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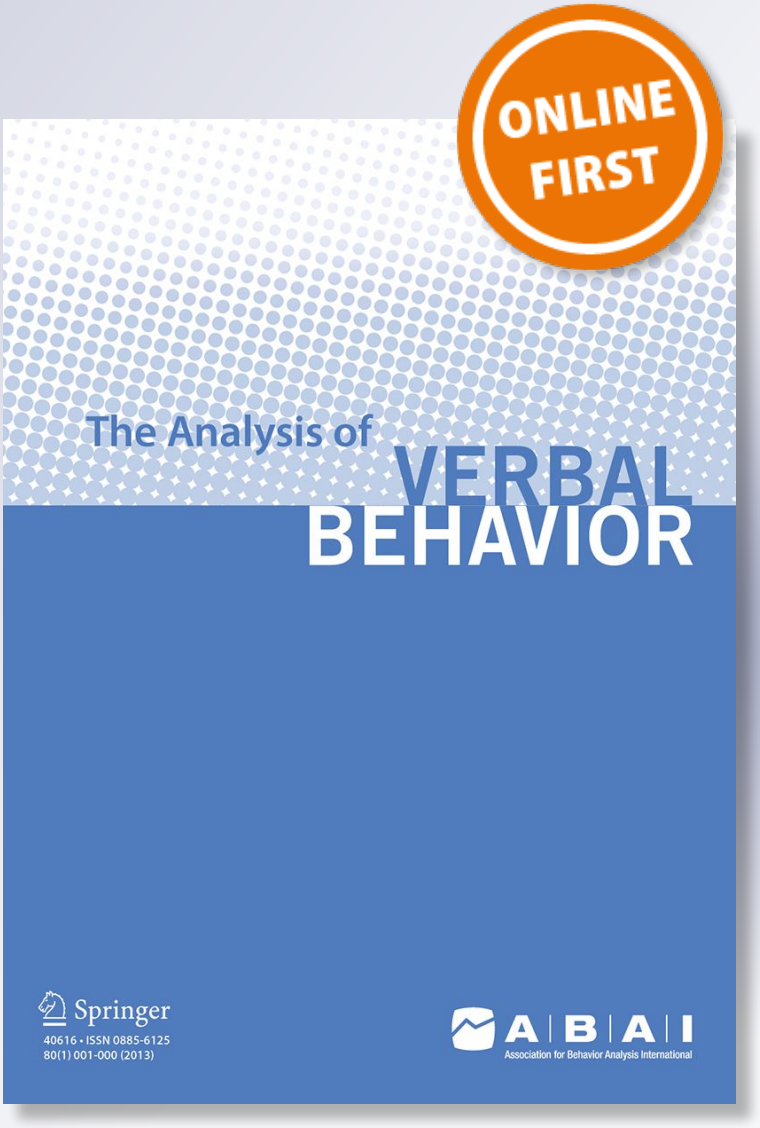

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Establishing Concurrent Mands for Items and Mands for Information about Location in Children with Autism

Alexis Somers · Tina M. Sidener · Ruth M. DeBar · David W. Sidener

Abstract This study replicated and extended the methodology used in Howlett et al. (*Journal of Applied Behavior Analysis*, *44*, 943–947 2011) to bring the mands "Where's (item)?" and "I want (item)" under appropriate antecedent control in two boys diagnosed with autism. Trials were alternated in which items were present, missing, and within view (but inaccessible) and missing and out of view. To program for generalization, fifteen items, multiple trainers, and multiple settings were used during teaching. For both participants, manding generalized to novel items, instructors, settings, and situations and maintained after 2 weeks following teaching. Results of the social validity assessment indicated that school staff found the procedures highly acceptable.

Keywords Mand · Location · Information · Autism

Many learners with autism require specific training to learn to mand for information about the location of items (e.g., "Where's the ball?"). There is a growing body of literature demonstrating methods for establishing information about location as a conditioned reinforcer and bringing this type of mand under the control of relevant establishing operations (EOs). The typical arrangement of these studies is to contrive EOs by removing a high-preference item from a view (e.g., Betz et al. 2010; Endicott and Higbee 2007; Howlett et al. 2011; Sundberg et al. 2002) or removing an item from a view that is part of a chain resulting in the access of a high-preference item (e.g., Lechago et al. 2010; Shillingsburg et al. 2011). Vocal prompts have been provided in vivo (e.g., Betz et al. 2010; Endicott and Higbee 2007; Lechago et al. 2010; Shillingsburg et al. 2011; Sundberg et al. 2002) and via audio-recorded scripts (e.g., Howlett et al. 2011). In some studies, no prompt fading strategy was reported (e.g., Endicott and Higbee 2007; Shillingsburg et al. 2011), while, in others, prompt delay (e.g., Lechago et al. 2010; Sundberg et al. 2002) and/or script fading was used (e.g., Howlett et al. 2011).

