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Generalization of Mands for Information across Establishing Operations

Lechago

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Sarah A. Lechago
This study sought to extend the developing literature on teaching mands for information by systematically assessing whether they generalize across different EOs. Three children with autism were taught to perform multiple behavior chains, three of which included a common response topography (e.g., “Where is the spoon?”) used for different purposes. An interrupted-behavior-chain procedure was used to contrive the EO for each mand. After a mand for information was taught under one EO, the remaining chains were interrupted to determine whether the mand had generalized across EOs. For all three participants, mands for information generalized across EOs. For one participants, a new mand for information topography emerged after training. The results are analyzed according to Skinner's analysis of verbal behavior.
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INTRODUCTION

Generalization of Mands for Information across Establishing Operations

Children diagnosed with autism display significant impairments in communication (American Psychiatric Association, 2000; Creak, 1972). Most caregivers typically identify a delay or total absence of language early in their child's development (Young, Brewer, & Pattison, 2003), which often precipitates formal assessment for the diagnosis of autism. The development of language is irrefutably important to an individual's functional independence. Most children with autism must be explicitly taught those communication skills that typically developing children seem to acquire naturally and with relative ease (Taylor & Harris, 1995). As such, a number of treatment approaches have been developed to reduce and eliminate these communication deficits. Some of these approaches include the traditional psycholinguistic approach employed by most speech language pathologists, the Developmental Individual-Difference Relationship model (Greenspan, Wieder, & Simons, 1998), and play therapy (Schuler, 2003). In addition, within behavior analysis the "verbal behavior approach" is one of several approaches used to address language deficits. This treatment approach is based on Skinner's (1957) analysis of verbal behavior. Skinner's analysis highlights the use of functional analysis to identify those variables that control verbal behavior. Based on their function, verbal behavior is then classified according to one of the major verbal operant classes that were delineated by Skinner.

The verbal behavior approach to teaching children with autism begins with an assessment of their language skills in reference to the different verbal operants (Sundberg
& Partington, 1998). A curriculum is subsequently developed based on the results of the assessment. Curricular programs target the different verbal operants, which typically include mands, tacts, intraverbals, and echoics. These verbal operants exemplify
differential functional relations of verbal behavior.

A common type of language deficit in children diagnosed with autism is the inability to mand (Taylor & Harris, 1995). Manding serves important functions in the development of language, including getting needs met (e.g., asking the location of needed items), proficiency with social skills (e.g., by learning to rely on others for help or valuable information), and the continued growth of vocabulary (e.g., asking others to tell you the name of unknown items or persons) (Brady, Saunders, & Spradlin, 1994; Sundberg, Loeb, Hale, & Eigenheer, 2002). Due to its possible direct benefits to the speaker, mand training is recommended as one of the initial targets in a child’s curriculum (Skinner 1957; Sundberg & Michael, 2001).

The Mand Relation

According to Skinner (1957), the mand is a verbal operant that has a characteristic reinforcer and is under the influence of relevant states of deprivation and aversive stimulation. A particular response is more likely to occur after a state of deprivation and less likely to occur after a state of satiation. The characteristic reinforcer that follows a given form of the mand is related to this state of deprivation or aversive stimulation. For example, the response “I want water” is more likely to occur after a state of water deprivation because is it under the functional control of water deprivation. The speaker
receives water after emitting the response which reinforces this particular mand under conditions of water deprivation. The mand is a unique verbal operant due to its relation to controlling states of deprivation and aversive stimulation and its characteristic consequences.

Michael's (1988) expansion of Skinner's (1957) conceptualization of the mand has contributed significantly to a greater understanding of the mand and its clinical value. The concepts of deprivation and aversive stimulation were insufficient to account for all of the motivative variables that influenced the mand. Consequently, Michael introduced a thorough analysis of the concept of the establishing operation (EO) in order to account for these motivative variables. Of particular importance was that the EO included an account of those conditioned motivative variables that influence the mand. Skinner's analysis only seemed to account for unconditioned motivative variables such as pain or water deprivation.

Before the mand relation is considered further, it is necessary to discuss the concept of the EO.

The Establishing Operation (EO)

For years, the concept of reinforcement replaced the traditional psychological concept of motivation in behavioral approaches to psychology (Michael, 1993). This was beneficial for a science of behavior in that it moved explanations of the maintenance of behavior away from hypothetical internal processes. However, reinforcement alone did not sufficiently account for motivative influences on behavior. Michael (1982, 1993)
provided an analysis of the EO which has significantly contributed to the field's understanding of motivative variables and their effects on behavior. An EO is an event or condition which has two specific effects. The first effect is the reinforcer establishing effect in that the EO momentarily alters the reinforcing effectiveness of a given stimulus, condition, or event. For example, water deprivation establishes water as a reinforcer. The second effect is the evocative effect. Michael (1993) highlighted three aspects of the evocative effect which are: 1) it is a direct result of the EO, 2) it increases the evocative effect of discriminative stimuli that have been followed by the specified reinforcer in the past, and 3) it increases the frequency of the behavior that has put the organism in contact with the specific reinforcer in the past.

A contemporary taxonomy of the EO. Since Michael’s initial analysis of the EO, articles on the concept and the incorporation of the EO in behavioral analyses have increased substantially (Laraway, Snyderski, Michael, & Poling, 2003). In addition, most behavior analysts have adopted his terminology. However, terminology used to describe the EO and its effects have failed to precisely describe their effects on behavior. In response to this challenge, Laraway et al. proposed a new taxonomy for the EO and its effects.

The term EO implies that all motivative variables increase the reinforcing or punishing effects of a stimulus or event. However, some motivative variables decrease reinforcing or punishing effects. Laraway et al. (2003) recommended that variables that increase reinforcing or punishing effects be termed EOs and those that decrease
reinforcing or punishing effects be termed abolishing operations (AOs), with both effects subsumed under the more generic term of motivating operation (MO).

Until recently, most MOs have been discussed in terms of reinforcement; however, they also have the ability to establish or abolish the punishing effects of a given stimulus. Therefore, it seemed imprecise to describe the second effect of the MO as only “evocative.” Thus, Laraway et al. (2003) recommended the term “evocative effect” for MO-related increases in behavior and “abative effect” for MO-related decreases in behavior.

_Distinguishing between EOs and S^D_s._ Due to the fact the EO and the discriminative stimulus (S^D) are both antecedent events, confusion between the two are common. Some have interpreted stimuli resulting from the relevant EO as S^D_s for the behavior evoked by the EO (Michael, 1993). For example, a dry throat resulting from water deprivation might be viewed by some as an S^D for obtaining a glass of water. However, based on Michael’s conceptualization, it is not an S^D because a dry throat is not correlated with the availability of reinforcement. A dry throat increases the reinforcing effectiveness of water and increases the frequency of behavior that has been reinforced by water in the past, establishing it as an EO. Michael (1993) provided a clear distinction between these two antecedent events. The S^D relates to the differential availability of a reinforcer given the presence of the relevant EO. The EO relates to the reinforcing effectiveness of a given stimulus or event.
Distinguishing between CMOs and UMOs. All organisms are born susceptible to certain types of stimuli or conditions as reinforcers or punishers in which their value-altering effects are unlearned. These types of MOs are termed unconditioned motivating operations (UMOs) (Michael, 1993). For example, food functioning as a reinforcer as a result of food deprivation, or the removal of pain functioning as a reinforcer as a result of pain onset, are examples of unlearned relations. It is important to note that although the value of a given stimulus or condition might be unlearned, the behavior resulting in the relevant reinforcer or punisher is typically learned. For example, the reinforcing effectiveness of food as a result of food deprivation is unlearned, but the behavior of making a bowl of soup is learned.

