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INCREASING RESPONSE VARIABILITY OF MAND FRAMES WITH SCRIPT TRAINING AND EXTINCTION

ALISON M. BETZ, THOMAS S. HIGBEE, KRISTEN N. KELLEY, TYRA P. SELLERS, AND JOY S. POLLARD

UTAH STATE UNIVERSITY

We examined the effects of script training and extinction on response variability of mand frames used by children with autism. Results demonstrated that extinction following script training was effective for increasing variability for 2 of the 3 participants.

Key words: extinction, mands, script training, variability, verbal behavior

Children with autism often demonstrate less variable behavior than their typically developing peers and those with other cognitive disabilities (Frith, 1972). This lack of variability may have detrimental effects and result in a loss of reinforcement for appropriate behavior. An individual who has acquired only one effective form of appropriate behavior in a response class will not be able to access reinforcement if that form is placed on extinction. A possible reason for lack of response variability emitted by children with autism is that they do not have a variety of response forms in their repertoire.

Multiple-exemplar training through the use of scripts is one strategy that has been used to build verbal repertoires of children with autism (McClannahan & Krantz, 2005). Research findings have demonstrated that using scripts can increase the frequency of scripted and unscripted responses (i.e., responses that consist of recombined elements of scripted statements or additions of new or different nouns, verbs, or both; Lee, Sturmey, & Fields, 2007). An increase in unscripted responses may suggest increases in response variability; however, authors typically report only the total number of unscripted responses and not the number of different or novel responses, which makes it difficult to draw conclusions about the amount of variability demonstrated.

Extinction also has been shown to increase response variability (e.g., Goetz & Baer, 1973; Harding, Wacker, Berg, Rick, & Lee, 2004; Lalli, Zanolli, & Wohn, 1994). To promote extinction-induced variability, reinforcement is typically provided the first time a particular response topography is emitted, after which that response form is no longer reinforced.

Given the effectiveness of script training in increasing verbal repertoires and the effectiveness of extinction for increasing response variability, we attempted to evaluate the effectiveness of these procedures, in isolation and in combination, on the response variability of young children with autism as they requested preferred items during snack time.

METHOD

Participants, Setting, and Materials

Participants (Jill, Travis, and Drew) were all preschool aged (3 to 4 years old) and had been diagnosed with autism. They communicated vocally using a minimum of three-word phrases; prior to the beginning of the study they used at least one, but no more than two, mand frames

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Alison Betz is now at the Florida Institute of Technology.

Address correspondence to Thomas S. Higbee, Department of Special Education and Rehabilitation, Utah State University, 2865 Old Main Hill, Logan, Utah 84322 (e-mail: tom.higbee@usu.edu).

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to request snack items (e.g., "I want —," "I need —"). Sessions were conducted in the participant's home (Jill) or preschool classroom (Drew and Travis) during a simulated snack time.

Auditory scripts were presented via a voice recorder button. The voice recorder button was a circular device approximately 5 cm in diameter with a small button in the center. The participant activated the recorded script by pressing the button. A colored sticker associated with each script was placed on the button when that particular script was presented (e.g., a red sticker was associated with the script, "Can I please have —?").

Design, Response Measurement, and Interobserver Agreement

An ABAB design was used to determine the effects of script training and extinction on the number of novel mand frames. A mand frame was defined as a verbal request consisting of a subject (i.e., *I, we*), verb (e.g., *want, need*), and noun (i.e., the relevant snack item). A novel mand frame was defined as one that varied from any frame previously used in the current session beyond adding or subtracting any (or combination) of the following: (a) articles and conjunctions, (b) the word please, or (c) the instructor's name. For example, if the participant first stated, "I want cookie, please," and then said, "I want some cookies," the latter would be scored as a novel mand frame. In contrast, if the participant said, "I want cookie, Tom," this would not be scored as a novel mand because the only variation was the addition of the instructor's name. Novel mand frames were only scored within each session, and the first mand frame in each session was always scored as a novel mand frame. Observers used paper and pencil to transcribe word for word each mand frame emitted in the exact order in which it was emitted; this resulted in a chronological list of mand frames used during each session and allowed the researcher to immediately judge whether a given mand frame was novel.

Interobserver agreement data were collected for all participants during at least 30% of sessions. To calculate interobserver agreement, we compared each mand frame on the chronological list recorded by the observers. An occurrence was scored as an agreement if the mand frame recorded by both observers matched word for word. We then divided the number of agreements by the total number of occurrences of mand frames and multiplied that fraction by 100%.The mean agreement score across participants was 98%. Agreement for all sessions ranged from 63% to 100% across participants. Treatment fidelity data were collected on the accuracy of researcher implementation of prompting and reinforcement procedures for at least 30% of sessions. The mean treatment fidelity score across participants was 97% (range, 81% to 100%).

