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BRIEF REPORT

Mands for Information Using "How" Under EO-Absent and EO-Present Conditions

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Abstract The present study replicates and extends previous research on teaching "How?" mands for information to children with autism. The experimental preparation involved mand training in the context of completing preferred activities and included training and testing under conditions when the establishing operation (EO) was present and absent. Results show that two children with autism acquired mands for information using How? only in situations where information was valuable (i.e., the EO was present); they then consistently made use of the information provided in activity completion. Generalization to novel, untaught situations was assessed.

Keywords Abolishing operation · Establishing operation · Mands for information · Verbal behavior

Research on mands for "information" have focused on manipulating establishing operations (EOs) and have included mands using who, what, where, and which questions (Endicott and Higbee 2007; Lechago et al. 2010; Marion et al. 2012; Shillingsburg et al. 2011, 2013b; Shillingsburg and Valentino 2011; Williams et al. 2000). The information obtained via these types of mands can be conceptually defined as a conditioned reinforcer for the mand and a discriminative stimulus (S^D) for subsequent behavior that leads to a terminal reinforcer. Less is known about teaching mands using "How?" Asking How? is a pivotal skill that can have a critical impact on learning if targeted in a clinical or educational setting. After this skill is acquired and generalizes to the natural environment, it can provide innumerable opportunities for independent learning from the environment and peers. How? mands have rarely been evaluated in the literature presumably due to the difficulty in contriving the necessary EOs as highlighted in a recent study (Shillingsburg and Valentino 2011).

Specifically, first, one identifies preferred activities that the individual cannot complete independently. Following the mand How?, information regarding *how* to complete the task is provided, subsequently abolishing the EO, because the individual can now complete the task. Therefore, that task may no longer be used during teaching, underscoring the importance of assessing and programming for the generalized use of the mand How?. It is not sufficient to show acquisition of the mand How? during teaching because future use in those situations may not be necessary. For the skill to be meaningful, generalized use in various untrained and novel situations must occur. Generalization of the mand How? using two distinct mand frames has been examined by Lechago et al. (2013). Additionally, as unknown tasks become known through the provision of information, the EO-present scenarios may become EO-absent scenarios, emphasizing the necessity to carefully examine teaching the mand for information "how" under appropriate EO conditions. Although the procedures employed by Shillingsburg and Valentino (2011) were successful, there were limitations including lack of assessment

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under EO-absent conditions. It is possible that the How? response was emitted when information regarding how to complete a task was needed but may also has been emitted when not needed, suggesting a lack of EO control. If the response also occurs when the EO is absent, other controlling variables are likely responsible (e.g., S^Ds). In the case of mands for information, lack of information serves as an EO to evoke the mand. Lechago et al. (2013) included one control behavior chain to demonstrate that mands for information only occurred in the chains in which information was needed. Demonstrating the EO as an independent variable bolsters the assertion that the response is functioning as a mand. It may be beneficial to include numerous EO-absent scenarios throughout mand training and assessment to ensure EO control.

Empirical demonstration of behavior in the presence and absence of the EO using numerous opportunities throughout mand acquisition trials has been shown in previous studies when teaching mands to remove an aversive stimulus (Shillingsburg et al. 2013a) and when teaching mands for information using "who" and "which" (Shillingsburg et al. 2013b). In both studies, all participants emitted mands only under EO-present conditions empirically demonstrating the EO as the controlling variable. The current study replicates and extends the previous research on teaching mands for information using How? by replicating findings across two participants and including EO-present and EO-absent conditions posttraining and by assessing generalization to novel situations.

Method

Participant, Setting, and Materials

Two males, Josh (7 years old) and Doug (3 years old), diagnosed with autism served as participants. At the time of the study, Josh emitted spontaneous vocal requests for preferred items and activities using short phrases and sentences and requested information using "wh" questions (e.g., "Who?" and "Where?"). He consistently responded to verbal instructions as a listener, emitted over 100 tacts, used carrier phrases, and emitted approximately 90 intraverbals. Doug's mand repertoire consisted of high rates of multiple-word vocal phrases using mand frames. He also consistently responded to verbal instructions as a listener, emitted at least 50 tacts for common items, and emitted approximately 50 intraverbals in the form of answering wh questions. Neither participant manded with How? to access information.

Sessions were conducted in a classroom, computer room, or an area containing a microwave, telephone, and vending machines. Materials included items necessary to complete preferred activities such as pictures of cars, DVDs, walkie talkies, telephone, camera, and iPad.

