THE INFLUENCE OF MOTIVATING OPERATIONS ON GENERALIZATION PROBES OF SPECIFIC MANDS BY CHILDREN WITH AUTISM

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We investigated the influence of motivating operations on the generalization of newly taught mands across settings and communication partners for 3 children with autism. Two conditions were implemented prior to generalization probes. In the first condition, participants were given access to a preferred item until they rejected the item (i.e., abolishing operation). In the second condition, the item was not available to participants prior to generalization probes (i.e., establishing operation). The effects of these conditions on the generalization of newly taught mands were evaluated in a multielement design. Results indicated differentiated responding during generalization probes in which more manding with the target mand was observed following the presession no-access condition than in the presession access condition. These results support the consideration of motivating operations when assessing generalization of target mands to various untrained contexts.

Key words: mands, motivating operations, generalization, autism

Individuals with autism and other developmental disabilities often exhibit difficulties in acquiring language skills and the ability to communicate effectively or appropriately (National Research Council, 2001). One skill frequently targeted in language programs is manding or teaching an individual to request access to reinforcement (Sundberg & Michael, 2001). Giving an individual more control over the delivery of reinforcers may increase the likelihood that the person will attempt to communicate in the future (Shafer, 1994; Sundberg & Michael, 2001).

Manding is inherently linked to motivating operations. Skinner (1957) implicated the presence of motative variables (most commonly deprivation or aversive stimulation) as controlling variables for the mand. Motivating operations (MOs; also known as establishing operations in earlier literature) are changes in the environment that momentarily alter the reinforcing value of an object or event. MOs also affect the frequency of behaviors previously associated with that reinforcer (Michael, 1982). MOs that increase the value of reinforcers and frequency of behaviors are called establishing operations (EOs), and MOs that decrease the value of reinforcers and frequency of behaviors...
are called abolishing operations (AOs; Laraway, Snyderski, Michael, & Poling, 2003). The clinical impact of MOs in the assessment and treatment of individuals with developmental disabilities has been demonstrated through recent research on functional analysis assessment results (Langthorne, McGill, & O’Reilly, 2007; O’Reilly et al., 2008; Roantree & Kennedy, 2006), choice and preference (Chappell, Graff, Libby, & Ahearn, 2009; Reed, Pace, & Luselli, 2009), academic behaviors (Rispoli et al., 2011), and treatment of problem behaviors (Lang et al., 2010; McComas, Hoch, Paone, & El-Roy, 2000; O’Reilly et al., 2007).

The effects of manipulating MOs also have been illustrated in the context of teaching mands to children with developmental disabilities, although the effects on generalization of mands have not been investigated fully. In most cases, generalization, or the use of learned skills in untrained contexts or over time, usually indicates true improvement (Baer, Wolf, & Risley, 1968). However, generalization without explicit training appears to be particularly problematic for individuals with autism (National Research Council, 2001; Scott, Clark, & Brady, 2000). Specifically, these individuals may acquire mands but then fail to use them outside the trained settings or when the cues related to the teaching condition are no longer present (Scott et al., 2000; Taylor & Harris, 1995). In some studies on mands, generalization effects were not reported or were not measured sufficiently.

Sundberg, Loeb, Hale, and Eigenheer (2002), for example, taught two children with autism to acquire mands in the form of question asking. Results indicated a relation between the MO and question asking such that participants correctly manded “where is [item]?” more for preferred items than for items assumed to be less preferred. Sundberg et al. also tested question asking with novel items (preferred and less preferred) and found that participants manded for the items’ whereabouts without additional training. However, manding for these items was not measured in baseline, which precluded any conclusions about generalization effects. Pellecchia and Hineline (2007) taught participants to mand for preferred items with an instructor and then probed for transfer of mands using the same items with parents, siblings, and peers. The participants did not require further training to mand with parents, but they did require additional training to mand with siblings and peers. Taylor et al. (2005) reported similar findings. In these last two studies, the experimenters did not identify reasons why manding did not generalize across recipients.

For individuals who have difficulty generalizing newly learned skills, active planning and systematic programming of environmental conditions may promote maintenance and generalization (Stokes & Baer, 1977). Some recommended strategies include sequential modification, training sufficient exemplars, and using indiscriminable contingencies. These methods are intended to structure conditions in the acquisition phase in a purposeful way that promotes the transfer of stimulus control from training stimuli to nontraining stimuli found in the natural environment. Recent evidence suggests that the manipulation of MOs may affect the assessment of response maintenance. In O’Reilly et al. (in press), three students with autism engaged in higher levels of newly taught mands when access to the requested item was restricted prior to maintenance probes than when access was given. Given these findings, it is plausible that MOs also may be important when assessing and programming for generalization of skills in untrained contexts. Furthermore, such research also may clarify findings of Pellecchia and Hineline (2007) and Taylor et al. (2005) by providing a potential explanation for the reported failures to generalize.

