The Effects of a Stimulus-Stimulus Pairing Procedure on the Unprompted Vocalizations of a Young Child Diagnosed with Autism

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The current study evaluated the effects of a stimulus-stimulus pairing procedure intended to increase spontaneous vocalizations of a young child diagnosed with autism. A multiple-baseline design across two target phonemes was used to evaluate the effects of the pairing procedure on the frequency of phonemes uttered by the participant. Data were collected during presession, postsession, and follow-up periods across three conditions: Baseline, Control, and Pairing. During the Pairing conditions, a target phoneme was repeatedly vocalized by the experimenter and was systematically paired with preferred stimuli. Results from postsession observations following the pairing condition evidenced no increase in the target sounds. Practical and theoretical implications of the results are discussed.

Key words: autism, automatic reinforcement, conditioned reinforcement, spontaneous vocalizations, stimulus-stimulus pairing, verbal behavior.

Historically, behavior analytic accounts of language development have placed great emphasis on the acquisition and maintenance of verbal responding via social consequences. Indeed, Skinner's (1957) taxonomy is rooted entirely in the relationship between various types of verbal operants and the characteristic socially mediated consequences thereof. This mediation of reinforcement by the verbal community is for many the defining feature of verbal behavior (e.g. Skinner). However, the automatic reinforcement produced for the speaker as a result of uttering verbal responses that match those of the verbal community has not gone unnoticed (Horne & Lowe, 1996; Palmer, 1996; Skinner, 1957, p. 164; Vaughan & Michael, 1982). That is, the refinement of our vocal repertoires might in part be accomplished via the shaping of our behavior through contact with self-produced auditory stimulation that matches the particular sounds of our verbal community (termed *parity* by Palmer). These self-produced vocalizations might serve as reinforcers for a variety of reasons, including their extensive pairing with a wide array of reinforcers mediated by our verbal community.

Recently, two studies have reported increases in the unprompted vocalizations of young children with developmental delays following a stimulus-stimulus pairing procedure (Miguel, Carr, & Michael, 2002; Yoon & Bennett, 2000). Both studies utilized a procedure in which the experimenter repeatedly vocalized a target phoneme while delivering a preferred stimulus, thereby pairing a presumed reinforcer with a specific phoneme absent the direct reinforcement of any vocalization by the participant. The results of the Yoon & Bennett study suggest a robust, albeit short-lived, effect of the pairing procedure. Miguel et al., however, reported less robust effects, with a clear effect obtained for one participant, a possible effect for a second participant, and no effect for a third participant.

The present study applied the procedure described by Miguel et al. to the behavior of a young child diagnosed with autism. The methods of the Miguel et al. study were expanded to include a follow-up observation period 60 min after the pairing procedure. Prior to the study, a primary concern with the participant was poor vocal articulation and lack of unprompted vocalizations. It was hoped that the establishment of several targeted phonemes as conditioned reinforcers would increase his unprompted vocalizations and, in doing so, improve his articulation via repeated vocal practice with self-produced feedback.

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Participant and Setting

Evan, a 3-year-old male diagnosed with autism, participated in the study. At the time of the study, he was receiving 10-15 hours per week of applied behavior analysis therapy (similar to that described in Lovaas, 1981, and Sundberg & Partington, 1998). The Behavior Language Assessment form (Sundberg & Partington) was administered by the first author and classified Evan as a Level 4 profile.[1] He could follow many simple directions, tact many different items, mand vocally for a few items, and mand non-vocally (i.e., he pointed at or pulled a caregiver toward items) for a number of other items and activities. However, his vocal articulation was poor and he rarely vocalized absent prompts to do so.[2] All sessions were conducted in the home, either in a designated therapy room or in the living room.

Dependent Measure and Interobserver Agreement

Two low-frequency single-syllable vocal sounds were selected as targets. The frequency of these target vocalizations was recorded in 30 s bins for 5 min, both prior to and immediately following the baseline, control, and pairing sessions. Additionally, a 5 min follow-up observation session occurred 60 min after the 5 min postsession observation. All sessions were audio taped and data collection occurred following the conduct of each session. A second independent observer scored 35% of all presession, postsession, and follow-up session observations and interobserver agreement was calculated by dividing the smaller frequency of target vocalizations by the larger frequency of scored target vocalizations recorded for each 30 s bin and multiplying the quotient by 100 to yield a percentage of agreement. Mean agreement levels were 86% (range, 72%–100%).

Procedure

Sessions were conducted in a manner identical to that described by Miguel et al. (2002), with the addition of the 5 min follow-up observation. A multiple-baseline design across the two target phonemes was arranged, consisting of Baseline, Control, and Pairing conditions. For all conditions, the participant's vocalizations were recorded for 5 min immediately prior to and immediately following the experimental sessions, and an additional 5 min follow-up period was recorded 60 min after each experimental session. During these recording periods, the participant was allowed to play and move around freely with minimal interaction with the experimenter. A few toys were available to the participants during this time. Preferred stimuli were identified prior to each session via a brief multiple-stimulus preference assessment (Higbee, Carr, & Harrison, 2000).