Response Measurement

Trial-by-trial data were collected on independent responses during baseline and posttraining and independent and prompted responses during mand training. Task completion data were collected for all phases. An independent mand consisted of the vocal responses How? for Josh and "How do I do it?" for Doug when the EO was present and prior to a prompt. Prompts consisted of the vocal response How? for Josh and a textual prompt (i.e., a card with the printed sentence, How do I do it?) for Doug. Mands emitted within 5 s of a prompt were recorded as prompted. An incorrect mand was scored when no response or a response other than the target mand was emitted within 5 s of an indicating response (i.e., eye contact with therapist, guiding therapist's hand towards the activity, persisting incorrectly, or verbally asking the therapist to complete the task). Completion of a task was defined as the participant independently emitting any appropriate and task-relevant behavior that corresponded with the information provided by the therapist. Task completion was scored when the participant engaged in task completion within 5 s of the information being provided or completed it independently without the information. If the participant did not independently complete the task or did not begin the task within 5 s of the provided information and independently complete the task, task completion was scored as not completed.

Point-by-point interobserver agreement (IOA) was calculated by dividing the number of agreements by the number of agreements and disagreements and converting to a percentage. An agreement occurred when both observers recorded the same response on the same trial. A second independent observer collected data for all dependent variables. Agreement data were collected during 29.1 % of trials for Josh and averaged 96.1 % (range, 66.7–100 %) and during 51.4 % of trials for Doug and averaged 98.1 % (range, 66.7–100 %).

Procedural fidelity was measured via a five-item checklist of therapists' behaviors and included providing the appropriate S^D, implementing the appropriate delays and consequences, providing the pertinent information, and terminating the trial contingent on the participant's nonresponse. Procedural fidelity was calculated by summing the number of correct procedures and dividing by the total number of relevant procedures per trial and converting to the ratio to a percentage. Procedural fidelity was 100 % and was assessed for 21.7 % of trials for Josh and was 98.7 % and was assessed for 20.9 % of trials for Doug.

Experimental Design

An alternating treatment design was used to compare the effects of mand training during EO-present and EO-absent conditions. A nonconcurrent multiple-baseline design across participants was used to demonstrate replication of the treatment effects.

Procedures

Pretraining Assessment We identified preferred activities that participants completed independently or needed help to complete. Preferred activities were identified by asking if the participant wanted to engage in an activity. Each participant indicated interest by vocally replying "yes" and/or engaging with the materials. The participant was allowed to attempt all activities. Independently completed tasks were categorized as "known" preferred activities and used during the EO-absent condition. Incomplete tasks were categorized as "unknown" preferred activities and were used during the EO-present condition. Neither participant indicated "no" for an activity or refused to complete an activity.

Numerous activities were included to ensure a sufficient number of teaching opportunities because after information was provided, its status could change from unknown to known. For Josh, a preferred spelling activity that included both known and unknown words was identified. Josh frequently requested to spell car names by writing the word. Josh spelled some vehicle names independently, but he required help with others. Approximately 60 unknown and known names of cars were used exclusively during teaching trials. Eight nonspelling tasks were assessed for generalization: four unknown and four known (Table 1). For Doug, 46 known tasks and 27 unknown tasks using five different activities (Table 2) were included.

General Procedures

EO-Present Trials Prior to a trial, preferred activities identified during the pretraining assessment were available to the participant. The therapist asked the participant if he wanted to engage in the activity. A trial began following an indication of motivation to complete the activity after which the therapist provided the initial instruction. For example, if Josh indicated preference for spelling, the therapist verbally instructed him to spell an unknown word (e.g., "Spell Bugati"). If Doug indicated current preference for computer games, the therapist presented verbal instructions to complete an unknown step (e.g., "Plug in the mouse").

EO-Absent Trials Prior to a trial, preferred activities identified during the pretraining assessment were available to the participant. The therapist asked the participant if he wanted to engage in the activity. A trial began following an indication of motivation for the activity. The therapist presented the instruction for a known task (e.g., "Spell Ferrari" for Josh or "Press Play" for Doug), after which the participant was given the opportunity to complete the task.

Activities were initially designated as EO present or EO absent. Some of Doug's activities were presented multiple times throughout teaching; thus, he learned to complete some tasks. These tasks were reclassified as EO absent during that trial and subsequent trials.

