

ASSESSING AND TREATING VOCAL STEREOTYPY IN CHILDREN WITH AUTISM

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Previous research implies that stereotypic behavior tends to be maintained by the sensory consequences produced by engaging in the response. Few investigations, however, have focused on vocal stereotypy. The current study examined the noncommunicative vocalizations of 4 children with an autism spectrum disorder. First, functional analyses were conducted in an attempt to identify the function of each child's behavior. For each of the participants, it was found that vocal stereotypy was likely not maintained by the social consequences. Following assessment, response interruption and redirection (RIRD) was implemented in an ABAB design to determine whether vocal stereotypy could be successfully redirected. RIRD involved a teacher issuing a series of vocal demands the child readily complied with during regular academic programming. Vocal demands were presented contingent on the occurrence of vocal stereotypy and were continuously presented until the child complied with three consecutively issued demands without emitting vocal stereotypy. For each child, RIRD produced levels of vocal stereotypy substantially lower than those observed in baseline. For 3 of the children, an increase in appropriate communication was also observed. The children's teachers were trained to implement RIRD. Brief follow-up probes and anecdotal information implied that the treatment had a positive impact in the natural environment.

DESCRIPTORS: vocal stereotypy, automatic reinforcement, response interruption, autism

Stereotypic behavior has been the subject of intense study for a number of years. Although it is behavior that occurs during typical development (Foster, 1998; Troster, 1994), its persistence in the repertoires of persons with developmental disabilities is thought to interfere with skill acquisition (e.g., Dunlap, Dyer, & Koegel, 1983; Morrison & Rosales-Ruiz, 1997) and can have adverse social consequences (e.g., Jones, Wint, & Ellis, 1990; Wolery, Kirk, &

Gast, 1985). Stereotypic behavior is also among the diagnostic criteria for autism spectrum disorders (e.g., Lewis & Bodfish, 1998). Although it is often also present in persons with mental retardation, it has been thought that stereotypy occurs more frequently and at greater intensities in people with autism (Bodfish, Symons, Parker, & Lewis, 2000).

Topographical definitions of stereotypic behavior characterize it as repetitive motor and vocal responses (e.g., Matson, Kiely, & Bamberg, 1997; E. A. Smith & Van Houten, 1996). It is also widely presumed that stereotypy serves no function (e.g., Bodfish et al., 2000; Matson et al.), but it has also been postulated that it might be automatically reinforced by the sensory consequences that it produces (e.g., Iwata, 1999; Lovaas, Newsom, & Hickman, 1987; Rincover, 1978). There is some evidence

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that stereotypy can be related to demand situations (Mace, Browder, & Lin, 1987) and is perhaps sensitive to other social consequences (e.g., Kennedy, Meyer, Knowles, & Shukla, 2000); however, experimental analyses of stereotypy often indicate that it is either reinforced by sensory consequences emanating from engaging in the behavior or is controlled by multiple sources of reinforcement, including the sensory consequences (Iwata; Kennedy *et al.*).

Vocal stereotypic behavior has received little recent study in the behavioral literature. Schreibman and Carr (1978) describe echolalia as the "parroting of the speech of others." This study focused on immediate echolalia, and the authors developed procedures for replacing the contextually inappropriate repetitions (or partial repetitions) of teacher-issued demands by children with autism with a more appropriate response (e.g., "I don't know" or a correct response to the question). Echolalic responses can also involve vocalizations that do not involve immediate or near-immediate repetitions of the vocalizations of others or do not bear a resemblance to words (e.g., Falcomata, Roane, Hovanetz, Kettering, & Keeney, 2004; Fay & Schuler, 1980; Lovaas *et al.*, 1987; Prizant & Rydell, 1984; Taylor, Hoch, & Weissman, 2005). These vocalizations can vary in intensity, comprehensibility, and bout length, and whether they are echos of the vocalizations of others is often questionable.

One approach to developing treatment for automatically reinforced behavior has been to attempt to isolate the specific source of stimulation that maintains such responding. It has long been thought that identifying a specific source of stimulation that maintains a behavior can be translated into establishing other means of accessing similar sensory stimulation that can then be used to reduce undesirable behavior (e.g., Favell, McGimsey, & Shell, 1982; Vollmer, 1994). This hypothesis has spurred productive research that has found that providing alternative access to the sensory stimu-

lation that maintains behavior (e.g., Goh *et al.*, 1995; Piazza, Adelinis, Hanley, Goh, & Delia, 2000) can lead to lower levels of stereotypic behavior. It should be noted that access to dissimilar forms of sensory stimulation can also produce lower levels of stereotypy (e.g., Ahearn, Clark, DeBar, & Florentino, 2005; Vollmer, Marcus, & LeBlanc, 1994). Furthermore, Taylor *et al.* (2005) found that providing contingent access to matched stimulation through a negative punishment contingency (i.e., differential reinforcement of other behavior) produced a low level of vocal stereotypy for a child with autism, but response-independent access to that stimulation was ineffective. Such differential reinforcement is also not always successful in decreasing stereotypic responding (e.g., Fellner, Laroche, & Sulzer-Azaroff, 1984). Fellner *et al.* found it necessary to include response blocking with differential reinforcement in a treatment package to produce lower levels of stereotypy.

