

AN ANALYSIS OF VOCAL STEREOTYPY AND THERAPIST FADING

ELIZABETH S. ATHENS, TIMOTHY R. VOLLMER, AND KIMBERLY N. SLOMAN

UNIVERSITY OF FLORIDA

AND

CLAIRE ST. PETER PIPKIN

WEST VIRGINIA UNIVERSITY

A functional analysis for a boy with Down syndrome and autism suggested that vocal stereotypy was maintained by automatic reinforcement. The analysis also showed that instructions and noncontingent attention suppressed vocal stereotypy. A treatment package consisting of noncontingent attention, contingent demands, and response cost effectively reduced vocal stereotypy. The treatment package remained effective even when noncontingent attention was removed, making the procedure easier to implement. Also, the presence of the therapist in the room with the participant was faded systematically. After completion of fading, vocal stereotypy remained low during conditions similar to the no-consequence phase of the functional analysis.

DESCRIPTORS: autism, Down syndrome, response cost, treatment fading, vocal stereotypy

Some individuals with developmental disabilities display repetitive noncontextual vocal behavior or vocal stereotypy. The exact topography of vocal stereotypy can vary, and published reports include echolalia (Ahearn, Clark, DeBar, & Florentino, 2005), noncontextual phrases or words (Falcomata, Roane, Hovanetz, Kettering, & Keeney, 2004), repetition of unintelligible sounds (Taylor, Hoch, & Weissman, 2005), or some combination. Vocal stereotypy is a concern to caregivers because its occurrence can adversely affect the individual who engages in the behavior by interfering with more desirable behavior and can be disruptive to those around the individual.

Several studies have shown that vocal stereotypy can be maintained by automatic reinforcement (e.g., Ahearn, Clark, MacDonald, & Chung, 2007; Falcomata et al., 2004; Taylor et al., 2005). Automatically reinforced behavior is often difficult to treat, because the contingency of reinforcement that maintains the behavior is

generally inaccessible (see Vollmer, 1994). Falcomata et al. found that noncontingent reinforcement (NCR) plus response cost was more effective than NCR alone in decreasing the vocal stereotypy of an 18-year-old boy with autism. Ahearn et al. found that response interruption and redirection effectively decreased the vocal stereotypy of 4 children with autism spectrum disorder. In the current study we used a treatment approach similar to those used by Falcomata et al. and Ahearn et al., but we also attempted to develop a treatment package that required fewer resources to implement by gradually reducing the therapist's presence.

METHOD

Participant, Setting, and Data Collection

Joe was an 11-year-old boy who had been diagnosed with Down syndrome and autism. His parents sought services for treatment of his vocal stereotypy, which took the form of loud, repetitive, noncontextual verbalizations (e.g., saying "banana" when this was not contextually appropriate) and repetitive, loud, unintelligible vocalizations (e.g., "ahhh"). Joe's expressive skills included communicating vocally for the

Correspondence should be directed to Timothy R. Vollmer, Department of Psychology, University of Florida, Gainesville, Florida 32611 (e-mail: vollmera@ufl.edu).

doi: 10.1901/jaba.2008.41-291

purposes of requesting items or activities and labeling; his receptive skills included responding appropriately to simple vocal instructions. When not engaging in vocal stereotypy, he spoke appropriately without the aid of external prompting. Sessions were conducted at Joe's home in a playroom; the room contained numerous play-related items that could not be removed from the room. Sessions were 5 min in duration, and two to three sessions were conducted 3 days per week.

Observers were graduate students who had been trained in behavioral observation. Observers used handheld computers that recorded real-time data on duration of vocal stereotypy and on the therapist's presence or absence from the therapy room. Data were also collected on delivery of demands, noncontingent attention, and removal of toy items during treatment phases. The mean for these measures was above 98% (exact measures are available from the second author). In 48% of functional analysis sessions, 25% of treatment sessions, and 48% of treatment fading sessions, two observers simultaneously and independently collected data. To calculate interobserver agreement, each session was divided into 10-s bins, and the number of observed responses was tallied for both observers. For each bin, the smaller number of observed responses was divided by the larger number of observed responses (Bostow & Bailey, 1969). Agreements on the nonoccurrence of behavior in a bin were counted as 100% agreement. The percentage of each bin was then averaged across the entire session. During functional analysis, treatment, and treatment fading, mean agreement for vocal stereotypy was 91% (range, 86% to 100%), 93% (range, 83% to 100%), and 92% (range, 81% to 100%), respectively. Agreement for the therapist's absence from the therapy room was assessed on 46% of the sessions with a mean of 93% (range, 88% to 99%).