The purpose of the current study was to evaluate the effects of MOs on generalization probes of newly taught mands for three participants. Generalized responding across settings and communication partners was
assessed following periods with and without access to a preferred item.

METHOD

Participants
Participants were three children who attended a private elementary school for children with language delays and autism. An educational goal for all three children included increasing the length of requests from simple single words to contextually appropriate phrases. Sharon was a 4-year-old girl with speech disturbance, expressive language disorder, and autism. Her mean length of utterance (MLU) was three words, and independent verbal responses generally consisted of rote phrases. Sharon scored a 42 on the Childhood Autism Rating Scale (CARS; Schopler, Reichler, & Renner, 1988), placing her in the severe autism category. Ellen was a 4-year-old girl with autism. She scored a 36.5 on the CARS, placing her on the borderline between moderate and severe autism. Her MLU was four to five words, but she requested items independently using single words. She labeled items using the item name and occasionally adjectives or descriptors, such as big, little, or the color of the item. Charlie was an 8-year-old boy with hypotonia, chronic otitis media, congenital scoliosis, and autism. He scored a 46.5 on the CARS, placing him in the severe autism category. He often engaged in vocal stereotypy by making a repetitive “eeee” sound and communicated with others using a Dynavox speech-generating device. This device was operated using a touch screen and consisted of multiple pages with 24 buttons per page. Charlie’s independent communication served mainly to request items and actions using one-to two-word phrases (e.g., “eat chips”).

Three doctoral students in special education with extensive classroom experience implemented the study. One of these doctoral students acted as trainer throughout the study. The trainer taught the specific mand phrases to the participants during teaching trials and conducted generalization probes across settings. Generalization of newly taught mands was assessed across the other two doctoral students, who were considered familiar and unfamiliar communication partners to the participants. The familiar communication partner had a previous history of working with the participants, and the unfamiliar communication partner did not have any prior history of working with the participants. Neither communication partner participated in the teaching trials.

Settings
The study was conducted in an instructional setting and two generalization settings. The instructional setting was used primarily for one-on-one teaching and consisted of an emptied classroom furnished only with several small tables, chairs, and portable room dividers. All teaching trials were conducted in the instructional room by the trainer. No other students were present in the room during teaching trials. The first generalization setting was the child’s regular classroom. Classrooms were furnished with child-sized tables and chairs, and various areas of the room were decorated and designated for specific activities (e.g., kitchen area, circle time area, reading area, etc.). Generalization probes were conducted at a table during regularly scheduled individualized instruction time when other students were present but whole-class instruction was not occurring. The second generalization setting was a cafeteria that the participants did not visit on a regular basis. The cafeteria was a small room with picnic style tables, refrigerator, microwave, and sink. Generalization probes were conducted during times when it was generally empty or other people entered briefly. Potentially preferred toys or classroom items were moved out of reach of the child, leaving only the preferred toy associated with the specific target mand present during teaching trials and generalization probes.

Preference and Communication Assessments
Prior to beginning the study, a preference assessment and communication assessment were administered to identify behavioral indicators of satiation for each participant. The first assessment, a brief multiple-stimulus without
replacement (MSWO) preference assessment (DeLeon & Iwata, 1996), was conducted to determine a rank of preferred items for each participant. The array consisted of toys from the classroom that the child’s teacher identified as preferred. Toys were used due to their portability, and edible items were excluded at the request of the teachers. The top preferred item identified using the MSWO was selected for teaching the target mand phrase individualized for each participant. Teachers agreed to remove these toys from the regular school environment and restrict access for use during the study only. Sharon’s preferred toy was a set of wooden blocks that she engaged with by repeatedly tapping them together. Ellen’s preferred item was a toy with four television characters that emitted a phrase when a button or switch for the specific character was activated. She engaged with the toy by repeatedly pushing the buttons and sometimes repeated the phrase that the toy emitted. Charlie’s preferred toy was a book with a variety of buttons on the cover that made sounds when pressed. The majority of his engagement with the book involved repeatedly pressing the buttons and holding it up to his ear. On some occasions he was observed to open the book and look at the pages.