Conversely, there are variables that alter the value of a given stimulus or event only as a result of an individual’s particular learning history (Michael, 1993). These motive variables are termed conditioned motivating operations (CMOs). Michael (1993) proposed three main types of CMOs. When a neutral event is paired with another CMO or UMO establishing it as a CMO, this is termed a surrogate CMO. For example, a student always has a caffeinated beverage during her early class because she is normally tired. On a morning when she has gotten an exceptional amount of sleep, she still purchases a caffeine drink. Feeling tired establishes caffeine as a reinforcer. Consistently pairing caffeine consumption with the morning class has established the class as a surrogate CMO for caffeine consumption. The second type of CMO is the reflexive CMO. When a stimulus systematically precedes an event whose removal is
reinforcing (or punishing), it establishes its own removal as reinforcing (or punishing).

For example, a person turns on the fan to remove the smoke from cooking to avoid setting off the smoke detector. The termination of the smoke detector is reinforcing because the sound of the alarm is aversive. Removing smoke that sets off the smoke detector, thereby avoiding the activation of the smoke detector, then becomes established as a reinforcer. Finally the third type of CMO is the transitive CMO in which a stimulus establishes another stimulus as a conditioned reinforcer or punisher. An example of this would be a boy who wants to play a videogame, but only has 75 cents and needs one more quarter to activate the game. He sifts though his pockets because this behavior has produced change in the past. The “desire” to play the video game establishes the change as a conditioned reinforcer.

The preceding summary of the EO/MO concept is germane to any discussion of mand training. Since the mand is controlled by an EO, mand training must necessarily include the EO during training.

*Clinical Benefits of Mand Training*

A significant impact that Skinner’s (1957) analysis of verbal behavior has had on language training for individuals with developmental disabilities is the assessment and training of verbal behavior according to the different functional operants (Sundberg & Michael, 2001). As previously stated, the mand is the only verbal operant that directly benefits the speaker. Because of their direct benefits to the speaker and the fact that mands are the first type of verbal behavior infants acquire (Skinner), it has been
recommend that mand training be the focus of initial language training (Shafer, 1994; Sundberg & Michael). Mands put the speaker in direct contact with specified reinforcers (i.e., the speaker's immediate need is met), consequently giving the speaker control over his or her environment. This initial positive experience may facilitate further language training. These factors indicate that mands may be more easily acquired than other verbal operants (Shafer). In addition to pairing the teacher and language training sessions with the mand-produced reinforcers, mand training also helps the learner to discriminate between the roles of speaker and listener which is critical for successful development of a verbal repertoire (Sundberg & Michael). Finally, mands are recommended as the initial focus of language training because they are likely to be emitted spontaneously and to generalize more easily than other verbal operants because they are under motivational rather than discriminative stimulus control (Sundberg & Michael).

Controlling Variables and the Mand

When training the mand, it is important to consider and utilize the two distinguishing features of the EO (Shafer, 1994). The first feature of the EO is the value-altering or reinforcer-establishing effect, in which the EO momentarily alters the reinforcing effectiveness of a given stimulus or event (Michael, 1993). Due to the transient nature of this reinforcer establishing effect, it is critical for the trainer to be able to capture the EO (Sundberg & Partington, 1998). For example, if it has been many hours since the client has eaten, this may be an optimal time to train mands for food since it is likely that the EO for food is strong. It is also possible to contrive EOs. This entails manipulating environmental events so that the reinforcing effectiveness of a given event or stimulus is strengthened. For example, the trainer can hide the last piece of the puzzle
that a child is putting together. The removal of that puzzle piece establishes the completion of the puzzle as a form of reinforcement.

The evocative aspect of the EO is also relevant to consider during training. The EO evokes the behavior that has successfully put the individual in contact with the reinforcer in the past (Michael, 1993). Individuals with a limited verbal repertoire generally emit idiosyncratic mands or problem behavior when the EO is in effect because these are the behaviors that have successfully put them into contact with reinforcers in the past. When these behaviors are evoked, this is the optimal time for the trainer to shape appropriate mand forms through prompts and modeling. Thus, it is critical to successful mand training to consider both effects of the EO.

The distinction between the EO and the $S^D$ is important for mand training especially as it pertains to teaching a pure mand (Brady et al., 1994; Shafer, 1994). The EO relates to the reinforcing effectiveness of a given stimulus or event whereas the $S^D$ relates to the availability of a given reinforcer (Michael, 1993). The point at which a mand can be considered pure may be related to the number of controlling variables. For example, a trainer may hold up a cookie and provide the $S^D$ “What do you want?” The mand here may not be considered pure since the response is part mand (if the relevant EO is present), part tact which is controlled by the $S^D$ (presence of the cookie), and part intraverbal which is controlled by the verbal $S^D$ (prompt of “What do you want?”). Responses considered pure are those that are only influenced by the EO. Although most mands involve some degree of multiple control, it is most beneficial for the client to learn how to mand under the influence of the EO alone so that mands are more likely to generalize to situations in which irrelevant training $S^D$s are absent (Shafer).
Mand Training Procedures

There are a few procedures typically used to train mands. *Incidental teaching* involves the trainer observing and interacting with the child and using naturally occurring opportunities to provide instruction (Anderson, Taras, & O'Malley Cannon, 1996; Shafer, 1994). The trainer observes an opportunity where an EO is present and then he or she teaches a mand at that moment. For example, the trainer may observe the child pull on the lid of a toy trunk and at that moment teach the child to say “toy?” In other words, this procedure relies on capturing EOs to train mands.

*Training nonspecific requests* entails presenting a variety of putative reinforcers to the learner and blocking his or her attempt to physically obtain an item. The learner is then taught to make a response to gain access to all of the reinforcers. This training is considered nonspecific because there is no one-to-one correspondence between the response form and the consequence (Brady et al., 1994). By contrast, *training specific requests* involves presenting a putative reinforcer to the client, and blocking his or her access to it until a specific response is emitted. In this case, there is one-to-one correspondence between the response form and the consequence.

The *interrupted behavior chain* procedure is a common way to train mands. This procedure involves presenting the client with an opportunity to complete a behavior chain (e.g., setting the table). An item that is needed to complete the chain is then removed, thereby contriving an EO for the missing item. The missing item would presumably then function as a reinforcer. The trainer would use that opportunity to teach the client to mand for the missing item. The trainer can also block access to the missing item and use the presence of the item as a supplemental stimulus, if necessary. However it may be
more beneficial for the trainer to remove the needed item altogether so that it is certain
that the mand comes entirely under the control of the EO (Brady et al., 1994). This
procedure is considered highly effective in teaching individuals with very limited
repertoires (Brady et al.; Hunt & Goetz, 1988; Shafer, 1994). A main advantage of using
the interrupted behavior chain is that EOs are contrived, thus ensuring its presence when
the mand is being trained (Shafer). In addition, this procedure can take advantage of
already existing routines in which the client participates on a daily basis, which may be
helpful for purposes of generalization (Hunt & Goetz).