Across studies, authors have identified some key components of an effective preparation for teaching the mand, "Where?". First, authors have discussed the importance of demonstrating an EO both for the missing item and for information about location of the item. Deprivation prior to a session may be insufficient for ensuring that there is an EO at the time of teaching. Similarly, identifying an item as high-preference in a stimulus preference assessment may be insufficient for demonstrating an EO for an item unless the assessment is conducted immediately prior to teaching (Betz et al. 2010). To demonstrate an EO for information about location, the location of the item must be unknown, that is, removing an item from a view may be insufficient if

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the location of the item is known (e.g., the cookies are in the cabinet where they are always kept). Second, to demonstrate that mands for information about location are under EO control, it may be necessary to alternate trials in which the item is missing (EO) and not missing (abolishing operation; AO). For example, Howlett et al. (2011) alternated EO and AO trials and found that one participant initially asked, "Where's (item)?" when items were both present and missing. Interspersal of trials in which the item is present allows for analysis of accurate antecedent control and (if necessary) subsequent additional teaching to bring the request under EO control. Third, some authors (e.g., Betz et al. 2010; Shillingsburg et al. 2011) have suggested not providing an instruction such as "Get (item)" because responding may come under the control of the instruction and, thereby, preventing generalization to novel items and situations for some learners. In addition, stating the item in the instruction may function as a prompt. Fourth, previous researchers have commented on the importance of programming for generalization. For example, Lechago et al. (2010) conceptualized a mand for location as a partial autoclitic frame (e.g., "Where's") in which multiple responses involving the autoclitic frame ("Where's ball?," "Where's puzzle?," and "Where's train?") must be learned before novel responses (e.g., "Where's car?") emerge. Fifth, authors have stressed the importance of maintenance of mands following training (Shillingsburg et al. 2011). For maintenance of an intervention to be evaluated, researchers might specify how often opportunities to mand for location are given between the end of teaching and maintenance probes. Finally, the social validity of procedures used to teach mands for information about location should be evaluated. Howlett et al. (2011) found that special education teachers and speech pathologists found their procedures to be highly acceptable, but lower scores were reported for a question about willingness to hide toys and record their locations prior to the student's arrival at school.

An issue that has not been specifically addressed in this literature is when in a curriculum sequence "Where?" should be introduced as a target. Studies that have taught the mand "Where?" have reported participant verbal repertoires in a variety of ways, making this variable difficult to compare across studies. However, one commonality across studies is that all participants had learned to mand for some items prior to the intervention.

If "Where" is taught following mastery of mands for (at least some) items, one consideration would be ensuring different antecedent control of the mands "Where's (item)?" and "I want (item)". In observing typically developing children, we noted that mands for items tended to occur when the location of an item was known (but the item was inaccessible), and mands for information about the location of items occurred when an item was not in its typical location and the location was unknown. Because the antecedent control for these mands is different, removing an item from a view may be insufficient for teaching the mand "Where" while also maintaining the mand "I want" under differential EO control. Therefore, the purpose of the current study was to replicate and extend the methodology used in Howlett et al. (2011) to bring the mands "Where's (item)?" and "I want (item)" under appropriate antecedent control. Howlett et al. evaluated the effects of contriving motivating operations (MOs) on the acquisition of the mand "Where's (toy)?" in two boys with language delays. Trials were alternated in which high-preference items were present (AO trials) or missing (EO trials) from their typical locations. Both participants learned to mand during EO trials and not to mand during AO trials during training. However, differential antecedent control of "I want (toy)" and "Where's (toy)?" was not evaluated. In the current study, to demonstrate momentary EOs, preference assessments were conducted prior to each trial. To further demonstrate EO control, instructions specifying the item were not provided, and trials were alternated in which items were present, missing, and within view (but inaccessible) and missing and out of view. To program for generalization, multiple exemplar training with fifteen items, multiple trainers, and multiple settings was used during teaching. Generalization, maintenance, and social validity were assessed.