The second assessment was a communication assessment to identify indicators of satiation that was developed by O’Reilly et al. (2009). Behaviors thought to communicate rejection were first identified by teachers and confirmed by giving participants continuous access to low-preference items and recording the frequency of these rejecting behaviors (see O’Reilly et al. for further procedural details). These individualized behavioral indicators then were used as operational definitions to indicate satiation for the remainder of the study. Sharon’s rejection behaviors included putting the item down and not taking it when it was offered to her. Ellen’s rejection behaviors were saying “no” or putting the item down and refusing to take it when it was offered to her. Charlie’s rejection behaviors were pushing the offered item away or indicating “all done” on his Dynavox device. Detailed results for the preference and communication assessments can be obtained through correspondence with the first author.

**Dependent Variables and Data Collection**

During baseline and generalization probes, the dependent variable was a specific target mand response, developed in accordance with the participants’ school instructional goals and input from their teachers. Mands included “May I have blocks, please?” for Sharon, “Can I have Elmo?” for Ellen, and “Can I have book, please?” using the Dynavox device for Charlie. Responses were not counted if they were (a) different from the target mand (e.g., “have blocks,” “want Elmo,” “I have Elmo,” or “can I have book?”), (b) not emitted within 10 s of the item presentation, or (c) mands for an item other than the preferred item. Mands that were socially valid but different from the target mand were not scored because we intended to provide a controlled demonstration of the effects of MOs on one specific behavior across untrained contexts rather than on the class of behaviors for requesting (e.g., reaching towards, pointing, other verbal behavior). Therefore, only one specific target mand was reinforced. Frequency data on target mands were calculated as a percentage of 10 trials in which the newly taught target mand occurred unprompted when the item was presented.

During teaching trials, the number of trials and whether they were completed independently or with prompts were recorded. These data were not reported but are available from the first author.

**Design**

A multielement design was used to examine the effects of prior access versus no access on responding during generalization probes of newly taught mands for each participant. The order of presession conditions was randomized initially; however, due to time constraints (the end of the school year), conditions were semirandomized. Presession no-access conditions always preceded presession access conditions when both were assessed on the same day. No more than two conditions were assessed per
day, with a 5-min break between conditions to control for satiation effects.

**Procedure**

We probed for the specific mands during baseline and after teaching trials to assess generalization across two settings and two communication partners under both presession access and no-access conditions.

**Baseline and generalization probes.** Each probe consisted of 10 trials or opportunities to mand for preferred items. A trial consisted of presenting the preferred item within sight but out of reach of the participant for 10 s. If the participant used the target phrase, he or she was given access to the preferred item for 10 s. If he or she gave any response other than the target phrase or did not respond within 10 s of item presentation, the item was removed from view, marking the end of the trial. A new trial began after 3 s. Baseline and generalization probes were conducted across settings and communication partners under presession access and no-access conditions. Baseline probes were conducted prior to teaching trials, and generalization probes were conducted after the introduction of teaching trials.

The trainer conducted generalization probes in the classroom and cafeteria. The order of settings was randomized. For example, the generalization probe was conducted in the classroom, followed by a short break, and then a generalization probe was conducted in the cafeteria (or vice versa), under both presession conditions. Generalization probes across communication partners were conducted by the familiar and unfamiliar persons in the instructional room. Again, the order of communication partners was randomized in both presession conditions.

**Teaching trials.** The purpose of the teaching trials was to teach a specific target mand phrase to each participant. Therefore, mands for other items or responses that varied from the specific target mand phrase were not reinforced. Each presentation of the item was considered a trial. To confirm interest in the preferred item, the participant sampled the item for 10 to 15 s prior to teaching trials. If he or she did not engage with the item, the teaching trials were not conducted but were attempted again the following day. However, none of the participants failed to engage with the preferred items.

