Assessing Acquisition of and Preference for Mand Topographies During Functional Communication Training

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Abstract We assessed acquisition and preference for various mand topographies in the presence of establishing operations that, historically, evoked the aggression of a child with autism. First, we implemented functional communication training (FCT) and reinforced picture exchange, iPad®, or GoTalk® activations in a multi-element format (noting differences in aggression and/or mand independence across conditions). Then, we conducted a concurrent-operant mand preference assessment. Finally, we presented assessment results to the subject's mother and asked her to indicate her own preference. Parent and subject preferences were aligned and we completed therapy using the iPad®.

Keywords Functional analysis · Functional communication training · Mand · Preference assessment

Little is known about how to select the mand topographies we use to replace problem behavior. Factors such as corollary discriminative stimuli (Fisher et al. 1998; Winborn-Kemmerer et al. 2010), reinforcement history (Winborn et al. 2002), and response effort (Winborn-Kemmerer et al.

2009) all appear to influence mand preference. Notwithstanding, some research suggests mand independence will emerge regardless of topography (e.g., Winborn-Kemmerer et al. 2010). However, this research was conducted in the absence of problem behavior's establishing operations (EO; Laraway et al. 2003), and some evidence suggests parameters of alternative responding related to effort will influence the probability of problem behavior in these “hot” contexts (cf. Horner and Day 1991). Furthermore, although previous research has evaluated mand preference after controlling for response effort (i.e., Winborn-Kemmerer et al. 2009), such control is only reasonable if similar efforts yield similar outcomes. For example, the effort required to emit a mand on a speech-generating device (SGD) is low, but remains effective because pressing a button generates a sound that simultaneously recruits attention from non-attending individuals while specifying reinforcement. Conversely, a similar response effort in a picture exchange system (i.e., touching a picture symbol) would not likely recruit attention from a non-attending individual. With this system, a similar effect might only be observed if physical contact is made and a picture exchanged. Thus, assessments that control for effect on environment, rather than response effort, may generate more ecologically valid evaluations.

Within the context of problem behavior interventions, Ringdahl et al. (2009) recently found that individuals' pre-treatment mand proficiency influenced subsequent treatment effects during functional communication training (FCT; Carr and Durand 1985). Thus, there appears to be some justification for selectivity when choosing alternative communication topographies for individuals who engage in problem behavior. Given this reality, practitioners with limited time may benefit from a mand-selection process embedded within the context of intervention (as opposed to prior to it; as was done in Ringdahl et al.). Thus, the purpose of our study was to outline

Implications for Practitioners • It is possible to assess the mand-topography preferences of individuals with limited verbal repertoires.

- Incorporating a learner's preferred mand topography into FCT may increase treatment efficacy.
- Mand-topography acquisition and preference assessments can be embedded into FCT.
- Response effort may influence a learner's mand-topography preference.

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a method for evaluating the probability of mand independence and problem behavior, as well as mand preference, during “triggering” situations (i.e., during FCT) and using outcome data to inform caregiver mand-topography selection.

Lucas was a 4-year-old boy whose mother reported had been diagnosed with an autism spectrum disorder. He owned two iPads® prior to initiating the study: one “play” iPad® and one “communication” iPad®. Lucas’ communication iPad® only contained ProLoQuo2Go® software and did not have access to the Internet. Lucas had access to games, apps, and Internet through his play iPad®. He did not communicate vocally, but his mother indicated he would occasionally mand via PE, a GoTalk® device, and his communication iPad®.

Lucas was referred to a university-based outpatient behavior clinic for aggression, where he received therapy for 5 h per week across two and a half months. We conducted all sessions in a room equipped with a table, two chairs, and a one-way mirror. We defined *aggression* as forceful physical contact between Lucas, or an object controlled by Lucas, and another person (hitting, throwing, etc.). We scored a *mand* when Lucas independently activated an SGD (iPad® or GoTalk®) or when he independently picked up a picture card and touched a therapist with it. Trained graduate student observers collected frequency data on dependent variables using handheld computers with ABC Data Pro® software.