Method

Participants and Settings

Two boys, aging 8 and 9 years old, participated in the study. Both participants were diagnosed with autism by an independent specialist prior to the study and attended a self-contained public school classroom for children with autism that used behavior-analytic procedures. To be included in the study, participants demonstrated mands for at least 20 items with eye contact in the form,

"I want (item)," but not mands for information about location, based on the *Verbal Behavior Milestones and Placement Program* assessment (*VB-MAPP*; Sundberg 2008).

Sessions were conducted for approximately 30 min once per day five days per week in a 3 m by 4.5 m area in the experimenter's classroom. The area contained a choice board, shelves with toys, and a desk.

Materials and Scripts

For each participant, materials included 15 high-preference toys and 15 corresponding photographs that were laminated and affixed with Velcro® to a 30 cm× 35 cm choice board. Photographs were arranged in a 5 column×3 row format, and each participant's board was within 1.5 yards from a toy shelf. The toy shelf held clear containers with the same laminated photographs that were on the choice board. High-preference toys were available only during experimental sessions.

Auditory scripts were played and faded via a Sony ICD B600 512 MB Digital™ voice recorder. A different file was made for each participant and included a full script and a partial script for each mand for each of the 15 items for each participant. The scripts were recorded by four children matched on age and gender to provide appropriate and socially valid speech models.

Pre-experimental Assessments

Preference Assessment The *Reinforcer Assessment for Individuals with Severe Disabilities* (*RAISD*; Fisher et al. 1996) was administered to caregivers of the participants before the study to identify toys that the participant seemed to prefer. A paired-stimulus preference assessment (Fisher et al. 1992) was conducted with 20 items with each participant, and the 15 top-ranked toys were used for the study.

Choice Board Assessment The purpose of this assessment was to assess whether the participants demonstrated going to the choice board when vocally instructed, selecting a photograph, adhering it to the corresponding photograph on a container on the shelf, and retrieving the toy inside it to play with for 2–3 min. The experimenter presented the choice board and asked, "What do you want?" or "What do you want to play with?". Correct responding resulted in praise and/or access to tokens in the participant's individualized motivation system. Criterion for this assessment was independent performance with all photographs/toys for 2 consecutive sessions. Both participants had learned this sequence prior to the study and met criterion for this assessment without training.

Location Assessment The purpose of this assessment was to assess whether the participants demonstrated going to a location when instructed to do so. Ten locations were assessed that would be used for hidden toys in the study (e.g., sink, closet, and someone's desk). Participants were given the instruction, "Go to (location)" and given 5 s to go to the given location. Correct responding resulted in praise and/or access to tokens in the participant's individualized motivation system. Criterion for this assessment was independent performance with all locations for 2 consecutive sessions. Both participants met criterion for this assessment without training.

Voice Recorder Assessment The purpose of this assessment was to assess whether the participants demonstrated vocal imitation of models from the voice recorder. The experimenter stood approximately 0.5 m from the participant and played five 3- to 6-word statements and questions (not targets) from the voice recorder. Correct responding resulted in praise and/or access to tokens in the participant's individualized motivation system. Criterion for this assessment was imitating all models within 3 s for 2 consecutive sessions. Both participants met criterion for this assessment without training.

Design and Data Collection

A concurrent multiple-baseline design across participants was used to evaluate the effects of the intervention. Each session comprised fifteen trials, five of each of the following trial types: *Item Present* trials, *I Want* trials, *Where* trials. During *Item Present* trials, a response was scored as correct if the participant went to the shelf, adhered the photograph to the corresponding photograph, removed the toy from the container within 5 s, and did not mand for the item or information about location. During *I Want* trials, a response was scored as correct if within 5 s of matching the photograph the participant manded "I want (toy)" with eye contact (as defined as head orientation within 45° of the teacher's face for 2 s before, 2 s after, and/or during the mand) with the teacher who was holding the toy (within view).

During *Where* trials, a response was scored as correct if within 5 s of matching the photograph the participant manded "Where's (toy)?" with eye contact with the teacher. Event recording was used to collect trial-by-trial data on correct (unprompted) responding during each trial type, and data were summarized as the percentage of correct trials of each type per session. Criterion for mastery was 100 % across all trial types for 2 consecutive sessions. The assignment of toys to *Item Present*, *I Want*, and *Where* trials during each session was quasi-random. The order of trials for each session was determined by the order in which the participant selected the photographs from the choice board.