As an approach to treating behavior presumably maintained by sensory stimulation, response blocking has been referred to as sensory extinction (Rincover, 1978). Sensory extinction is typically achieved by either modifying the environment (e.g., Rincover; Rincover & Devany, 1982) or directly disrupting the behavior (e.g., Dorsey, Iwata, Reid, & Davis, 1982; Reid, Parsons, Phillips, & Green, 1993). However, behavior change achieved through such procedures can be attributed to punishment and not extinction (see Lerman & Iwata, 1996). Moreover, altering the sensory feedback provided by problem behavior might be necessary to facilitate an increase in the probability of other more appropriate behaviors such as social interaction and cooperative play.

The purpose of the current study was to systematically assess and treat vocal stereotypy in children with an autism spectrum disorder. Initially vocal stereotypy, in children who exhibited high to moderate levels thought to interfere with either skill acquisition or social

acceptance, was exposed to an experimental analysis to rule out typical social consequences as a primary maintaining variable (e.g., Iwata et al., 1994). Response interruption was used in the current study as an intervention for vocal stereotypy because response blocking has been shown to be effective for other forms of automatically reinforced behavior (e.g., Fisher, Grace, & Murphy, 1996; Lerman & Iwata, 1996; Reid et al., 1993; R. G. Smith, Russo, & Le, 1999). In addition, only these four studies have used response interruption as the sole means of producing lower levels of problem behavior (Worsdell, 2000), and none of these studies involved interruption of vocal responses. It was assumed that interrupting vocal responses and redirecting behavior towards appropriate vocalizations the child had acquired during instruction (i.e., answering social questions, vocal imitation) would decrease the probability of the problem behavior.

METHOD

Participants and Setting

The participants were 2 boys and 2 girls who had been diagnosed with an autism spectrum disorder and had been referred by their clinical and educational service providers as exhibiting vocal stereotypy that interfered with their participation in educational activities or occurred at unacceptable levels outside class. Each child was receiving intensive vocal and augmentative (except for Mitch, who received only vocal) communication training prior to and during the study.

Mitch was a 3-year-old boy who had been diagnosed with pervasive developmental disorder (not otherwise specified) and who received educational and clinical services in a preschool setting; he lived with his parents. Although he initiated communicative attempts inconsistently, he was able to communicate vocally for the purposes of requesting specific items and activities, labeling, rejecting, imitating, greetings, and farewells. In addition, he was able to

answer some social questions (e.g., "What is your name?"). His vocal stereotypy primarily consisted of word approximations and noises. Peter was an 11-year-old boy who had been diagnosed with autism and who was a residential student. He also communicated vocally for the purposes of requesting specific activities and items, labeling, rejecting, and answering familiar questions, although unintelligible speech was frequently observed. The majority of his spontaneous vocalizations were for the purpose of requesting desired items and rejecting tasks, but initiation of communicative attempts was inconsistent. His vocal stereotypy consisted of a mixture of repeated words, word approximations, and noises. Nicki and Alice, fraternal twins, were 7-year-old girls who had been diagnosed with autism. They were also residential students at the time the study was conducted. Nicki's primary method of communication was vocal, although she frequently spoke unintelligibly and initiated communicative attempts inconsistently. The majority of her spontaneous communication attempts were for the purposes of requesting desired items. Her vocal stereotypy consisted of repeated words, word approximations, and noises. Alice did not often communicate vocally and rarely initiated vocally. Her primary mode of communication was through the use of a picture exchange communication system (PECS), natural gestures, and some manual signs. The majority of her spontaneous communicative attempts were to request desired items. She also readily participated in vocal imitation exercises. Her vocal stereotypy primarily consisted of noises and some word approximations.

All sessions were conducted in a room (1.5 m by 3 m) equipped with wide-angle video camera, microphone, video recording equipment, materials necessary to conduct the experimental conditions, and a table with two chairs. No materials were included in the rooms during the treatment comparison that might confound the effects of the intervention.

