Facilitating derived requesting skills with a touchscreen tablet computer for children with autism spectrum disorder

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ABSTRACT

Two experiments were conducted employing derived relational responding and conditioned motivating operations to establish untaught mands with 11 children with autism spectrum disorder (ASD) who lacked a vocal repertoire. Following formal language assessments and preference assessments, a multi-stage automated protocol was implemented on touchscreen tablet computers. Children were first taught to mand by picture exchange for missing items necessary to play with a toy and then learned to conditionally relate the dictated names of the items to the corresponding pictures of the items (A-B training) and to relate the dictated names to the corresponding printed words (A-C training). Test probes, in the absence of reinforcement, were presented to determine whether or not participants would mand for the missing items using text exchange (hence demonstrating derived manding/requesting). Probes for spontaneous matching (B-C and C-B) and labeling (B-A and C-A) were also presented in both experiments, one of which employed a pretest/posttest design and the other a multiple probe across participants design. Across both experiments, all but one of the participants showed evidence of derived requesting and derived stimulus relations. Implications for research on high-tech devices for facilitating independent communication skills of children with ASD and for derived relational responding approaches to verbal operants are discussed.

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1. Introduction

In his taxonomy of verbal behavior, Skinner (1957) defined the mand as "a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation" (Skinner, 1957, p. 35). Manding or requesting allows the user to contact the social world of wants and needs and is an essential feature in promoting independent, functional communication skills across the developmental lifespan. Indeed, children with autism spectrum disorder (ASD) often lack the key behavioral flexibility with requesting

demonstrated by their typically developing peers (Wahlberg & Jordan, 2001). Facilitating the development of untaught requests/mands is therefore a meaningful and worthy goal for early intervention programs; developing procedures that successfully demonstrate trained, and untrained, responding would also likely be of benefit to educators and caregivers.

Environmental conditions required for an instance of manding to occur are called establishing or motivating operations (Michael, 1982) and refer to the manipulation of variables to alter the momentary value of a reinforcer and the frequency of behaviors associated with that reinforcer (Laraway, Snycerski, Michael, & Poling, 2003; Michael, 1993). Michael (1993) distinguished between two types of establishing operations: conditioned (CEO) and unconditioned (UEO). The latter's value-altering effects are unlearned (e.g., the presence of heat increases the momentary value of a fan), while CEOs depend on individual learning histories (e.g., the presence of a lock on a cupboard establishes the reinforcing value of a key when access to food is valuable as a source of reinforcement; Langthorne & McGill, 2009). In educational and clinical settings, the CEO has long been found to be an effective means of teaching manding skills (e.g., Hart & Risley, 1975). For instance, one procedure to establish manding skills using the CEO is the *missing items protocol* (Carroll & Hesse, 1987; Marion, Martin, Yu, Buhler, & Kerr, 2012). This procedure involves contriving a state of deprivation by removing a vital part of something needed to enjoy a preferred item. For example, withholding a marble needed to enjoy playing with a marble run would set the occasion for the relevant mand (i.e., "may I have the marble?") to occur in order to play with the toy.

Recently, researchers have sought to synthesize mand-training procedures with research on derived relational responding as a means of facilitating untrained manding skills in people with ASD and other developmental disorders (Barnes & Rehfeldt, 2013; Rehfeldt & Barnes-Holmes, 2009). Derived relational responding refers to the outcome where, after being taught a series of interconnected conditional discriminations involving physically dissimilar (arbitrary) stimuli, the stimuli involved become related to each other in ways not explicitly trained. Sidman (1971) account of stimulus equivalence is an example of one such route to untrained learning outcomes. For example, if an individual is taught to conditionally relate dictated names of items to their corresponding pictures (i.e., A-B) and text (i.e., A-C), he or she may, without further reinforcement, correctly label the pictures (i.e., B-A) and text (i.e., C-A), which are referred to as symmetry relations, and match the pictures to the text (i.e., B-C) and the reverse (i.e., C-B), which is known as combined symmetry and transitivity or equivalence relations (Sidman, 1994).

Research on derived relational responding has mainly used match to sample (MTS) procedures in which choice of the correct comparison stimulus is reinforced in the presence of a specific sample stimulus. Other procedures, such as the computer-based Relational Completion Procedure (RCP), have been developed that more closely approximate linguistic-communicative episodes involving reading and completing sentences and in making requests (Dymond & Whelan, 2010; Munnelly, Freegard, & Dymond, 2013; Walsh, Horgan, May, Dymond, & Whelan, 2014). For instance, Walsh et al. (2014) adapted the RCP with the goal of establishing two, 3-member equivalence relations in individuals with ASD. During all phases, the computer screen was divided into two areas (the top half was blue and the bottom half was gray). Trials commenced with a sample stimulus appearing on the left upper half of the screen and a blank box appearing on the right upper half of the screen. Then, after a 1-s delay, two comparison stimuli appeared on the bottom half of the screen. The participants' task was to drag and drop one of the comparison stimuli to the blank box. Once the comparison stimulus had been "dropped", participants could either cancel ("start again") or confirm ("finish trial") their response. After the confirmatory response, the screen cleared and the sample and selected comparison were presented together along with feedback before the inter-trial interval and another trial commenced. Walsh et al. found that seven of nine participants with ASD passed tests for derived equivalence relations using the RCP, while, in Experiment 2, four of the five participants with developmental delay demonstrated equivalence relations. These promising findings were obtained with exclusively visual, arbitrary (e.g., experimenter-determined) relations. It remains to be seen whether similar findings may be obtained with children with ASD with limited verbal abilities when both auditory and visual stimuli drawn from meaningful real-world objects or events are incorporated into the RCP.

The flexibility of the RCP for studying manding suggests considerable potential and also warrants further empirical attention. Indeed, synthesizing mand training procedures with instructional procedures for establishing derived relational responding allows one to study untrained or derived requesting (Halvey & Rehfeldt, 2005; Murphy & Barnes-Holmes, 2010; Rehfeldt & Root, 2005; Rosales & Rehfeldt, 2007). An instance of derived requesting is a request for an object or action that has not been reinforced in the past, is not the result of direct pairing with a reinforced mand, and does not physically resemble an object that previously reinforced the mand (generalization; Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000). For example, if a child has received water by vocally requesting in English, for "water" and then the word water is conditionally related to the Welsh word for water, "dwr", a child subsequent request for "dwr" would exemplify a derived mand involving symmetry relations (assuming the influence of Pavlovian contingencies may be ruled out). Rehfeldt and Root (2005) examined derived requesting skills involving equivalence relations in three adults with severe intellectual disabilities and no functional requesting skills. Participants were initially taught to mand for preferred items using the Picture Exchange Communication System (PECS; Frost & Bondy, 2002). Following this, pretest probes were conducted to evaluate the extent to which participants were able to request those same items using text rather than pictures (which they were not). During these probes, five textual stimuli were placed on the top of the PECS book and the available preferred item was held up in front of the participant. Subsequent conditional discrimination training was conducted where participants learned to relate dictated names to corresponding pictures (A-B), then dictated names to corresponding printed words (A-C). Finally, posttest derived mand probes were initiated in an identical fashion to the pretest probes. All three participants requested using text during the post-test probes demonstrating the emergence of derived requesting.