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Generalized Reinforcement Effects on Manding: A Replication

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Generalized Reinforcement Effects on Manding:

A Replication

A Thesis
By

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Submitted to the Faculty of the Health Professions
at Rollins College in Partial Fulfillment
of the requirements for the Degree of

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Abstract

Current research is split on findings of the functional independence of mands and tacts. Some studies have shown a response taught as a tact might emerge as a mand without training. The aim of this study was to replicate findings of Wallace, Iwata, and Hanley (2006) by creating conditions that facilitated the transfer of tacts to mands. The current study supported the functional dependence of verbal operants and found that after at least 3 sessions of exposure to the mand reinforcement contingency, the subject successfully emitted mands after being trained to tact. In extension, a functional assessment (FA) methodology was applied post-intervention to test the functions of the verbal operant classes (Kelley et al., 2007b). Results for the FA portion of the study were inconclusive.

.....*Keywords:* functional independence, mand, tact training, verbal behavior

Introduction

Children with disabilities, including those with Autism Spectrum Disorder (ASD), often have a difficult time acquiring language (Sundberg & Michael, 2001). The prevalence of ASD has increased in the past few years to the extent that 1 in 68 children are estimated to be affected. Autism Spectrum Disorder is characterized by developmental impairments in communication, language, and social skills (Centers for Disease Control and Prevention, 2016). Language is one of the basic building blocks in learning and should be a major focus of early intervention programs and treatment for children with ASD (Sundberg & Michael, 2001). Applied behavior analysis (ABA) services are a safe and effective treatment for children with ASD (Autism Speaks, 2016) and often focus on the acquisition of verbal and nonverbal skills as well as the reduction of problem behavior.

Verbal behavior involves the acquisition of language, social interactions, knowledge, and perception. Skinner (1957) defined verbal behavior as behavior reinforced through the mediation of another person's behavior. The speaker is the person who is communicating, and the listener receives the information from the speaker. Children with ASD must be taught to behave appropriately in social interactions to be effective communicators, both as a speaker and a listener (Cooper, Heron, & Heward, 2007).

The first verbal operant typically acquired by children in early development is the mand (Bijou & Baer, 1965; Novak, 1996). Mands are verbal operants in which the speaker asks for what he or she "needs" or "wants" by saying, signing, using picture communication, or gesturing. For example, a child says "cracker" when he has not had food and the mand "cracker" has produced crackers in the past. The mand is defined as "a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional

control of relevant conditions of deprivation or aversive stimulation and the response has no specified relations to a prior stimulus” (Skinner, 1957). Cooper et al suggested that problem behavior might develop if mands are not acquired as a form of functional communication because the child will lack the ability to get their needs and wants met appropriately. Further, they recommended that early intervention programs for nonverbal children include procedures to teach appropriate mands.

A tact is a type of verbal operant in which the speaker names things and actions (labels) with which the speaker has direct contact through any of the senses (Skinner, 1957). For example, a child says, “pencil” when seeing a pencil. The verbal response must be brought under nonverbal stimulus control and result in generalized conditioned reinforcement for the response to function as a tact (Skinner, 1957).

Skinner (1957) claimed the verbal operants, including mands and tacts, are acquired through a history of reinforcement and are functionally independent. Skinner noted that if one response has been acquired as a mand, one would not expect a person to emit the same response as a tact; they must be accounted for separately. When the function of responding is in doubt, prior research has shown a functional analysis of verbal operants can determine the operant’s function (Kelley et al., 2007b; Lerman et al., 2005).

There has been a considerable body of research since Skinner published *Verbal Behavior* in 1957, some in support of the functional independence of mands and tacts (Hall & Sundberg, 1987; Lamarre & Holland, 1987; Normand et al., 2011; Shillingsburg et al., 2009) and some research that has partially supported an apparent transfer of function, or functional dependence (e.g., Albert et al., 2012; Finn et al., 2012; Kelley et al., 2007a; Pettursdottir et al., 2005; Sundberg et al., 1990; Twyman, 1996). The above-mentioned studies showed partial support for

functional dependence, meaning that not all subjects in the study acquired the untrained operant after direct training. For example, three out of four subjects in the Finn et al. study passed mand probes after tact training, suggesting that they acquired mand responses after being trained to tact.

Conflicting results might be due to a variety of factors such as age of subjects, level of disability of the subject, and pre-existing repertoires (Gamba, Goyos, & Petursdottir, 2015). A variety of subjects were used in prior research, ranging from typically developing children to the developmentally disabled, with a similarly wide range in ages, from 8 months old to adulthood. Some research included individuals with autism (Albert, Carbone, Murray, Haggerty & Sweeney-Kerwin, 2012; Davis, Kahng, & Coryat, 2012; Egan & Barnes-Holmes, 2009; Finn, Miguel, & Ahearn, 2012; Gilliam, Weil, & Miltenberger, 2013; Kelley et al., 2007b; Kooistra, Buchmeier, & Klatt, 2012; Shillingsburg, Kelley, Roane, Kisamore, & Brown, 2009) while other studies included typically developing children (Egan & Barnes-Holmes, 2011; Lamarre & Holland, 1985; Normand, Machado, Hustyi, & Morley, 2011; Petursdottir, Carr, & Michael, 2005). More specifically, the verbal repertoires of individuals also varied across studies; some subjects had existing mand repertoires (Albert et al., 2012; Finn et al., 2012; Shillingsburg et al., 2009) while others included subjects with no vocal language repertoires (Normand et al., 2011; Sigafos, Doss, & Reichle, 1989). Methodological differences also have been found. For example, while a few studies conducted preference assessments (Finn et al., 2012; Kelley et al., 2007a; Shillingsburg et al., 2009) prior to implementing an intervention, most did not. In addition, verbal behavior assessments were not consistently used in previous studies to measure the pre-existing verbal repertoire of subjects; only one study included standardized language assessments (Kooistra et al., 2012). It is possible some of the abovementioned methodological

variations might affect the outcome of these studies.

Review of the Literature

Functional Analysis of Verbal Operants

According to Skinner's (1957) taxonomy of language, mands and tacts have different functions. The seminal study by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) paved the way for a new type of assessment, functional analysis (FA), that could be used to identify the function of problem behavior to create effective treatments. More recent studies have focused on applying the FA to verbal behavior (Kelley et al., 2007b; Lerman et al., 2005; Normand et al., 2011; Plavnik & Normand, 2013).

Lerman et al. (2005) were the first to create and utilize the FA procedure to determine the function of verbal behavior (mands or tacts). Lerman et al. suspected children with disabilities might acquire mands before other verbal operants, suggesting the consequences of reinforcement are stronger for mands than other verbal operants. Discriminative stimuli, motivating operations, and consequences were controlled in varying test conditions to identify the functions of verbal operants emitted by four children with developmental disabilities. The responses with the highest frequency were selected as target vocal responses, as identified by the child's teachers. Test conditions were alternated at least three times with a control condition in a multi-element design. Because they are most relevant to the current study, only the mand and tact conditions will be discussed next.

