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USE OF A DIFFERENTIAL OBSERVING RESPONSE TO EXPAND RESTRICTED STIMULUS CONTROL

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This study extends previous work on the use of differential observing responses (DOR) to remediate atypically restricted stimulus control. A participant with autism had high matching-to-sample accuracy scores with printed words that had no letters in common (e.g., *cat, lid, bug*) but poor accuracy with words that had two letters in common (e.g., *cat, can, car*). In the DOR intervention, she matched the distinguishing letters of the overlapping words (e.g., *t, n, r*) immediately prior to matching the whole words. Accuracy scores improved, and accuracy remained high when DOR requirements were withdrawn.

DESCRIPTORS: autism, differential observing response, discrimination, match to sample, observing behavior, restricted stimulus control, sight words

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Many individuals with developmental disabilities display atypical restrictions in range or breadth of stimulus control (Dickson, Deutsch, Wang, & Dube, 2006; Dube et al., 2003; Lovaas, Koegel, & Schreibman, 1979; Schreibman, 1988, 1997). For example, such an individual may identify complex stimuli such as pictures of people on the basis of an isolated feature, or sets of letters on the basis of the initial letter only (e.g., Dickson, Wang, Lombard, & Dube, 2006). This phenomenon has been referred to as *stimulus overselectivity* (Lovaas et al.) and *restricted stimulus control* (Stromer & Dube, 1994).

One technique for ameliorating restricted stimulus control is the differential observing response (DOR). DOR procedures control observing behavior and verify discrimination of critical stimuli or stimulus features (Cohen, Brady, & Lowry, 1981; Urcuioli & Callender, 1989). For example, previous research has shown that matching-to-sample accuracy improved when naming the sample stimulus aloud was required as a DOR (Constantine & Sidman, 1975; Geren, Stromer, & Mackay, 1997; Gutowski, Geren, Stromer, & Mackay, 1995).

DOR procedures, however, need not involve additional response requirements such as naming. In a laboratory-based bridge study, Dube and McIlvane (1999) reported a DOR technique that used matching-to-sample procedures only. The baseline task was delayed matching to sample with two-element sample stimuli and single-element comparisons (Dube & McIlvane, 1997; Stromer, McIlvane, Dube, & Mackay, 1993). Participants had intermediate

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baseline accuracy scores that indicated restricted stimulus control by only one sample stimulus on most trials. The DOR intervention required participants to match the two-element samples to identical and simultaneously displayed two-element comparisons immediately prior to each delayed-matching trial. Accuracy scores improved, and thus restricted stimulus control was reduced, although accuracy reverted to baseline levels when the DOR was no longer required. This report describes an extension of the approach taken by Dube and McIlvane to an applied setting and task.

METHOD

Participant, Setting, and Stimuli

Marie was a 16-year-old girl who attended a special-education residential program. School records indicated a primary diagnosis of autism and the American Association on Mental Retardation Adaptive Behavior Scale age-equivalent scores of 4.0 years for independent functioning, less than 3 years for language development, and 4.75 years for prevocational/vocational. Her educational program included matching-to-sample training with printed words. Sessions were conducted in her classroom and residence. The experimenter and participant sat facing each other on opposite sides of a table. One or two sessions were conducted per day, 2 to 5 days per week.

Stimuli were three sets of printed words (Set CA: *can, cat, car*; Set BU: *bug, bus, buy*; and Set LI: *lid, lie, lip*). Stimuli were printed in landscape orientation on letter-sized white paper in a lower-case 80-point font. Each trial was printed on a separate page and placed in a three-ring binder. On each page the sample stimulus was centered 4 cm from the bottom, and the three comparison stimuli were in a row 3 cm from the top. The correct comparison was identical to the sample. Within word sets, stimuli appeared equally often as samples and comparisons, and stimuli appeared equally often in each comparison position. A piece of construction paper (10 cm by 28 cm) was used to cover comparison stimuli during the initial part of each trial (details below).

Procedure

Sessions consisted of 18 to 21 identity matching-to-sample trials. Each trial began when the experimenter presented the binder with the sample stimulus visible and the comparison stimuli covered. After the participant pointed to the sample, the experimenter lifted the flap that covered the comparison stimuli. After the participant pointed to a comparison, the experimenter provided consequences (details below) and closed the binder. Evaluation and training for Word Sets CA and BU were conducted concurrently in a multiple baseline design; the word set presented on overlapping trials alternated irregularly across sessions. The sessions with Set LI followed completion of all sessions with Sets CA and BU.

Baseline. Sessions consisted of regular alternation between nine overlapping trials and nine nonoverlapping trials for a total of 18 trials per session. On overlapping trials, the comparison stimuli consisted of three words from the same word set. Thus, the comparisons had the first two letters in common, and the third letter of each word was the critical feature that distinguished among them (e.g., the sample *cat* and comparison stimuli *cat, can,* and *car*). Within sessions, the same word set was presented on all nine overlapping trials. Overlapping trials were included to detect stimulus control restricted to the initial letter or letters of the printed words. On nonoverlapping trials, the comparison stimuli came from different word sets and thus had no letters in common (e.g., the sample *cat* and comparison stimuli *cat, lid,* and *bug*). Nonoverlapping trials were included because high accuracy on these trials would verify continued discrimination of the printed letters and continued effectiveness of the reinforcing consequences.