Experimental Procedure

General Procedures During all trials, when the participant removed a photograph from the choice board, matched the photograph to the corresponding photograph on the container on the shelf, and looked inside the container, he found that the toy was sometimes present and sometimes missing (counterbalanced across trials). Once a photograph was selected, it was not replaced on the choice board until the next session. Each participant's current token system was always present to reinforce on-task behavior and mastered skills during maintenance trials. Tokens were not delivered contingent upon choice making, manding, or locating toys. Sessions were videotaped for subsequent data collection.

Baseline (No Script) During *Item Present* trials in the baseline, when the participant found the toy in the matching container, he removed it and played with it for 2–3 min. A timer was set to signal that it was time to clean up and put the toy away. During *I Want* trials, in which the toy was not in the container but was in the teacher's hands (within view), if the participant manded, "I want (item)" (with eye contact), he was given the item and allowed to play with it for 2–3 min. During *Where* trials, in which the toy was not in the container, nor in the teacher's hands, if the participant manded, "Where's (item)?" (with eye contact), he was told the location of the item and allowed to go to the location and obtain the item to play with for 2–3 min. If the participant did not respond correctly within 5 s of looking at the teacher, he was given a mastered task, and the trial was terminated.

Mand Training During *I Want* trials, after the participant looked in the container and then at the teacher, if he did not respond by manding "I want (item)" within 5 s, an audiotaped full script was played (e.g., "I want puppet"). All scripts were played via the voice recorder approximately 0.5 m from the participant and out of his view. When the participant repeated the script, he was given access to the item. This was a previously mastered skill and was implemented infrequently. During *Where* trials, after the participant looked in the container and then at the teacher, if he did not respond by manding, "Where's (item)?" within 5 s, an auditory script was played via the voice recorder. When the participant repeated the script, he was told the location of the item, went to that location, obtained the toy, and played with it for 2–3 min. After meeting criterion during the full script condition (i.e., 100 % correct responding, with or without scripts, across all 3 conditions for 2 consecutive sessions), a baseline (no script) probe was conducted to test for independent manding. If the participant responded at 100 % accuracy for 2 consecutive sessions independently, generalization probes were conducted.

Because Rob did not respond correctly during all *Where* trials during the baseline probe, a partial script prompt condition was implemented in which the prompt "Where's" was played during *Where* trials. After Rob emitted a correct unprompted response (or within 5 s of being given the partial script "Where's") with 100 % accuracy across all 3 conditions for 2 consecutive sessions, a baseline probe was again conducted to assess independent responding in the absence of the script prompt. When Rob still did not meet criterion, the partial script condition was conducted again until criterion responding. When he met the criterion during the subsequent baseline probe, generalization probes were conducted.

Generalization and Maintenance Generalization was assessed in both pre- and post-treatment sessions with novel instructors, settings, items, and situations. During these sessions, *Item Present* trials, *I Want* trials, and *Where* trials were each conducted 5 times, with 5 different trial types (i.e., novel instructor, novel setting, novel items, 2 natural situations). Natural situation probes were activities in each participant's daily routine (e.g., getting an instrument during music time and trading in tokens for a snack). During *Item Present* generalization trials, an item essential to the activity (e.g., instrument and snack) was present. During *I Want* generalization

trials, the item was in the teacher's hands instead of in its typical location. During *Where* generalization trials, the item was not in its typical location or in the teacher's hands. Maintenance probes were conducted at 2 weeks following the completion of the study. Following training, teachers were asked to ensure that the participants were given at least five opportunities to mand for location and items each day during the time between the conclusion of the study and the maintenance probe.

Interobserver Agreement (IOA) and Treatment Integrity

Secondary data were collected during at least 45 % of randomly selected sessions across all conditions for both participants. An agreement was defined as both observers recording a trial as unprompted correct, prompted correct, or incorrect. IOA was calculated using the point-by-point agreement method (# of agreements/[# of agreements+disagreements])×100 %. IOA was 100 % for both participants.

Treatment integrity data were collected during randomly selected sessions across all conditions for both participants. Trial-by-trial data were collected on the correct delivery of prompts, availability of items, and correct delivery of consequences and were summarized as the percentage of correct trials per session. Treatment integrity was calculated using the point-by-point agreement method (# of agreements/[# of agreements+disagreements]×100 %). For Rob, treatment integrity data were collected for 33 % of sessions and had a mean of 99.6 % (range, 96 %–100 %), and IOA data on treatment integrity data were collected for 40 % of the sessions of treatment integrity collected and were 100 %. For Vernon, treatment integrity data were collected for 45 % of sessions and had a mean of 99.7 % (97 %–100 %), and IOA data on treatment integrity were collected for 40 % of the sessions of treatment integrity collected and had a mean of 99.25 % (97 %–100 %).