In the mand test sessions there was a listener present, access to the reinforcer was restricted for 60 min prior to the beginning of the sessions, and the consequence for manding included naming the reinforcer in the praise (e.g., "Great job saying *baby*," with *baby* being the name of the targeted vocal response). In mand test sessions, the experimenter sat close to the subject, showed the selected item to the subject, and then placed it in a bag. The item was

removed from the bag and given to the subject for 20 s if he or she emitted the correct name of the item. After the 20-s interval, the item was placed back in the bag. The verbal prompt, “What do you want?” was given if no response was emitted within 20 s. It should be noted that, although they would typically be categorized as discriminative stimuli in discrete trial training, the authors considered “What do you want?” and “What is it?” to be verbal prompts in this context. Authors were trying to examine spontaneous manding and tacting. In the mand control condition, the object was present and there was no listener available. The mand control sessions entailed the subject engaging with the item for 60 min prior. Consequences were not provided for responding; that is, the item was not delivered if manding did occur, praise was not given, nor was the object named if the subject emitted the correct response.

In the tact test condition, the listener and object were present. Praise was provided without naming the object for correct verbal responding. In the tact control condition, there was no listener nor was the object present. There were no consequences for responding. In the tact test and control conditions, the subject had access to the item for 60 min (as in the mand control session). The experimenter was near the subject and provided the prompt, “What is it?” if no responding occurred within 20 s of the last prompt. All other behavior was ignored for both mand and tact test sessions.

In summary, Lerman et al. (2005) manipulated antecedents and consequences for each operant to identify its function (mand, tact, or intraverbal). Tacting was tested by allowing access to the stimuli beforehand and providing praise for tacts whereas manding was tested by withholding access to the item for an hour prior to testing (an establishing operation for said stimuli as reinforcers) and by providing labeled praise and the item. If the correct response was emitted in the mand test condition, the child gained access to the item for 20 s. The operant was

labeled as a mand or a tact if responding was higher in the test condition (with tan establishing operation or object present, respectfully) compared to the control condition (where the establishing operation or object was absent, respectively). They then suggested the subject would benefit from tact training. Results showed some responses had multiple functions (mand and tact or mand and intraverbal) and other responses just functioned as mands. The function of responding was identified for at least one vocal response per child. For example, if the response rarely occurred in the tact test, tact control, and mand control sessions, but did occur at high levels in the mand test sessions, and not in the mand control sessions, then experimenters considered the response to be a mand.

Kelley et al. (2007b) replicated Lerman et al.'s (2005) experiment. Like Lerman et al., Kelley et al. included subjects with developmental disabilities who engaged in verbal responses with unclear functions (i.e., it was unclear whether the subject was manding or tacting). Two responses were selected for each subject. Procedures were similar to those of Lerman et al. except that sessions included 10 discrete trials, several prompts were given based on the test condition, and a control condition was included for every two test conditions. Lerman et al. included alternating control and test conditions repeatedly, at least three times. Again, the authors considered "What do you want?" and "What is it?" as verbal prompts. Additionally, session lengths were shortened (to 5 min from 60 min) and the antecedent operations of restriction from items or access to preferred items was limited to 5 min (as opposed to 60 min).

As in the study conducted by Lerman et al. (2005), Kelley et al. (2007b) manipulated the controlling variables of each verbal operant separately in alternating test and control conditions in a multi-element design. Also like Lerman et al., the function was determined based on which condition had a higher frequency of responding compared to its control condition. (Intraverbal

and echoic tests were conducted as well but are not being described as they are not relevant to the present study.)

Kelley et al. (2007b) reported the function of at least one vocal response was identified for each subject, and all subjects except one successfully tacted or manded. None of the subjects responded in 100% of the trials. In the Lerman et al. (2005) study, three out of four subjects exhibited mand responses, whereas only one subject in Kelley et al. exhibited mands. Subjects' remaining responses varied, but mainly functioned as either echoics or tacts. Kelley et al. suggested that, when responding did not occur, it might have been due to the differences in strengths of the establishing operations. Although the researchers deprived the subjects of the items prior to the mand test sessions, a preference assessment was not conducted in either study. Instead, both Lerman et al. and Kelley et al. chose vocal target responses as identified by parents and teachers. Thus, it is not clear if the subjects preferred the items associated with the target responses. Despite this procedural limitation, the results of both studies demonstrated the functions of verbal behavior generally can be identified using experimental analysis.

LaFrance, Wilder, Normand, and Squires (2009) also systematically replicated Lerman et al. (2005) by studying the effectiveness of an FA to identify the function of verbal behavior with children ages 2 to 5 years who were diagnosed with developmental disabilities. Two vocalizations were targeted per subject based on parental input. Mand, tact, intraverbal, and echoic test and control conditions for each operant were included. Like the aforementioned studies, LaFrance et al. identified functions based on a higher frequency of verbal responses during the test condition compared to the corresponding control condition. Unlike the previous studies, LaFrance et al. included a reinforcer assessment that confirmed praise served as a reinforcer for each individual subject (and was used as such in the tact, intraverbal, and echoic

conditions). Further, they modified their mand test by keeping the item in sight for two of the subjects because otherwise they did not emit responses (possibly due to a lack of stimulus control over responding when the item was absent). Another modification to Lerman et al.'s procedure was made by placing the item in an open plastic container in the tact test condition. Functions were successfully identified, supporting prior research (Kelley et al., 2007a; Lerman et al., 2005; Normand, Severtson, & Beavers, 2008). In the first experiment, subjects emitted vocalizations as mands, tacts or both. In the second part of the experiment, vocalizations were emitted as tacts, echoics, or both.

Normand et al. (2011) conducted the first verbal behavior FA with typical children, as opposed to children diagnosed with some form of developmental disability (Kelley et al., 2007b; LaFrance et al., 2009; Lerman et al., 2005; Normand et al., 2008), by teaching infants to use sign language. A delayed model and physical prompt procedure used by Thompson, Cotnoir-Bichelman, McKerchar, Tate, and Bancho (2007) was used in combination with reinforcement. All subjects successfully learned to sign under each condition; however, subjects only emitted signs later under specific test conditions, indicating the specific functions of responding (Kelley et al., 2007b; LaFrance et al., 2009; Lerman et al., 2005; Normand et al., 2008). Authors then verified most signs functioned as mands, with very few functioning as mimetic (A type of verbal operant- echoic- in which someone imitates, usually a sign) by utilizing the trial-based verbal behavior FA methodology of Kelley et al. (2007b). The subjects could mand, but not tact, thus, supporting the idea of functional independence. Further, the authors concluded none of the signs functioned as tacts because of the lack of responding emitted in that test condition. Based on these results, Normand et al. suggested the FA methodology could be used by practitioners to develop and track language acquisition programs in functional communication, potentially

resulting in a more comprehensive level of efficient care for clients.

