Increasing the Mand Repertoire of Children With Autism Through the Use of an Interrupted Chain Procedure

Kristin M. Albert, Vincent J. Carbone, Danielle D. Murray, Margaret Hagerty, and Emily J. Sweeney-Kerwin
Carbone Clinic

ABSTRACT

Mand training is an essential component of verbal behavior training for any individual who lacks this skill. The current study replicates and extends, with some procedural differences, the work of Hall and Sundberg (1987) by using an interrupted chain procedure to teach mands for missing items to children with autism. The participants were 3 children with autism, ranging between 5 and 8 years of age, who would regularly mand for a wide variety of reinforcers when they were present but would rarely mand for items that were not in sight (i.e., missing items). Participants were first taught to complete 3 behavior chains. Subsequently, the chains were interrupted by removing 1 item needed to complete each chain to contrive motivating operations (MOs) as a means of teaching mands for missing items. Following mand training incorporating vocal prompt and prompt fading procedures, all participants emitted unprompted mands for the missing items within the context of the trained chains and within the context of novel, untrained chains. After teaching mands for missing items, probes were conducted to test for untrained tact acquisition. All participants also demonstrated tact responses relative to the missing items as a result of the mand training.

Keywords: autism, establishing operation, interrupted chain, mand, motivating operation

The mand repertoire is essential for early language learners and is therefore of clinical importance. First, mands increase the probability of obtaining access to specific items, activities, actions, information, etc., when access to those stimuli is delivered or controlled by another person. For example, when a child wants social and physical interaction, the child may ask a parent, "Can I have a hug?" The parent in turn delivers the reinforcer specific to the mand topography, in this case, a hug. Because the reinforcer for a mand corresponds precisely with the child's motivation, the mand is directly beneficial to the speaker and may foster the development of a communicative repertoire (Sundberg & Michael, 2001). In addition, manding helps establish the reciprocal speaker and listener roles that are essential for increasing verbal competence (Sundberg & Michael).

Children with autism frequently present with limited interests and often do not readily learn to emit mands without specific teaching (Shafer, 1994). Furthermore, children with autism do not readily acquire mands as a result of tact or receptive discrimination training alone (Shafer). As a result, the development of a mand repertoire and its relevance to early language training for children with language delays and disorders, specifically those with autism, has been documented in the behavior analytic literature (Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002; Michael, 1988; Shafer; Sundberg, 1993; Sundberg & Michael, 2001). The benefits of mand training for children with autism often include a reduction in maladaptive behavior, an increase in social initiations, and an increase in spontaneous language (Carr & Durand, 1985; Charlop-Christy et al.; Shafer).

For practitioners working with children with autism and other language disorders, B. F. Skinner's (1957) analysis of verbal behavior provides a conceptual framework for language training, and, specifically for teaching mands. Skinner defined the mand 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" (pp. 35–36). More simply, a mand is a request for a preferred event. The mand is unique because it is the only verbal operant for which a response is directly evoked by a motivating operation (MO; Laraway, Snycerski, Michael, & Poling, 2003; Michael, 1988, 1993, 2007).

An MO is defined as any stimulus condition or environmental event that (a) momentarily alters the value of some stimulus as a reinforcer (i.e., value-altering effect) and (b) evokes all responses that have produced that reinforcer in the past (i.e., behavior-altering effect; Laraway et al., 2003; Michael, 1993, 2007). In other words, MOs momentarily change the value of reinforcers and thus increase

the probability of behavior that has previously produced them. For more in depth information on MOs, see Michael's (1993) conceptual analysis and Langthorne and McGill's (2009) practitioner-oriented tutorial.

Review of Effective Mand Training Procedures

Many studies have investigated the effectiveness of procedures for teaching children, ages 2 to 18 years old with autism and other developmental disabilities, to mand for desired items, activities, actions, and information. As a result of this research, a number of behavior analytic procedures have been demonstrated to be effective in teaching children to mand using the following response forms: vocalizations (e.g., Lechago, Carr, Grow, Love, & Almason, 2010; Sweeney-Kerwin, Carbone, O'Brien, Zecchin, & Janecky, 2007), manual sign language (e.g., Hall & Sundberg, 1987; Tincani, 2004), picture exchange communication system (PECS) or other forms of picture exchange (e.g., Buckley & Newchok, 2005; Tincani, Crozier, & Alazetta, 2006), and speech-generating devices (SGDs; e.g., Bock, Stoner, Beck, Hanley, & Prochnow, 2005; van der Meer, Sutherland, O'Reilly, Lancioni, & Sigafoos, 2012). The procedures effective in teaching these skills can be broken down into two main categories: antecedent strategies and consequence strategies.

Antecedent strategies. Antecedent strategies consist of all the teaching procedures that are implemented before an individual emits a response. They are used to increase the likelihood that an individual will emit the target response so that the behavior can be reinforced. All studies demonstrating effective mand training procedures for children with autism and other developmental disabilities have implemented some type of antecedent strategy. These antecedent strategies can be further broken down into three types: assessing MOs, manipulating MOs, and prompting.

Assessing MOs. Most studies that have conducted mand training with children with autism have assessed MOs. Many of these studies have done so indirectly prior to the study. For example, many researchers have conducted paired-stimulus (Fisher et al., 1992), free operant (Roane, Vollmer, Ringdahl, & Marcus, 1998), or multiple stimulus without replacement (DeLeon & Iwata, 1996) preference assessments to identify preferred stimuli to teach the participants to mand (Betz, Higbee, & Pollard, 2010; Bock et al., 2005; Bourret, Vollmer, & Rapp, 2004; Carr & Kologinsky, 1983; Davis, Kahng, & Coryat, 2012; Endicott & Higbee, 2007; Ganz, Simpson, & Corbin-Newsome, 2008; Gutierrez et al., 2007; Hartman & Klatt, 2005; Kodak & Clements, 2009; Kodak, Paden, & Dickes, 2012; Lechago et al., 2010; O'Reilly et al., 2012; Sidener et al., 2010; Tincani, 2004). Other researchers selected suspected reinforcers to teach individuals to mand by observing the individuals' reactions to those items or by measuring the amount of time the participants spent engaging with those items (Kelley et al., 2007; Lechago et al., 2010; Sweeney-Kerwin et al., 2007). Finally, some researchers experimentally validated that items functioned as reinforcers via functional analyses (Bowman, Fisher, Thompson, & Piazza, 1997; Buckley & Newchok, 2005; Grow, Kelley, Roane, & Shillingsburg, 2008).