Baseline EO-present and EO-absent conditions were presented semi-randomly across trials without prompts. During EO-present trials, if the participant asked How?, the therapist provided the needed information and the participant was given an opportunity to complete the task. If the participant emitted an incorrect response (e.g., repeated the instruction, completed the task incorrectly) or did not respond, the trial was terminated. During EO-absent trials, no consequences were provided for the response How? and persistent incorrect completion of the task resulted in trial termination; however, neither occurred. For both conditions, after the task was completed or after 5 s of no attempt, the trial was terminated and the therapist initiated the next trial. Tasks were not

Table 1 EO-present and EO-absent activities for Josh

	EO-present	EO-absent
Teaching activities	Unknown spelling words	Known spelling words
Generalization activities	Remote with no batteries	Making popcorn
	Use a walkie talkies	Opening a Capri Sun
	Opening a locked cabinet	Volume of TV with remote
	Using the phone	Turn TV on
	Plug in a TV	Play DVD with remote

repeated during baseline. That is, no word (Josh) or task (Doug) was presented twice during baseline.

Mand Training An average of 10 trials per day was conducted for Josh and an average of five trials for Doug. Trials were interspersed with regular language programming and were typically completed within an hour and presented any time within the participant's 3-h clinic attendance. Vocal prompts were used for Josh and textual prompts for Doug. During EO-present trials, an initial 0-s prompt delay was employed (i.e., the therapist immediately prompted How?). When at least eight trials had been conducted and the participant had responded correctly to the prompt for three consecutive trials, a 2-s prompt delay was incorporated to allow an opportunity for an independent response. Additional prompt delays were adjusted individually. The acquisition criterion consisted of manding prior to the prompt for 9 out of 10 consecutive trials. For EO-present trials, contingent on a prompted, or independent mand for information, the experimenter provided information and allowed the participant to complete the activity. The therapist also provided verbal praise and joined in the activity the participant had initiated. Incorrect responses resulted in termination of the trial.

During EO-absent trials, a 5-s delay was provided following the therapist instruction. If the participant initiated the activity, he was allowed to complete it. If the participant did not engage in the activity or emitted How?, the trial was terminated. Neither participant emitted the mand How? during this condition.

Posttraining Following acquisition of the mand How?, posttraining trials were conducted under baseline conditions. EO-present trials consisted of activities that were presented in baseline and mand training, but for which, the participants still did not complete the task independently (unknown spelling words for Josh and unknown activities for Doug). EO-absent trials consisted of known activities that were presented in baseline and mand training.

Generalization Generalization trials were conducted to assess manding during novel, untaught activities. Activities were those presented in baseline, but never during teaching. Trials were conducted identically to baseline and a minimum of 30 min following any prompted trials. If generalization was not observed, teaching trials were conducted similarly to mand training. To further assess generalization, trials of untaught activities were conducted after each additional activity was taught.

Table 2 EO-present and EO-absent activities for Doug

	EO-present	EO-absent
Teaching activities	Unknown computer activity (9)	Known computer activity (6)
	Unknown iPad activity (6)	Known iPad activity (5)
	Unknown container activity (8)	Known container activity (6)
	Unknown camera activity (9)	Known other activity (5)
	Unknown "other" activity (9)	
Generalization activities	Unknown iPad activity (1)	Known iPad activity (2)
	Unknown other activity	
Novel activities	Unknown puzzle activity (3)	Known puzzle activity (3)

Activities labeled other include common activities not fitting a particular category

Given the limited opportunities to assess and promote generalization with Josh, six additional tasks (three EO-present and three EO-absent) were identified and tested following the completion of posttraining and generalization for Doug. These additional tasks were not tested previously in any other condition nor were they included in any mand training, which is why they are presented separately from generalization data but were added to further demonstrate the importance of generalized use of the mand.

Results and Discussion

Cumulative response data are presented in Figs. 1, 2, 3 and 4 for Josh and Doug. Figure 1 shows mands emitted during baseline, posttraining, generalization, and novel activities conditions (Doug only). In baseline, neither participant responded How? for teaching tasks (closed data paths) or generalization tasks (open data paths). Task completion data (Fig. 2) indicate that Josh completed two of three tasks, and Doug completed all 17 tasks. Neither participant completed any of the EO-present tasks, indicating that these tasks were unknown. During mand training, Josh acquired the mand in 63 trials and Doug in 61 trials (Fig. 3), and neither manded in the EO-absent trials. Two modifications were introduced at trials 64 and 84 for Doug. It was observed that Doug often made attempts to complete the activity without seeking help, suggesting no EO for the information until he had initially attempted on his own. Therefore, the prompt delay was increased to 10 s to allot more time for Doug to attempt the task. This was ineffective, so the second modification entailed lengthening the delay to allow Doug to attempt the task on his own until he indicated toward the therapist a second time. That is, Doug's initial indicating response suggested preference for the activity and preceded the start of a trial. A prompt was not provided until a second indicating response occurred, indicating that he had attempted the task and now required help from the therapist. For example, the therapist presented the activity and delayed the prompt until a second indicating response (e.g., eye contact, grabbing therapist's hand for assistance) was observed suggesting an EO for the information. During teaching, Josh correctly completed all EO-absent tasks, and all but one EO-present task after information was provided (Fig. 4). Doug also