Baseline. During baseline conditions, the participant was given a 20 min free-play period during which the experimenter did not interact with him.

Control. During the control condition, the experimenter vocalized the target phoneme seven times. A preferred item was delivered to the participant 30 s after the last experimenter vocalization. If the participant emitted the target phoneme prior to the delivery of the reinforcer, the delivery of the reinforcer was delayed by 30 s from the occurrence of the last target phoneme to ensure that the participant's vocalizations were not directly reinforced. Participant vocalizations during the course of the experimenter's vocalizations did not alter the session in any other way.

Pairing. During the pairing condition, the experimenter vocalized the target phoneme seven times and delivered the preferred item after the fourth vocalization. This constituted one pairing trial, with ten trials conducted per session. If the participant emitted the target phoneme, reinforcer delivery and further experimenter vocalization of the target phoneme was delayed by 30 s.

Overall, neither the control condition nor the pairing condition produced any obvious increase in vocalizations of the target sounds in the postsession or follow-up observation peri-

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[1] Based on a 5 level classification scale, with Level 1 indicating a minimal verbal repertoire and Level 5 indicating a relatively sophisticated verbal repertoire. For more details see Sundberg & Partington (1998).

[2] Although his articulation was generally poor, he could clearly articulate the phonemes targeted for this study.
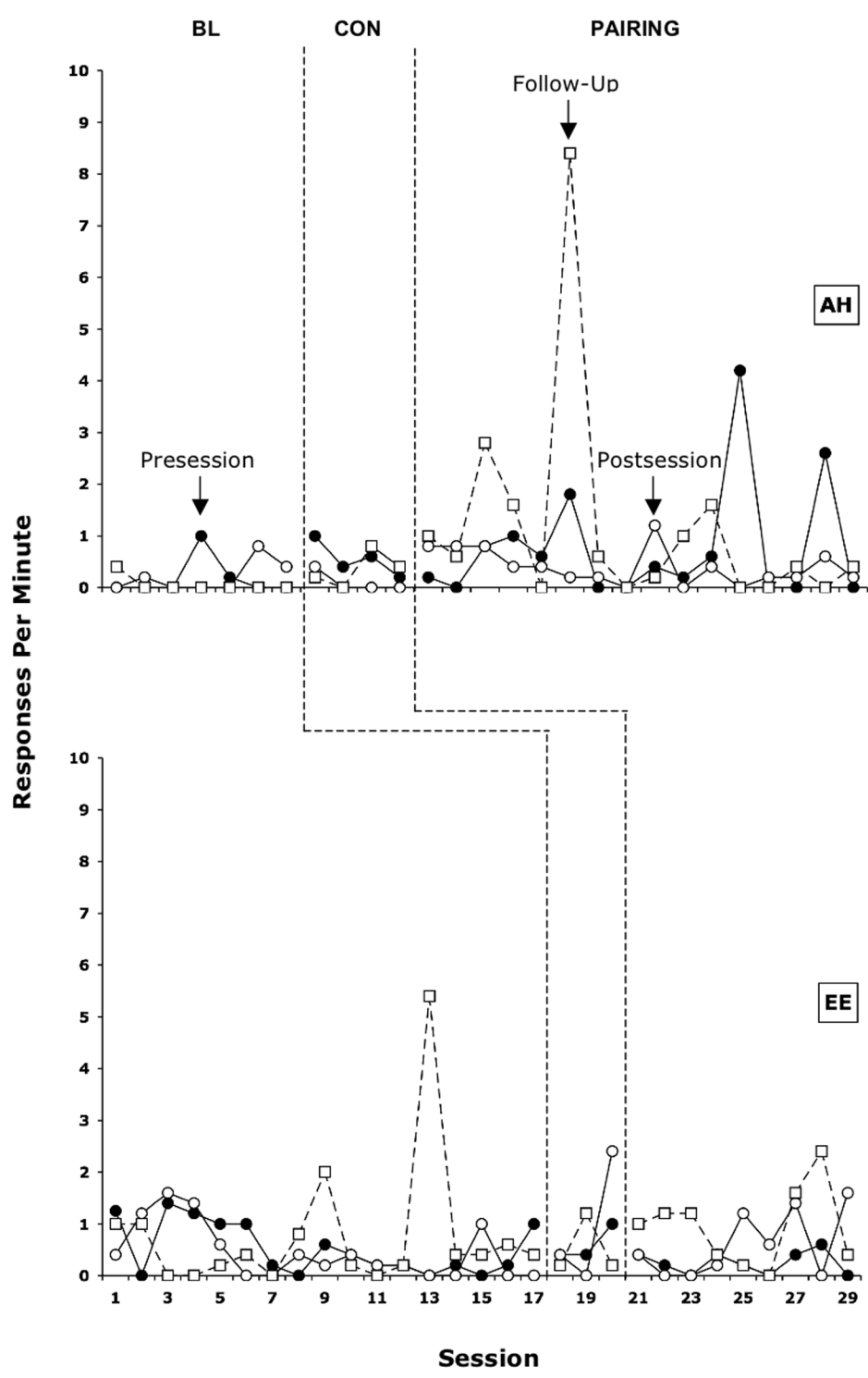
Fig. 1. Responses per minute during presession (closed circles), postsession (open circles), and follow-up (open squares) observations during baseline, control, and stimulus-stimulus pairing conditions across two phonemes.