Given that the effects of MOs are momentary, these pre-study assessments may not be the most effective ways to assess moment-to-moment changes in motivation when conducting mand training. Other studies have directly confirmed MOs just prior to each mand training trial by offering items and looking for some behavior that indicated the participant's motivation (Drasgow, Halle, & Ostrosky, 1998; Drash, High, & Tudor, 1999; Sweeney-Kerwin et al., 2007). For example, Shillingsburg and Valentino (2011) offered the participant an item and asked if he wanted it. Only if the child confirmed his motivation by saying, "yes," nodding his head, or reaching for the activity did they then teach him to mand for information about how to complete the activity.

Manipulating MOs. Many researchers have directly manipulated MOs by attempting to contrive or sustain them in a variety of ways during mand training. One way of doing this has been by withholding reinforcers for a specified period of time prior to conducting mand training (Davis et al., 2012; Nuzzolo-Gomez & Greer, 2004; Kelley et al., 2007; O'Reilly et al., 2012). For example, Hartman and Klatt (2005) required that participants did not have access to reinforcers targeted for mand training for 23 hours prior to each training session. Similarly, researchers have sustained motivation by limiting the number of consecutive teaching trials for a particular reinforcer to avoid satiation (Charlop, Schreibman, & Thibodeau, 1985; Kelley, et al., 2007; Tincani, 2004; van der Meer, Sutherland, et al., 2012). Another procedure to contrive MOs has been to provide a brief period of free access to suspected reinforcers and to subsequently block access to those items (Betz et al., 2010; Endicott & Higbee, 2007; Halle, Baer, & Spradlin, 1981; Jennett, Harris, & Delmolino, 2008; Sundberg, Loeb, Hail, & Eigenheer, 2002). For example, Buckley and Newchok (2005) contrived motivation for a movie by allowing the participant to watch it briefly and then pausing the TV.

Hall and Sundberg (1987) described an alternate procedure for contriving motivation, the interrupted chain procedure. First participants were taught to complete a chain of behavior, which led to a terminal reinforcer. Once a behavior chain was learned, experimenters interrupted the chain by removing an item necessary to complete it. This meant the chain could only be completed, and the terminal reinforcer accessed, if the participant manded for the missing item. Through the use of this procedure, Hall and Sundberg taught 2 individuals aged 16 and 17 years old, who were deaf and diagnosed with mental retardation, to use manual sign language to mand for missing items that were needed to complete behavior chains for making coffee, making soup, and purchasing items from vending machines. Each chain produced a terminal reinforcer (i.e., coffee, soup, or items from the vending machine), but access to that reinforcer was interrupted because an item needed to complete the chain (i.e., cup, water, money) was missing. By removing specific items needed to complete these chains, the experimenters contrived motivation for these previously neutral

items. The researchers then implemented a prompt/prompt fading method to teach the mand response that produced the missing items that had been conditioned as reinforcers within the behavior chain. As a result, this study demonstrated that an interrupted chain procedure could be used to manipulate MOs to teach mands for missing items under motivational but not discriminative control (i.e., the items were not present). Moreover, this study demonstrated how the interrupted chain procedure could be used to momentarily condition previously neutral items as reinforcers, thereby expanding a participant's mand repertoire.

Hall and Sundberg's (1987) findings have since been replicated with diverse participants under varying conditions to teach both mands for missing items and mands for information (Arntzen & Almas, 2002; Betz et al., 2010; Carroll & Hesse, 1987; Endicott & Higbee, 2007; Hall & Sundberg, 1987; Lechago et al., 2010; Rosales & Rehfeldt, 2007; Sidener et al., 2010; Sigafoos, Doss, & Reichle, 1989; Sundberg et al., 2002; Williams, Donley, & Keller, 2000; Ziomek & Rehfeldt, 2008). Some of the above studies have adopted Michael's (1993) terminological refinement from interrupted chain to transitive conditioned establishing operation (CEO-T) to describe their primary independent variable. Of all of these studies, however, only one study conducted with 1 participant has demonstrated the effectiveness of the interrupted chain procedure (i.e., CEO-T) to teach children with autism to mand for missing items (Sidener et al., 2010).

Prompting. A variety of prompting procedures have been used to teach children with developmental disabilities to mand. When teaching manding using a vocal response form, vocal prompts and prompt fading have been effective (e.g., Sundberg, Loeb, Hail, & Eigenheer, 2002). One method of fading vocal prompts to increase independence when manding has been to start with a full echoic prompt (i.e., vocal model) and to then fade to a partial echoic, or phonemic prompt (Bourret et al., 2004; Williams, Donley, & Keller, 2000). Another method for establishing independent prompting has been the use of a vocal prompt delay. With a progressive prompt delay, the amount of time before a prompt is gradually increased according to some prespecified criterion (Charlop, Schreibman, & Thibodeau, 1985; Davis, Kahng, & Coryat, 2012; Halle, Marshall, & Spradlin, 1979; Jennett, Harris, & Delmolino, 2008; O'Reilly et al., 2012; Sidener et al., 2010; Taylor & Harris, 1995). With a constant prompt delay, the amount of time that passes before a prompt remains consistent, for example, once every 15 s (Betz et al., 2010; Bourret et al., 2004; Carbone, Sweeney-Kerwin, Attanasio, & Kasper, 2010; Endicott & Higbee, 2007; Halle, Baer, & Spradlin, 1981; Hartman & Klatt, 2005; Jennett et al., 2008; Kelley et al., 2007; Kodak & Clements, 2009; Lechago et al., 2010; Nuzzolo-Gomez & Greer, 2004; Shillingsburg & Valentino, 2011).

When teaching manding using manual sign language, picture exchange, PECS, and SGDs, full and partial physical prompts along with prompt fading have been regularly used (Bock et al., 2005; Buckley & Newchok, 2005; Frea, Arnold, & Vittimberga, 2001; Ganz, Simpson, & Corbin-Newsome, 2008; Kodak, Paden, & Dickes, 2012; Tincani et al., 2006). Physical prompts have been faded or the need for these prompts has been reduced using graduated guidance (Drasgow et al., 1998; van der Meer, Kagohara et al., 2012; van der Meer, Sutherland et al., 2012), least-to-most intrusive prompting (Gutierrez et al., 2007; Paden, Kodak, Fisher, Gawley-Bullington, & Bousxein, 2012), progressive prompt delay (Tincani, 2004), and constant prompt delay (Gregory, DeLeon, & Richman, 2009; Hall & Sundberg, 1987; Paden et al., 2012; van der Meer, Kagohara et al., 2012; van der Meer, Sutherland et al., 2012). In addition, gestural or model prompts and prompt fading have been used when teaching both sign mands (Gregory, DeLeon, & Richman, 2009; Gutierrez et al., 2007; Hall & Sundberg, 1987; Tincani, 2004) and picture exchange mands (Carr & Kologinsky, 1983; Gregory et al., 2009). Vocal prompts and a progressive prompt delay have also been used when teaching sign mands (Tincani, 2004).