Social Validity

Eight staff members at the participants' school, including 1 occupational therapist, 2 speech therapists, 1 BCBA, 1 physical therapist, 2 school psychologists, and 1 special and general education teacher were invited to complete the social validity questionnaire about the acceptability of the procedures in the current study (on a scale of 1–5, with 5 being very acceptable and 1 being not acceptable at all). Each staff member completed the questionnaire alone and was either shown a video of the procedures of the study or watched a participant in a study session.

Results

Data for both participants are shown in Fig. 1. As can be seen in the top panel, during baseline, Vernon responded correctly during at least 80 % of *Item Present* and *I Want* trials. However, he did not mand correctly during *Where* trials. During full script mand training, Vernon repeated the script during *Where* trials during the first two sessions; during the third session, he began to mand for information independently before the script was played. Criterion for mastery of this condition was met after 7 sessions. Subsequently, Vernon responded correctly and independently during all *Item Present*, *I Want*, and *Where* trials during a return to baseline (no script), generalization probes, and a 2-week maintenance probe.

As can be seen in the bottom panel, during baseline, Rob did not mand correctly during *Where* trials. During the first three sessions, his correct responding during *I Want* and *Item Present* trials was variable; however, as he continued to be exposed to trials in baseline, his correct responding during these conditions increased to 100 % in the absence of further intervention. During full script mand training, Rob met the criterion by repeating the script during *Where* trials for two consecutive sessions; however, during a return to baseline (no script), he did not mand "Where's (toy)?" independently during any trials. When partial script fading was implemented, Rob again met the criterion by repeating the partial script (plus toy) and sometimes independently manding "Where's (toy)?" When independent manding was low during a return to baseline, the partial script condition was implemented again. After two sessions in this partial script condition, Rob began manding "Where's (toy)?" independently. Subsequently, Rob responded correctly and independently during all *Item Present*, *I Want*, and *Where* and trials during a return to baseline (no script), generalization probes, and a 2-week maintenance probe.

Results of the social validity assessment indicated that the school staff found the procedures highly acceptable (M=4.4; range=2–5). The lowest scores were given on questions about using and fading audio-recorded scripts.