Procedure

Functional analysis. The functional analysis was based on the procedures of Iwata, Dorsey,

Slifer, Bauman, and Richman (1982/1984). Attention, demand, control, and no-consequence conditions were conducted. During the attention condition, brief social reprimands ("Joe, don't do that") were delivered contingent on stereotypy. These reprimands were similar to the attention observed in a descriptive assessment as frequently following vocal stereotypy in the home. During the demand condition, a 30-s break from academic demands (e.g., "What color is this?") was provided contingent on vocal stereotypy. Academic demands were selected based on parental report that these demands were skills targeted for instruction in his school classroom. An alone condition (Iwata *et al.*) was not conducted based on parent report that when in the home, Joe had continuous access to tangible items. A no-consequence condition was therefore conducted in place of the alone condition. During the no-consequence condition, play items were available; however, social interaction was withheld, and there were no programmed consequences for vocal stereotypy. Also, observers remained a minimum of 1.52 m from Joe and out of his direct line of sight. Following the functional analysis, a phase of repeated no-consequence sessions was implemented. This allowed further examination of the occurrence of vocal stereotypy in conditions in which there were no programmed social consequences for the behavior (Vollmer, Marcus, Ringdahl, & Roane, 1995).

Treatment. Baseline was similar to the no-consequence condition from the functional analysis. During treatment sessions, play items remained available. In some of the treatment sessions, the intervention consisted of three components including noncontingent attention (NCA), contingent demand, and response cost. In other sessions, the intervention consisted of contingent demand plus response cost only (two-component condition). NCA consisted of delivering 5 to 10 s of attention in the form of social statements (e.g., "That's a cool car") on a

fixed-time 30-s schedule. During the contingent demand component, academic demands similar to those delivered in the demand condition of the functional analysis were delivered contingent on vocal stereotypy. At least 12 types of different, yet related, demands were delivered in varied order. All demands required a vocal response. These demands were selected based on data from the functional analysis indicating Joe was both accurate and fluent with the required responses. Correct responses were followed by brief praise (e.g., "good job!"). Incorrect responses were followed by a model of the correct response (e.g., "say 'red'"). If vocal stereotypy occurred within 5 s of delivery of the academic demand, another demand was delivered. If vocal stereotypy occurred within 5 s of delivery of the second academic demand, response cost was implemented, and Joe lost access to the toy he was playing with for 10 s. He continued to have access to other toys in the room. After 10 s, the toy he had been playing with was returned. If vocal stereotypy continued to occur, the therapist continued to present the sequence of demands followed by toy removal. If vocal stereotypy ceased, contingent demand and response cost did not occur.

Treatment fading. Although levels of vocal stereotypy decreased during both the three-component treatment and the two-component treatment, neither treatment was practical to implement given the resources available. Joe's parents wanted him to play by himself without a high level of vocal stereotypy. Therefore, the presence of the therapist was faded systematically in a manner similar to the procedure described by Van Camp, Vollmer, and Daniel (2001). Throughout these sessions, the two-component treatment package was implemented contingent on vocal stereotypy. The two-component treatment was selected because it was less effortful than the three-component treatment but was equally effective.

A goal was adopted in conjunction with Joe's parents specifying that Joe would play alone

with vocal stereotypy occurring less than 3% of the time. The fading schedule involved gradually increasing the amount of time the therapist was out of the room (generally in 10-s increments). For example, the therapist first left the room for 10 s and returned for 60 s, and then she left for 20 s and returned for 60 s, and so on. While in the room, the therapist implemented the two-component treatment contingent on stereotypy. When out of the room, the therapist would come into the room and implement the treatment contingent on vocal stereotypy. In each case, treatment implementation ceased when 5 s without vocal stereotypy had passed. The interval indicating the amount of time to spend outside the room continued to elapse if the therapist reentered the room; if there was time left in the interval when vocal stereotypy ceased, the therapist exited the room for the remainder of the interval. Each fading step occurred after Joe had spent less than 3% of the session engaged in vocal stereotypy for at least two consecutive sessions. Throughout the fading conditions, the observers remained outside of the room and collected data by listening through a crack in the door.