Finally, vocal, sign, picture exchange, PECS, and SGD mands have all been taught by displaying the desired item as a prompt (Bock et al., 2005; Charlop et al., 1985; Frea et al., 2001; Ganz et al., 2008; Gregory et al., 2009; Jennett et al., 2008; Kelley et al., 2007; Tincani, 2004; Tincani et al., 2006; van der Meer, Kagohara et al., 2012; van der Meer, Sutherland et al., 2012). The reliance on these tact-stimulus prompts has been reduced using a constant time delay (Hall & Sundberg, 1987) and by displaying the object briefly and then hiding it (Hartman & Klatt, 2005; Sweeney-Kerwin et al., 2007).

Consequence strategies. In addition to using antecedent strategies, all studies demonstrating effective mand training procedures for children with autism and other developmental disabilities have incorporated consequence strategies. Given the defining features of a mand, the one consequence strategy that has been implemented across all of these studies has been the contingent delivery of reinforcers specific to the MO and the mand topography. In addition to delivering specific reinforcement, some studies have also implemented additional differential reinforcement procedures (Betz et al., 2010; Carr & Kologinsky, 1983; Gutierrez et al., 2007; Kodak & Clements, 2009; Nuzzolo-Gomez & Greer, 2004; Paden et al., 2012; van der Meer, Kagohara et al., 2012). For example, Bourret et al. (2004) shaped the quality of vocal responses by initially reinforcing the vocal production of single phonemes; over time they treated the vocal production of single phonemes with extinction and only reinforced the vocal production of whole words. Finally, the use of extinction to decrease inappropriate but functionally equivalent alternative responses to the mands being taught, such as various forms of problem behavior, has been demonstrated to be effective (Bowman et al., 1997; Buckley & Newchok, 2005; Grow et al., 2008).

As can be seen from this review, there are a number of evidence-based instructional practices for teaching children with autism to mand. There have been limited studies, however, that taught children with autism to mand for missing items (Hartman & Klatt, 2005; Sweeney-Kerwin et al.,

2007) and only one study conducted with 1 participant that has taught this skill in the context of an interrupted behavior chain (Sidener et al., 2010). Given its relation to early language training for children with autism, this is an important line of research. Therefore, there were three purposes for this study. The first was to replicate the Hall and Sundberg (1987) study, with some minor procedural modifications, with children with autism. The second was to extend the behavior analytic research on mand training for children with autism by using the interrupted chain procedure to contrive motivation for previously neutral items and teach mands for those items when they were missing. The final purpose was to test for untrained tact acquisition subsequent to mand training that was conducted within the context of an interrupted chain, something that has not been done in previous studies with children with autism.

Method

Participants and Setting

There were 3 participants in this study. All 3 were enrolled in a private educational program offering one-on-one intensive teaching in the form of discrete trial training interspersed with teaching in the natural environment, which was facilitated through play-based activities. Victor and Carina attended this setting for 3 hours per day, 2 days per week. Nathaniel attended this setting for 3 hours per day, 4 days per week.

All 3 participants vocally manded for a wide variety of reinforcers (e.g., items, actions, activities) using both single words and multiple-word phrases. They all emitted some unprompted mands (i.e., manded when preferred items were not present and without any vocal prompts from the instructor). However, the majority of their mands were evoked by the presence of items. Victor was a 5-year-old boy diagnosed with autism who presented with moderate disabilities. He had limited but developing tact and intraverbal repertoires. Nathaniel was an 8-year-old boy with a primary diagnosis of autism and a secondary diagnosis of seizure disorder who presented with moderate to severe disabilities. He also had limited but developing tact and intraverbal repertoires. Carina was a 5-year-old girl diagnosed with pervasive developmental disorder/autism spectrum disorder who presented with moderate disabilities. Carina had well-developed tact and intraverbal repertoires and acquired new responses with few presentations of the stimulus.

Dependent Variable and Response Definitions

The dependent variable was the type of mand response emitted by the participant (i.e., unprompted or prompted). Mand responses were coded across these two categories, and a third category (i.e., no response) was also coded. An unprompted vocal mand for the missing item was defined as the participant emitting the target vocal mand topography within a 10-s delay interval in the absence of a vocal prompt and the relevant nonverbal stimulus (i.e., the item); these were coded as MO. A prompted vocal mand for the missing item was defined as the participant emitting the target vocal mand topography as the result of the teacher's presentation of a vocal prompt (i.e., model); these were coded as P. No response was defined as the participant emitting any response other than the target vocal mand topography within a 10-s delay interval without a vocal prompt and without the presence of the nonverbal stimulus (i.e., the item); these were coded as NR.

Reliability

The instructors who conducted the one-on-one teaching sessions with each student served as the primary data recorders. Another instructor observed and served as a secondary data recorder during approximately 25% of the sessions, spread across all phases of the study, so that interobserver agreement (IOA) could be assessed. Both data recorders independently coded mand responses as MO, P, or NR. Agreements and disagreements regarding the coding of these responses were scored after the sessions. An agreement occurred when both recorders coded a response identically (e.g., both coded it as MO). A disagreement occurred when the same mand occurrence was coded differently by each observer (e.g., one recorder coded it as MO and the other coded it as P). IOA was calculated by dividing the number of agreements by the number agreements plus disagreements and multiplying by 100. The average IOA for Victor was 96% (range, 72%–100%). The average IOA for Nathaniel was 92% (range, 25%–100%). The average IOA for Carina was 98% (range, 85%–100%).

Experimental Design

A concurrent multiple baseline across activities design was used to verify the effectiveness of the experimental procedures (Hersen & Barlow, 1976).

Procedures

Pretraining. For each participant three previously established preferred activities were selected to form chains of responses. Moreover, it had been determined that these activities presumably functioned as reinforcers because the participants consistently vocally manded for these activities when the relevant nonverbal stimuli were present, and when they were not present, but without any instructor-provided vocal prompts. For example, Victor would mand, "eat a sandwich," Nathanial would mand, "listen to music," and Carina would mand, "drink juice," when the sandwich, CD player, and juice, respectively, were or were not present. Response chains were developed to teach each participant to complete these three reinforcing activities (e.g., for Victor a chain was developed to teach him how to make a sandwich that he could then eat). Each response chain included multiple steps, or component behaviors, leading to the production of the terminal reinforcer (e.g., the sandwich that could be eaten).