A correct response was followed by presentation of a token and an intertrial interval

(ITI) of approximately 2 s. Tokens were exchanged after sessions for snack foods or leisure activities (this was Marie's regular educational reinforcement system). An incorrect response was followed only by an ITI of approximately 4 s.

DOR. Sessions consisted of nine DOR trials, each followed by a corresponding overlapping trial. On DOR trials, the sample and comparison stimuli were the individual letters that distinguished the words within each set (Set CA: *n, t, r*; Set BU: *g, s, y*; and Set LI: *d, e, p*). Each DOR trial was immediately followed by an overlapping trial in which the third letter of the sample stimulus was the same as the sample letter on the preceding DOR trial. For example, the DOR trial with sample *t* and comparison stimuli *t, n,* and *r* was immediately followed by an overlapping trial with sample *cat* and comparisons *cat, can,* and *car.*

The positions of the correct comparison stimuli on DOR and corresponding overlapping trials were uncorrelated. There were no programmed differential consequences for responses on DOR trials, and there was no ITI between the DOR trial and the corresponding overlapping trial.. That is, every response on DOR trials, whether correct or incorrect, was followed immediately by presentation of the corresponding overlapping trial.

Three nonoverlapping trials were also included in each DOR session, for a total of 21 trials per session. The criterion to end the DOR condition and return to a second baseline was a minimum of six sessions and at least 89% accuracy on overlapping trials for three consecutive sessions.

Generalization. A generalization condition was conducted following training with the last word set (Set LI) to determine whether effective observing would also occur when the position of the critical feature within the word varied. Sessions consisted of nine generalization trials that were similar to the overlapping trials, except the distinguishing letter varied in position within the comparison words. On one third of the trials, the distinguishing letter was in the third position (as on overlapping trials; comparisons *lid, lie,* and *lip*); on another one third of the trials, the distinguishing letter was second (*iel, idl,* and *ipl*); and on the remaining one third of the trials, the distinguishing letter was first (*eli, dli,* and *pli*). Consequences and ITIs were as described for overlapping trials.

Interobserver Agreement and Procedural Integrity

An independent observer recorded Marie's responses and the experimenter's procedural integrity in 30% of the sessions. Interobserver agreement was calculated by dividing the number of trials with response agreement by the total number of trials. Mean agreement was 99% (range, 95% to 100%). Procedural integrity was calculated by dividing the number of trials in which both (a) the correct trial was presented (according to a prepared data sheet) and (b) the correct consequence was presented by the total number of trials. Mean integrity was 99% (range, 95% to 100%).

RESULTS AND DISCUSSION

Results are presented in Figure 1. In the initial baseline, accuracy scores were 100% for all nonoverlapping trials, indicating a secure identity-matching baseline. Accuracy was at approximately chance levels for all overlapping trials, indicating that stimulus control was restricted to the initial letters of the words. There was a strong bias towards the center comparison stimulus on the overlapping trials. One interpretation is that (a) the participant observed only the initial letters of the stimuli and selected the first comparison she observed in which those initial letters matched the sample, and (b) the first comparison observed was in the center position, nearest the sample. On all overlapping trials and one third of the nonoverlapping trials, the initial letters of this comparison matched the sample, and it was selected. On the remaining nonoverlapping