Mands for Information

Michael’s (1988) introduction of the EO concept in relation to the mand not only
expanded the analysis of the mand relation to include conditioned variables, but also
highlighted the major presence of the mand in daily verbal interactions. In addition,
Michael (1988) noted that most of the mands that people emit are mands for information.
A mand for information is a mand which specifies a verbal stimulus as its reinforcer and
is under the influence of a relevant CEO. These CEOs make the information valuable to
the speaker (Sundberg & Michael, 2001). It is important to teach mands for information
because these mands allow the speaker to react more precisely to the environment and
result in the acquisition of additional verbal behavior (Sundberg & Michael; Sundberg &
Partington, 1998). If an individual requires a specific item to complete a task, for
example he or she needs a hammer to hang a picture, and the individual does not know
where the hammer is located, manding for the location of the needed item, “Where is the
hammer?”, will help the individual interact more effectively with the environment by
looking where he or she was told the item was located versus wasting time looking in
other locations. In addition, if a child is not familiar with the names of items and he or she learns the mand for information, "What's that?", this can help greatly expand the tact repertoire of the child. With this greater understanding of the considerable role mands for information play in individuals' verbal behavior, Michael (1988) illuminated the potential impact that mand training would have on the development of language training programs of individuals with developmental disabilities.

Several recent investigation have focused on teaching mands for information. For example, Williams, Donley, and Keller (2000) conducted a study which involved teaching two 4-year-old girls diagnosed with autism to ask three questions about hidden objects. A multiple-baseline design across response topographies was used to evaluate treatment effects. The experimenters used many different types of boxes to conceal many objects assumed to be attractive to the children (e.g., a sparkling, spinning wheel). The experimenters used imitative prompts to train the three response forms, "What's that?", "Can I see it?", and "Can I have it?" Emission of the correct response or imitation of the experimenter produced the corresponding reinforcer: the item's name, the sight of the item, and the item itself. A stimulus generalization phase followed each instructional phase and took place in the living room (as opposed to the child's bedroom where training took place) with the mother. A follow-up phase was conducted after 20 days for one participant and after 11 months for the other one. No prompts were used during follow-up.

The frequency for asking all three questions increased substantially from baseline (responding was at 0) and maintained during the generalization phase. Frequency of the emission of the second response form, "Can I see it?" decreased while emission of the
first response form, “What’s that?” maintained during training of the third response form, “Can I have it?” This may suggest that the EO for information about the hidden item was strong, while the EO to see the item after it had been identified was not as strong. A structured preference assessment may have helped identify the EO for the second response form, “Can I see it?”. In conclusion, the Williams et al. (2000) investigation demonstrated an effective procedure to train and maintain different mand topographies across settings and across instructional agents including a mand for information, “What’s that?”

Williams, Pérez-Gonzalez, and Vogt (2003) conducted a systematic replication of the aforementioned Williams et al. (2000) study. The study included three participants diagnosed with autism ranging in age from 2 to 9 years. The three participants learned to ask all three of the question forms. However, after training, the experimenters varied the consequences to the second (“Can I see it?”) and third (“Can I have it?”) response forms. The experimenters sometimes provided unpleasant consequences sometimes such as saying “No!” and even hiding the box to determine whether the three questions were functionally independent, were part of the same response class, or belonged to a chain of responses. It is important to note that the experimenters used novel stimuli; however, they made sure that all the novel stimuli were similar to known reinforcers (e.g., a shiny red race car). Varying the consequences to the second or third response form did not impact the emission of the other two response forms, which suggests that all three response forms were not part of the same response class. In addition to varying the consequences to the response forms, the experimenters also used known unpleasant items during one phase of the study. During this phase the children still asked, “What’s in the
box?" while the other two response forms decreased. This suggests that the three response forms were not part of a chain of behavior. In addition, the results of this study demonstrate that the mand for information, “What’s in the box?” was influenced by an EO separate from those of the other two mands and that the mand for information generalized across the presentation of different items.

Sundberg et al. (2002) conducted a study that involved contriving EOs to teach mands for information. The participants were two young boys (5-6 years) diagnosed with autism. In their first experiment, the participants were offered 2-3 reinforcers and 2-3 neutral items in a box, one item at a time. The children were instructed to retrieve the item from the box. During baseline, the experimenters handed the now-empty boxes back to each participant. After being instructed to remove the item from the box, the experimenter recorded each child’s verbal behavior after he had looked in the empty container. During the intervention phase, the experimenters chose one preferred item and one neutral item for training. The participants had brief contact with each of the items, which were again placed in the box one item at a time. The experimenters then removed the items, handed the empty box back to the participants, and instructed them to get the item out of the box. At that point, the experimenters used imitative prompts to train the mand “Where is the ___?” Correct responses and successful imitation of the experimenter’s prompts produced information about the location of the missing item. Both participants learned to successfully mand for information regarding the location of the missing items.

A multiple-baseline design across response topographies was used to evaluate treatment for each participant, and a multielement design was used to compare two
different levels of the EO. One level consisted of highly preferred items (i.e., the EO was strong). The other level consisted of neutral items (i.e., the EO was weak). For one participant only, generalization was seen across baselines for each pair of items. This participant was able to successfully mand for the location of two new items without direct training. In addition, faster acquisition of mands for information for the preferred item occurred for one participant while the reverse was true for the other participant. In reference to the latter, the experimenters noticed that the participant interacted more with the item they assumed to be neutral and showed progressively less interest in the item with assumed reinforcing properties. They concluded then that this demonstrated a relation between the value of a missing item and the evocative effect of the EO. However, this conclusion by the experimenters was purely speculative. A daily structured preference assessment would have been able to better identify that the EO was in effect when mands for information were taught.

The procedure and design in experiment 2 were identical to those of experiment 1 except that the investigators trained the participants to mand “Who has the ___?” The results demonstrated that both participants acquired the “Who?” mand. Generalization across baselines for the “Who?” mand was observed with both participants. No difference in acquisition was observed between preferred and neutral items; however, the experimenters observed that both participants walked faster to the adult who had the missing item when the preferred item was missing, thereby motivating the experimenters to collect latency data toward the end of the experiment. The mean latency for items presumed to be more desirable was shorter than for items presumed to be less desirable for both participants. They speculated once again that this demonstrated the evocative
effect of the EO. In conclusion, the Sundberg et al. (2002) investigation demonstrated that contriving the EO is an effective way to train mands for information and for some individuals, mands for information will generalize across topographies.

Endicott and Higbee (2007) conducted a systematic replication of the Sundberg et al. (2002) study. Their replication extended the Sundberg et al. (2002) study by including a structured preference assessment. The participants were four males diagnosed with autism between the ages of 3 and 5. In the first experiment, a brief 1-array stimulus preference assessment was conducted at the start of every session in order to identify the most and least preferred items. During baseline, the participants were seated in their cubicles and given free access to a highly preferred item for 30 s, and then they were escorted out of the cubicle for approximately 1 min. During this time, the experimenter hid the item in 1 of 3 designated hiding locations (a shelf, a toy box, or the participant’s backpack) thereby contriving the EO for the location of the missing item. After the experimenter instructed the participant to retrieve the item, the participant’s verbal behavior was recorded. If the participant did not emit the mand for information after 30 s, they were brought back to their cubicle and a new trial began with free access to the item. Five trials were conducted with the most highly preferred item, followed by five trials with the least preferred item. During the intervention phase, trials were identical to those in baseline except if the participant did not emit the “Where?” mand for the missing item, the experimenter provided him with an echoic prompt. Upon emission of the mand or successful imitation of the experimenter, the participant was provided with information regarding the location of the missing item. As during baseline, five trials were conducted with the most highly preferred item followed by five trials conducted with the least
preferred item. A generalization probe was conducted in the homes of two of the participants after the intervention phase. All three participants learned to emit the “Where?” mand for information after the intervention.