The authors of the studies discussed thus far identified the function of various verbal operants emitted by their subjects. It is possible that, as suggested by Normand et al. (2011), we can create more individualized programming for clients in need of verbal behavior training or at least identify which types of clients might benefit from direct training of operants with different functions versus those who might be more likely to acquire operants without direct training.

Functional Independence of Verbal Operants

The question remains whether teaching one verbal operant (e.g., a tact) will automatically result in the emergence of another operant (e.g., a mand) with the same form and vice versa. Skinner (1957) stated verbal operants are functionally independent, meaning establishing one verbal operant in a client's repertoire will not automatically result in the emergence of the other. Lamarre and Holland (1985) were the first to support Skinner's assertion of the functional independence of mands and tacts when they taught nine typically developing children to mand or tact the positional phrases "on the left" or "on the right." Each group of subjects was tested for the emergence of the other (untrained) verbal operant. None of the subjects naturally acquired the other operant after initial training sessions. On the other hand, it could be argued Lamarre and Holland did not manipulate the motivating operations for mands, meaning subjects were taught to mand arbitrary responses "on the left" or "on the right" in response to item location. It is not clear if subjects preferred either location, thus calling in to question the establishing operation for emitting each phrase as a mand.

Hall and Sundberg (1987) further supported Skinner's (1957) theory of the functional independence of mands and tacts. Hall and Sundberg taught tacts first and discovered mands of the same form only emerged after direct training of manding. Additional researchers have shown

functional independence exists after the tact repertoires were initially trained by consistently failing mand probes (Finn et al., 2012; Lamarre & Holland, 1985; Hall & Sundberg, 1987; Shillingsburg et al., 2009; Twyman, 1996). That is, subjects manded or tacted for items only after they were trained to do so. It is possible subjects' learning histories interfered with the different conditions to affect the transfer or functional interdependence. It is difficult to identify the amount of exposure subjects have previously had with mand and tact training. It is possible some subjects have been previously taught to tact or mand in the past. Studies could attempt to identify previous exposure with verbal behavior training potentially through the use of assessment.

In one study, Sigafos et al. (1989) observed tacts did not transfer into mands. Subjects were taught to tact and mand for food items and the utensils needed for consumption. The authors hypothesized that, once the tacts were acquired, the antecedent stimulus would serve as a prompt to mand for the item. However, this was not the case. Subjects failed to mand for needed utensils even though they were taught to tact the same items. During the mand probes, subjects attempted to acquire the food or beverage items by reaching for the items. This led authors to conclude that the failure of acquiring mands was not due to a reinforcement problem because the relevant establishing operation was in place, as shown by the behavior of reaching for items. It is possible that, because the food or beverage items used in the study were visible to subjects during training, they might have served as discriminative stimuli that the items were available for consumption so that manding was perceived to be unnecessary, as other researchers have postulated (e.g., LaFrance et al., 2009). Sigafos et al. then utilized a procedure to bring mands under the control of conditioned establishing operations through a transfer of stimulus control, as in previous research (e.g., Hall & Sundberg, 1987), and manding then was acquired. For

example, Hall and Sundberg showed a needed utensil to subjects and asked, “What’s that?” when the utensil was needed to consume the food item. A model imitative prompt was provided when needed and prompts were gradually faded; this allowed mands to come under the control of conditioned establishing operations.

Sigafoos et al. (1989) largely supported previous findings for the functional independence of verbal operants (Finn et al., 2012; Hall & Sundberg, 1987; Lamarre & Holland, 1985; Shillingsburg et al., 2009; Twyman, 1996), even though some responses were emitted as tacts or mands without direct training of the other respective operant. Further, this study supported the notion that responses trained as tacts were emitted as mands only after direct training (i.e., the responses were functionally independent). The authors of these studies concluded the transfer of function was not automatic but improved once subjects had additional mand and tact training. For example, Carol was taught to tact “applesauce” and “spoon” but did not acquire the mands during a baseline mand probe. She did acquire the mand for spoon without direct training after learning to mand for applesauce. Sigafoos et al. concluded that the subjects’ prior learning histories might have affected the results. For example, they noted that one of their subjects, Dan, had a history of using symbols and exhibited a mand repertoire along with greater generalization of responses. The authors also recommended that future researchers evaluate procedures that promote the transfer of stimulus control across response classes so effective interventions can be developed to enhance verbal repertoire of people with disabilities.

It is possible the researchers who failed to show transfer of manding and tacting functions did not adequately manipulate the motivating operations for mands to emerge (e.g., LaFrance et al., 2009; Sigafoos et al., 1989). After all, preference and reinforcer assessments were almost never conducted to identify potential reinforcers for manding. Further, once access to items that

were to be manding were identified, items should have been withheld prior to teaching as an establishing operation for manding. The addition of these procedures might explain why other researchers have found evidence in support of the functional dependence, or transfer of function, of verbal operants.

Functional Dependence of Verbal Operants

Mand-to-tact transfer. Carroll and Hesse (1987) replicated Hall and Sundberg (1987) by evaluating two training procedures for tact training, one in which mand training occurred prior to tact training and another where only tacts were trained. Six typically-developing preschool children were subjects in their study. Toys with separate pieces were used, such as puzzles, games, or vehicles. Names were created for each part of the toy that were not already in the subjects' repertoires. Subjects were trained to assemble a toy and then exposed to two phases, each with a different training condition.

In tact-only training, subjects were taught to tact a part of the toy by asking the subject, "This is a _____. What is this?" The experimenter said the name of the part if the subject did not provide the correct answer. The subjects then were asked again, "What is this?" Correct responses resulted in praise. Minimal prompts were given in the form of saying a few sounds or syllables of the word. The experimenter mixed in trials of random compliance tasks like "touch your nose," to match the length of the mand-tact training condition. Mand-tact training consisted of alternated mand and tact trials, beginning with mand training. Subjects were told to construct a figure with the given toy parts, although one piece was intentionally missing so subjects had to request the missing piece. The missing part was provided only when the subject emitted the correct response (i.e., when they named the missing piece). Subjects had to mand and tact the toy part over six consecutive trials or 20 min, whichever came first. After training was completed, a

tact retention test was administered in which the experimenter asked the subject, “What is this?” Praise was provided for correct responding; if the subject did not provide the correct response, the item was removed and a new trial started. Carroll and Hesse (1987) concluded the mand-tact training method was more effective for training tacts than tact training alone because fewer trials were needed to achieve mastery and because subjects remembered more part names when learned via the mand-tact condition.