Procedure

Prior to the study, the experimenter used manual guidance to teach all participants to use the voice recorder. Throughout the study, sessions were conducted one to four times per day, 3 to 5 days per week, and were 5 min in duration. Each session began with a modified brief preference assessment that included 10 snack items, using procedures similar to those described by Carr, Nicolson, and Higbee (2000). The first three snack items the participant chose were used for the following experimental session. At the beginning of each session, the experimenter presented the snack items. If 30 s elapsed without the participant manding for a snack item, the researcher prompted a response by either stating, "pick one" (baseline and extinction phases) or manually prompting the participant to use the script (script training). Incomplete mand frames and inappropriate behaviors were ignored throughout the study.

Baseline. The experimenter reinforced all mand frames by providing access to the item requested.

Extinction. The experimenter reinforced each mand frame the first time it was emitted by the

participant during a session. After the participant emitted a mand frame, it no longer resulted in reinforcement for the remainder of the session.

Script training. The experimenter taught the participant to emit three mand frames, one during each phase, using script-training procedures. Scripted and unscripted mand frames were reinforced with access to the relevant snack item. Each session began with the voice recorder button that contained the target auditory script, placed in front of the student on a placemat labeled with his or name. The experimenter manually guided the participant to use the script (i.e., press the voice recorder button) if he or she did not emit a request or if he or she used any mand frame other than the target script for two consecutive requests. Scripts were faded using the following steps: (a) The full script was presented via the voice recorder button (i.e., ''I would like''); (b) the last word was removed from the script (i.e., ''I would,'' then ''I''); (c) only the voice recorder button was present; and finally, (d) only the colored sticker was present. The script was faded each time the participant followed the target script for 90% of opportunities for one session. We faded scripts independent of button pressing or sticker touching so that we could continue to prompt use of the targeted script instead of previously taught mand frames if the participant used two nontarget scripts consecutively.

Maintenance. Following each script-training phase, we evaluated the extent to which the participant used the previously taught mand frame in the absence of the auditory button. Procedures were identical to those in baseline.

Alternate intervention (Drew). An alternate intervention was implemented with Drew after he showed only minor increases in the variability of mand frames following the previous conditions. Sessions were similar to those in script training except that all three auditory scripts were present during each session. Prompting procedures were similar to those used in the previous script-training condition except that the experimenter prompted one of the three scripts in a semirandom fashion. Scripts were faded simultaneously after two consecutive sessions in which Drew independently responded during 90% of opportunities (i.e., button pushes) for one session. Script fading was similar to that described above, except that the experimenter removed more than one word at a time.

Generalization and follow-up. Follow-up probes were conducted 1 and 2 weeks following the completion of the study. Follow-up probes were identical to baseline (for Jill and Travis) or the alternate intervention (for Drew). Following the 2-week follow-up session, a generalization probe was conducted during routine snack time for each participant. Three to four other people (i.e., students or family members) were present during generalization probes. The alternate intervention remained in place during Drew's generalization probe.

RESULTS AND DISCUSSION

The number of novel mand frames displayed by Jill, Drew, and Travis are shown in Figure 1. The arrows indicate the sessions in which script-fading steps were implemented. During baseline, all participants emitted zero or one novel mand frame per session. The levels of novel mand frames remained low for all participants during the first extinction condition (i.e., the condition prior to initial script training). These data suggest that extinction in the absence of teaching multiple mand frames via script training did not increase response variability.

For all participants, however, the number of novel mand frames emitted increased after multiple script-training conditions. Two participants (Jill and Travis) emitted more novel mand frames during extinction after consecutive training of three scripts than during previous exposures to extinction. In the final extinction condition, Jill used as many as four novel mand frames and Travis used as many as five novel