In addition to the multiple-baseline design across participants that was used to evaluate the aforementioned intervention, a multielement analysis was added to assess the effects of the two levels of the EO. Generalization across settings and instructional agents was observed for the participants for whom generalization probes were conducted. The mand for information was acquired at high rates for both the high- and low-preference items with even slightly quicker acquisition for the least preferred items over the highly preferred items. This outcome may be an artifact of the study’s design as the first five trials of every session were conducted with the highly preferred item to maintain high levels of the EO. This pattern of responding could have been the result of acquisition of the response during the trials with the highly preferred item and maintenance of the response during the trials in which the less preferred item was used. Another potential reason this pattern of responding was observed was that perhaps the difference in reinforcing value between the items was insufficient to produce a significant difference in acquisition rates. Finally, perhaps something about the procedure itself acquired reinforcing properties (i.e., it became a game) thereby minimizing the potential differential effects of item preference. Future research in this area which attempts to assess differential rates of acquisition based on item preference, should perhaps intersperse trials between most and least preferred items in an effort to minimize order effects.
In experiment 2 of the Endicott and Higbee (2007) investigation, procedures were identical to those in experiment 1 with the addition of a second component. When the participant emitted the “Where?” mand for the missing item, the experimenter would respond with the statement, “I gave it to somebody.” During, the intervention phase, echoic prompts were used to train the “Who?” mand. As in experiment 1, the procedures were conducted with the most highly preferred item for the first five trials followed by five trials with the least preferred item. Following the intervention, all three participants were able to emit the “Who?” mand. As was observed in experiment 1, there was no significant difference in acquisition rates between the preferred and non-preferred items. The results of the experiment demonstrate that manipulation of the EO is an effective method for training mands for information and for some individuals, generalization across settings and instructional agents was observed.

Rationale for the Present Study

In the Sundberg et al. (2002) and Endicott and Higbee (2007) studies, the ultimate reinforcer (access to a toy) and the immediate reinforcer (information about the item’s location) were identical for all of the items indicating the same EO across all the items used for mand training. However there was generalization of the mand “Where ___?” across baselines for one participant in the Sundberg et al. study and for two participants in the more recent Endicott and Higbee study, and generalization of the mand “Who ___?” across baselines for 2 participants in the Sundberg et al. study demonstrating generalization across topographies. In addition, the Williams et al. (2000) and the Endicott and Higbee studies demonstrated generalization across settings, instructional agents, and items.
The four aforementioned studies demonstrate that mands for information may generalize across response topographies, settings, and instructional agents. However, the EOs of the different target items in all three of the studies were functionally similar. A more fundamental question, is whether mands for information generalize across EOs. Current clinical practice involves training one mand under one EO. If it is the case that mands do not generalize across EOs, then current clinical practice may need to be modified. Conversely, if it is the case that mands do generalize across EOs, then current clinical practice is appropriate. Thus, the present study sought to extend the developing literature on teaching mands for information by systematically assessing whether they also generalize across different EOs.

METHOD

Participants, Settings, and Materials

Three children diagnosed with autism as specified in the Diagnostic and Statistic Manual of Mental Disorders (American Psychiatric Association, 2000) were recruited from two area schools. Matt was a 4.5-year-old boy who attended a special education class that serves children diagnosed with autism. His autism quotient on the Gilliam Autism Rating Scale -2 (GARS; Gilliam, 1995), which was completed by a parent during the initial parent interview, was 87. This score falls in the upper moderate range, suggesting that Matt displays behavioral characteristics and deficits commonly observed in individuals diagnosed with autism. Matt’s parents and teachers reported moderate levels of noncompliance (slouching in his chair when a demand was placed on him and occasional tantrums when it was time to go to school). An informal interview (see Appendix A) with a parent revealed that when Matt wanted or needed an item, he
typically physically guided a caregiver to the item or pointed to the item. His parent reported that he did not generally use words to request for items. Matt’s Behavior Language Assessment Form (Sundberg & Partington, 1998), which was completed by his classroom teacher, revealed that he was able to emit at least 100 tacts, was able to fill in or answer 20 questions, and had a moderate mand repertoire in which he occasionally manded for a few select items or activities (e.g., candy, potty). Matt did not emit any mands for information.

John was a 4.5-year-old boy who attended a special education class that serves children diagnosed with autism. John’s autism quotient on the GARS, which was completed by a parent during the initial parent interview, was 96. This score falls in the upper range, suggesting that John displays behavioral characteristics and deficits commonly observed in individuals diagnosed with autism. An informal interview with a parent revealed that John was able to vocally mand for items he wanted or needed. In addition, his parent reported that he started emitting the “Where?” mand two months prior to the beginning of the study. John’s Behavior Language Assessment Form which was completed by his classroom teacher, revealed that he had over 300 tacts, had an emerging intraverbal repertoire, and an extensive mand repertoire.

Anthony was a 7.25-year-old boy who attended a special education class that serves children diagnosed with autism. His autism quotient on the GARS-2, which was completed by a parent during the initial parent interview, was 81. This score falls in the moderate range, suggesting that Anthony displays behavioral characteristics and deficits commonly observed in individuals diagnosed with autism, especially in the areas of communication and social interaction. An informal interview with a parent revealed that
Anthony typically manded for items. The parent interview and a quick informal assessment revealed that he was also able to emit the “Where?” mand. Anthony’s Behavior Language Assessment Form, which was completed by his parent, revealed that he was able to emit at least 100 tacts, was able to answer 30 questions, and had an extensive mand repertoire in which he used 5-10 words to mand for a variety of activities and reinforcers.

The involvement of five other participants was terminated prior to the collection of any evaluation data. Two participants emitted the target responses during the baseline phase, thereby automatically excluding them from further participation in the study. Two other participants engaged in high levels of noncompliant behavior during the preference assessment for one participant (crying, throwing, and running away) and during behavior chain training for the other participant (would consistently get up and run around the table or attempt to engage the experimenters in interaction on the floor). Although it may have been possible to reduce the noncompliant behavior for these two participants, time was of great consideration in this study, and recruiting new participants represented a more cost effective option. Finally, the fifth participant was withdrawn from the study upon his admission into a new school program. The family had been on the waitlist for the program and participated in the current study in the interim in an effort to supplement the number of service hours the participant received. Nothing about the conditions surrounding termination or the data collected prior to termination for any of these participants suggests any implications for the research question under investigation.

All experimental sessions were conducted in a small conference room at the participants’ school for Matt and John, and in a small therapy room in a first floor suite of
Wood Hall at Western Michigan University for Anthony. Anthony’s mother observed the research sessions via a television screen in a neighboring observation room. Sessions were conducted with 2-4 experimenters present with the experimenters seated on both sides of the participant at a table. One experimenter implemented the procedure, while the remaining experimenters would collect data. Contriving the relevant EO for the participants involved hiding the target item in a designated hiding location or on the person of one of the experimenters. Multiple experimenters were required to distract the participant and quickly hide items. Sessions were conducted 3-4 times per week and lasted approximately 60 min.

