to LP items, based on the results of the preference assessment, and that differentiation in response topographies during the mand testing was a function of relative reinforcer strength. Moreover, differential responding during the mand test suggests that responses that occurred during this condition were under motivational, rather than discriminative, control.

The present results have several implications for teaching communication skills to individuals who have severe communication deficits.

First, operant approaches to language training have long favored the primacy of mand training over tact training. The lack of maintenance of participants' LP responses following tact training is consistent with this view; however, the emergence of HP mands following tact training suggests a slightly different view. It is possible that tact training often fails to facilitate the establishment of mands because the stimuli that individuals are taught to tact do not otherwise function as reinforcers (e.g., "Show me the [geometric shape]"). By contrast, if the stimuli used during tact training function as reinforcers in other contexts (e.g., "Show me the [toy]"), and if those stimuli are available outside the training environment, the emergence of mands might occur more reliably following tact training.

A potential limitation of the current study is that, because mand testing included the delivery of differential consequences, the procedures may have functioned to train manding. However, differentiation in sign topographies was observed during the initial mand test following tact training for Jarred and Jay, suggesting that if acquisition occurred as a function of consequences, it was facilitated, at least, by prior tact training. Future research might conduct mand tests under extinction conditions (i.e., without programmed consequences) or using a common, generalized reinforcer. An account based on pure generalization from discriminative to motivational control for any differentiation observed under such conditions would be strengthened due to the absence of differential consequences during testing.

Finally, we examined only one variable (reinforcer strength) that may influence the establishment of mands following tact training, and researchers may wish to consider additional possibilities. For example, although we varied stimuli in the mand test (HP and LP), the EO was held constant in that participants had not had recent access to either of the items, which were unavailable in the absence of responding.

Systematically manipulating EOs for responses that produce access to the stimuli used during mand testing might provide additional evidence about the motivational versus discriminative sources of control over responding in that condition.

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