RESULTS AND DISCUSSION

Results of the functional analysis (Figure 1) indicated that Joe's vocal stereotypy was sensitive to automatic reinforcement. Maintenance of responding during repeated no-consequence sessions supported this conclusion. Results also suggested that vocal stereotypy may have been sensitive to positive reinforcement in the form of social attention, although this function was not explored in the current study. Results of the functional analysis indicated the presence of academic demands and NCA (during control) in the form of social statements competed with the occurrence of vocal stereotypy. Attention in the form of reprimands during attention sessions (e.g., "It is time to be quiet now, Joe") did not, however, compete with the occurrence of vocal stereotypy.

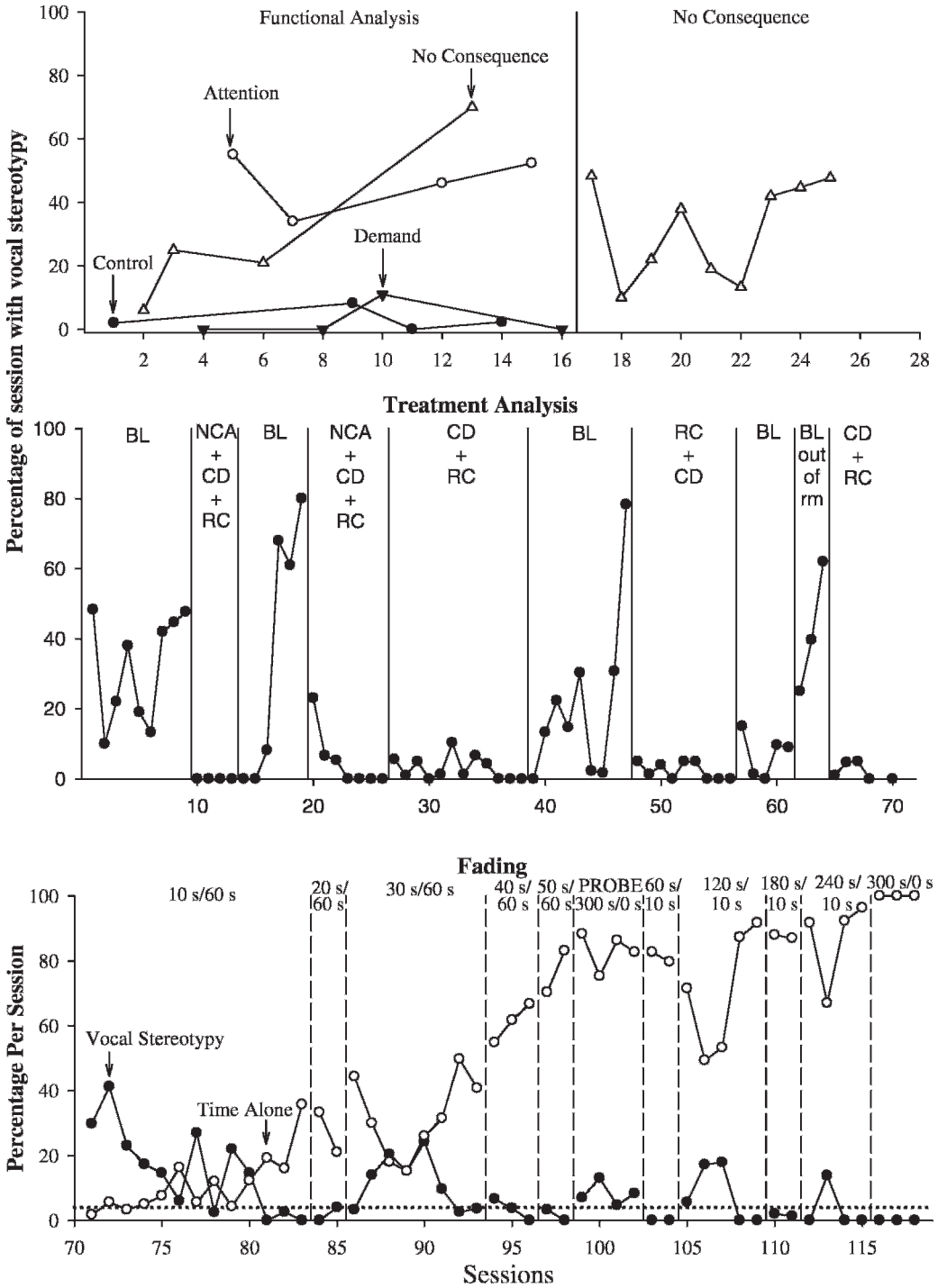


Figure 1. Percentage occurrence of vocal stereotypy during the functional analysis (top); treatment (middle) during baseline (BL), noncontingent attention (NCA), response cost (RC), and contingent demand (CD); and percentage occurrence of vocal stereotypy and the amount of time the therapist spent out of the room (bottom).