A variety of materials was utilized for teaching behavior chains. Materials consisted of plastic containers in which stimuli corresponding to each behavior chain were presented to the participants. The volcano chain included a small box of baking soda, a small bottle of vinegar, a clear plastic cup, a plastic spoon, and various colors of food dye. The ice-cream chain included a small bowl and plastic spoon. Materials for the spoon-doll chain included a spoon, colorful pipe cleaners, and happy face stickers. The truck chain involved a toy truck and a small remote control. The strawberry/chocolate milk chain included a clear plastic cup, a plastic spoon, milk, and strawberry/chocolate syrup. The table setting chain included a yellow placemat with outlines for the corresponding items for the place setting, plastic utensils including a spoon, knife, and fork, a paper cup, and a paper plate. Materials for the puzzle chain included the puzzle board and three pieces. Hiding places included three different colored drawers (red, yellow, green) and a medium-sized cardboard box.
Data Collection

Dependent variables. The primary dependent variable was the target mand for information ("Where ___?" or "Who has ___?") emitted under the influence of three different EOs. For example, emission of the mand for information about a spoon for eating ice-cream or making a spoon doll after having been directly trained under the influence of a different EO (e.g., making a volcano). In addition, data were collected on mastery of each behavior chain, and emission of the full mand for information during training phases.

Response measurement. Prior to the evaluation, participants were trained to complete each activity chain, each of which involved 3-6 steps. A percentage correct measure was used to measure performance for each chain by dividing the number of steps performed independently by the number of total steps in the chain, and multiplying by 100%. Independent responses were operationally defined as initiation of the behavior chain within 5 s of the experimenter’s instruction (e.g., “Make a volcano”), and the unprompted completion of each remaining step of the chain, with each step of the chain being completed within 5 s of the previous step.

During baseline, mand for information training, and post-training generalization probe phases, the experimenter recorded whether the participant emitted the corresponding mand for information. The number of trials conducted per session was partly determined by participant behavior (e.g., the participant would walk to the door, ask to go back to class, or ask to complete an activity chain) to ensure that the relevant EO was in effect. A session never exceeded 11 trials for either participant. Responses were recorded as “correct” or “incorrect” after each trial. For Matt, the response was
recorded as correct if he emitted the mand, "Where is spoon?" within 10 s of looking for the missing item. For John and Anthony, the response was recorded as correct if they emitted the mand, "Who has spoon?" within 10 s of the experimenter’s response, “One of your teachers has the spoon.” The full mand for information consisted of “Where?” or “Who?” plus the name of the object (e.g., “Where is the spoon?” or “Who has the spoon?”). The response was recorded as incorrect if the participant did not emit the full mand for information within 10 s of looking for the missing item or within 10 s of an experimenter’s response, if the participant emitted only the name of the missing item (e.g., “Spoon?”) or only the words “Where?” or “Who”, or if the participant made any response other than the full mand.

**Interobserver agreement.** A second observer independently collected interobserver agreement (IOA) data during behavior chain training, baseline, direct training of the mand for information, and generalization probe phases for Matt, John, and Anthony. An agreement was scored for each trial in which the experimenter and the observer both recorded a correct or incorrect response. Point-by-point agreement was calculated for each session by dividing the number of agreements by the sum of agreements and disagreements and multiplying by 100%. IOA was assessed for 100% of Matt’s behavior-chain training trials and was 97%. IOA was assessed for 95% of Matt’s baseline, training, and generalization probe trails and was 100%. IOA was assessed for 100% of John’s behavior-chain training trials and was 100%. IOA was assessed for 100% of John’s baseline, training, and generalization probe trials and was 100%. IOA was assessed for 69% of Anthony’s behavior-chain training trials and was 100%. IOA
was assessed for 92% of Anthony’s baseline, training, and generalization probe trials and was 99%.

*Procedural fidelity.* In an effort to ensure correct and consistent implementation of the treatment procedure during the behavior-chain training, baseline, training, and generalization probe conditions, a secondary observer was present and recorded antecedents and consequences delivered by the experimenter on each trial. A trial was scored as correct if the experimenter delivered the instruction and prompts appropriate to the phase and the child’s response.

During the behavior-chain training condition the observer recorded whether the experimenter provided the instruction appropriate to the chain (e.g., “Make a volcano”, “Set the table”), modeled the entire behavior chain the first time, and provided verbal/point prompts within 5 s of the participant completing the previous step in the chain. In addition, the observer recorded whether the experimenter provided verbal praise for independently completing the entire behavior chain (e.g., “Wow, you did the whole thing by yourself!”).

During the baseline phase, the observer recorded whether the experimenter provided the instruction appropriate to the behavior chain and provided no consequences for any incorrect response the participant made. If the participant would have emitted a correct mand for information, the experimenter would have provided him with the information. This was counted as a correct response. During the mand training phase, the observer recorded whether the experimenter provided the instruction appropriate to the behavior chain, waited the correct number of seconds from the last step completed in the chain to provide the echoic prompt (e.g., “Say, ‘Where is the spoon?’”), and provided
the participant the location of the missing item after the participant either independently emitted the desired response or imitated the desired response. During the generalization probe phase, the observer recorded whether the experimenter provided the instruction appropriate to the behavior chain, provided the location of the missing item upon the participant’s independent emission of the correct response, or ended the chain and began a new behavior chain if more than 10 s passed before the participant made a correct response or if the participant made an incorrect response. Procedural fidelity was calculated for each session by dividing the number of correctly implemented trials by the total number of trials and multiplying by 100%. Procedural fidelity was assessed for 96% of trials for Matt and was 93%. Procedural fidelity was assessed for 100% of trials for John and was 99%. Procedural fidelity was assessed for 86% of trials for Anthony and was 100%.

Finally, point-by-point IOA was assessed on procedural fidelity collected for 59% of those trials for Matt, 36% of procedural fidelity trials for John, and 32% of procedural fidelity trials for Anthony. IOA on procedural fidelity data was 100% for all three participants.

*Procedures*

*Preference assessment.* In order to identify food that would contribute to the maintenance of the relevant EO for Matt and Anthony during the table-setting chain and be made available to Matt, John, and Anthony during breaks throughout the sessions, parents nominated a list of 3-5 preferred edibles by completing the Reinforcer Assessment for Individuals with Severe Disabilities (Fisher, Piazza, Bowman, & Amari, 1996). These edibles were then used to conduct a multiple-stimulus (without
replacement) preference assessment (MSWO) using procedures described by Carr, Nicolson, and Higbee, 2000. The edibles were arranged in a semi-circle array on the table in front of the participant. All three participants were allowed to sample the food items before the preference assessment began. Before the participants sampled the food items, the experimenter tacted each item for the participant by pointing to the item and saying its name (e.g., “skittle”). After the participants had finished sampling each food item, a new array was arranged in front of them. Each participant was instructed to “pick one,” at which point he was given access to the array and was able to consume a small portion of the selected item. The experimenter and secondary observer recorded which item was chosen. As the participant consumed the item, the experimenter randomly rotated the position of the remaining items on the table without replacing the consumed item. The experimenter instructed the participant to choose again, and continued in the same fashion until all the items in the array had been selected by the participant. Three arrays of food were presented during the assessment. Selection percentages were calculated by dividing the total number of instances an item was selected by the total number of choice trials in which the item was presented, and multiplying by 100%. A 1-array assessment using the 3 food items with the highest selection percentages was conducted before each session to ensure that the relevant EO was present during training.

Results from the MSWO assessment of food for John are depicted in Figure 1. John’s MSWO assessment data indicate that his top three choices were fruit snacks, Cheetos™, and Cheese-itz™ crackers. The experimenter conducted a 1-array preference assessment at the start of each session to ensure that the most preferred food item was available to John during periodic breaks. However, John would reliably mand for the
other two items during the session in addition to manding for the food item that he had selected first during the session’s brief preference assessment. Hence, it appeared that all three food items were preferred equally during these sessions.