Arntzen and Almas (2002) replicated and extended this research with different results by showing mand-to-tact training established both mands and tacts as fast as tact training only for all subjects. Arntzen and Almas included children with and without disabilities who were taught to tact random items selected by parents and teachers. Identical procedures were used for the tact-only and mand-tact conditions to address previous concerns of sequence effects they noted in the Carroll and Hesse (1987) study. Arntzen and Almas utilized a multi-element design in which subjects were exposed to a second phase, so that the mand-tact and tact-only procedures occurred simultaneously. After doing so, they found there was no difference in tacts acquired under the two procedures, in contrast with the results of Carroll and Hesse. Arntzen and Almas suspected the differing results might have been due differences in how soon after training follow-up tests were administered; Carroll and Hesse gave the test immediately after training whereas Arntzen and Almas gave the test several days apart.

Tact-to-mand transfer. There also is evidence that transfer of learning can occur in the opposite direction, that is, for mands to be exhibited after tacting is acquired. Specifically, Wallace et al. (2006) identified conditions under which the transfer of tacts to mands could be facilitated. They taught three adults with developmental disabilities to tact high-preference (HP) and low-preference (LP) items. Subjects then were tested to see if the responses emerged as

mands. Subjects manded for HP items at higher rates compared to LP items. However, for LP items, tact-to-mand transfer occurred at near zero levels of responding. These different results for HP and LP items further suggest that, in some previous studies (e.g., Hall & Sundberg, 1987; Lamarre & Holland, 1985; Sigafos et al., 1989; Twyman, 1996), the items being tacted might not actually have functioned as reinforcers. Furthermore, Wallace et al. recommended future research utilize naturally occurring establishing operations to evoke manding. This suggestion implies that using reinforcing stimuli to teach tacts might facilitate the simultaneous emergence of mands.

Kooistra, Buchmeier, and Klatt (2011) also studied the transfer of tacts to mands in children diagnosed with ASD, specifically, the effects of motivating operations on the emergence of mands. The authors identified HP items through a preference assessment and taught subjects to tact them. After teaching tacts, both subjects manded for the HP items under conditions with an establishing operation was in place (i.e., deprivation) but not in the presence of an abolishing operation (i.e., satiation). These results suggested the transfer of tacts to mands might be facilitated using an HP item and ensuring restriction of access to that item prior to training.

Similarly, Davis, Kahng, and Coryat (2012) taught a 4-year-old boy with ASD to tact HP and LP items and then tested mand emergence by manipulating motivating operations. A preference assessment was conducted prior to mand and tact baseline sessions. In the tact baseline, 10 trials per stimulus were conducted in which experimenters asked, “What is it?” while holding up the HP or LP items. Praise was delivered contingent on appropriate responses. Prior to the mand baseline, deprivation was established. Both items were present on the table but out of reach of the subject. Praise was not provided for mands, but the item was delivered for 30 s. Tact training consisted of a progressive prompt delay procedure that included immediate

model prompts (such as the therapist saying the name of the item), 2-s delay to model, 5-s delay to model, and no model prompt. Like the tact baseline, “What is it?” was asked when each trial began and appropriate responding resulted in praise. Mand tests were conducted pre- and post-tact training and consisted of arranged periods of deprivation or satiation in which the transfer of control from discriminative to motivational conditions was measured. After tact training, probes were conducted after periods of deprivation or satiation from preferred items. After the 10th session, three tact trials were conducted for each item to facilitate the emergence of mands. Prior to mand test sessions beginning, three tact trials were conducted in which the experimenter held up an item and asked, “What is it?” Praise, instead of the item itself, was provided for correct answers. Incorrect answers were ignored. After the three tact trials, mand test sessions began. Three tact trials were conducted at the start of each mand test session in hopes that this would facilitate manding.

The subject in Davis et al. (2012) achieved 100% correct, independent tacting after approximately 17 sessions for HP and LP items after zero manding or tacting in baseline sessions. Manding was not exhibited until after the mand test with pre-session tact trials. Not surprisingly, given the importance of motivating operations, the subject had higher responding under deprivation sessions for HP. Transfer of control from discriminative to motivational conditions without direct training was exhibited when manding continued for the HP item while responding for the LP item decreased to near zero levels. Davis et al. suggested the level of deprivation evoked manding for the HP item with satiation producing an abolishing effect. The authors recommended future research evaluate mand test sessions under extinction conditions to control for the effects of manipulating the motivating operations and further determine the function of responding.

Gilliam, Weil, and Miltenberger (2013) taught three students to tact HP and LP items and then measured manding. Subjects ranged from age 3 to 5 years, were diagnosed with ASD, and had limited mand and tact repertoires. Formal verbal behavior assessment results were not reported. Procedures replicated Wallace et al. (2006). Gilliam et al. conducted a multiple baseline design across subjects to study tact training effects on the emergence of mands without direct training. Items that could serve as the HP and LP items were identified via preference assessment. Learning histories were controlled by assigning nonsense words to items. A baseline phase, considered a pre-training tact probe, was conducted to measure responding but none occurred. Prior to tact training, which followed baseline, pure mands were probed for 30 s. Sessions included 20 trials with a new trial beginning every 30 s. Both items were presented in a semi-random order until each was presented 10 times. Subjects were asked, “What is it?” and responding was ignored. A second baseline was conducted for impure mand probes before tact training. These sessions lasted 10 min with both items present on the table, during which no responding occurred.

Tact training occurred in two phases, starting with a 30-s pure mand probe. In the pure mand probe, HP and LP items were not visible to the subject; however, manding did not result in access to the item. Tact training was identical to Wallace et al. (2006). After tact training, an impure mand condition (considered such because the items were in sight and therefore possibly being tacted as well) was conducted to measure if manding occurred after learning to tact. Following the 10-min sessions, another pure mand probe (in which the items were out of sight) was conducted just like the tact training condition. Tacts were acquired in 5 to 12 sessions of tact training by all subjects. Subjects then manded for HP items during the impure mand probe with items in sight. The authors concluded that it is possible an establishing operation was present for

HP items given the variability in responding compared to LP items for all subjects, even though responding might have been under discriminative control as well.

Bailey (2014) evaluated the effects of generalized reinforcement on responding during mand testing after tact training, attempting to replicate and extend findings by Wallace et al. (2006) with one subject. Results of the mand testing showed manding emerged following tact training. A preference assessment (Fisher et al., 1992) was used to identify HP and LP items. During tact training, the subject correctly tacted the LP item more so than the HP item, which contradicted the hypothesis. This aligns with a subject (Jason) from Gilliam et al. (2013) who exhibited similar response patterns with higher rates of manding for the LP item when it was in sight compared to the HP item which was not in sight. It could be, then, that in the absence of HP stimulus, the LP item functioned as an effective reinforcer (Roscoe, Iwata, & Kahng, 1999). As the study went on, however, the subject continually requested the LP item, which might have been due to the LP item being more highly preferred than initially suspected.