FUNCTIONAL ANALYSIS

Response Measurement and Interobserver Agreement

Vocal stereotypy was defined as any instance of noncontextual or nonfunctional speech and included singing, babbling, repetitive grunts, squeals, and phrases unrelated to the present situation. Examples include “ee, ee, ee, ee” outside the context of a vocal imitation task and laughter in the absence of a humorous event. Nonexamples include repeating a delivered instruction and making or responding to a request. All functional analysis sessions were 5 min in duration, and data on vocal stereotypy were collected using 10-s momentary time sampling. For every 10 s of session time, an observation of 2 s occurred during which the occurrence or nonoccurrence of vocal stereotypy was recorded. The observation moment began as each 10-s interval elapsed within a session and lasted for an additional 2 s (e.g., from the 10th through the 12th second). Momentary time sampling was used because it provided an efficient and more accurate estimate of frequency and duration for stereotypic behavior than partial-interval recording (Gardenier, MacDonald, & Green, 2004). Interobserver agreement was calculated by dividing the number of intervals with agreements by the total number of intervals with agreements plus disagreements and multiplying by 100%. Agreement was scored for a minimum of 33% (range, 33% to 57%) of each condition for each participant. Mean total agreement for vocal stereotypy was 95% (range, 91% to 100%) for Mitch, 91% (range, 86% to 98%) for Peter, 95% (range, 92% to 100%) for Alice, and 94% (range, 87% to 100%) for Nicki.

Assessment Design, Conditions, and Results

A functional analysis of vocal stereotypy, based on the procedures reported by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994), was conducted (see Figure 1). Five-minute sessions were used because the partici-

pants alternated rapidly between activities in their educational setting. The demand condition was modified so that demands were delivered every 15 s, and 15-s breaks after the occurrence of vocal stereotypy were delivered. Demands were those typically encountered during the child’s instructional programming, had not been mastered (i.e., performance below 80% correct), and were nonvocal in nature. The play condition was modified so that response-independent attention was delivered every 15 s. The attention and alone conditions were unmodified, except for session length. Materials used during the attention and play conditions were identical, moderately preferred activities that the child engaged with during assessment. Immediate echos of the verbal utterances of the teachers did not result in consequences, were omitted from the data analyses, and were not targeted responses. Following the multielement assessment, a series of alone sessions was conducted for Mitch, Peter, and Alice. A series of play sessions was conducted for Nicki because her vocal stereotypy occurred most consistently in this condition; however, there was no response-independent delivery of attention during this block of sessions. These sessions were used to determine whether vocal stereotypy would persist in the absence of contingent social consequences. During this phase of the assessment, three 5-min sessions were conducted each day.

It was found that vocal stereotypy occurred at the highest level during the alone condition for both Mitch and Peter. Vocal stereotypy persisted at high levels during the alone-only phase for Mitch and for Peter after some initial variability. Alice’s multielement assessment was undifferentiated, with the lowest level of behavior observed during the demand condition. During the alone-only phase, Alice’s vocal stereotypy was more stable and averaged above 85%. Vocal stereotypy was highly variable during Nicki’s multielement assessment but occurred at the highest level in the play