Results from the MSWO assessment of food for Anthony are also depicted in Figure 1. Anthony’s MSWO assessment data indicate that his top three choices were gummy candies, M&Ms™, and Skittles™. The experimenter conducted a 1-array preference assessment at the start of each session to ensure that the most preferred food item was available to Anthony during the placemat puzzle chain and during periodic breaks. However, Anthony reliably manded for all five food items included in the MSWO assessment during the session. He manded most often for his top three choices indicating that the MSWO was successful in identifying a preference hierarchy.

Matt’s parent reported he consumed a very limited number of foods. His parent initially, and tentatively, nominated only three items which included a peanut butter and jelly sandwich, chocolate chip cookies, and cereal. During the initial MSWO, Matt did not select or consume the sandwich or the cereal. He did, however, consistently select and consume the chocolate chip cookies. Later, the parent informed the experimenter that Matt also enjoyed consuming m&m™ candy. The experimenter did not conduct another formal MSWO preference assessment due to the fact that there only appeared to be two food items Matt would consume. At the beginning of each session, the experimenter conducted a 1-array preference assessment with the chocolate chip cookies and the m&m’s™ to ensure the relevant EO was at strength during training. Matt reliably selected the cookies first at every session. The cookies were reserved for
delivery during the table setting chain and the m&m’s™ were delivered during session breaks.

*Echoic assessment.* After the preference assessment had been conducted, the experimenter conducted an informal echoic assessment with each participant. The experimenter read a list of items that were used in training each behavior chain including the target words, “where”, “who”, “cup”, and “spoon.” The experimenter asked the participant to repeat each word, for example “Say cup.” This assessment was conducted to ensure that the participants were able to respond to the echoic prompts (e.g., “Say ‘Who has the spoon?’”). All three participants were able to imitate all of the experimenter’s responses including short phrases (e.g., “Where is cup?”). The echoic assessment form is depicted in Appendix B.

*Behavior chain training.* The total-task presentation procedure was used to teach the behavior chains. Behavior chains were selected based on the participants’ level of functioning and on observations of the participants’ preferences for each of the activity chains. A behavior chain consisted of removing the lid of the plastic container, removing the materials from inside the plastic container, and then using the materials to complete the chain. For example, the volcano chain consisted of removing the lid of the plastic container, removing the cup, spoon, and baking soda from the container, using the spoon to scoop out the baking soda and place it in the cup. The experimenter would assist the participant with the rest of the chain (i.e., adding food coloring and pouring the vinegar). The experimenter provided an instruction for each behavior chain, for example, “Make a volcano.” The experimenter then modeled the behavior chain for the participant. The experimenter modeled the behavior chain only one time. Afterward, the experimenter
provided the instruction again, presented the participant with the plastic container with
the corresponding materials inside, and allowed the participant to engage in the behavior
chain while providing verbal and gestural prompts as necessary. For all three
participants, prompted completion of a behavior chain resulted in an unenthusiastic
delivery of a statement about the chain (e.g. “You made a volcano”, “You made a doll”).
Independent completion of the chain resulted in enthusiastic praise regarding their
performance (e.g., “Wow! You made the volcano all by yourself!”). The mastery
criterion for each behavior chain was independent completion of the chain 3 consecutive
times across 2 days. The experimenter recorded whether the participant completed each
step of the chain on a data sheet. Behavior chain responses were analyzed and reported
as number of steps performed correctly out of a total given number of steps for each
chain. All behavior chains were trained prior to all other phases in the experiment.

A graphical display of each participant’s performance during the behavior-chain
training phase is depicted in Figure 2 for Matt and John and Figure 3 for Anthony. Matt
was taught to complete three chains that all involved the use of a spoon and a fourth
control chain that did not involve the use of a spoon. A control chain was included in
order to ensure that the mand for information was emitted under the influence of the
relevant EO. The three chains involving the use of the spoon were the volcano chain in
which the spoon was used for scooping, the strawberry milk chain in which the spoon
was used for stirring, and the table-setting chain in which the spoon was used to complete
a place setting. The fourth chain was a three-piece puzzle. Matt required between 3-9
trials to master each of the behavior chains.
John was also taught to complete three chains that all involved the use of a spoon and a fourth control chain that did not. The three chains that involved the use of the spoon were the volcano chain, an ice-cream chain in which the spoon was used to eat ice-cream, and a spoon-doll chain in which the spoon functioned as the body of a doll. The fourth chain consisted of a truck and a remote control. John required between 5-8 trials to master each of the behavior chains.

Like Matt and John, Anthony was taught to complete three chains that all involved the use of a spoon and a fourth control chain that did not. The three chains that involved the use of the spoon were the volcano chain, the table-setting chain, and the chocolate milk chain. The fourth chain was the toy truck chain. Anthony required between 3-6 trials to master each of the behavior chains.

Experimental design. A multiple-baseline design across EOs for a single response topography (e.g., “Where is the ___” and “Who has the ___?”) was used to evaluate treatment effects. Matt was trained to emit the “Where?” mand under one EO and probes for generalization to three other EOs were conducted afterward. John and Anthony were trained to emit the “Who?” mand under one EO and probes for generalization to three other EOs were conducted afterward. For Matt, John, and Anthony, the mand for information was directly trained for one function, and then probes for the generalization of the mand for information were conducted using the same topography across three different functions and a different topography for a fourth function.

During baseline, an interrupted behavior-chain procedure was implemented. The experimenter provided the participant with the instruction appropriate to the chain (e.g., “Make a volcano”). The spoon was withheld and hidden from the participant in one of
the aforementioned designated hiding places. The experimenter observed and recorded the participant's verbal behavior in response to the missing spoon or control-chain piece (puzzle piece for Matt and truck for John and Anthony). If the participant failed to emit the mand for the location of the spoon or the missing item in the control chain within 10 s of completing the previous step or within 10 s of the experimenter's response ("One of your teachers has it"), the experimenter terminated the behavior chain and introduced a new behavior chain. Baseline was conducted until the data path was stable (i.e., the data path had no trend and no variability). These data were analyzed and reported cumulatively. Baseline probes were interspersed with completed chains in an effort to maintain the relevant EO. The experimenters were concerned that if the participants repeatedly were unable to complete the behavior chains, this may possibly abolish the reinforcing value of chain completion.

*Mand-for-information training.* The procedure began with an interrupted-behavior chain procedure as in baseline. The experimenter intervened on the volcano chain to train the mand for information for Matt, John, and Anthony. The experimenter provided the instruction, "Make a volcano." When the participant completed the step right before the step that required a spoon or after the experimenter provided the response "One of your teachers has it", the experimenter used an echoic prompt to train the mand, "Where is spoon?" or "Who has the spoon?" The experimenter provided the participant with the location of the spoon upon successful imitation of the prompt. During the next opportunity to perform the volcano behavior chain, the experimenter used a prompt delay and waited 2 s before providing the echoic prompt. For Matt, successful emission or imitation of the "Where?" mand produced the name of the hiding location (e.g., "It's in
the green drawer”). During John and Anthony’s sessions, 2-3 experimenters would wear a yellow, red, or blue colored t-shirt, each one wearing a different color from the other. For them, successful emission or imitation of the “Who?” mand would produce the color of the t-shirt of the experimenter (i.e., “teacher”), who had possession of the spoon (e.g., “Blue has the spoon”). A prompt delay greater than 2 s was not required for any of the participants. The mastery criterion for this phase was independently manding within 10 s of the previous step for the location of the cup or within 10 s of the experimenter’s response for 5 consecutive complete chains, across 2 days per EO. These data were analyzed and reported cumulatively.