During pretraining, the participants were taught to independently complete each of the three response chains. Instructors set up all materials needed to complete one of these chains on a table and seated the participants in a chair directly in front of the table. Next instructors presented a vocal instruction (i.e.,

discriminative stimulus; S^D) to begin the chain (e.g., "Make a sandwich"). After providing this vocal stimulus the instructors used total-task presentation (Cooper, Heron, & Heward, 2007; Miltenberger, 2012) incorporating physical prompts and prompt fading in the form of graduated guidance (Foxx & Azrin, 1972; Miltenberger, 2012) to teach these response chains. Data were recorded for each identified step within the chain and scored as fully physically prompted (i.e., the instructor provided full hand-over-hand guidance to complete the entire step), partially physically prompted (i.e., the instructor provided a less intrusive or faded physical prompt to complete the step), or independent (i.e., the participant completed the step without any instructor-provided prompts). The pretraining mastery criterion was established as a minimum of 80% of the responses within the chain being scored as independent across three consecutive sessions. Only one teaching session per chain was conducted during each day that the participants attended school. Because this was a preexisting and ongoing educational program, these pretraining sessions were interspersed among the participants' regularly scheduled instructional activities.

An example of one of the response chains taught to Victor was making a sandwich. The materials needed to complete this chain were a bag of bread, a toaster, a plate, a jar of peanut butter, and a knife. During prebaseline, the instructor seated Victor in a chair in front of a table that contained all of these materials. Next the instructor told Victor, "Make a sandwich." After presenting this vocal stimulus the instructor taught Victor to complete the following steps in the response chain: opening the bag of bread, putting the bread in the toaster, pushing down the toaster button, taking the bread out of the toaster (once it had popped back up), putting the bread on the plate, opening the jar of peanut butter, putting peanut butter on the knife, spreading the peanut butter on the bread, and eating the sandwich. Teaching was conducted using total-task presentation incorporating physical prompts and prompt fading in the form of graduated guidance as described above. See Table 1 for a summary of all of the response chains taught to each participant.

Baseline. The arrangement was the same as during pretraining, except that the item targeted for mand training was not presented (i.e., this item was missing). For example, within the context of the *make a sandwich* chain for Victor, all materials were put out on the table except for the toaster. (See Table 1 for a list of the missing items for each chain.) The instructor then presented the same vocal instruction to begin the chain as had been presented during pretraining (e.g., "Make a sandwich.") and the participant was given the opportunity to complete the response chain and contact the terminal reinforcer (e.g., eating the sandwich). If the participant paused or completed a step within the response chain incorrectly, the instructor provided a physical prompt to evoke the correct response for that step and then allowed the participant to continue to independently complete the remainder of the steps in the response chain.

One baseline session was conducted per chain each day. Within each chain, the participant paused at the point at which the missing item was needed to complete the chain and the instructor began timing a 10-s interval to provide an opportunity for the participant to emit an unprompted vocal mand for the missing item. If the participant emitted an unprompted vocal mand during this interval the instructor immediately delivered the item (i.e., reinforcer), and the participant was allowed to complete the remainder of the response chain and contact the terminal reinforcer. If the participant emitted any response other than the target vocal mand topography, the instructor waited for the completion of the 10-s interval and then discontinued the response chain by removing all items relevant to completing the chain. This response was coded as NR. These sessions were incorporated into the participants' typical 3-hour educational program. After discontinuing the chain, the instructor directed the participant to transition to whatever instructional activity was next on his or her schedule.

The baseline phase was continued until each participant demonstrated stable responding within one activity. Subsequently, as per the conventions of the multiple baseline design (Hersen & Barlow, 1976), mand training began within the context of that activity while the other two activities remained in the baseline phase.

Mand training. During mand training, all setup and procedures were identical to those described for baseline up to the point at which the chain was interrupted. A prompt was provided at the end of the 10-s delay period if, during that time, the participant had only emitted responses other than the target vocal mand topography. If a prompt occurred, the instructor said the name of the missing item at the end of the 10-s delay period. When the participant echoed this response, the instructor immediately delivered the missing item (i.e., reinforcer) and allowed the participant to complete the remainder of the steps in the response chain and contact the terminal reinforcer. When each participant's unprompted responding was stable within the first activity, mand training began within the second activity.

Probes for untrained mand responses. Upon completion of mand training for all three activities, each participant's responding was assessed under novel conditions to determine whether or not they would emit mands for the same missing items. Responding was assessed under conditions of novel stimuli (i.e., at least one of the materials used to complete the chain was different), novel settings (i.e., the specific room in which the chain was completed was different), and novel instructors (i.e., the person presenting the vocal instruction, providing prompts, and delivering the missing item was different). Procedures used during these probe sessions were identical to those described for mand training.

Nine novel chains, three per activity, were developed for Nathaniel and Carina. Within these chains only one variable (i.e., stimuli, setting, or instructor) was changed at a time. For example, for Nathaniel one of the novel *listen to music* chains was completed in the same room using the same stimuli, but a different instructor conducted this session. During a separate session, another novel *listen to music* chain was completed in

Table 1. Descriptions of Chains Taught to Participants

Participant and Chain	Materials	Steps
Victor		
Making an art project	Shapes cut from paper, Glue, **Glitter**	Pick up paper shapes, Put glue on each shape, Arrange shapes into a picture, Put glue on top of arranged shapes, Sprinkle glitter on top of glue
Painting a picture	Smock, Paper, Clip, Paintbrush, Water, Paint, **Easel**	Put on smock, Hand clip to instructor (to clip paper onto easel), Pick up paintbrush, Dip paintbrush in water, Dip paintbrush in paint, Apply paintbrush to paper, Repeat painting steps several times
Making a sandwich	Bread, **Toaster**, Plate, Peanut butter, Knife	Open bag of bread, Put bread in toaster, Push down toaster button, Take bread out of toaster (after bread has popped back up), Put bread on plate, Open peanut butter, Put peanut butter on knife, Spread peanut butter on bread, Eat sandwich
Nathaniel		
Listening to music	**Portable CD player**, CD, Headphones	Open CD player, Put CD in CD player, Put headphones on, Press play button, Listen to music
Science project	Plastic container, Bottle of water, **Two bottles of food coloring**, Spoon	Pour water into container, Drop food coloring into container, Pick up spoon, Mix liquid with spoon
Painting a picture	Smock, Paper, Paintbrush, Water, Paint, **Easel**	Put on smock, Put paper on easel, Pick up paintbrush, Dip paintbrush in water, Dip paintbrush in paint, Apply paintbrush to paper, Repeat painting steps several times
Carina		
Painting a picture	Smock, Paper, **Clip**, Paintbrush, Water, Paint, Easel	Put on smock, Hand clip to instructor (to clip paper onto easel), Pick up paintbrush, Dip paintbrush in water, Dip paintbrush in paint, Apply paintbrush to paper, Repeat painting steps several times
Making an art project	Paper, Three crayons, Glue stick, **Glitter**	Color picture, Rub glue on paper, Sprinkle glitter on top of glue
Making juice	Cup, Powder to make juice, Spoon, two ice cubes, **Measuring cups containing water**	Scoop powder into cup, Pour water from measuring cups into cup, Mix solution in cup using spoon, Put ice cubes into cup, Drink juice

Note. Materials removed to teach mands for missing items are shown in **boldface**.

the same room with the original instructor, but a different pair of headphones was used. Finally, during another session, a third novel *listen to music* chain was completed in a different room, but was conducted by the original instructor and the original stimuli were used to complete the chain. Due to time constraints associated with Victor's availability only six novel chains, two per activity, were developed. Each novel chain included the use of different stimuli, was conducted in a different setting, and was conducted by a different instructor. For example, for the novel *make a sandwich* chains an English muffin and bagel were substituted for the bread, the chains were completed in two different rooms than where the original chain had been taught, and two different instructors who were trained in the prompting and data collection procedures conducted these sessions.