The first five consecutive trials consisted of presenting the item in front of the participant accompanied with an immediate prompt. For Sharon and Ellen, the prompt was a full verbal model for the specific mand. For Charlie, the procedures included physical prompts due to the use of the Dynavox. The device was present on the table less than a foot directly in front of Charlie throughout all teaching trials. In accordance with how his teachers typically taught new icons on the device, the trainer showed Charlie the preferred item and then spoke the corresponding words while physically prompting him to press three icons, “can I have,” “book,” and “please.” Charlie was not required to make any verbal approximations. The trainer’s verbal behavior accompanied only full physical prompts. After the first five consecutive trials with immediate prompts, the trainer instituted a 5-s prompt delay and most-to-least prompting hierarchy. For example, the trainer visually presented the item and waited 5 s. If Charlie did not respond after 5 s, the trainer physically prompted the response by guiding his finger to press the icon, shadowing his arm, or using a pointing prompt. The level of prompt assistance was determined using clinical discretion rather than a specific criterion. If the participant’s response differed from the target mand (e.g., a word was left out), the verbal model (Sharon and Ellen) or physical prompts (Charlie) were repeated until he or she responded correctly. Independent and prompt-induced responses were reinforced with access to the item for 10 s, at which point the item was removed and the next teaching trial began. Consecutive trials were separated by 3 to 5 s. If the participant manded for other items, the trainer either ignored and re-presented the model or denied access to the item (e.g.,
physically blocked access and said something to the effect of “not right now”). For non-responses, the model was repeated once before the item was removed, marking the end of the trial.

A set of teaching trials was conducted after every six baseline or generalization probes and ended when the participant either (a) completed 50 trials, (b) exhibited independent mands using the target phrase for five consecutive trials, (c) no longer displayed interest in the item (e.g., no attempts to reach for or request the item, repeated requests for other items), or (d) displayed rejecting behaviors during the 5-s prompt delay for three consecutive trials. Breaks (5 min each) were given approximately every 20 teaching trials to reduce potential satiation effects. However, prompt levels were continued from the trials prior to breaks. Two sets of teaching trials were conducted for Ellen and Charlie with an average of 25 and 31 trials, respectively. These sets ended due to participants no longer displaying interest in the target items. Three sets of 50 teaching trials each were conducted for Sharon.

**Presession access versus no-access conditions.** The influence of MOs on manding was assessed by exposing participants to two conditions prior to baseline and generalization probes. The presession access condition consisted of giving the participant free access to the preferred item in the instructional room. The participant was presented the item and instructed to play with it. The instructor remained in the room but did
not provide additional verbal or physical attention. If the participant engaged in rejecting behaviors, the instructor re-presented the item. After three displays of rejecting behaviors, the session was terminated and the child immediately participated in baseline or generalization probes. For Sharon, the mean duration to display three rejecting behaviors was 20 min (range, 5 to 39 min). For Ellen, the mean duration was 10 min (range, 7 to 17 min), and for Charlie, the mean duration was 22 min (range, 9 to 50 min).

The presession no-access condition consisted of preventing the participants from accessing the preferred item no less than 23 hr prior to baseline and generalization probes. This was done by removing the item from the classroom. In addition, we confirmed with parents that none of the preferred items were present in the home environments.

Interobserver Agreement

Interobserver agreement of target mands was scored for 33% of both presession conditions across baseline and generalization probes. Two observers simultaneously and independently observed sessions and scored the occurrence of target mands during each trial. Interobserver agreement was calculated by dividing the total number of agreements by the total number of agreements plus disagreements and converting this number to a percentage. Agreement on target mands across settings was 100% for each participant, and agreement across communication partners was 100%, 100%, and 98% for Sharon, Ellen, and Charlie, respectively.
RESULTS

Results of presession access and presession no access on responding across settings are presented in Figures 1 through 3 for Sharon, Ellen, and Charlie. The top panels show results in the classroom (familiar setting) where he or she typically spent the majority of the school day. The bottom panels show results for the cafeteria (unfamiliar setting) where the participants spent the least amount of time during the school day. Overall, a similar pattern of responding emerged for all participants.

During baseline probes, none of the participants manded for preferred items using the target mand phrase in either presession access or no-access conditions for the two generalization settings (classroom or cafeteria). After the first set of teaching trials, Ellen consistently manded in both settings, more in the no-access condition (classroom \(M = 63.3\%\); range, 60% to 70%) and cafeteria \(M = 90\%\)) than in the access condition (classroom \(M = 3.3\%\); range, 0% to 10%) and cafeteria \(M = 3.3\%\); range, 0% to 10%). Mands by Sharon and Charlie remained low and undifferentiated across both settings after the first set of teaching trials. However, after additional teaching trials, differentiation of mands between presession conditions emerged across settings for Sharon and Charlie, for whom mands mainly occurred in the no-access condition rather than the access condition. Probes of manding resulted in similar patterns in familiar and unfamiliar settings.