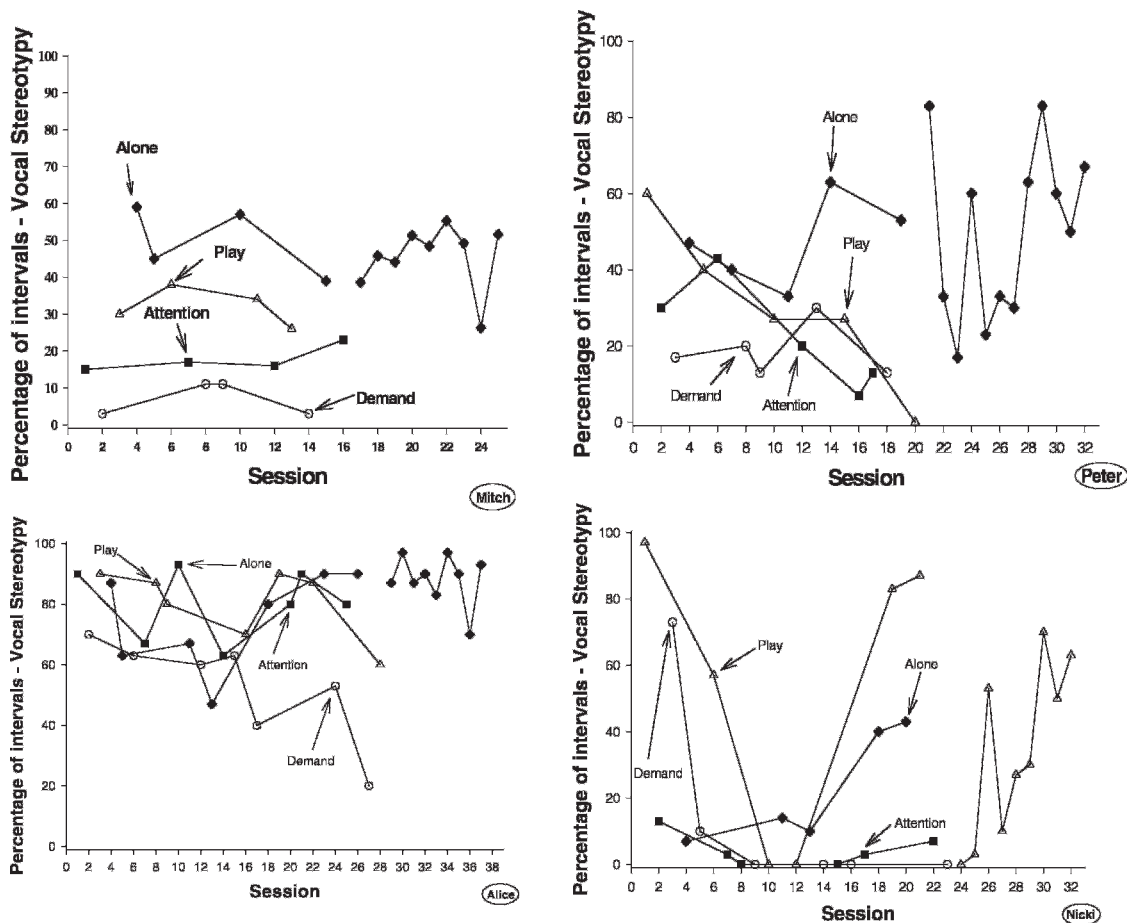


Figure 1. Percentage of intervals with stereotypic behavior for Mitch and Peter during multielement sessions and a series of alone sessions. Percentage of intervals with stereotypic behavior for Alice and Nicki during multielement sessions and a series of alone sessions for Alice and play without attention sessions for Nicki.

condition. During the modified play phase, Nicki’s vocal stereotypy occurred more frequently across each day’s sessions with an increasing trend across days. The results imply that vocal stereotypy was not mediated by social contingencies and was presumably maintained by the sensory consequences of vocalizing.

TREATMENT

Response Measurement and Interobserver Agreement

During treatment, data on vocal stereotypy and appropriate vocalizations were collected using continuous duration recording. Both

vocal stereotypy and appropriate vocalizations were measured during the baseline and treatment conditions. The definition of vocal stereotypy was the same as the definition used during assessment. *Appropriate vocalizations* were defined as any contextually appropriate vocalization not directed by a teacher and included requests for attention, breaks, or tangible activities, and comments. An occurrence of appropriate vocalization was always immediately followed by a teacher comment. Examples of appropriate vocalizations include requests for social interaction (e.g., “I want tickles”), edible items (e.g., “I want chips”),

activities (“I want playground”), and comments (e.g., “Your shirt is blue”). However, if the appropriate vocalization occurred twice before the teacher responded, it was not scored as an appropriate vocalization. If the vocalization was repeated following the teacher’s response, it was scored as another appropriate vocalization. Nonexamples include repeating a teacher-issued comment and vocal stereotypy. The total number of seconds of vocal stereotypy in each session was divided by the total number of seconds in the session (300 s) and multiplied by 100% to calculate the proportion of the session in which stereotypic behavior occurred. Two independent observers recorded responding for a minimum of 32% of sessions for each participant (range, 32% to 45%). Exact agreement (total seconds of vocal stereotypy in a session recorded by each observer) was calculated, and agreement exceeded 90% across conditions and participants. Mean agreement for vocal stereotypy was 99% (range, 98% to 99%) for Mitch, 90% (range, 84% to 96%) for Peter, 96% (range, 95% to 98%) for Alice, and 93% (range, 89% to 97%) for Nicki. Data on appropriate vocalizations were also recorded continuously. Appropriate vocalizations were discrete and varied little in duration for all participants. Cumulative frequency per session is reported for each participant. Exact agreement was calculated for a minimum of 32% of each condition for each participant by comparing the cumulative frequencies recorded by observers; agreement was 100% across conditions and participants.

Response Interruption and Redirection (RIRD)

The effects of response interruption and redirection (RIRD) were tested in an ABAB withdrawal design. Baseline sessions were 5 min in duration and consisted of the student and the teacher present in the room with a table, chairs, and no other materials (i.e., no edible items or activities were present). The purpose was to systematically apply response blocking and assess the intervention’s effect on vocal stereo-

typy. Research showing the decelerative effects of environmental enrichment on behavior and our clinical experience applying RIRD and enriched environments led us to question whether we would be able to identify a treatment effect once we initiated intervention. It had been anecdotally noted that some children began to initiate communicative attempts during RIRD that persisted in the absence of the treatment and that enriching the environment sometimes produced more appropriate responding. This would compromise the determination of functional control over behavior.