Probes for tact acquisition. During pretraining, tact probes were conducted for each stimulus that was to be targeted for mand training. These probes were conducted by having the participant sit at a small instructional table directly across from the instructor. The same instructor who conducted the tact probes also conducted the pretraining, baseline, and mand training phases. A variety of instructional materials (e.g., manipulatives, colored index cards) were organized on the table. The instructor held up the target items, one at a time, and asked the participant, "What's this?" Participants were given 5 s to respond, and data were recorded on the accuracy of responses. A correct response was defined as the participant vocally tacting (labeling) the name of the item that was to be taught during mand training within the allotted 5-s interval. An incorrect response was defined as the participant emitting any other response within this 5-s interval. No programmed consequences (e.g., reinforcement, error correction) were implemented for correct or incorrect responses. One tact probe was conducted per item and all three items were probed within the same session. Once each participant had met criteria for demonstrating stable manding across all three activities, another set of tact probes was conducted following the same procedures.

Results

Results were consistent across all 3 participants, as displayed in Figure 1. During baseline, nonresponding was the norm. Unprompted mands for the missing items occurred when, and only when, vocal prompts were provided and then eliminated using the 10-s prompt delay. Across all activities, this occurred within the first 2 to 6 mand training sessions. Unprompted mand responding stabilized within 4 to 13 mand training sessions and maintained across subsequent sessions.

Upon completion of mand training across all three activities, probes for untrained mand responses were conducted with each participant. Nathaniel's responding was assessed across nine novel chains. He emitted unprompted mands for the missing items at the correct point in the chains during 9/9 probes. Carina's responding was also assessed across nine novel chains and she also emitted unprompted mands for the missing items at the correct point in the chains during 9/9 probes. Victor's responding was assessed across six novel chains. He emitted unprompted mands for the missing items at the correct point in the chains during 4/6 probes. He did not emit an unprompted mand for the easel during the two probes conducted using novel *paint a picture* chains.

When tact probes were conducted during the pretraining phase, all 3 participants emitted 0/3 correct tact responses. Following mand training, all 3 participants emitted 3/3 correct tact responses, one for each of the items for which they had been taught to mand.

Discussion

The results showed that children with autism could be taught to mand for missing items within the context of an interrupted behavior chain. With the exception of Victor, who manded for the toaster during 3 of the 14 baseline sessions, none of the participants emitted mands for any missing items during baseline. The results demonstrated that all 3 participants learned to emit unprompted mands for missing items only after mand training was conducted. These findings, that an interrupted chain along with prompt and prompt fading procedures could be used to teach unprompted mands for missing items, are consistent with those of Hall and Sundberg (1987) and Sidener et al. (2010).

There were many similarities between this study and the one conducted by Hall and Sundberg (1987), but there were a number of procedural differences as well. First, Hall and Sundberg's participants were teenagers who were deaf and diagnosed as severely mentally impaired. In this study, participants were children with typical hearing who were diagnosed with autism. Because the participants were different, there was a change in the presentation of the S^Ds to begin each chain from signed instructions in the Hall and Sundberg study to vocally stated instructions in this study. The difference in participants also compelled changes in the response forms taught from manual sign mands in the Hall and Sundberg study to vocal mands in this study. Therefore, this study employed vocal prompt and prompt fading procedures, rather than the imitative prompt and prompt fading procedures used by Hall and Sundberg. Tact-stimulus prompts and prompt fading were not used in this study because tact training was not conducted prior to mand training. This procedural difference was intentional as one goal of this study was to extend the work done by Hall and Sundberg by assessing whether the participants would acquire untrained tact responses as a result of mand training. Therefore, there were no probes for untrained mand responses subsequent to tact training as there had been in the Hall and Sundberg study. Instead, in this study, probes for novel mand responses across changes in stimuli, settings, and instructors were conducted. Another difference is that token economies were used as systems of reinforcement by Hall and Sundberg. These were not used in this study because the activities themselves (e.g., listening to music) already functioned as reinforcers, as evidenced by the participants' histories of vocally