We calculated interobserver agreement (IOA) during every experimental condition by scoring and averaging mean-count-per-interval (10 s) agreements for each dependent variable. Mean IOA was 93 % (range 80–100 %) and was scored for 71 % of all sessions/probes.

Observers evaluated procedural fidelity by completing a checklist to evaluate whether: (a) therapists conducted pre-session reviews, (b) correct materials were present, and (c) sessions fell within 5 s of prescribed duration. Observers also recorded the frequency of correct and incorrect (a) therapist responses to problem behavior and (b) mand-prompt deliveries. We calculated session fidelity by dividing the number of “correct” by the sum of “correct” and “incorrect” and multiplying by 100. Mean fidelity was 99 % (range 89–100 %) and was collected during 80 % of sessions/probes across all conditions.

All sessions in this experiment were 5 min long and conducted by graduates in an applied behavior analysis training program. We first conducted a functional analysis (FA; Iwata et al. 1994) of Lucas’ aggression. During attention, therapists ignored Lucas who had continuous access to low-preferred tangible items (identified via preference assessment). Contingent upon aggression, therapists delivered brief physical contact and statements of reprimand and/or concern. During escape, therapists presented a continuous series of demands using a three-step prompting procedure (i.e., vocal, model, manual guidance). Compliance produced praise and

the next demand. Aggression produced a 30-s break. During play, Lucas had continuous access to high-preferred items, therapist attention, and no demands were presented. Aggression produced no programmed consequences. During tangible, therapists removed Lucas’ high-preferred items. Contingent upon aggression, therapists replaced said items for 30 s. We left Lucas’s communication iPad® in the therapy room across conditions to establish baseline rates of manding for functional reinforcers.

Following the FA, we conducted a “device acquisition” phase. The purpose of this phase was to train Lucas to emit independent mands using targeted devices in the presence of aggression’s EOs. Device acquisition consisted of three FCT with extinction conditions randomly alternated (without replacement) in a multi-element format comprising of six sessions per condition in tangible and five in escape (with a sixth for PE to determine whether the observed increasing trend would maintain). Differences in mand topography (PE, iPad®, and GoTalk®) represent the only programmed differences across conditions. We chose these topographies because Lucas’ mother reported he had some experience using all three devices, and we were unsure which to target for continued use. Lucas’ preference among the topographies was unknown. We first addressed aggression’s tangible function and then its escape function.

FCT with extinction sessions were procedurally similar to escape and tangible FA conditions with a few exceptions. First, each session started with a forced-choice contingency review. Second, the primary therapist reinforced mands and placed aggression on extinction. Finally, a secondary therapist manually guided Lucas to mand for functional reinforcers using a progressive time delay (Touchette and Howard 1984). That is, during the first session of each condition, the second therapist guided Lucas to mand immediately following each presentation of the relevant EO. In each new session, the delay to prompt increased by an additional 5 s until reaching a terminal delay of 30 s. Although we only recorded independent (i.e., unprompted) mands, the therapist also delivered requested reinforcers (i.e., iPad® or break) for prompted mands. This phase ended after Lucas independently manded across each condition (consecutively) in the absence of aggression.

Immediately following device acquisition, we conducted a concurrent-operants mand preference assessment in the presence of both relevant EOs. The purpose of this assessment was to establish a hierarchy of preference among the three mand topographies in order to better inform parent device selection. A secondary purpose of this assessment was to determine whether this hierarchy changed across functional classes. Assessment probes were conducted in two phases. In the first phase, therapists placed all three devices on a table in front of Lucas (approximately 20 cm apart) and then presented the relevant EO. Aggression remained on extinction. If Lucas

independently emitted a mand, therapists removed the devices and provided a 30-s access to the functional reinforcer. If Lucas did not independently respond within 10 s, therapists maintained the EO and gave Lucas a verbal prompt to “pick one.” Following reinforcement, therapists replaced all devices (in different positions relative to each other) and re-presented the EO. Once a clear preference (or indifference) was apparent (as determined via visual inspection), therapists ended the probe and moved on to the second phase of assessment. During the second phase, the highest-preferred mand device was removed and procedures were repeated to establish a second-preferred mand topography. We sought to establish a secondary preference for Lucas in case his first choice did not correspond with his mother’s preference.