If the student independently vocalized, the teacher delivered praise for using appropriate language and delivered the request if possible. For instance, if the student said, “I want a tickle,” the teacher responded by saying, “Nice job asking for a tickle,” and briefly tickled the student. If the child requested an item (e.g., a chip) that was not available, the teacher responded by saying, “Nice job asking for a chip, maybe we can have some soon.” There were no programmed consequences for vocal stereotypy. Baseline continued for at least three sessions and until vocal stereotypy was relatively stable or a deteriorating trend was obtained.

RIRD was implemented in sessions that resembled baseline in that the teacher delivered praise to the student for using appropriate language and honored requests if possible (no additional materials were included during treatment). However, occurrences of vocal stereotypy were interrupted immediately and redirection to other vocalizations took place. For example, the student and teacher were seated in the room; if the student engaged in vocal stereotypy, the teacher prompted attending and then provided prompts for appropriate language. More specifically, in a neutral tone of voice the teacher stated the child’s name while initiating eye contact and issued the prompts that required a vocal response. The prompts were in the form of social questions for Mitch,

Paul, and Nicki (e.g., “What’s your name?”; “Where do you live?”; “What color is your shirt?”). Vocal imitation (e.g., “say ball,” “say red,” “say dog”) was used for Alice because she did not reliably answer social questions. For each child, the vocal demands were skills that had been performed correctly (i.e., at least 89% correct per opportunity) and fluently (i.e., correct across at least two teachers and settings) during regular educational instruction. The teacher continued to provide prompts for appropriate language until the student complied with three consecutive correct responses in the absence of vocal stereotypy, at which time the teacher delivered social praise for using appropriate language (e.g., “Super job talking!”). Furthermore, a session clock that started at the beginning of the session was stopped each time the teacher implemented RIRD, and was restarted after the teacher-delivered social praise following the three consecutive instances of compliance. The session continued until the session clock indicated that 5 min had transpired in which the student was not in treatment. When the treatment sessions were scored, seconds during which the procedure was being implemented were subtracted from the total session time so that each session consisted of 5 min in which behavior was free to occur. Neither vocal stereotypy nor appropriate vocalizations that occurred during the RIRD sequence were included in the reported data.

Follow-Up

Training was conducted for each participant’s teachers. Mitch’s primary teacher served as the therapist for all of his sessions, and further training was unnecessary. However, for the other children, a team of teachers provided their daily instruction. Therefore, teachers who worked regularly with the child were provided training until they reached a high level of treatment integrity. Teachers also reviewed videotapes of treatment sessions and were given written instructions.

For Peter, Alice, and Nicki, pre- and postintervention probe data were collected. Prior to the initiation of the functional analysis and 1 month after the implementation of the procedures by the child’s teachers in their classrooms, four videotaped probes were obtained. Each probe was 5 min long and occurred during naturally occurring demand and leisure times. Vocal stereotypy was defined as in assessment and treatment, and was scored using momentary time sampling as in assessment. Interobserver agreement scores were obtained in 100% of the pre- and postintervention probes and exceeded 95% across conditions and children. Data on vocal stereotypy were also recorded by the student’s clinical team during regular instructional hours for each participant. Following the introduction of the intervention, these data were reviewed for each child for the remainder of the academic quarters in their educational plan.

RESULTS

For Mitch, vocal stereotypy occurred at a moderate to high level, and appropriate vocalizations occurred infrequently during the initial baseline (Figure 2). When RIRD was introduced, vocal stereotypy immediately decreased to a low level, and appropriate vocalizations occurred more often. During the return to baseline, vocal stereotypy increased to a moderate level, and appropriate vocalizations became slightly less frequent. After the reintroduction of RIRD, vocal stereotypy approached zero, and appropriate vocalizations became more frequent. For Peter, vocal stereotypy occurred at a moderate level and appropriate vocalizations were infrequent during the initial baseline (Figure 2). When RIRD was introduced, vocal stereotypy decreased to a lower level, and appropriate vocalizations became more frequent. During the return to baseline, a downward trend was obtained for vocal stereotypy; however, baseline levels were not recovered. Appropriate vocalizations remained