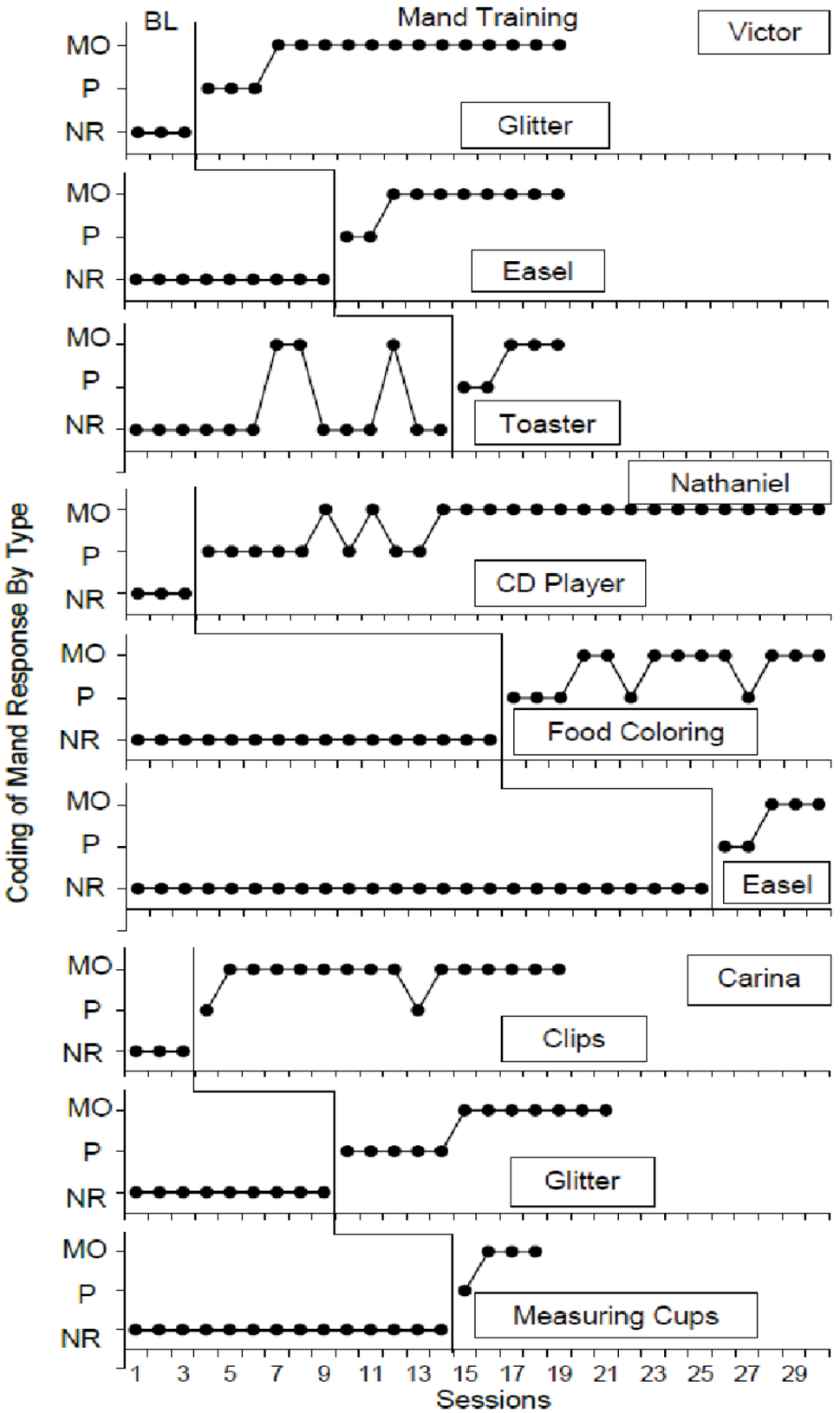

Figure 1. Coding of mand responses by type across baseline and mand training phases for Victor, Nathaniel, and Carina. MO = Unprompted; P = Prompted; NR = No Response.

manding for them. Finally, upon completion of one chain Hall and Sundberg's participants were immediately presented with the next chain. Within this study completion of the three chains was interspersed among the participants' regularly scheduled instructional activities.

Through implementation of the mand training procedures, instructors reduced vocal prompts and participants began to emit unprompted mands for the missing items. Once learned, these unprompted mand responses were well maintained under the control of the transitive conditioned establishing operation (CEO-T) without requiring supplemental prompts, such as the presence of the item or a vocal prompt from the instructor. Moreover, all 3 participants emitted unprompted mands for these missing items under novel and untrained stimulus conditions where the same CEO-T had been contrived. In other words, the mand training procedures were effective in expanding the frequency and variety of unprompted mands emitted by all of the participants. These findings are important because, according to Sundberg and Michael (2001):

> The ultimate value of the mand to the speaker is to obtain objects or to bring about conditions that are not present. This means that to be optimally useful a mand should occur in the absence of the object or condition that is the reinforcement for the mand; it should occur primarily under the control of the EO. (p. 710)

The type of mand training demonstrated through the current study has direct implications for targeting a hallmark characteristic of children with autism, a lack of spontaneous language such as emitting unprompted mands (Charlop et al., 1985; Charlop-Christy et al., 2002; Sundberg, 2005; Sundberg & Michael, 2001). Several studies have targeted increasing the "spontaneous" mand repertoires of children with autism and similar developmental disabilities. In all of these studies, "spontaneous" mands were defined as mands emitted in the presence of a nonverbal stimulus (i.e., the item was present) but without an additional vocal prompt (Charlop et al., 1985; Halle et al., 1981; Halle et al., 1979; Matson, Sevin, Fridley, & Love, 1990; Twyman, 1996). Whereas, other studies have focused on achieving what should be an important goal for practitioners working with persons with autism and similar developmental disabilities, teaching an unprompted mand repertoire where mands are evoked by an MO rather than the presence of the item (Carr & Kologinsky, 1983; Hall & Sundberg, 1987; Rosales & Rehfeldt, 2007; Sidener et al., 2010; Sweeney-Kerwin et al., 2007; Wallace, Iwata, & Hanley, 2006; Ziomek & Rehfeldt, 2008). The present study extends this latter line of research by using an interrupted chain procedure to teach children with autism to mand for missing items under the control of an MO, specifically the CEO-T, something that has only been demonstrated in one previous study (Sidener et al., 2010).

These mand training procedures can be used by practitioners working with children with autism to increase the frequency and variety of unprompted mands emitted by their clients. Practitioners whose focus is on helping to increase their clients' social use of language and independence and efficiency in obtaining reinforcers within their social environments can also make use of these procedures to achieve these important goals.

Another important outcome of this study is that it replicated Hall and Sundberg's (1987) findings that the interrupted chain procedure could be used to contrive MOs for missing items, when those items momentarily functioned as reinforcers because they were needed to access terminal reinforcers. These findings may be of value to practitioners who are teaching mands within language training programs. When teaching mands, it is important to either capture naturally occurring MOs or to contrive relevant MOs. According to Michael (1988), "relying on naturally occurring EOs in a language training setting will not usually result in sufficient variety" (p. 8) of mands. Moreover, contriving relevant MOs is something that may at first glance appear difficult and may therefore lead to practitioners neglecting mand training (Michael, 1988; Sundberg & Michael, 2001). A benefit of this interrupted chain procedure is that it provides practitioners with a simple and straightforward method by which to contrive relevant MOs to conduct mand training. Because children with autism often display motivation for a limited number of reinforcers and because an MO is necessary to evoke a mand, the number of different mands that can be taught is limited by the variety of items and activities that act as a form of reinforcement for some children. By identifying terminal reinforcers and the behavior chains that must be completed to access those terminal reinforcers, practitioners can identify additional objects (or actions) without which the terminal reinforcers cannot be obtained. By interrupting the chains at the point at which these additional objects (or actions) are needed, practitioners can momentarily establish them as reinforcers and contrive opportunities to teach a wider variety of mands.

A final finding of this study was that following mand training, but without direct tact training, all participants learned tact responses for the missing items. Previous studies have demonstrated that mand training resulted in untrained tact acquisition for children with autism (Nuzzolo-Gomez & Greer, 2004; Sundberg, et al., 2002). However, this study was the first to demonstrate that children with autism could acquire untrained tact responses following mand training via the interrupted chain procedure. Petursdottir, Carr, and Michael (2005) suggested that this type of untrained tact acquisition may result from mand training because, "the training of a mand may necessarily involve implicit tact training" because "any time a mand is reinforced, a stimulus is presented that may acquire discriminative control over a tact response identical to the mand" (pp. 71–72). Regardless of the exact mechanism by which this generalized responding occurs, the fact that it does occur is of significant importance to practitioners who must consider the efficiency of the interventions they implement.

Author Note

We would like to thank the parents of the participants who took part in this study. Correspondence concerning this article should be addressed to Kristin M. Albert, Carbone Clinic, 614 Corporate Way, Suite 1, Valley Cottage, NY, 10989. Phone: 845.267.0920. Email: kristin.albert@gmail.com.