After the mand for information, “Where is spoon?” or “Who has the spoon?”, had been successfully trained under the first EO (i.e., the volcano chain), generalization probes were conducted using the other two behavior chains that involved the use of the spoon for different purposes and with the control chain which, as stated previously, did not involve the use of the spoon. These probes were identical to baseline. For Matt, a minimum of 5 generalization probe trials were conducted with all four chains, including the puzzle control chain. Also, the appropriate mand for information did not generalize to the control chain involving the puzzle piece at which point the experimenters directly trained the mand for information using a procedure identical to the one described above. For John, a minimum of 4 generalization probe trials were conducted with all four chains including the truck control chain. Additional direct training was not required for John. For Anthony, a minimum of 5 generalization probe trials were conducted with all four chains including the truck control chain. Additional direct training was not required for
Anthony. As during in baseline and mand-for-information training, these data were analyzed and reported cumulatively.

RESULTS

Baseline

Results for Matt’s performance during baseline are depicted across all four panels in Figure 4. During baseline, Matt failed to emit the mand for information, “Where spoon?” or “Where four?” (for the control chain), but instead manded for the item itself (“spoon?” or “four?”). Based on the topography of the mands he did emit in conjunction with his searching responses, the experimenters were confident that the relevant EO was in effect. These results indicate that Matt was unable to emit the “Where?” mand for the spoon or the puzzle piece prior to intervention.

Results for John’s performance during baseline are depicted across all four panels in Figure 5. During baseline, John failed to emit the mand for information, “Who has spoon?” or “Who has truck?” (for the control chain), instead emitting the “Where?” mand for each stimulus (“Where is spoon?” or “Where is truck?”). Occasionally he would instruct the experimenter to retrieve the item for him (e.g., “Please get the spoon” or “Give it to me now”). Based on the responses he did emit in conjunction with searching responses, the experimenters were confident that the relevant EO was in effect. These results indicate that John was unable to emit the “Who?” mand for the spoon or the truck prior to intervention.

Results for Anthony’s performance during baseline are depicted across all four panels in Figure 6. During baseline, Anthony failed to emit the mand for information, “Who has the spoon?” or “Who has the truck?” (for the control chain), instead emitting the
“Where?” mand for each stimulus (“Where is the spoon?” or “Where is the truck?”). In addition to manding for the location of the spoon, he would mand for the item itself (“May I have the spoon please?” “Spoon?”). Based on the responses he did emit in conjunction with searching responses, the experimenters were confident that the relevant EO was in effect. These results indicate that Anthony was unable to emit the “Who?” mand for the spoon or the truck prior to intervention.

Mand-for-Information Training

The results for Matt’s mand-for-information training are depicted in the middle panel of Figure 7. These data demonstrate that Matt required 8 trials before he acquired the response and a total of 12 trials for responding to meet the mastery criterion.

The results for John’s mand-for-information training are depicted in the top panel of Figure 7. These data demonstrate that after 4 trials, John emitted the “Who?” mand, however he did not for the subsequent 4 trials. During these trials, John would emit the “Where?” mand (i.e., “Where is spoon?”) and then would immediately follow up with a mand about one of the experimenter’s (e.g., “Blue has it?”, “Red has it?”). John re-acquired the “Who?” mand on the ninth trial, and he reliably emitted the mand until responding met the mastery criterion. These data demonstrate that 13 trials were required for John’s responding to meet mastery criterion for the “Who?” mand. However, he was manding for the identity of the individual who had possession of the spoon on trials 5-8 (e.g., “Blue has it?”), which could be interpreted as a response although topographically different from the target “Who?” mand, still functionally equivalent to the “Who?” mand. These other responses may also be evidence of flexibility in John’s mands-for-
information repertoire. For the sake of experimental control however, the target response of “Who has spoon?” was the only answer accepted as correct.

The results for Anthony’s mand-for-information training are depicted in the bottom panel of Figure 7. These data demonstrate that Anthony required 17 trials before he acquired the response and a total of 22 trials for responding to meet the mastery criterion.

Generalization Probes

The results of Matt’s generalization probe sessions are depicted in all four panels of Figure 4. Panels 2 and 3 represent behavior chains that require the use of a spoon (table setting chain and stirring chain), and thus represent different EOs from the first panel. The fourth panel represents the control chain, which did not require the use of the spoon (the puzzle chain), and thus represents a different response topography and a different EO from the first panel. In the fourth panel, which represents the control puzzle chain, there are two data paths. The closed data path represents the “Where spoon?” response, and the open data path represents the “Where four?” response.

Results of John’s generalization probes are depicted across all four panels in Figure 5. Panels 2 and 3 represent behavior chains that required the use of a spoon (ice-cream chain and spoon-doll chain), and thus represent different EOs from the first panel. The fourth panel represents the control chain, which did not require the use of the spoon (the truck chain), and thus represents a different response topography and a different EO from the first panel. In the fourth panel, which represents the control truck chain, there are two data paths. The closed data path represents the response, “Who has spoon?” and the open data path represents the response, “Who has truck?”
Results of Anthony's generalization probes are depicted across all four panels in Figure 6. Panels 2 and 3 represent behavior chains that required the use of a spoon (chocolate milk chain and table setting chain), and thus represent different EOs from the first panel. The fourth panel represents the control chain, which did not require the use of the spoon (the truck chain), and thus represents a different response topography and a different EO from the first panel. In the fourth panel, which represents the control truck chain, there are two data paths. The closed data path represents the response, “Who has the spoon?” and the open data path represents the response, “Who has the truck?”

In the first panel of Figure 4, in which the performance during the volcano chain is depicted, Matt continued to reliably emit the “Where?” mand after training. In panels 2 and 3 of Figure 4, the circled data points represent evidence of generalization of the “Where?” mand across EOs because they emerged without training after the response was acquired in the presence of the first EO (volcano chain). Every response after those initial probes was maintained by direct reinforcement (i.e., information about the location of the missing item). During generalization probes with the control puzzle chain, Matt emitted the “Where spoon?” mand during the second probe; however, he immediately followed the “Where spoon?” mand with a mand for the missing item itself (“four?”). The response topography of this follow-up mand provided the experimenters with confidence that the relevant EO was in effect for the puzzle chain. The experimenters then intervened on the control puzzle chain and directly trained the “Where four?” mand. Mand-for-information training for the control chain was procedurally identical to the training conducted with the volcano chain. After the training, Matt was reliably emitting
the “Where four?” mand during control chain trials and the “Where spoon?” mand with
the three chains that required the use of the spoon.

The first panel of Figure 5, in which the performance during the volcano chain is
depicted, John continued to reliably emit the “Who?” mand after training. In panels 2-4
of Figure 5, the circled data points represent evidence of generalization of the “Who?”
mand across EOs. During generalization probes with the control truck chain, John did
not emit the “Who has spoon?” mand but interestingly, he was able to emit the “Who has
truck?” response in the absence of additional training.

The first panel of figure 6, in which the performance during the volcano chain is
depicted, Anthony continued to reliably emit the “Who?” mand after training. In panels
2-4 of Figure 6, the circled data points represent evidence of generalization of the
“Who?” mand across EOs. During generalization probes with the control truck chain,
Anthony did not emit the “Who has the spoon?” mand but like John, he was able to emit
the “Who has the truck?” response in the absence of additional training.