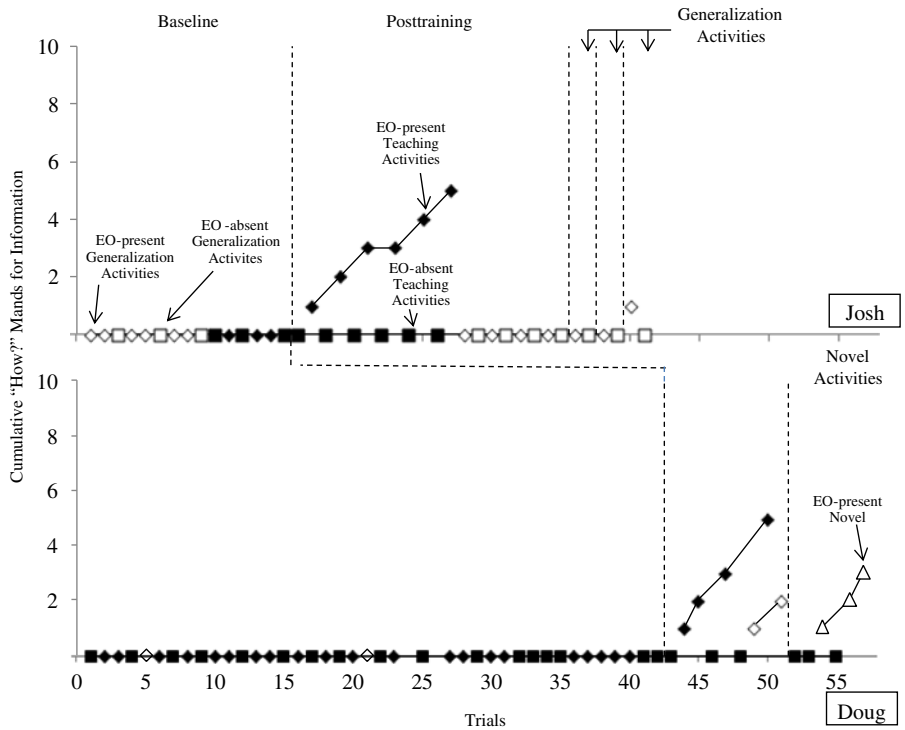

Fig. 1 Cumulative number of independent mands across EO-present and EO-absent conditions for Josh (*top panel*) and Doug (*bottom panel*)