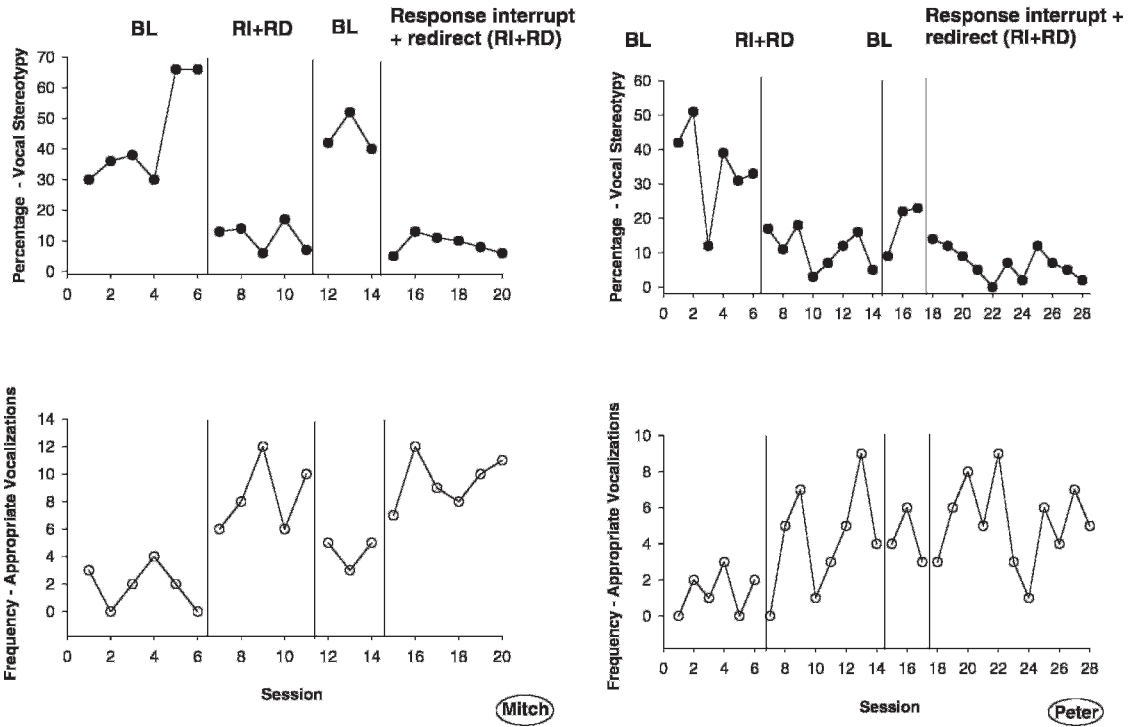


Figure 2. The percentages of each session with stereotypic behavior for Mitch and Peter are depicted on the left axis. The frequency of appropriate speech is depicted on the right axis.

more frequent than during the initial baseline. After the reintroduction of RIRD, vocal stereotypy decreased and appropriate vocalizations were more frequent. For Alice, vocal stereotypy occurred at a high level, and appropriate vocalizations were not observed during the initial baseline (Figure 3). When RIRD was introduced, vocal stereotypy decreased, and some appropriate vocalizations were observed. In the return to baseline, vocal stereotypy increased to a high level, and no appropriate vocalizations were observed. When RIRD was reintroduced, vocal stereotypy occurred at a low level, and appropriate vocalizations became more frequent but were variable. For Nicki, vocal stereotypy occurred at moderate to high levels during the initial baseline (Figure 3). When RIRD was introduced, vocal stereotypy immediately decreased. During the return to baseline, a moderate level of vocal

stereotypy was observed after several sessions. When RIRD was reintroduced, a zero level of occurrence was approached. No appropriate vocalizations were observed in any of the conditions for Nicki.

Follow-Up

It was also noted that levels of vocal stereotypy in the natural environment were substantially lower in the postintervention probes than in the preintervention probes (Peter: pretreatment 33% and 44%, posttreatment 1% and 4%; Alice: pretreatment 25% and 77%, posttreatment 3% and 13%; Nicki: pretreatment 54% and 78%, posttreatment 16% and 24%). Following the intervention, two to three academic quarters remained in the educational plans. Each child's vocal stereotypy objective was met for each of these quarters, with the exception of Nicki. For one quarter she