DISCUSSION

The results of this experiment extend the existing literature on mand-for-
information training by demonstrating generalization of mands-for-information across
EOs. This effect was demonstrated for all three participants. In addition, generalization
of the mand for information across response topographies was observed for 2 out of 3
participants lending further evidence to the occurrence of this phenomenon observed in
previous studies (Sundberg et al., 2002; Williams et al., 2000). The findings of this
evaluation have a number of clinical implications. Current clinical practice involves
training one response topography under one EO. This study’s findings support the
efficacy of current clinical practice in this area. One aspect that is interesting about the outcomes specific to the participants in this study, is that generalization of mands for information across EOs was demonstrated between individuals with very different verbal repertoires. John and Anthony had more advanced verbal repertoires as compared to Matt. This finding may suggest that mands for information are a more flexible response than typically considered by most providers of EIBI programs and it may be possible to target this response earlier in a client’s curriculum. Not surprisingly however, Matt’s responding did not generalize across response topographies as was the case with John and Anthony. After the experimenter directly trained the mand for information for the second response topography (puzzle piece – “four”) with Matt, another brief generalization probe across topographies was conducted. Again, Matt emitted the mand “Where spoon?” in response to a missing cup and he immediately followed it with a mand for the item itself (“cup?”). The topography of the subsequent mand suggested to the experimenters that the relevant EO was in effect. The number of exemplars requiring direct training before generalization of the mand for information across response topographies can occur remains an empirical question. Given these findings, efforts toward promoting generalization of the mand for information across response topographies in a child’s curriculum is warranted. This is discussed in greater detail below.

In an effort to examine the results of this study, it may be beneficial to conceptualize the mand for information as a partial autoclitic frame (Skinner, 1957). Autoclitic responses are those responses that further describe or qualify other verbal behavior and thus alter responding on the part of the listener (Skinner). An autoclitic frame addresses the unitary function of verbal behavior. For example, the phrase “Come
and get it!” is functionally equivalent to the response “Food!” Skinner would argue that grammatical or syntactical analysis of the response, “Come and get it!” is unimportant and the functional unity of the phrase is the where the focus of the analysis should lie. As an individual’s verbal repertoire continues to grow, these functional units continue to expand as well. Relational autoclitic frames are also involved when a partial autoclitic frame, such as “Where is?” is combined with responses appropriate to the specific situation, such as “spoon”. According to Skinner, a series of responses involving the partial autoclitic frame must be acquired before the individual is able to emit a novel response within this partial frame. For example, an individual may have to learn a series of responses such as, “the girl’s toy”, “the girl’s dress”, “the girl’s cup”, before he or she is able to produce a new unit such as, “the girl’s book.” These autoclitic frames are not merely the emission of two or more responses separately acquired. The relational aspects of the situation evoke the response frame (e.g., the sight of the girl evokes the response “the girl’s”) and specific features of the situation evoke the response fitted into the frame (e.g., the sight of the book evokes the response “book” that is fitted in the frame).

In Matt’s case, conceptualizing the mand for information, “Where spoon?” as a partial autoclitic frame, there are two main EOs which evoked the response. The missing item functioned as the relational aspect of the situation which evoked the response “Where?” and the needed item being a spoon specific to the experimental condition is the feature which evoked the response “spoon.” Matt was able to emit this response after direct training under one EO and when probed under other conditions in which the spoon was required. The EOs represented by the different activity chains were functionally similar enough to evoke the response “spoon.” Matt’s emission of the “Where spoon?”
mand during the control puzzle chain may indicate that he had failed to learn the response as a partial autoclitic frame. His emission of the mand for the appropriate item following the “Where spoon?” mand (e.g., “four”) indicated that the mand was under the control of the relevant EO. So the specific situation (i.e., missing puzzle piece) did influence the emission of the mand for the appropriate stimulus (the “four?”). Interestingly, although Matt’s mand for information did not generalize across response topographies, his simple mands did generalize across response topographies as evidenced by the emission of the mand for the correct missing item in each instance (“four?”, “cup?”). This may lend support for the idea that, for Matt, the response “Where spoon?” was functionally equivalent to the mand “Spoon?” or the mand for whatever other item was missing.

According to Skinner’s (1957) analysis, John and Anthony did truly acquire the mand for information “Who has the spoon?” as is evidence by generalization of the mand for information across response topographies (“Who has the truck?”). John and Anthony had more advanced verbal repertoires compared to Matt and they both had an emerging mands-for-information repertoire as they were able to emit the “Where?” mand prior to participation in the current study. It is likely that John and Anthony had learned a series of responses with the autoclitic frame “Where?” for example, “Where is juice?”, “Where is truck?”, and “Where is mommy?” before they was able to emit a novel response with this autoclitic frame (“Where_?” frame). Given a more extensive history with manding for information, it is likely that John and Anthony had learned the partial autoclitic frame “Where is_?” and this generalized to a new partial autoclitic frame, “Who has_?”
In conclusion, the results of this study suggest that mands for information generalize across EOs for learners with varying verbal repertoires. Although generalization of mands for information across response topographies was not observed for Matt, the generalization of simpler mands (i.e., mands for items) across response topographies was observed in his case. In addition, the generalization of mands for information across response topographies was observed for John and Anthony. The results of this study may suggest that mands and mands for information are fundamentally different types of responses and that mands for information may be conceptualized as partial autoclitic frames. Given this, it may be the case that different EOs for the same item are functionally similar enough to reliably evoke the specific mand for the item itself. Further research on the generalization of simpler mands across EOs may be warranted to separate the effects of the influence of the EO on the mand response and the acquisition of a partial autoclitic frame. Additional research investigating those variables that contribute to generalization of mands for information across response topographies is also warranted. It would be beneficial to identify those verbal behavior skills that contribute to generalization of mands for information across response topographies. It may be that a more extensive autoclitic repertoire may function as a pre-requisite skill for generalization of mands for information across response topographies. This information may be beneficial for administrators of EIBI programs in helping them identify the appropriate time in a client’s program to target mands for information or target those pre-requisite skills that will contribute to generalization of the mand for information across response topographies.
Figure 1. Relative Ranks of Food from MSWO Preference Assessment for John and Anthony.
Figure 2. Results from Matt’s (Left Column) and John’s (Right Column) Behavior Chain Training.
Figure 3. Results from Anthony’s Behavior Chain Training
Figure 4. Results from Matt's Baseline and Generalization Probe Sessions
Figure 5. Results from John’s Baseline and Generalization Probe Sessions
Figure 6. Results from Anthony’s Baseline and Generalization Probe Sessions
Figure 7. Matt’s (Top Panel), John’s (Middle Panel), and Anthony’s (Bottom Panel) Mand-for-Information Training Sessions
REFERENCES


Appendix A

Initial Interview with Guardian(s)
Appendix A

Initial Interview with Guardian(s)

Participant #_______ Experimenter:___________ Date:___________

GARS score—Autism Quotient: SS_____ %ile_____

1. What does ________ do when he/she needs or wants something, like a snack or a toy?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

2. How do you normally respond to him/her when he/she asks you for something he/she wants?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

3. If _________ does verbally request for some snacks—Does he/she use his/her words to ask for most things throughout the day, or for a few select things only?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Appendix B

Echoic Screening
Appendix B

*Echoic Screening*

Participant: ___________________  Date: __________
Data Collector: ___________________

"Say....."

When
Who
Spoon
Cup
Is
Has
The
Where is the cup?
Who has the spoon?
Bowl
Napkin
Paper
Square
Triangle
Star
Snack
Puzzle
Sticker
Appendix C

HSIRB Approval Letter
Date: February 20, 2006

To: James Carr, Principal Investigator
Sarah Lechago, Student Investigator for thesis

From: Mary Lagerwey, Ph.D., Chair

Re: HSIRB Project Number: 06-01-11

This letter will serve as confirmation that your research project entitled “Generalization of Requests for Information Across Needs” has been approved under the full category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: January 25, 2007