ods (see Figure 1). There were, however, three follow-up observation sessions of high-rate vocalizations, one during baseline and two during intervention. Anecdotally, the intervention outliers might be explained as the inadvertent establishment of a mand repertoire. That is, Evan was occasionally observed to reach for one of the preferred items used during the pairing sessions and, when unable to independently reach the item, to look at the item and then at the experimenter while repeating the sound "ee" or "ah" as an apparent mand for the item. It is not clear what could account for the outlier during baseline.

The data reported herein add to the existing literature indicating mixed results from the stimulus-stimulus pairing procedure. Although Yoon & Bennett (2000) reported robust effects, Miguel et al. (2002) reported clear increases in vocalizations for only one of three participants studied. As such, researchers should further investigate the overall efficacy of the procedure and the variables influencing the effectiveness thereof. For example, it is unclear whether the verbal repertoire of the individual influences responsiveness to the procedure, as the participants in the Yoon & Bennett report had more limited verbal repertoires than those of the participants in this study or in the Miguel et al. study. More specifically, the participant in the current study was identified as having a Level 4 repertoire (via the Behavior Language Assessment) and the one for which no effects were evident in the Miguel et al. study had been identified as having a Level 3 repertoire. In comparison, the Miguel et al. participant for which the clearest effect was evidenced was identified as having a Level 1 repertoire and, based on the descriptions by Yoon and Bennett, their participants would likely have been identified as having a Level 1 repertoire as well.

Another logical step for future research concerns the way in which potential reinforcers are identified for use in the pairing procedure. The rigor with which these stimuli are identified should be increased in order to ensure that effective reinforcers are being paired with the vocalizations of the experimenter. The Yoon and Bennett (2000) report did not describe any formal preference or reinforcer assessment procedures, whereas the present study and the Miguel et al. study used brief multiple-stimulus preference assessments (Higbee et al., 2000) prior to each experimental session. However,

the current study did not involve a formal reinforcer assessment and no such assessment was reported by Miguel et al. (2002). If the particular stimuli used in the pairing conditions do not serve as reinforcers then any intervention attempts using those stimuli will be ineffective. In addition to conducting systematic stimulus preference assessments prior to intervention, future research might be well served to conduct and report the results of brief reinforcer assessments wherein the establishment of some arbitrary response unrelated to the target vocalizations is strengthened via contingent presentation of the preferred stimulus or stimuli.

It also is possible that the number of pairings per trial or total number of trials could be altered to produce more consistent effects. Yoon & Bennett (2000) reported 36 pairings per session whereas the current study arranged 10 pairings per session and Miguel et al. (2002) reported 20 pairings per session. Perhaps it should not be surprising, then, that the effects so far observed have been short-lived if present at all. Consider that during the intervention a very brief pairing history is provided but quickly followed by extended periods during which the child vocalizes without those vocalizations being systematically paired with reinforcers. The brief pairing history is continually altered by extended non-pairing experiences and with somewhat predictable effects. Specifically, the established vocal response might extinguish due to the weakening of the effectiveness of the vocalization as a conditioned reinforcer. Over extended periods of intervention and observation, a situation might actually be arranged wherein the probability of the vocalization being followed by a reinforcer is much lower than it was before the intervention. That is, the rate of responding is somewhat higher due to the intervention but very few of the vocalizations (most likely only the first few vocalizations made following the pairing session) might be followed by potent reinforcers. This is not to be confused with an intermittent schedule of reinforcement, which would be expected to produce behavior very resistant to extinction. Rather it is the equivalent of an FR1 schedule for the first few responses followed by an extinction schedule for the remaining responses.

A final but important consideration for future research is the specific experimental ar-

rangement employed to investigate the effects of the pairing procedure. In this study and in the Miguel et al. (2002) study, an experimental phase was introduced prior to the pairing phase to control for any possible effects of systematically introducing a reinforcer absent any pairing of the reinforcer with the experimenter's vocalization. However, doing so establishes a specific history of the reinforcer being present but not closely contiguous with nor contingent upon the targeted vocalization. In essence, a negative pairing history is arranged prior to the introduction of the stimulus-stimulus pairing procedure. Conversely, Yoon and Bennett employed no such control phase and demonstrated the most robust effects to date using this procedure. Future research should manipulate the presence and placement of the "control" phase to determine what if any role it plays in the results reported thus far in the literature.

In closing, it is important that behavior analysts employing a stimulus-stimulus pairing procedure to increase spontaneous vocalizations in clinical practice proceed with caution until a clearer picture of both the effects of the pairing procedure and the optimal conditions for its use is available. Widespread dissemination of a promising intervention before it has been empirically validated is a potentially harmful practice. As a science-based discipline, we need to put our horses squarely in front of our carts.

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