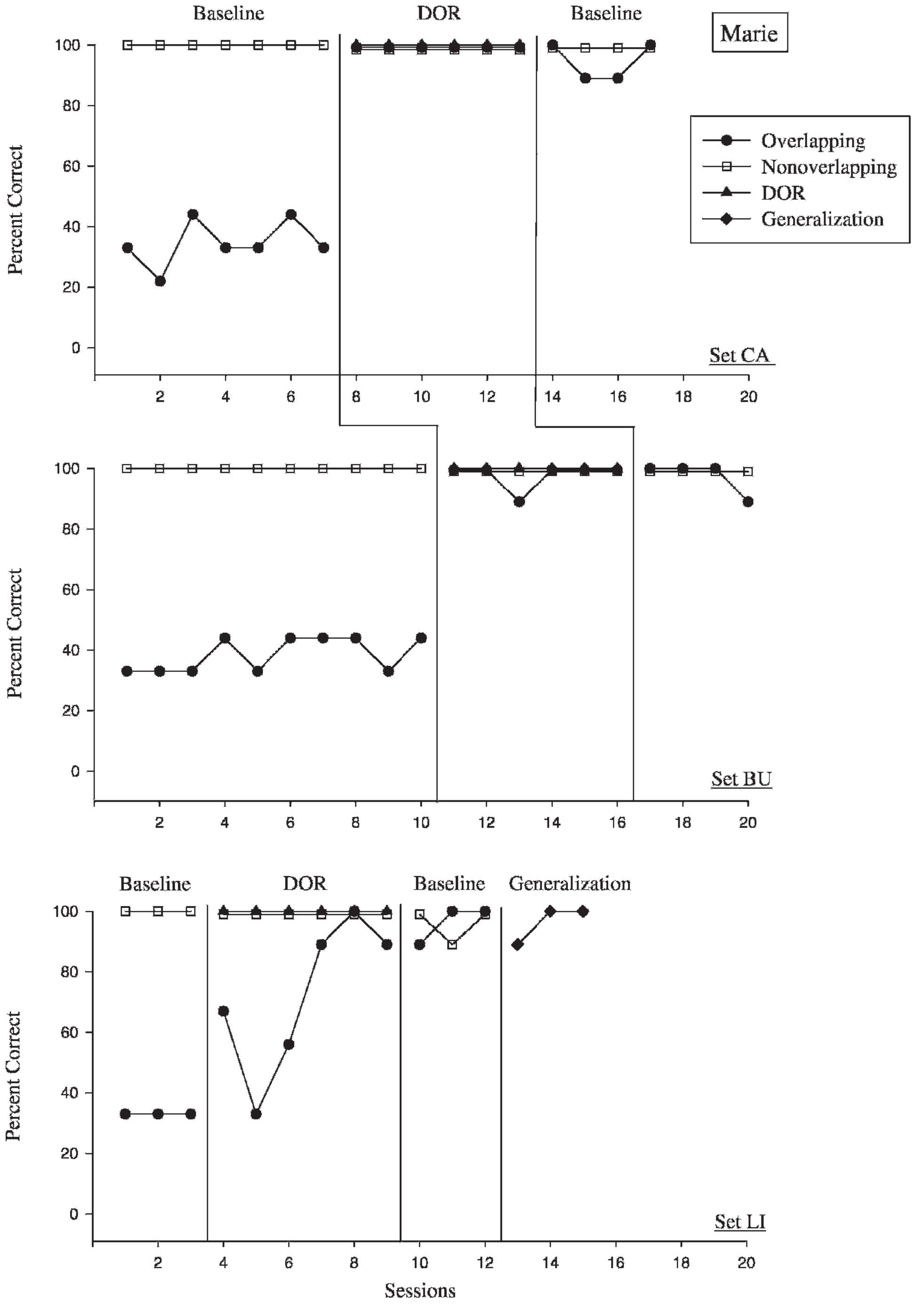

Figure 1. Marie's percentage correct for each trial type with Set CA, Set BU, and Set LI. Sessions are numbered consecutively within word sets.

trials, the initial letters of the center comparison stimulus did not match the sample, and this set the occasion for additional observing behavior. It thus seems possible that stimulus control was also restricted to initial letters on the nonoverlapping trials. Restricted stimulus control would not produce errors on these trials because the initial letters were different for each comparison word. The nonoverlapping trials, therefore, seem to represent an educational context in which restricted stimulus control is sufficient to satisfy the reinforcement contingencies.

When the DOR condition was initiated, accuracy scores were 100% on both nonoverlapping trials and DOR trials. On overlapping trials, accuracy immediately increased to 100% for Set CA, to at least 89% for Set BU, and to 89% for Set LI in the fourth DOR session.

For all three word sets, the accuracy gains on overlapping trials were maintained after returning to baseline. This result is in contrast to those of Dube and McIlvane (1999), in which the removal of a DOR requirement was accompanied by a decrease in accuracy. Two differences between the present study and Dube and McIlvane may be relevant. First, the DOR procedure in Dube and McIlvane was simultaneous matching (as in the present study), but the baseline task was delayed matching to sample. Because the sample stimulus on baseline trials was no longer visible after the comparisons were presented, participants could not engage in chains of sample–comparison observations (i.e., looking back and forth between the sample and comparisons). In contrast, baseline trials in the present study used a simultaneous matching procedure that permitted chains of sample–comparison observations. Thus, any observing behavior established on DOR trials that included such chains could also occur on baseline trials in the present study but not in the previous one. The development of effective DOR-based interventions for both types of situations is important for further research because the controlling stimuli for adaptive behavior may, or may not, be simultaneously available when responding must occur (e.g., "PUSH" and "PULL" located on opposite sides of a door).

The second difference between the present study and that of Dube and McIlvane (1999) is that each instance of DOR intervention in the present study was conducted with a set of only three words. Dube and McIlvane used a trial-unique matching procedure in which different stimuli were presented on every trial. The persistence of improvements in observing behavior following a DOR intervention may be related to extended practice with specific stimuli. The importance of stimulus set size and training or overtraining duration is another question for further research.

During the generalization condition that followed training with Set LI, the distinguishing letter varied from trial to trial, and accuracy remained high. Marie was apparently scanning the entire word and observing the distinguishing letter regardless of its position within the word. This result suggests that the DOR intervention led to a broadening of the range of observing behavior rather than merely shifting the locus of restricted stimulus control from the first letters of the words to the third letter. Because the generalization test was conducted with the last word set only, however, our interpretation of broad observing behavior is limited to Set LI. In both future research and application, this limitation could be avoided by presenting the distinguishing letters in varied locations within words during training.

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