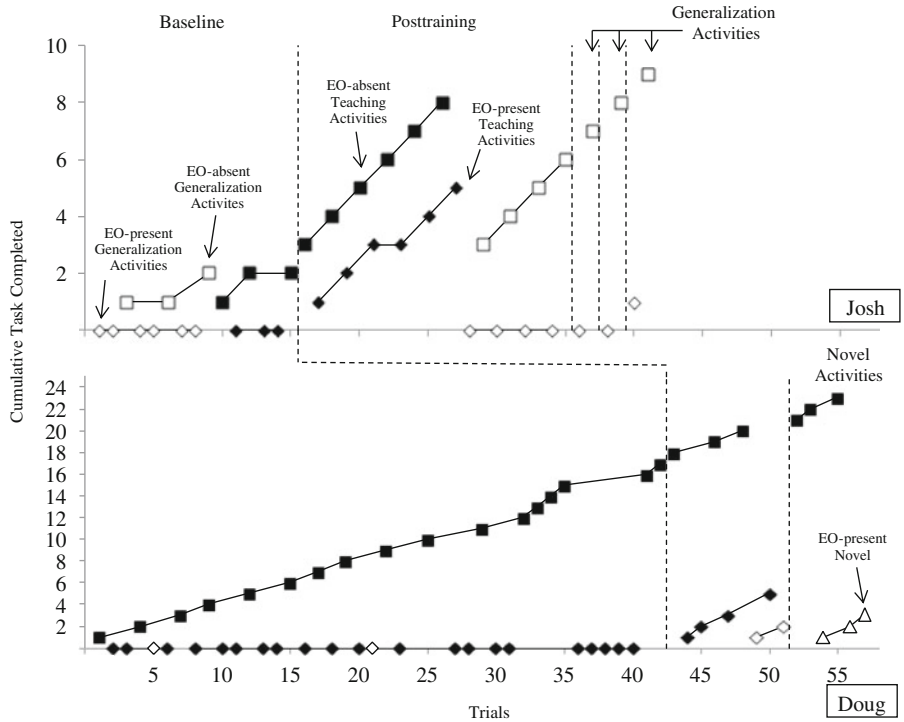

Fig. 2 Cumulative number of tasks completed across EO-present and EO-absent conditions for Josh (*top panel*) and Doug (*bottom panel*)

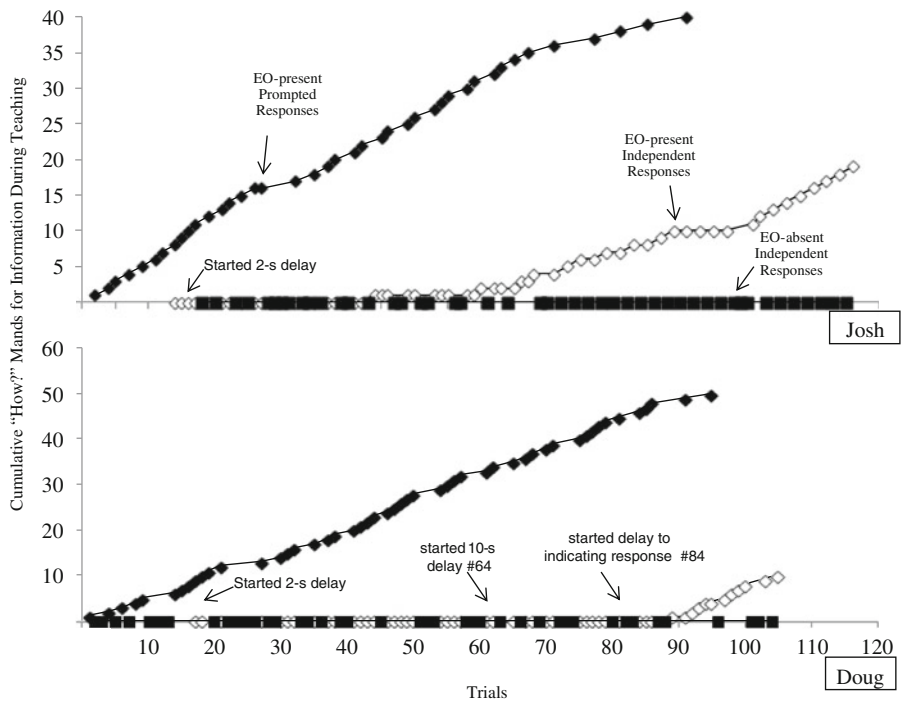

Fig. 3 Cumulative number of independent and prompted mands during EO-present trials and independent mands during EO-absent trials for Josh (*top panel*) and Doug (*bottom panel*)