Results of presession access and no-access conditions on responding across communica-

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Figure 3. Percentage of trials with the target mand during generalization probes across settings under presession access and no-access conditions for Charlie.
MOTIVATING OPERATIONS AND GENERALIZATION PROBES

Results suggest that MOs are essential to consider when assessing generalization of specific mands by individuals with autism. After two sets of teaching trials, all participants began to use the newly taught mand primarily in the condition in which access to the preferred item was restricted prior to generalization probes. We hypothesize that restricting access most likely served as an EO, increasing the value of

DISCUSSION

Figure 4. Percentage of trials with the target mand during generalization probes across communication partners under presession access and no-access conditions for Sharon.
the preferred item and evoking the target mand established with access to the reinforcer. Participants did not respond with the newly taught mand as much, if at all, when they were given access to the item prior to generalization probes. A likely explanation is that access to the item served as an AO, decreasing the value of the preferred item and making use of the mand less probable. These results are consistent with those reported by O’Reilly et al. (in press), who demonstrated that manding primarily occurred when access to the reinforcer was limited rather than provided prior to maintenance probes. Similarly, for each of the three participants in the present study, this pattern was observed across settings and communication partners that were not part of the original instructional conditions. This evidence of a functional relation between MOs and mands in non-training contexts confirms the critical role of MOs when assessing and programming for generalization of language skills.

These results have several implications. If the object of the mand has lost value as a reinforcer, it may only appear that the student has not acquired or generalized the mand phrase. Without considering MOs as an influence, absence of responding in acquisition or generalization may lead to a variety of programming decisions, such as adjusting instructional formats, increasing visual or verbal prompts, or increasing the number of practice opportunities (Scott et al., 2000). However, when responding fails to occur due to MOs, more parsimonious program decisions may be implemented, such as restricting access to items before probes are
conducted in various contexts. Therefore, failure to take into account MOs when assessing generalization may result in inaccurate and misguided program decisions that have negative consequences (e.g., programs continued unnecessarily, wasted time or other resources). On the other hand, consideration of MOs may result in positive consequences (e.g., more valid evaluation of generalization leading to appropriate program decisions, effective teaching and promoting of generalization during acquisition phases). The ultimate implication is that MOs should be considered to maximize the accuracy of generalization assessments.

Several limitations should be noted. In the generalization literature, there has been some debate on the interpretation of the term generalization and how this phenomenon should be assessed (Cuvo, 2003; Johnston, 1979). Some researchers advocate for the assessment of generalization under extinction conditions. Other researchers subscribe to the more topographical interpretation of generalization in which newly learned behaviors occur under nontraining conditions (i.e., across subjects, settings, behaviors, or time) without the same events as those in training conditions (Stokes & Baer, 1977). It is the latter definition that applies to our demonstration of generalization. Another limitation is the absence of fidelity data for teaching sessions or generalization probes, and it may not be feasible to restrict reinforcing items from students with autism who have a limited number of items that serve as reinforcers. It would be important to study how much restriction of reinforcers outside of instruction is required to maintain...
generalized responding. In addition, the mands may not have been controlled solely by the MO because the items were always in view. Because we taught, accepted, and reinforced only one specific mand, our results may not have generality to other socially relevant mands and responses. As an anecdote, during the conditions with prior access, participants generally did not make any effort to mand. However, in the no-access conditions, Sharon and Ellen engaged in responses that varied from the target mand (e.g., Ellen manded, “Can I have Ernie?” or “I want Cookie Monster”) but were not scored for the purposes of our study. Given the difficulties in communication that are characteristic of autism, the influence of MOs on variability of language or on communicative behaviors within the same response class are areas worthy of further analysis.

Finally, teaching trials ended for Ellen and Charlie due to manding for other items or displaying rejecting behaviors rather than because they met the criterion of five consecutive independent mands. It is possible that the arbitrarily chosen number of five trials was too high. Occasional probing for generalization during acquisition may be a worthwhile practice to explore in further studies on generalization. For example, if a student is beginning to demonstrate skills learned in a one-on-one setting with other peers or in different settings, it may also be an opportune time to introduce multiple opportunities in the generalization setting or provide reinforcement for generalized behaviors (Stokes & Baer, 1977).

Future research could extend these findings to other naturalistic contexts. It would be worthwhile, for example, to examine how teachers, parents, and clinicians could incorporate MOs into natural routines (e.g., during regular classroom instruction, at the grocery store, during play groups with peers, and in various therapies) to program for generalization of mands with this population.

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