For effective skill acquisition and aberrant behavior reduction in children with developmental disabilities, finding effective reinforcers is imperative (Davis et al., 2010). Therefore, it is possible the subject in Bailey (2014) did not actually prefer the items labeled HP and LP; the author mentioned the items included in the preference assessment were assumed to be preferred (Bailey, 2014). Further, Wallace et al. speculated the items subjects were to tact were not actually reinforcing, and thus tact training failed to facilitate the establishment of mands. It might have been possible to find alternative reinforcers if the subject had a wider array from which to choose. Family members and teachers could utilize a survey to identify potential reinforcers. Additionally, a forced-choice preference assessment could be administered before sessions to ensure the current level of motivation.

Statement of the Problem

Many studies claim to support the functional independence of mands and tacts (e.g., Hall & Sundberg, 1987; Lamarre & Holland, 1985; Twyman, 1996), meaning that after training one verbal operant, the other naturally emerged. However, some individuals in each study did not acquire all the trained mands or tacts without direct training, (e.g., Carroll & Hesse, 1987; Davis et al., 2012; Finn et al., 2012; Kooistra et al., 2012; Petursdottir et al., 2005; Sigafos et al., 1990; Wallace et al., 2006). Studies that show functional independence often show dependence as well. Even in studies that show functional dependence, dependence does not occur in every case. A possible confound affecting transfer of function is that there is uncontrolled variability in establishing operations across functions (e.g., Kelley et al., 2007; LaFrance et al., 2009; Lamarre & Holland, 1985; Wallace et al., 2006).

Other researchers (e.g., Davis et al., 2012; Wallace et al., 2006) demonstrated transfer of control from discriminative to motivational conditions (tact session to mand sessions) without directly training mands. In those studies, manding continued for HP stimuli and later decreased for LP stimuli. Two ways to potentially increase or maintain manding for items over time could be to use preferences assessments and to manipulate motivating operations. The use of preference assessments for identifying reinforcers might be useful to maintain manding longer (Davis et al., 2012). By manipulating motivating operations, an evocative or abolishing effect is predicted to sustain or suspend manding over time, respectively. Further, the present study will extend previous research (Davis et al., 2012; Wallace et al., 2006) by evaluating mand test sessions using extinction without programmed consequences to separate the effects of manipulating the motivating operation. This study sought to identify under which conditions functional independence or dependence in the acquisition of verbal operants occurs.

The purpose of the present study, then, was to further replicate and extend the findings of Bailey (2014) and Wallace et al. (2006) by conducting mand tests using a generalized conditioned reinforcer, praise. Mand responses were measured under the condition of generalized conditioned reinforcement to control for the motivating operation effects. Technically, this simulated a tact test because praise (and not the item itself) was delivered for correct manding, but because the expected effect was a decrease in responding under motivational control, this condition was considered a mand test with extinction. It was hypothesized that, following tact training, if the subject developed an untrained mand repertoire, she would more frequently mand for HP items relative to LP items.

Method

Subjects and Setting

One subject with speech Apraxia was included in the study: A 3-year-old girl who, several months after the study concluded, was diagnosed with ASD. The subject was enrolled in a daycare setting five days per week. She had echoic skills with limited mand and tact repertoire, as shown by results from the VB-MAPP (Verbal Behavior– Milestones Assessment and Placement Program; Sundberg, 2008). Her VB-MAPP assessment was in Level 1 for mands and tacts, indicating her mands and tacts are at the approximate age equivalence of an 18-month-old child. She could follow simple instructions and had an emerging verbal repertoire.

Sessions were conducted primarily in the subject's school and sometimes in the home, the latter due to scheduling and time constraints. Some sessions took place at an adult-sized table with two chairs located in the school cafeteria and in the hallway of the school with a child-sized table and two chairs for other sessions. The hallway space had bulletin boards and other classrooms nearby, but no other students or teachers were present. Several sessions of the mand test with access to the stimulus were conducted on the back patio of the subject's home. The patio location had three tables, one large table with two chairs and a child-sized table with two small chairs, enclosed by a screened-in porch with a door. A video camera with a tripod was set up in all locations to videotape sessions. The subject was currently receiving ABA therapy from the author two times per week. Two-to-four 10-min sessions were conducted per day, two-to-five days per week, based on the subject's schedule.

Response Measurement and Inter-Observer Agreement

A tact was defined as emitting the correct verbal response after the therapist held up an item and asked, "What is this?" A mand was defined as emitting a correct verbal response for an

item placed in front of the subject during mand testing. Chosen responses were “slinky” for the HP item and “darby” (the child’s pronunciation of “Barbie”) for the LP item. All HP and LP items were in the experimenters’ possession for the duration of the study. The subject only had access to these items during specified times in the given sessions.

A second observer collected data for 20% of the sessions by watching pre-recorded videos of the sessions. Tact session interobserver agreement (IOA) was calculated using trial-by-trial IOA, dividing the sum of agreements by the sum of trials with agreement and disagreement and multiplying by 100. Mand session IOA was calculated using total count IOA, in which the total number of responses is expressed as a percentage; the smaller number of responses is divided by the larger count and multiplied by 100 (agreement averaged 98.9% for tact phases, ranging from 95% to 100%); agreement for mand phases was 100%). During the post-intervention functional analysis condition, IOA was calculated for each session by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100 (agreement during the FA section was 100%).

Procedure

A structured interview, the RAISD (Fisher, Piazza, Bowman, & Amari, 1996), was administered with the subject’s mother to identify potentially preferred stimuli to include in the subsequent preference assessment. An MSWO preference assessment then was conducted with the subject in which objects were selected without replacement from an array (DeLeon & Iwata, 1996). The protocol identified by Kennedy Krieger Institute (2016) was used. Eight items were placed on a table in front of the subject in a straight line simultaneously, about 5 cm apart. The subject was exposed to pre-session sampling in which she had access to the materials prior to the assessment. The subject was shown how each toy worked. When the subject approached the

item, she was given access to the item for 5-10 s. The researcher prompted the subject to approach each stimulus for 5 s if the subject did not approach the item initially.

To begin the MSWO and after each previous trial ended, the experimenter instructed the subject to choose an item from the array. The subject had access to the chosen item for about 30 s. Following the selection of one item from the array, that item was no longer available in subsequent trials. Access to the other stimuli was blocked for the remainder of that trial. This procedure was repeated until all stimuli were chosen or the subject did not select within 30 s from the beginning of the trial. An MSWO was conducted three times to identify the items that would serve as the HP and LP items.

Baseline mand test. The therapist placed the HP and LP items on the table in front of the subject. If the subject manded for either item, the item was delivered for 30 s. Additional prompts or instructions were not delivered. Three separate sessions lasting 10 min each were conducted. If the subject reached or grabbed for the item, access was blocked by the therapist.