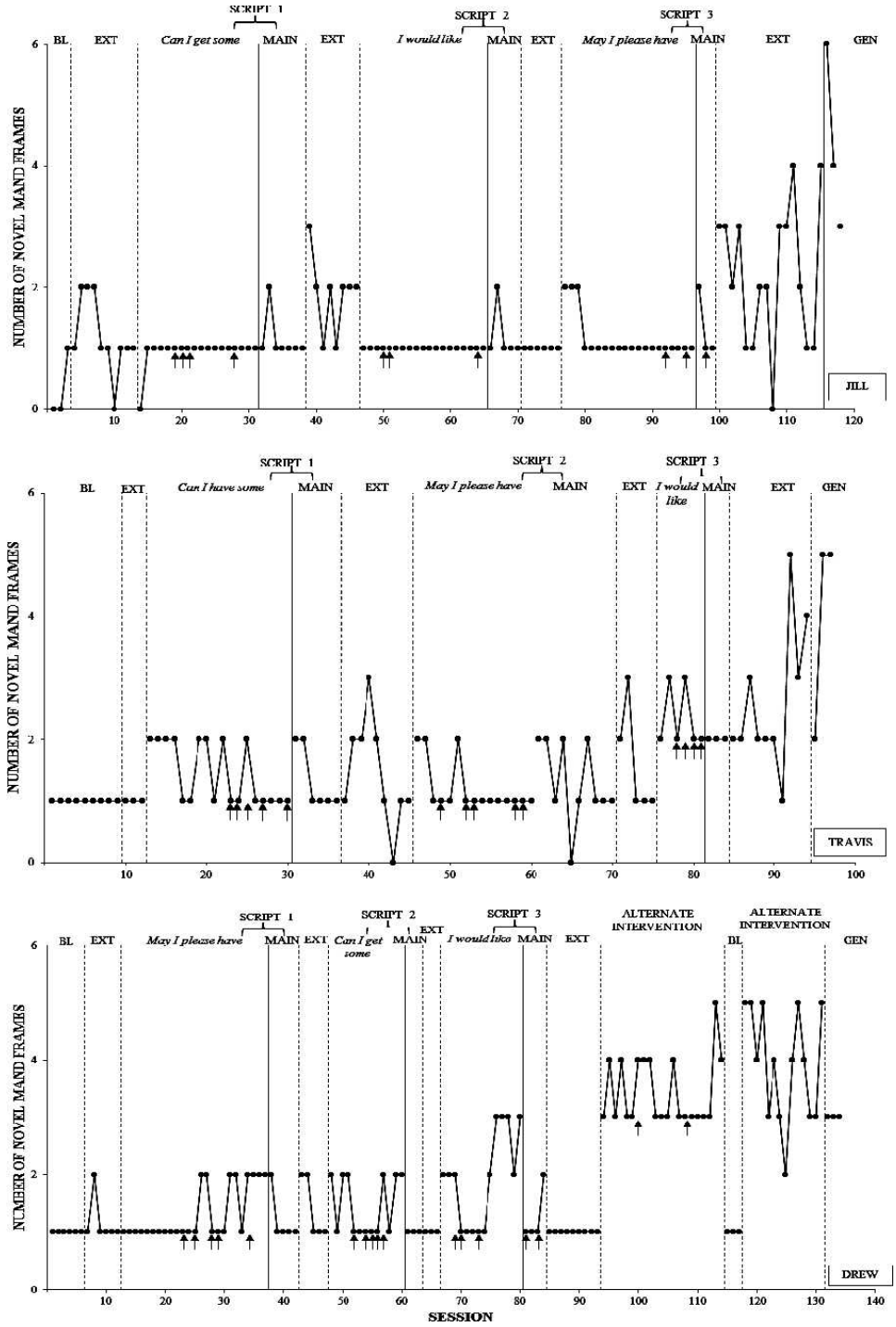

Figure 1. Number of novel mand frames during each session for Jill (top), Travis (middle), and Drew (bottom) during baseline (BL), extinction (EXT), script training (Script X), maintenance (MAIN), and generalization (GEN). Arrows indicate script-fading steps.

mand frames per session. These levels were maintained for both Jill and Travis during the follow-up and generalization probes. The number of novel mand frames Drew used remained low after consecutive training with three scripts and during the final extinction condition. However, during script training, he repeatedly emitted more novel mand frames as the scripts were faded (i.e., toward the end of each script-training condition). Thus, we implemented the alternate intervention in which all scripts were present at once. During this condition, Drew emitted as many as five novel mand frames during a session. However, he used only the three frames that were taught via script training during the follow-up and generalization probes.

Results showed that extinction prior to script training was not sufficient to produce variable mand frames. Furthermore, simply teaching new mand frames via script training also did not increase variability. Variability in responding did not increase until we combined the teaching of multiple mand frames with extinction. Although the results of the current investigation are promising, these data are preliminary and should be interpreted with caution due to several limitations. First, the definition of a novel mand frame may have been too stringent. As an alternative, we could have included the addition of any words, conjunctions, or articles as creating a novel mand. However, we restricted our definition of novel mand frames to take a more conservative approach. Therefore, these data may underestimate the level of response variability that actually occurred. Second, we prompted participants to use the target auditory script during script training following the use of two consecutive mand frames other than the target frame. Although these procedures promoted the acquisition of the target script, they may have also limited the opportunity to demonstrate variability by continually prompting the participant to use the same script. Third, our data-collection procedure may have affected the interobserver agreement data. If, for example, an observer completely missed an occurrence of a mand frame, it resulted in disagreements for all of the following responses on the chronological list. In future studies, observers should use a method of data collection that indicates not only the occurrence of a mand frame but also when it occurred during the observation (e.g., interval or real-time recording). Finally, inconsistent behavior reversals during the extinction conditions may have compromised functional control. For example, the number of Jill's novel mand frames increased following training with the first and third script but not the second script. Given the preliminary stages of this research, future research should continue to investigate the effects of these procedures and others (e.g., reinforcing response variability; Napolitano, Smith, Zarcone, Goodkin, & McAdam, 2010) on the variability of verbal behavior, perhaps by replicating the current investigation with less stringent response definitions or by testing these procedures as strategies to teach other verbal operants such as tacts or intraverbals. Future research may also investigate whether the sequence of conditions used in our study affected variability. For example, the lack of novel mand frames observed during early extinction conditions may have been influenced by the preceding maintenance condition. Finally, the length of script-training conditions and the fact that we taught scripts sequentially may have influenced the degree of variability observed. Researchers may consider varying the length of script-training conditions or teaching the scripts simultaneously to determine if these procedural variations promote greater variability.

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