Figure 1 also shows the results of the treatment analysis. During baseline, Joe engaged in vocal stereotypy during a mean of 32% of sessions. During the three-component treatment, he engaged in no vocal stereotypy. Vocal stereotypy reemerged during the reversal to baseline before eventually decreasing to 0% during the reversal to the three-component treatment. When NCA was eliminated, the two-component treatment was equally effective. Following a reversal to baseline in which vocal stereotypy increased, the two-component treatment was reinstated and effectively decreased vocal stereotypy. In a subsequent reversal to baseline, vocal stereotypy increased but baseline levels were not recaptured. It appeared that the presence of the therapist and observers, each of whom had been paired with treatment extensively, could be exerting some inhibitory stimulus control over Joe's vocal stereotypy. To test this hypothesis, the therapist and observers stepped outside the room, scoring instances of vocal stereotypy by listening through a crack in the door. Under these conditions vocal stereotypy reemerged to levels similar to those obtained in the previous baseline conditions. A final phase was conducted with the two-component treatment, and vocal stereotypy eventually decreased substantially. Following this, the therapist fading procedure was implemented to decrease the therapist's presence in the room.

Throughout the systematic therapist fading (Figure 1) there was a corresponding decrease in vocal stereotypy and an increase in the amount of time the therapist spent out of the room. In Figure 1, for every fading condition, time out of the room for every x amount of time in the room is denoted in the condition label as out/in (seconds). For example, after initial implementation of the fading procedure, 10 s were spent out of the room for every 60 s spent in it; this was denoted as 10 s/60 s. Initially, Joe engaged in relatively high levels of vocal stereotypy whenever the therapist left the room. Therefore,

the therapist reentered the room to implement the treatment, and the time the therapist spent out of the room did not immediately increase. Responding eventually decreased, and the therapist's presence was gradually faded. Following the 50 s/60 s phase, probe sessions were conducted to assess responding when the therapist aimed for a full session (300 s) outside the room. Even though vocal stereotypy remained lower than what was observed in prior baseline sessions, the treatment goal of vocal stereotypy occurring during less than 3% of a session was not obtained in these sessions. Following probe sessions, the therapist fading continued. The gradual fading procedure was successful, in that by the end, three consecutive sessions were conducted with the therapist outside the room for 5 min and contained no vocal stereotypy.

Results of the current study show that a treatment package including NCA, contingent demand, and response cost effectively reduced the occurrence of vocal stereotypy maintained by automatic reinforcement. The effectiveness of NCA plus response cost replicated findings of previous treatment studies on vocal stereotypy (e.g., Falcomata et al., 2004). The elimination of the NCA component made the treatment easier to implement.

Also noteworthy is that the response cost component (toy removal) was rarely required. The response cost was implemented during only 0.02% of sessions in which NCA was present, 0.03% of sessions in which NCA was not present, and 5% of sessions in which the therapist's presence was faded. Joe complied with 100% of the demands presented throughout all treatment phases and frequently ceased engaging in vocal stereotypy following the delivery of the demand. The simultaneous implementation of contingent demands and response cost does not permit an empirical analysis of their contributing effects, but there are several hypotheses that can be constructed in relation to the factors that contributed to the

efficacy of contingent demands. For example, the efficacy may be due in part to the fact that Joe's vocal response to the demand was incompatible with engaging in vocal stereotypy. Previous studies have shown the effects of using an incompatible response to compete with problem behavior (Skiba, Pettigrew, & Alden, 1971; Wagaman, Miltenberger, & Arndorfer, 1993). Another possibility is that the contingent demand functioned as a punisher. On the few occasions that demand presentation did not decrease vocal stereotypy, however, toy removal stopped the response. Thus, the vocal demand may have served as a warning stimulus for toy removal. Regardless of the causal factors behind its efficacy, the finding that contingent demands decreased vocal stereotypy is similar to the findings presented by Ahearn *et al.* (2007). Specifically, these researchers implemented response interruption and redirection that were similar to the contingent demands delivered in this study and observed decreases in the vocal stereotypy of 4 individuals. The effectiveness of toy removal was predicted by previous examinations of response cost (Falcomata *et al.*, 2004; Keeney, Fisher, Adelinis, & Wilder, 2000; Mason & Iwata, 1990), which indicated that the loss of highly preferred stimuli may compete with engagement in automatically reinforced problem behavior.