Tact training. Sessions were conducted to teach the subject to tact the HP and LP items that had been identified from the preference assessments. The HP and LP items were presented quasi-randomly for 20 trials per session. On the first trial, the therapist provided an immediate model prompt. Subsequent trials had a 5-s delay to allow for independent responding. The therapist held up the HP or LP item in front of the subject and asked, "What is it?" If the correct verbal response was emitted, a preferred edible item was delivered. Preferred edible items were identified via parent input and were sent to school with the subject for snack. Sessions were conducted in the mornings or afternoons at a time when the subject had not been exposed to food items for an hour before sessions began. A correct tact was scored when the subject responded correctly after the question, "What is it?" The therapist repeated the question and provided a

model prompt with an echoic correction prompt when the subject responded incorrectly or did not respond after 5 s. This phase concluded when the subject tacted both the HP and LP items for 100% of trials over three consecutive sessions with at least one overnight period in between. This mastery criterion, used in previous studies, was in place to avoid the possibility of tacts not being adequately acquired before manding was tested.

Mand test with access to stimuli. Sessions were conducted to determine whether a mand would emerge for the target response previously taught as a tact. The same procedure was used from the baseline mand test. The subject had to mand for at least one of the items for three consecutive sessions to move to the next mand phase. The item then was returned to the table.

Mand test with praise only. The mand test sessions were conducted under conditions of generalized conditioned reinforcement to determine if manding would decrease and if there would be a difference between HP and LP. to isolate the effects of the mot Correct responding resulted in praise instead of access to the stimulus; that is, extinction was in place for the mand response. This condition was completed long enough to determine if responding decreased for either response, as it would be expected to do if manding is the function of responding. If responding maintained, it would indicate a tacting function.

Mand test with access to stimulus. Sessions were conducted using the same procedure as the baseline mand test. This phase was conducted to reestablish the mand response under reinforcement conditions.

Post-intervention functional analysis. The analysis of verbal operants was conducted using the procedures from Lerman et al. (2005) and Kelley et al. (2007b). Antecedent and consequent events were manipulated to determine the function of the subject's verbal behavior. The function of subject's verbal responses was identified based on which condition resulted in

more responding when comparing test and control conditions.

In the *mand test* condition, access was restricted to preferred items for 5 min (Kelley et al., 2007b). When the session began, the therapist showed the subject the item and placed it in a bag near the child. If the child emitted the vocal response (e.g., Slinky or Barbie), the therapist removed the item from the bag and gave it to the child for 20 s. The item then was placed back in the bag. If the vocal response did not occur within 1 min, the item was removed from the bag as a subsequent prompt with the vocal prompt, "What do you want?" Other vocalizations and behavior were ignored except the targeted vocal response. A *mand control* condition was conducted after the child interacted with the object for the previous 5 min. The child had access to the object during the session. The therapist was not near the child, indicating praise was not available. No consequences were provided for vocal responses or behaviors.

A *tact test* condition was conducted in which the item was present during the session, but generalized reinforcement such as praise or edibles was delivered contingent on responding. Prior to this condition, subjects had access to preferred items for 5 min. Access to the item was not restricted or delivered upon verbalization. The therapist was seated near the child. When the item was in sight of the subject, a vocal prompt ("What is it?") was provided every 20 s if the subject did not emit the correct verbal response. Each time the response occurred, praise or preferred edibles were delivered but the name of the item was not mentioned in the praise. All other verbal responses and behavior were ignored. The *tact control* condition was conducted after the child accessed the items for the previous 5 min. The items were not present in the room. The therapist was seated across the room, indicating that neither praise nor the items themselves were available. No consequences were provided for vocal responses.

Test and control conditions were alternated in a multi-element design assessing the

targeted verbal responses. Responding was expressed as the percentage of trials with correct responding. Each session consisted of 10 discrete trials with several prompts. The length of control sessions was yoked to the average length of the corresponding test sessions. For each control condition, two test conditions were conducted. Item restriction (for the mand test condition) or access to items (for the tact test and tact control conditions) was in place for 5 min prior to the session. This procedure confirmed the function of the verbal operants and controlled for the strength of the establishing operation for manding.

Results

An MSWO was conducted with eight items and identified two items that were used as the HP and LP items. Figure 1 depicts the results of the subject's preference assessment. Her HP and LP items were a slinky and a Barbie (selected on 75% and 17% of trials, respectively). A stable preference emerged after a series of three MSWOs.

Figure 2 shows the results for mand tests and tact training. The baseline condition shows zero responding. During tact training, the subject emitted tacts to 100% by the third session for both the HP and LP items. By the 4th session, the subject began tacting the HP item at 100% accuracy and the LP item at 73% accuracy (# of correct responses over # of total trials). Both items were successfully tacted 100% accurately by the 5th session. During the first mand test with access to stimuli, the subject did not emit mands. Instead, she pointed to the items, saying "this one" or "that one," but did not emit the correct response of "darby" or "slinky." By the second session of mand test with access to stimulus, she correctly manded for the HP item within the 10-min session and manded for the LP item by the 3rd session. Responding was higher for the HP item in the mand test with access to stimulus phase.

In the mand test with praise only, responding remained higher for the HP item compared to the LP item. Responding dropped down to low levels over sessions in this condition. When the mand test with access to stimulus phase was reinstated, responding for both items increased; however, responding for the HP item remained higher than the LP item.

Figure 3 depicts the functional analysis of verbal operants. Results were inconclusive across sessions for identifying functions of the verbal operants. The response for HP item ("slinky") occasionally functioned as a tact, with higher responding compared to Barbie; in other sessions, responding was higher in the mand phase for slinky compared to Barbie.

Discussion

The effects of generalized reinforcement on manding following tact training and several sessions of manding were studied. The purpose of this study was to extend the findings of previous studies with additional subjects with minor procedural variations (Bailey, 2014; Gilliam et al., 2013; Wallace et al., 2006). The current findings provide support that evaluating manding under conditions where manding was, effectively, not reinforced helped to determine if a mand response was under motivational control. This was evidenced by low level of responding in the mand test with praise only condition. This study supported prior research for the functional interdependence of verbal operants: In other words, teaching a tact response can facilitate the occurrence of untrained mands (i.e., tact-to-mand transfer) (Kelley et al., 2007b; Sigafos et al., 1989; Sigafos et al., 1990; Sundberg et al., 1990). Specifically, this was true for a child with diagnosed speech impairments and, as revealed later, an ASD diagnosis. The current study found that after at least 3 sessions of exposure to the mand reinforcement contingency, the subject successfully emitted mands after being trained to tact. This supports other studies' results as well. For example, Gamba et al. (2015) noted in a literature review that, out of 12 studies with 44 subjects assessing tact-to-mand transfer, 12 subjects consistently exhibited mands after tact training.