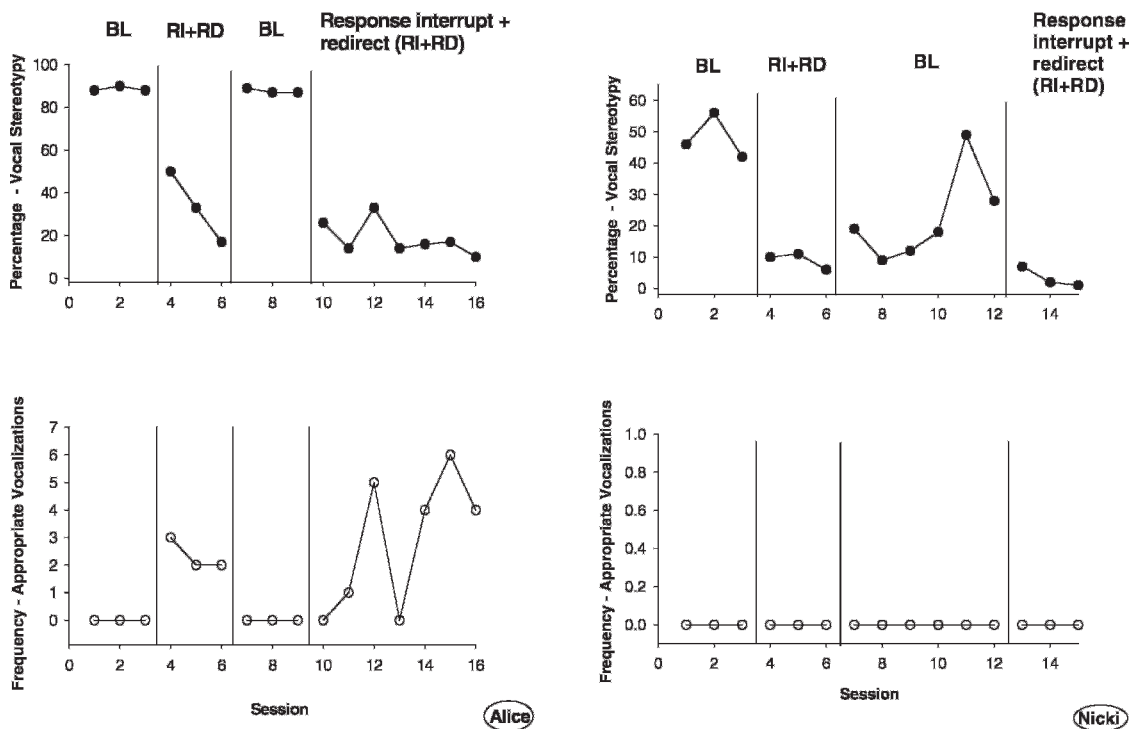


Figure 3. The percentages of each session with stereotypic behavior for Alice and Nicki are depicted on the left axis. The frequency of appropriate speech is depicted on the right axis.

made progress on this objective, and the objective was met for the other two quarters. Both Mitch and Nicki now receive educational services in their home school districts.

DISCUSSION

The present study found that vocal stereotypy is similar to other forms of stereotypic behavior in that, at least with these participants, it was not socially mediated and seemed to be maintained by its sensory consequences. This is similar to the findings of Taylor et al. (2005), which imply that the sounds produced by stereotypic vocalizations are the operative sensory consequence that maintains stereotypy. However, the vibration produced by engaging in the vocalizations cannot be ruled out as a reinforcer. Although the assessment data support this automatic reinforcement hypothesis, stereotypy that persists in the absence of

social contingencies does not rule out sensitivity to such variables; further research is warranted towards this end (Vollmer, 1994).

The present study also replicates the findings of several other studies showing that stereotypic behavior can be modified by blocking or interrupting its occurrence (e.g., Fisher et al., 1996; Lerman & Iwata, 1996; Reid et al., 1993; R. G. Smith et al., 1999). The current study replicates the finding that response interruption alone can produce significant behavior change. Each of the earlier studies measured the effects of response blocking with a single participant (with the exception of Reid et al., in which the hand mouthing of 2 persons was blocked by placing a therapist's hand in front of the client's mouth). A unique contribution of this study was the adaptation of response blocking for a vocal response.

There are two possible operant mechanisms for change via this technique. One possibility is

that the sensory consequences of vocal stereotypy were dampened by response interruption, and stereotypy was extinguished. This is consistent with the assertions of Rincover (1978) and Reid *et al.* (1993). However, the only empirical demonstration that response blocking produces change through extinction is provided by R. G. Smith *et al.* (1999). After demonstrating that response blocking effectively reduced behavior, Smith *et al.* blocked some but not all responses, varying the proportion of responses blocked systematically. It was not until nearly all responses had been blocked that behavior became less frequent, indicating that behavior changed through extinction. Alternatively, response blocking may serve as an aversive event contingently produced by behavior. Lerman and Iwata (1996) demonstrated that punishment was the operative mechanism of change when they systematically blocked some but not all responses. The current study was not, however, designed to distinguish between these possible mechanisms. Future research that arranges for systematically blocking proportions of responses as in Lerman and Iwata and Smith *et al.* across a large number of participants would be necessary to identify the most likely operant mechanism for response blocking. As these studies suggest, the mechanism may be idiosyncratic.