After finding that the presence of the therapist exerted some control over the occurrence of Joe's vocal stereotypy, her presence was faded over time. This potentially increased the practicality of the treatment, because it decreased the response effort for the therapist, who did not have to remain in the room for the treatment to be effective. This component helped to meet Joe's parents' goals of having him play by himself without high levels of vocal stereotypy; it could also increase social acceptance of the treatment.

A potential limitation to the current experiment was the lack of identification of the specific reinforcing property of Joe's vocal

stereotypy. It is unknown what element of his vocal stereotypy (e.g., the volume, some associated physical sensation) reinforced the behavior. Also, the time spent implementing the two-component intervention was not removed from the total session time during fading. This could make it difficult to interpret the efficacy of the procedures in the absence of the intervention. To some degree, however, this limitation is mitigated by the finding that treatment procedures were not required for maintenance of the absence of vocal stereotypy observed at the end of therapist fading. An additional limitation, however, is that only 1 participant was included in the current investigation, limiting the generality of the findings. Finally, there were no data on training Joe's parents to use this intervention. Anecdotally, however, we can report that the parents were able to use the final intervention effectively, and they eventually reported fading their own presence even further than what was presented here. Future research should examine other types and schedules of contingent demand, response cost, and NCR as treatment for automatically reinforced vocal stereotypy and parent training in relation to interventions that target vocal stereotypy.

REFERENCES

- Ahearn, W. H., Clark, K. M., DeBar, R., & Florentino, C. (2005). On the role of preference in response competition. *Journal of Applied Behavior Analysis, 38*, 247–250.
- Ahearn, W. H., Clark, K. M., MacDonald, R. P. F., & Chung, B. (2007). Assessing and treating vocal stereotypy in children with autism. *Journal of Applied Behavior Analysis, 40*, 263–275.
- Bostow, D. E., & Bailey, J. B. (1969). Modification of severe disruptive and aggressive behavior using brief timeout and reinforcement procedures. *Journal of Applied Behavior Analysis, 2*, 31–37.
- Falcomata, T. S., Roane, H. S., Hovanetz, A. N., Kettering, T. L., & Keeney, K. M. (2004). An evaluation of response cost in the treatment of inappropriate vocalizations maintained by automatic reinforcement. *Journal of Applied Behavior Analysis, 37*, 83–87.

- Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis, 27*, 197–209. (Reprinted from *Analysis and Intervention in Developmental Disabilities, 2*, 3–20, 1982)
- Keeney, K. M., Fisher, W. W., Adelinis, J. D., & Wilder, D. A. (2000). The effects of response cost in the treatment of aberrant behavior maintained by negative reinforcement. *Journal of Applied Behavior Analysis, 33*, 255–258.
- Mason, S. A., & Iwata, B. A. (1990). Artificial effects of sensory-integrative therapy on self-injurious behavior. *Journal of Applied Behavior Analysis, 23*, 361–370.
- Skiba, E. A., Pettigrew, L. E., & Alden, S. E. (1971). A behavioral approach to the control of thumbsucking in the classroom. *Journal of Applied Behavior Analysis, 4*, 121–125.
- Taylor, B. A., Hoch, H., & Weissman, M. (2005). The analysis and treatment of vocal stereotypy in a child with autism. *Behavioral Interventions, 20*, 239–253.
- Van Camp, C. R., Vollmer, T. R., & Daniel, D. (2001). A systematic evaluation of stimulus preference, response effort, and stimulus control in the treatment of automatically reinforced self-injury. *Behavior Therapy, 32*, 603–613.
- Vollmer, T. R. (1994). The concept of automatic reinforcement: Implications for behavioral research in developmental disabilities. *Research in Developmental Disabilities, 15*, 187–207.
- Vollmer, T. R., Marcus, B. A., Ringdahl, J. E., & Roane, H. S. (1995). Progressing from brief assessments to extended experimental analyses in the evaluation of aberrant behavior. *Journal of Applied Behavior Analysis, 28*, 561–576.
- Wagaman, J. R., Miltenberger, R. G., & Arndorfer, R. E. (1993). Analysis of a simplified treatment for stuttering in children. *Journal of Applied Behavior Analysis, 26*, 53–61.

Received March 21, 2007

Final acceptance June 28, 2007

Action Editor, William Ahearn