During the baseline mand test, the subject emitted vocal behavior during this condition while pointing to the items, "that one" but could not successfully mand for the item. This varied from the results of Wallace et al. (2006) in that they reported none of their subjects emitted signs or vocalizations during this condition. It is possible, however, the subject in the present study had a higher verbal behavior repertoire compared to the subjects in the Wallace et al study. Wallace et al. reported their subjects were middle-aged and diagnosed with levels of moderate to severe intellectual disability.

The subject tacted both items for the first time in the same session consecutively, like results exhibited by Gilliam et al. (2013). It is interesting to note mands did not automatically transfer in the first mand test with access to stimulus session, but they did in a following session. This is in opposition to previous findings in which tact-to-mand transfer did not happen (Hall & Sundberg, 1987; Lamarre & Holland, 1985; Sigafoos et al., 1989; Twyman, 1995).

Following tact training, the mand test with access to stimulus was conducted to serve as an impure mand condition after tact training, seeking to evaluate transfer from tact to mand once tact responses were mastered and replicating results from Wallace et al. (2006). Response maintenance might suggest the reinforcing function of food during tact training sessions transferred to accessing the item during the mand test. To ensure true manding occurred, a mand test with praise only was conducted under conditions of generalized conditioned reinforcement. This phase was considered to serve as a mand extinction phase because manding did not result in access to the item. Instead, the subject was praised when correct vocalizations were emitted. It is likely that because responding decreased in the mand test with praise only, the response had been functioning as a mand at that point in the study.

An additional phase was added to evaluate and ensure a clear function of verbal operants utilizing previous methodology (Kelley et al., 2007b; Lerman et al., 2005). Unfortunately, responding in the FA for both tacts and mands was variable across sessions, supporting previous research in which reinforcement might not have been strong enough for a deprivation period of 5 minutes to establish motivating operations for the items (Finn et al., 2012; Hall & Sundberg, 1987; Lamarre & Holland, 1985; Twyman, 1996). Based on lower rates of responding in the mand condition compared to the tact condition, it is possible and highly likely that the HP item was no longer reinforcing towards the end of the study. The subject requested other items

throughout all conditions in the FA section of the study. These results did not support prior research (Kelley et al., 2007b; Lerman et al., 2005) because the function of responding was not identified.

This study had some limitations worth discussing. One possible limitation was the inconsistent testing location for the subject due to scheduling time constraints and availability issues of the various locations throughout her school. There were many distractions in each environment. Another possible confound was the subject seemed to lack consistent motivation for both the HP and LP items towards the end of the study during the FA conditions. After working with this child for the past six months, reinforcers have been difficult to identify on an ongoing basis due to constant preference changes.

Further, prior to the study, the subject could emit mands and tacts for alternative HP items such as stamps, play-doh, snacks, and stickers, items which otherwise might have been selected as HP items. These items were not included in the MSWO preference assessment for this reason. Although she met the selection criteria for the present study, it was difficult locating items she could not already tact and that might also be preferred. Future studies should replicate these procedures using a variety of subjects to determine which subjects might benefit from extensive tact and mand training. Additionally, the subject was not accustomed or exposed to discrete-trial-training sessions during ABA therapy. Her sessions were more naturalistic and conducted between home and a Montessori-preschool setting. Future studies should begin with ensuring subjects have the appropriate session behavior skills such as sitting and attending to tasks, prior to initiating discrete-trial-training.

One component future research could incorporate forced choice trials between the HP and LP prior to mand conditions to determine if the items are still preferred. Conducting a

reinforcer assessment would have been an added control measure to be used in the tact condition for generalized reinforcement. Like the results of LaFrance et al. (2009), the subject did not consistently consume the cookies during initial tact training sessions. Although a forced-choice preference assessment was conducted prior to every tact training session, occasionally the subject chose an edible but did not consume it completely.

This study replicated the findings of Wallace et al. (2006) by creating conditions that facilitated the transfer of tacts to mands. Mands emerged without direct training after tacts were trained supporting additional research findings (Kelley et al., 2007b; Sigafoos et al., 1989; Sigafoos et al., 1990; Sundberg et al., 1990). Anecdotally, over the course of the present study, spontaneous manding began occurring for various items (food, cookies, drinks, toys) during sessions and outside of sessions. Prior to this, both the classroom teacher and parent reported the subject did not spontaneously request items. This is an exciting possibility for effects of tact training on early language learners and for practitioners creating verbal behavior programming. Future researchers should specifically measure for the occurrence of spontaneous mands.

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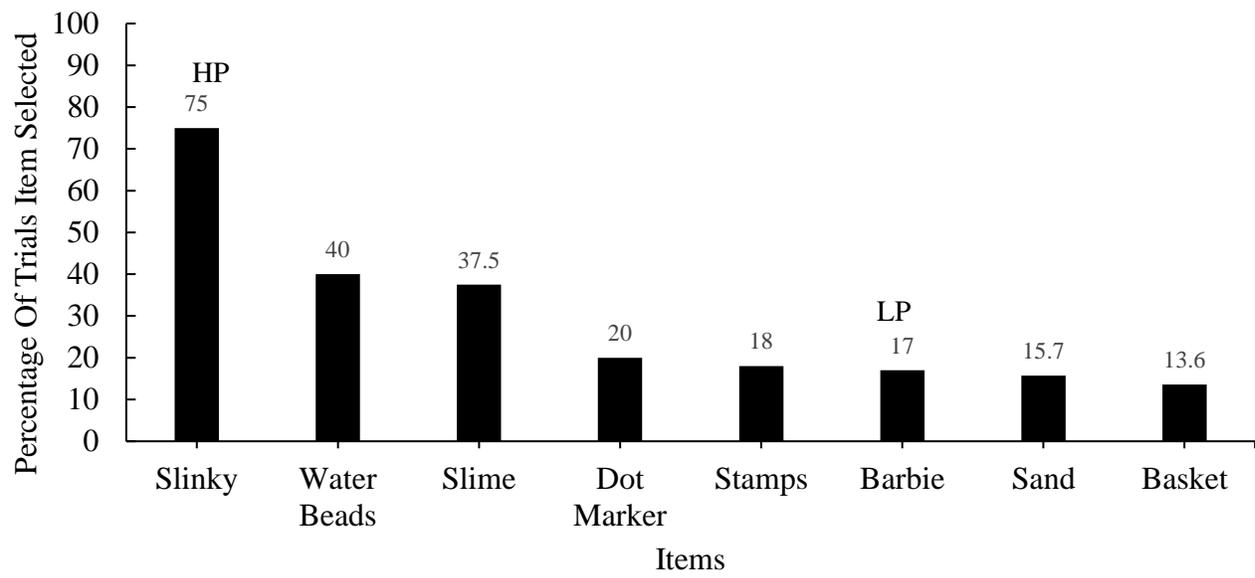


Figure 1. Data for the three MSWO's, indicating item preference. Slinky was selected as the HP item; Barbie was selected as the LP item.