In addition, the decreased occurrence of vocal stereotypy may have established the consequences for appropriate speech as more reinforcing for the 3 children who spoke more during the RIRD condition. Recall that there was no difference in the contingencies for appropriate speech across baseline and treatment. That appropriate vocalizations emerged was a positive side effect of RIRD. Teachers were directed to respond to appropriate speech in a manner analogous to how the speech would be responded to in the natural environment. That is, teachers praised the use of appropriate speech and honored those requests that could be accommodated. Having arranged specific or

incidental instruction to emit appropriate vocalizations (e.g., requests or comments) would have potentially augmented the treatment effects but could have interfered with establishing functional control by the treatment over responding. This study was arranged to specifically test the effects of response blocking, and future investigations should test the effects of arranging specific instruction for appropriate vocal behavior (e.g., mand or tact training or baiting the environment with preferred stimuli) in combination with response interruption. That appropriate vocalizations did not emerge for Nicki, who was more verbally competent than Alice, was surprising.

A variety of appropriate vocalizations, mands, tacts, comments, and greetings emerged for Mitch, Peter, and Alice. Most of the vocalizations emitted by Mitch were mands for social interaction (e.g., "I want tickles"), but some were for items that were not present (e.g., "I want raisins"). For Alice, social greetings (e.g., "Hi"), mands for social interaction (e.g., "Hugs, please"), and mands for tangible items that were not present emerged. None of the words spoken by these children were present in the demands issued during intervention. However, some of the words emitted by Peter occurred during intervention and were emitted as tacts (e.g., "Your shirt has stripes") or comments (e.g., "The sky is blue"). He also emitted mands.

Given that it is physically unfeasible to block vocalizations, issuing demands that involve a vocal response on the part of the child was assumed to have the advantage of producing appropriate behavior that was momentarily incompatible with vocal stereotypy. On the other hand, the demands used in the demand condition of the functional assessment were nonvocal, and generally lower levels of vocal stereotypy were observed during that condition for all participants. It is possible that the same treatment effect produced by RIRD could have been obtained with nonvocal demands. There

was a decreasing trend for both Alice and Nicki during the demand condition, and this could have been due to demands that reduced vocal stereotypy. However, if vocal stereotypy was occurring just as a demand was to be presented, the therapist removed the demand materials. It should also be noted that participating in academic demands was not associated with other problem behavior, and each of the participants readily complied with both vocal and nonvocal demands. Nonetheless, future investigators may wish to determine whether the presentation of any demand could reduce vocal stereotypy.

Demands used for each child consisted primarily of tasks that the child had mastered (i.e., accurately responded to on at least 89% of opportunities). Redirection to other verbal behavior (e.g., comments or requests that could be reinforced by teachers) may have also produced the observed changes and may have produced more frequent or more complex appropriate vocalizations. However, each of these children received instruction for commenting and requesting but initiated appropriate vocalizations inconsistently and required frequent prompting to emit such behavior. Therefore, familiar and mastered vocal demands were used in the current study. For several of the children, there were many of these responses in their repertoires, but for Alice these demands were limited to vocal imitation. It is possible that this procedure will be of limited effectiveness for individuals with similar or more restricted vocal repertoires. It is also important to note that vocal stereotypy maintained by attention could be increased by RIRD. Given that vocal stereotypy decreased for all participants during intervention, this is indirect evidence that their vocal stereotypy was not maintained by attention.

One limitation of the study was that the return to baseline for Peter was brief. Although a downward trend was obtained, the baseline level of vocal stereotypy was not recovered.

Among the other limitations of this study are the resources necessary for providing such intense intervention. In the initial sessions of RIRD, it was not uncommon for the overall session length (i.e., with intervention time added to the 5-min session) to exceed 10 min. Each of the children readily complied with the demands issued by the teacher. Vocal stereotypy tended to occur after complying with a demand, or before or immediately following the teacher-delivered praise. By the final sessions for each child (Figures 2 and 3), the overall session lengths generally were no more than about 6 min. This was the point at which teachers were trained to implement the procedure. Also, although treatment integrity was well above 95%, it is likely that low treatment integrity would have a detrimental effect on outcome. Finally, RIRD was initially introduced in brief sessions, and limited information was gathered about the lasting effects of the intervention on behavior in the natural environment. Future research is necessary to establish the social validity of this procedure. In addition, given that other complementary procedures, such as providing specific verbal behavior training (e.g., requests and comments) during response interruption, would likely enhance the effectiveness of the intervention, this study should be seen as a preliminary step towards determining the utility of RIRD.

Another limitation of the study was that different data-collection procedures were used across assessment and treatment and for appropriate and inappropriate responding. Ideally, the same data-collection procedures should be used across experimental phases. However, comparisons of the level of responding in assessment and treatment were not made nor particularly germane to the purpose of the study. Less time-intensive measures were used during assessment to proceed to treatment as rapidly as possible. More significant is the difference in measurement procedures used across responses. Both inappropriate and appropriate responding could

have been measured with duration recording. However, appropriate responding was often briefer and evoked a scripted response by the teacher. These scripted responses could have interrupted more lengthy utterances. Future investigators may want to alter their procedures to address such concerns.

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