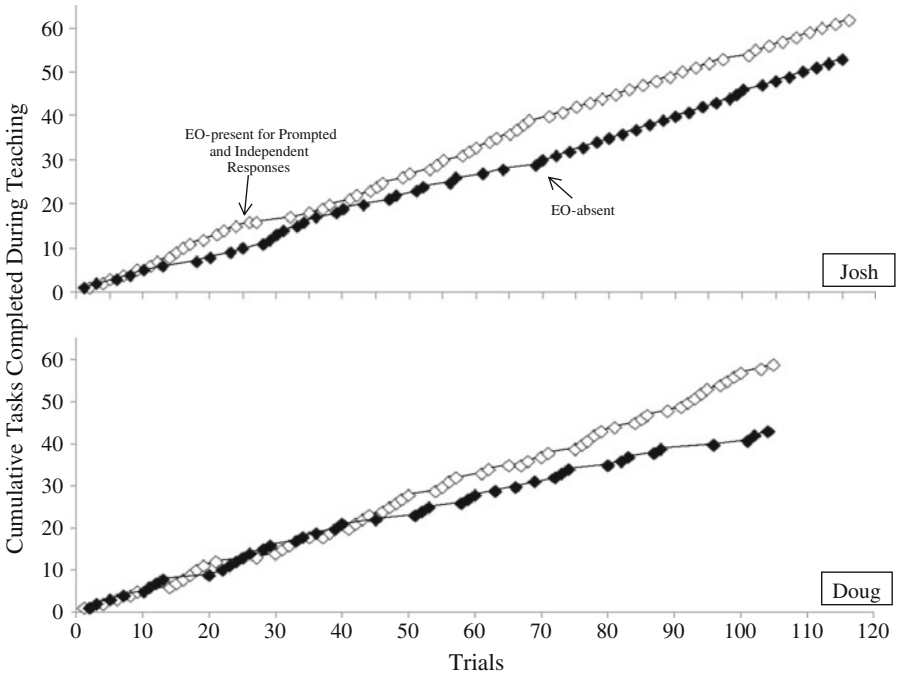

Fig. 4 Cumulative tasks completed across EO-present and EO-absent conditions during mand training for Josh (*top panel*) and Doug (*bottom panel*)

completed all EO-absent tasks and 56 out of 60 EO-present tasks following provision of the information. During posttraining trials (Fig. 1), Josh correctly emitted How? for five of six EO-present trials, but never during EO-absent trials. Josh completed all posttraining spelling tasks correctly (Fig. 2). During posttraining, Doug emitted the How? mand during all EO-present trials, never during EO-absent trials (Fig. 1), and completed all tasks during EO-present and EO-absent trials (Fig. 2).

During generalization trials, Josh correctly completed tasks in the EO-absent condition but did not mand during any EO-present trials. Therefore, training was implemented for one of the four untaught generalization tasks (i.e., opening a locked toy cabinet). A generalization trial for a second untaught activity (i.e., using a walkie talkie) was then conducted. No generalization was observed; therefore, mand training for the second task was implemented. Following independent manding for the second activity, the third generalization task was probed (i.e., putting batteries in remote). Lack of generalization resulted in teaching, followed by a trial of the fourth task (i.e., using the phone). One prompted trial was required for each generalization activity taught. During the generalization trial for the fourth activity, Josh independently emitted How? and completed the task using the information provided, demonstrating some generalized use of the mand, albeit limited.

Due to the limited opportunity to assess generalization with Josh and the importance of generalized use of the mand, additional novel activities were added for Doug. Thus, generalization trials during pretested activities *and* novel activities were conducted for Doug. He emitted the mand during all EO-present trials, omitting mands during EO-absent trials (Fig. 1) and completed all tasks in both conditions (Fig. 2). He also emitted the mand during the generalization trials, indicating the generalized use of the mand in various situations.

Results suggest the procedures were effective at teaching mands for information using How? for two participants diagnosed with autism. Participants emitted How? during EO-present trials only, used the information provided, and manded in untaught contexts. The present study offers several benefits over a previous study by Shillingsburg and Valentino (2011) in the stronger demonstration of experimental design and alternation between EO-present and EO-absent activities to assess EO control of responding (both during and after mand training). Participant's use of the information provided was also demonstrated. Future researchers should consider including similar procedures. The

inclusion of an EO-absent condition, at least posttraining, can assist researchers and therapists in concluding that a mand has been acquired and will be used only under appropriate EO-present conditions.

Multiple-exemplar training is a strategy designed to promote generalization and often facilitates novel verbal behavior (Carr and Miguel 2013; Fiorile and Greer 2007; Greer et al. 2005; Kurtz and Lind 2013). Multiple-context training may be important for generalization. Teaching trials for Josh included teaching across multiple exemplars (e.g., different spelling words), but not multiple contexts (e.g., different activities), which were only presented after mastery of the mand during spelling activities. This may give insight as to why Josh did not exhibit generalized manding until after direct teaching of the first three EO-present generalization tasks. Doug, however, was taught across multiple contexts that included multiple exemplars and immediately emitted mands during generalization and novel exemplars. Future research may focus on including multiple-context training to increase generalization and emergence of novel mands.

One limitation of the present study could include the contingency following the mand How? during EO-absent trials. If a mand occurred during an EO-absent trial, the activity was interrupted and the trial ended, which essentially results in the extinction of the mand. Therefore, we cannot rule out that unknown tasks could function as a S^D for the mand, rather than solely as an EO, increasing the value of the information. However, participants never emitted How? during EO-absent trials, suggesting that the EO-absent consequence is not a significant concern. Future studies should isolate the effects of the EO by including consequences that are identical across conditions. EO-absent conditions may also be established by presenting low-preference tasks the participant can complete independently.

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