We conducted this assessment twice for both functions of aggression. Afterward, we presented Lucas’ mother with data on his problem behavior, mand independence, and mand-topography preferences across functional classes during FCT with extinction and asked her to indicate the device with which we should complete therapy. Following this conversation, Lucas’ mother chose the iPad®. In this case, parent and

child preferences aligned and therapists resumed FCT with the iPad®.

During FCT for escape, a brief treatment withdrawal immediately followed the preference assessment. During FCT for tangible, therapists withdrew treatment following four consecutive sessions with the parent’s preferred device. Conditions during the withdrawal were identical to FA conditions. We kept this phase brief due to parental concern about withdrawing the intervention. Termination criteria included a return to baseline rates of responding for either problem behavior or manding.

Results of assessments are shown in Fig. 1. During the functional analysis (FA; Iwata et al. 1994) (first row and baseline in left panels), aggression occurred at consistently elevated rates in both tangible and escape conditions. Conversely, manding never occurred. During device acquisition (left panels, second and third rows), Lucas exhibited independent responding with all three mands. Manding occurred at consistently higher rates via iPad® in the escape condition. Alternately, manding via picture exchange (PE) was slightly lower than manding via other topographies, and aggression

Fig. 1 Results of FA of aggression (*top row*), device acquisition and maintenance sessions (*left column*), and preference assessments (*right column*)

occurred at slightly higher rates. Treatment withdrawals resulted in a return to baseline levels of aggression for both functions and a return to baseline levels of manding during the escape condition. When the intervention was reintroduced, manding reemerged and aggression was again suppressed.

During phase 1 of the preference assessment (right panels), Lucas allocated 80–90 % of responding toward the iPad® and 10–20 % toward the GoTalk® in the escape condition and 56–67 % toward the iPad® and 33–45 % toward the GoTalk® in the tangible condition. During phase 2, Lucas allocated the majority of responding toward the GoTalk®. Thus, Lucas' highest-preferred mand topography was "iPad® activation." Preference maintained across functional classes.

This study extends the findings of Ringdahl et al. (2009) by outlining a method for embedding mand proficiency and preference assessments within the context of FCT for children who engage in problem behavior. Furthermore, we showed that preference corresponded with higher rates of independent manding and lower rates of problem behavior in the presence of EOs that historically evoked problem behavior.

This study also extends Winborn-Kemmerer and colleagues' (2009) findings by assessing preference for mand topographies while controlling for their respective effects on the environment. Our results suggest response effort may influence mand independence, preference, and/or rates of problem behavior during FCT because (a) rates of aggression were higher and rates of manding were lower during PE sessions, (b) PE was the lowest-preferred mand topography, and (c) PE may have required the highest response effort. However, it is also possible that other variables (e.g., shared stimulus properties with "fun" iPads®) were responsible for differentially high iPad® selections during preference assessments (which might explain the observed preference for iPad® over GoTalk® given near identical response efforts). Ultimately, the variables responsible for these preferences may be less relevant than the fact that they were identifiable for a non vocal-verbal child with limited experience communicating in any format.

It is important to note that even FCT using PE eliminated aggression within a brief period of time. Thus, this study should not detract care providers from using PE when other factors (preference, finances, etc.) implicate its use. Rather, this study should encourage practitioners to consider multiple factors (i.e., subject and parent preference, proficiency, and problem behavior) when selecting the response topographies that others must use to communicate (potentially) for the rest of their lives. Finally, our results extend the current literature by providing preliminary evidence suggesting preference for mand topographies remains consistent across functional classes for both social-positive (i.e., tangible) and social-negative (i.e., escape) reinforcers.

Some procedural limitations should be noted. First, Lucas' pre-study experiences with the targeted communication devices could not be quantified. Second, even though baseline data indicate that Lucas would not activate his iPad® in the presence of his problem behavior's EOs, we do not know that he would not have manded via GoTalk® or PE under these same conditions.

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Compliance with Ethical Standards This manuscript is not published (or under review) elsewhere and was approved by all authors and responsible authorities where the work was carried out. We obtained informed consent before initiating study-related activities.

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