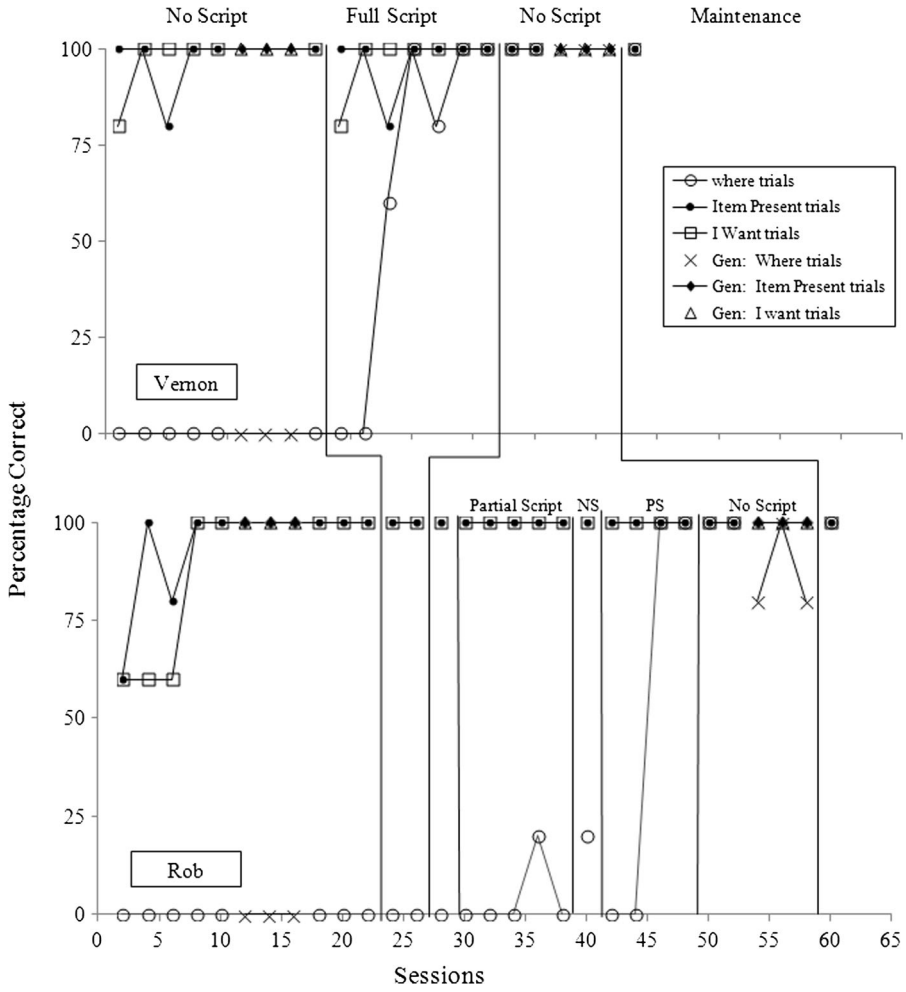

Fig. 1 Percentage of trials of correct responding per session during *Item Present* trials, *I Want* trials, and *Where* trials for Vernon (*top* panel) and Rob (*bottom* panel). Note: *NS*=No script; *PS*=Partial script

Discussion

The current study replicated and extended the procedures of Howlett et al. (2011) to bring mands for items and mands for information about location under appropriate antecedent control. Both participants with autism learned to differentially mand, "Where's (item)?" and "I want (item)," for information and items. In addition, they learned not to mand when an item was in its typical location. To our knowledge, this was the first study to evaluate a procedure for bringing these repertoires under differential functional control. Although programs for learners with autism may include separate programs for teaching these repertoires, it has been our observation that programs often do not typically arrange teaching for both repertoires maintained by accurate antecedent control. Results of the current study may provide clinicians with methods to arrange teaching for these repertoires.

Issues raised in previous research on mands for information about location were addressed in the preparation of the current study. First, to demonstrate momentary EOs, preference assessments were conducted prior to each trial. To further demonstrate EO control, instructions specifying the item (e.g., "Get puppet") were not provided, and trials were alternated in which items were present, missing but in the teacher's hand, and missing and out of view. It should be noted, however, that trials were not arranged in which the item was missing from its typical location but could be found within view in a different location. During "I want" trials, the participant looked in the container, found the item was missing,

looked at the teacher, and saw the teacher holding the item. Future studies might also teach and/or assess trials in which the participant sees that the item is not in the teacher's hands, but is in another location that should evoke the mand "I want (item)" (e.g., in another student's hands, up on a shelf) or should evoke retrieving the item without a mand (e.g., on the floor several feet away). Inclusion of these trials would presumably reinforce searching behavior concurrently with manding.

Second, multiple exemplar training with items and instructors was employed to program for generalization to novel items and instructors. When generalization was assessed, both Vernon's and Rob's manding generalized to novel items, instructors, settings, and natural situations (i.e., interrupted chains). Although the items removed during the natural situations were not demonstrated to be of high preference (and no EO was demonstrated), the situations and items were selected based on observations that the activities appeared to be reinforcing for each participant.

Third, maintenance of manding was programmed for by asking teachers to (minimally) offer 5 opportunities to mand for items and for information about location every day between the end of training and the maintenance probe. After 2 weeks, manding for information was maintained by both participants. Future studies might specify opportunities for manding between the end of teaching and maintenance probes to program for maintenance and assess maintenance for longer than 2 weeks.

Finally, social validity was assessed as in Howlett et al. (2011). Overall, the procedures were rated as highly acceptable; however, lower scores were given regarding the use of audio-recorded scripts. Comments from the respondents indicated that the use of audio-recorded scripts would be acceptable for students with autism in special education settings, but not in general education settings. In the current study, audio-recorded scripts were used (1) to facilitate discrimination between language to be imitated (i.e., vocal prompts) and language to respond to (e.g., "What do you want to play with?") and (2) to provide multiple, gender- and age-appropriate models of language. Future studies might specify these rationales for the use of audio-recorded scripts in social validity assessments. Interestingly, the mean response to the item "Hide toys and record their locations prior to the student's arrival to school" was 4.5 (range, 4–5). This differs from the findings of Howlett et al. (2011), in which lower ratings were given for these items. Taken together, these social validity findings suggest that clinicians and researchers might survey teachers/interventionists prior to implementation of this type of intervention to determine methods that will be socially acceptable in specific settings.

A limitation of the current study is the inclusion of only two participants. One participant required script-fading, while the other participant did not. Therefore, further replication of these procedures is needed. Another area for future research in this area is teaching differential control of mands such as "I want (item)" and "Help me."

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