Danielle D. Murray now works as a consultant in private practice.

References

Arntzen, E., & Almas, I. K. (2002). Effects of mand-tact versus tact-only training on the acquisition of tacts. *Journal of Applied Behavior Analysis, 35,* 419–422.

Betz, A. M., Higbee, T. S., & Pollard, J. S. (2010). Promoting generalization of mands for information used by young children with autism. *Research in Autism Spectrum Disorders, 4,* 501–508.

Bock, S. J., Stoner, J. B., Beck, A. R., Hanley, L., & Prochnow, J. (2005). Increasing functional communication in non-speaking preschool children: Comparison of PECS and VOCA. *Education and Training in Developmental Disabilities, 40,* 264–278.

Bourret, J., Vollmer, T., & Rapp, J. T. (2004). Evaluation of a vocal mand assessment and vocal mand training procedures. *Journal of Applied Behavior Analysis, 37,* 129–144.

Bowman, L. G., Fisher, W. W., Thompson, R. H., & Piazza, C. C. (1997). On the relation of mands and the function of destructive behavior. *Journal of Applied Behavior Analysis, 30,* 251–265.

Buckley, S., & Newchok, D. K. (2005). Differential impact of response effort within a response chain on use of mands in a student with autism. *Research in Developmental Disabilities, 26,* 77–85.

Carbone, V., Sweeney-Kerwin, E., Attanasio, V., Kasper, T. (2010). Increasing the vocal responses of children with autism and other developmental disabilities using manual sign mand training and prompt delay. *Journal of Applied Behavior Analysis, 43,* 705–709.

Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18,* 111–126.

Carr, E. G., & Kologinsky, E. (1983). Acquisition of sign language by autistic children II: Spontaneity and generalization effects. *Journal of Applied Behavior Analysis, 16,* 297–314.

Carroll, R. J., & Hesse, B. E. (1987). The effects of alternating mand and tact training on the acquisition of tacts. *The Analysis of Verbal Behavior, 5,* 55–65.

Charlop, M. H., Schreibman, L., & Thibodeau, M. G. (1985). Increasing spontaneous verbal responding in autistic children using a time delay procedure. *Journal of Applied Behavior Analysis, 18,* 155–166.

Charlop-Christy, M. H., Carpenter, H. M., Le, L., LeBlanc, L. A., & Kellet, K. (2002). Using the picture exchange communication system (PECS) with children with autism: Assessment of PECS acquisition, speech, social-communicative behavior, and problem behavior. *Journal of Applied Behavior Analysis, 35,* 213–231.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Pearson.

Davis, B. J., Kahng, S. W., & Coryat, K. (2012). Manipulating motivating operations to facilitate the emergence of mands for a child with autism. *The Analysis of Verbal Behavior, 28,* 145–150.

DeLeon, I., & Iwata, B. (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. *Journal of Applied Behavior Analysis, 29,* 519–532.

Drasgow, J. W., Halle, J. W., & Ostrosky, M. M. (1998). Effects of differential reinforcement on the generalization of a replacement mand in three children with severe language delays. *Journal of Applied Behavior Analysis, 31,* 357–374.

Drash, P., High, R., & Tudor, R. M. (1999). Using mand training to establish an echoic repertoire in young children with autism. *The Analysis of Verbal Behavior, 16,* 29–44.

Endicott, K., & Higbee, T. S. (2007). Contriving motivating operations to evoke mands for information in preschoolers with autism. *Research in Autism Spectrum Disorders, 1,* 210–217.

Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Ownes, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis, 25,* 491–498.

Foxx, R. M., & Azrin, N. H. (1972). Restitution: A method of eliminating aggressive-disruptive behavior of retarded and brain damaged patients. *Behaviour Research and Therapy, 10,* 15–27.

Frea, W., Arnold, C., & Vittimberga, G. (2001). A demonstration of the effects of augmentative communication on the extreme aggressive behavior of a child with autism within an integrated preschool setting. *Journal of Positive Behavior Intervention, 3,* 194–198.

Ganz, J., Simpson, R. L., & Corbin-Newsome, J. (2008). The impact of the picture exchange communication system on requesting and speech development in preschoolers with autism spectrum disorders and similar characteristics. *Research in Autism Spectrum Disorders, 2,* 157–169.

Gregory, M. K., DeLeon, I. G., & Richman, D. M. (2009). The influence of matching and motor-imitation abilities on rapid acquisition of manual signs and exchange-based communicative responses. *Journal of Applied Behavior Analysis, 42,* 399–404.

Grow, L. L., Kelley, M. E., Roane, H. S., & Shillingsburg, M. A. (2008). Utility of extinction-induced response variability in the selection of mands. *Journal of Applied Behavior Analysis, 41,* 15–24.

Gutierrez, A., Jr., Vollmer, T. R., Dozier, C. L., Borrero, J. C., Rapp, J. T., Bourret, J. C., & Gadaire, D. (2007). Manipulating establishing operations to verify and establish stimulus control during mand training. *Journal of Applied Behavior Analysis, 40,* 645–658.

Hall, G. A., & Sundberg, M. L. (1987). Teaching mands by manipulating conditioned establishing operations. *The Analysis of Verbal Behavior, 5,* 41–53.

Halle, J. W., Baer, D. M., & Spradlin, J. E. (1981). Teachers' generalized use of delay as a stimulus control procedure to increase language use in handicapped children. *Journal of Applied Behavior Analysis, 14,* 389–409.

Halle, J. W., Marshall, A. M., & Spradlin, J. E. (1979). Time delay: A technique to increase language use and facilitate generalization in retarded children. *Journal of Applied Behavior Analysis, 12,* 431–439.

Hartman, E. C., & Klatt, K. P. (2005). The effects of deprivation, presession exposure, and preferences on teaching manding to children with autism. *The Analysis of Verbal Behavior, 21,* 135–144.

Hersen, M., & Barlow, D. H. (1976). *Single case experimental designs: Strategies for studying behavior change*. New York, NY: Pergamon Press.

Jennett, H. K., Harris, S. L., & Delmolino, L. (2008). Discrete trial instruction vs. mand training for teaching children with autism to make requests. *The Analysis of Verbal Behavior, 24,* 69–85.

Kelley, M. E., Shillingsburg, M. A., Castro, M. J., Addison, L. R., & LaRue, R. H., Jr. (2007). Further evaluation of emerging speech in children with developmental disabilities: Training verbal behavior. *Journal of Applied Behavior Analysis, 40,* 431–445.

Kodak, T., & Clements, A. (2009). Acquisition of mands and tacts with concurrent echoic training. *Journal of Applied Behavior Analysis, 42,* 839–843.