Generalized Reinforcement Effects on Manding

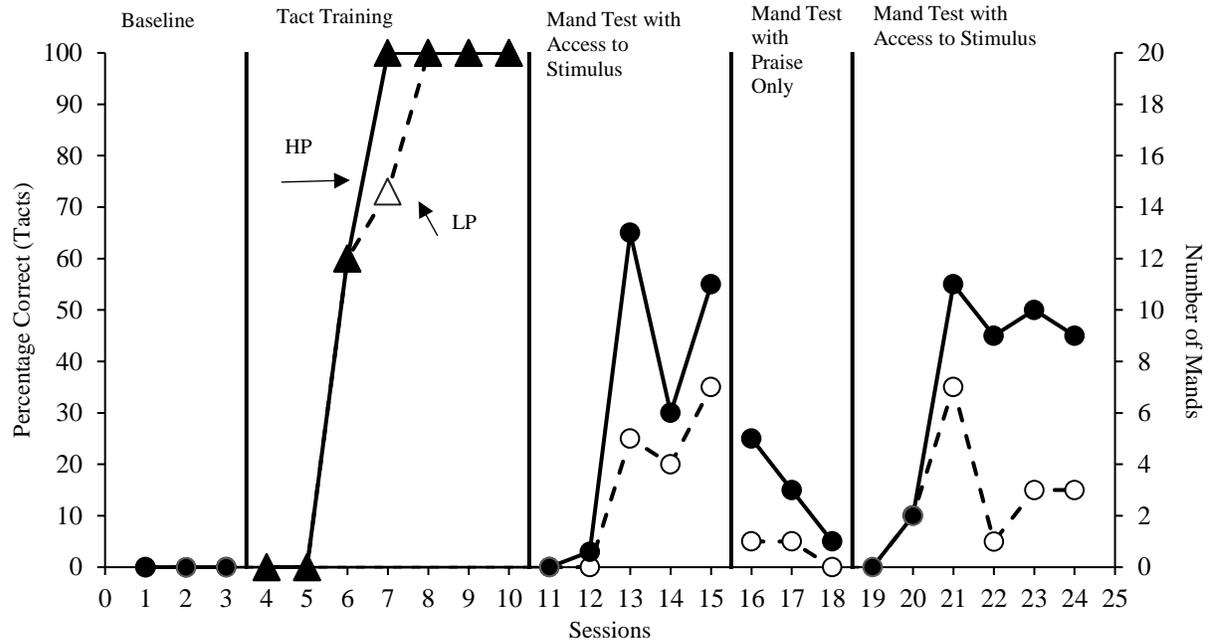


Figure 2. Data depict generalized reinforcement effects of mands. Percentage of correct tacts are graphed on the primary y-axis, which corresponds with tact training depicted with triangles. The secondary y-axis corresponds with the baseline and mand test data depicted with circles.

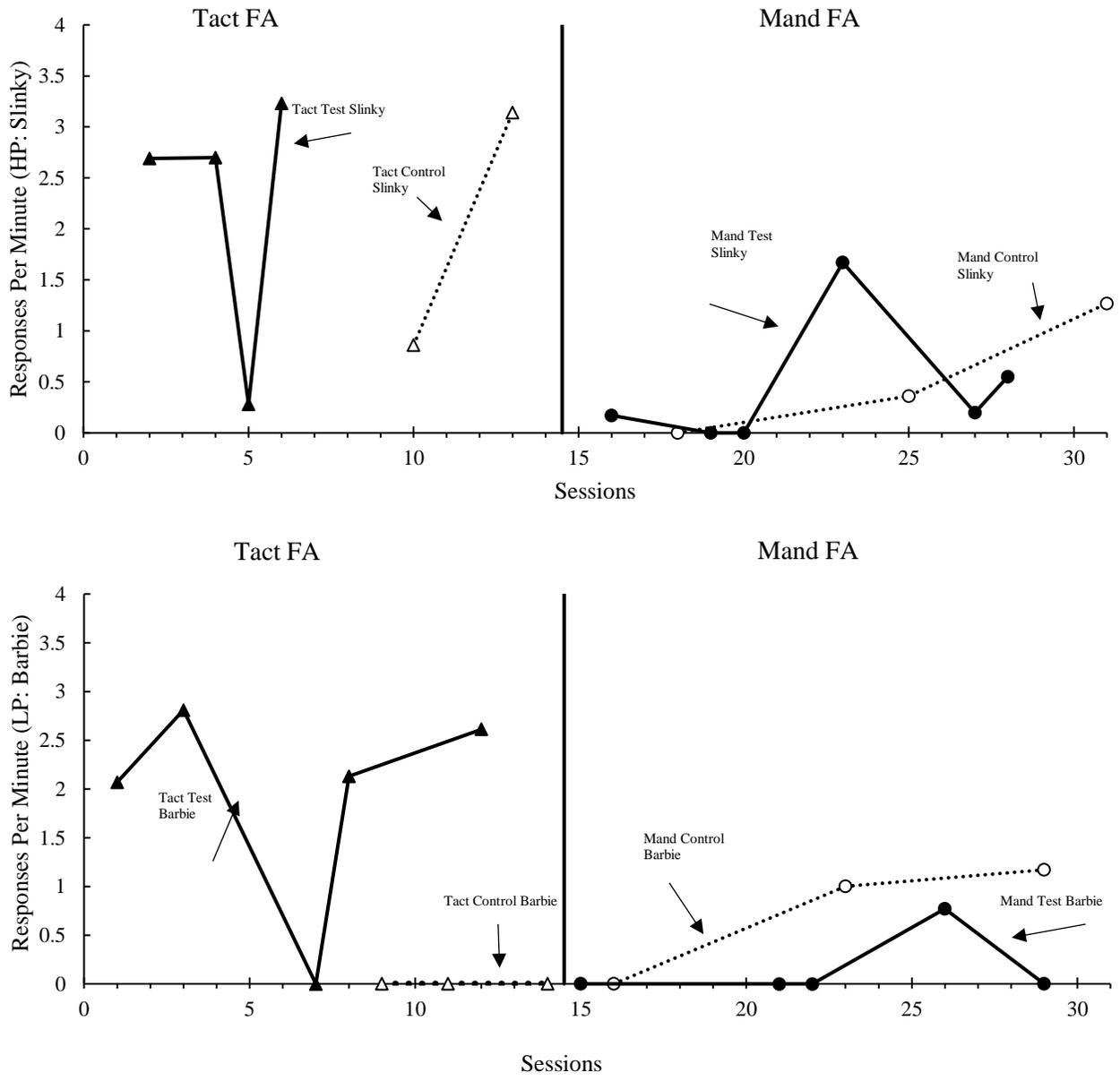


Figure 3. Functional analysis of verbal operants. Responses per minute for mands and tacts for both the highly preferred and less preferred items.