Kodak, T., Paden, A., & Dickes, N. (2012). Training and generalization of peer-directed mands with non-vocal children with autism. *The Analysis of Verbal Behavior, 28,* 119–124.

Langthorne, P., & McGill, P. (2009). A tutorial on the concept of motivating operation and its importance to application. *Behavior Analysis in Practice, 2,* 22–31.

Laraway, S., Snycerski, S., Michael, J., & Poling, A. (2003). Motivating operations and terms to describe them: Some further refinements. *Journal of Applied Behavior Analysis, 36,* 407–414.

Lechago, S. A., Carr, J. E., Grow, L. L., Love, J. R., & Almason, S. M. (2010). Mands for information generalize across establishing operations. *Journal of Applied Behavior Analysis, 43,* 381–395.

Matson, J. L., Sevin, J. A., Fridley, D., & Love, S. R. (1990). Increasing spontaneous language in three autistic children. *Journal of Applied Behavior Analysis, 23,* 227–233.

Michael, J. (1988). Establishing operations and the mand. *The Analysis of Verbal Behavior, 6,* 3–9.

Michael, J. (1993). Establishing operations. *The Behavior Analyst, 16,* 191–206.

Michael, J. (2007). Motivating operations. In J. O. Cooper, T. E. Heron, & W. L. Heward, *Applied behavior analysis* (2nd ed.) (pp. 374–391). Upper Saddle River NJ: Merrill/Prentice-Hall.

Miltenberger, R. G. (2012). *Behavior modification: Principles and procedures.* Belmont, CA: Wadsworth.

Nuzzolo-Gomez, R., & Greer, R. D. (2004). Emergence of untaught mands or tacts of novel adjective-object pairs as a function of instructional history. *The Analysis of Verbal Behavior, 20,* 63–76.

O'Reilly, M., Aguilar, J., Fragale, C., Lang, R., Edrisinha, C., Sigafoos, J., Lancioni, G., & Didden, R. (2012). Effects of a motivating operation manipulation on the maintenance of mands. *Journal of Applied Behavior Analysis, 45,* 443–447.

Paden, A. R., Kodak, T., Fisher, W. W., Gawley-Bullington, E. M., & Bousxein, K. J. (2012). Teaching children with autism to engage in peer-directed mands using a picture exchange communication system. *Journal of Applied Behavior Analysis, 45,* 425–429.

Petursdottir, A. I., Carr, J. E., & Michael, J. (2005). Emergence of mands and tacts of novel objects among preschool children. *The Analysis of Verbal Behavior, 21,* 59–74.

Roane, H. S., Vollmer, T. R., Ringdahl, J. E., & Marcus, B. (1998). Evaluation of a brief stimulus preference assessment. *Journal of Applied Behavior Analysis, 34,* 73–76.

Rosales, R., & Rehfeldt, R. A. (2007). Contriving transitive conditioned establishing operations to establish derived manding skills in adults with severe developmental disabilities. *Journal of Applied Behavior Analysis, 40,* 105–121.

Shafer, E. (1994). A review of interventions to teach a mand repertoire. *The Analysis of Verbal Behavior, 12,* 53–66.

Shillingsburg, M. A., & Valentino, A. L. (2011). Teaching a child with autism to mand for information using "how." *The Analysis of Verbal Behavior, 27,* 179–184.

Sidener, T. M., Carr, J. E., Karsten, A. M., Severtson, J. M., Cornelius, C. E., & Heinicke, M. R. (2010). Evaluation of single and mixed verbal operant arrangements for teaching mands and tacts. *The Analysis of Verbal Behavior, 26,* 15–30.

Skinner, B. F. (1957). *Verbal behavior.* Englewood Cliffs, NJ: Prentice Hall.

Sigafoos, J., Doss, S., & Reichle, J . (1989). Developing mand and tact repertoires in persons with severe developmental disabilities using graphic symbols. *Research in Developmental Disabilities, 10,* 183–200.

Sundberg, M. (1993). The application of establishing operation. *The Behavior Analyst, 16*, 215–218.

Sundberg, M. L. (2005). A behavioral analysis of motivation and its relation to mand training. In L. W. Williams (Ed.). *Development disabilities: Etiology, assessment, intervention, and integration* (pp. 1–22). Reno, NV: Context Press.

Sundberg, M. L., Loeb, M., Hail, L., & Eigenheer, P. (2002). Contriving establishing operations to teach mands for information. *The Analysis of Verbal Behavior, 18,* 14–28.

Sundberg, M. L., & Michael, J. (2001) . The value of Skinner's analysis of verbal behavior for teaching children with autism. *Behavior Modification, 25,* 698–724.

Sweeney-Kerwin, E. J., Carbone, V. J., O'Brien, L., Zecchin, G., & Janecky, M. N. (2007). Transferring control of the mand to the motivating operation in children with autism. *The Analysis of Verbal Behavior, 23,* 89–102.

Taylor, B. A., & Harris, S. L. (1995). Teaching children with autism to seek information: Acquisition of novel information and generalization of responding. *Journal of Applied Behavior Analysis, 28,* 3–14.

Tincani, M. (2004). Comparing the picture exchange communication system and sign language training for children with autism. *Focus on Autism and Other Developmental Disabilities, 19,* 152–163.

Tincani, M., Crozier, S., & Alazetta, L. (2006). The picture exchange communication system: Effects on manding and speech development for school-aged children with autism. *Education and Training in Developmental Disabilities, 41,* 3–15.

Twyman, J. S. (1996). The functional independence of impure mands and tacts of abstract stimulus properties. *The Analysis of Verbal Behavior, 13,* 1–9.

van der Meer, L., Kagohara, D., Achmadi, D., O'Reilly, M. F., Lancioni, G. E., Sutherland, D., & Sigafoos, J. (2012). Speech-generating devices versus manual signing for children with developmental disabilities. *Research in Developmental Disabilities, 33,* 1658–1669.

van der Meer, L., Sutherland, D., O'Reilly, M. F., Lancioni, G. E., & Sigafoos, J. (2012). A further comparison of manual signing, picture exchange, and speech-generating devices as communication modes for children with autism spectrum disorders. *Research in Autism Spectrum Disorders, 6,* 1247–1257.

Wallace, M. D., Iwata, B. A., & Hanley, G. P. (2006). Emergence of mands following tact training as a function of reinforcer strength. *Journal of Applied Behavior Analysis, 39,* 17–24.

Williams, G., Donley, C. R., & Keller, J. W. (2000). Teaching children with autism to ask questions about hidden objects. *Journal of Applied Behavior Analysis, 33,* 627–630.

Ziomek, M. M., & Rehfeldt, R. A. (2008). Investigating the acquisition, generalization and emergence of untrained verbal operants for mands using the picture exchange communication system in adults with severe developmental disabilities. *The Analysis of Verbal Behavior, 24,* 15–30.

Action Editor: William Ahearn