Reducing Vocal Stereotypy
Through an Antecedent and Consequence Intervention Package

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Abstract

Stereotypy is an interfering behavior often observed in individuals diagnosed with an Autism Spectrum Disorder (ASD). The present study examined the effects of an antecedent and consequence intervention package, including a visual cue card paired with verbal instructions and a trade-in opportunity, on the rates of vocal stereotypy in a student with ASD. The study made use of an alternating treatment design. Results indicated that the treatment package was effective in reducing vocal stereotypy during the red-card sessions. Follow-up probes and anecdotal information indicate that the treatment results were maintained over time and that the treatment required minimal training to implement in the school setting.

Keywords: vocal stereotypy, intervention package, Autism Spectrum Disorder
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Stereotypic behavior is frequently observed in individuals with Autism Spectrum Disorder (ASD) and has been studied for many decades in the field of behavior analysis. Stereotypic behaviors of adults and children with ASD include motor and vocal repetition, cognitive and behavioral rigidity and invariance, and a tendency to be socially inappropriate in nature, and are heterogeneous in presentation (Cunningham & Schreibmann, 2008).

Stereotypy’s underlying causes are unknown, but many scientists in the behavior analysis field have demonstrated that it is maintained by reinforcement contingencies, either automatic (sensory), through social contingencies, or a combination. Vocal stereotypy has multiple topographies, including echolalia, noncontextual phrases or words, repetition of unintelligible sounds, or some combination of these (Athens, Vollmer & Sloman, 2008).

Although stereotypy is an interfering behavior for individuals with ASD, it can function as an effective reinforcer and strengthens alternative behaviors (Charlop, Kurtz & Casey, 1990; Hanley, Iwata, Thompson & Lindberg, 2000). Stereotypy can also be socially mediated. Contingencies of negative or positive reinforcement are in effect by providing desirable stimuli or removing aversive stimuli contingent upon the person engaging in the behavior (Cunningham & Schreibmann, 2008).

Stereotypic behaviors also occur in typically developing individuals, however, those with ASD tend to display stereotypic behaviors that are more severe and have greater persistence than those without ASD. Stereotypic behaviors in ASD can be distinguished from those in typically developing children and other developmental disabilities by their lack of developmental and social appropriateness (Cunningham & Schreibmann, 2008).
Some instances of stereotypic behavior are harmful to an individual (e.g., self-injurious head hitting); however other responses may be additionally problematic because the behavior may be disruptive to learning or social interactions (Anderson, Doughty, Doughty, Williams & Saunders, 2010). Stereotypy can contribute to a child having limited interactions in the community, with peers and adults, or in educational settings. This in turn interferes with the child’s social, intellectual, and educational development. Stereotypy can be socially stigmatizing, especially for people with ASD, because the stereotypy is viewed as “age-inappropriate in form, focus, context, duration or intensity” (Cunningham & Schreibmann, 2008, p. 471). Specifically, vocal stereotypy can interfere with more desirable behavior and can be disruptive to those around the individual (Athens et al. 2008).

Behavioral research indicates that people with ASD have a limited ability to attend to salient social and other environmental cues. Engaging in stereotypy can further reduce a person’s ability to determine the relevant cues to follow in their learning environment. Stereotypy may interfere not only with skill acquisition in a structured setting, but also with learning that occurs during children’s play time because they are engaging in stereotypy rather than interacting with peers and using socially appropriate alternative behaviors during that time (Cunningham & Schreibmann, 2008). Interventions that teach a student when they can and cannot engage in a stereotypical behavior may be beneficial (Anderson et al. 2010).

Previous research has demonstrated that reductions in vocal stereotypy can be attained through the use of a variety of behavioral interventions. Following a functional analysis, Ahearn, Clark, MacDonald and Chung (2007) implemented “response interruption and redirection” (RIRD) when the subjects engaged in these vocalizations. Rates of vocal stereotypy were successfully reduced for all four subjects, and three of the four subjects demonstrated an increase
in appropriate communication. In a similar study, Schumacher and Rapp (2011) implemented RIRD and successfully decreased vocal stereotypy for two subjects with ASD. No increase in vocal stereotypy was found following the removal of RIRD, suggesting that the use of RIRD would not adversely affect levels of stereotypy in other settings.

Hanley et al. (2000) found for two of three subjects that restriction of stereotypy (in addition to a student’s access to leisure materials and teacher prompts to manipulate materials) was necessary to increase an alternative behavior of object manipulation. For the third subject, contingent access to stereotypy following successful object manipulation (which operated as a differential reinforcement of an alternative behavior) was required to increase his object manipulation, which suggested value in the use of stereotypy as reinforcement for alternative behaviors for some individuals with ASD.

Several studies have also shown that noncontingent reinforcement (NCR) can be used to reduce vocal stereotypy, especially when paired with response cost. Falcomata, Roane, Hovanetz, Kettering and Keeney (2004) compared NCR alone and NCR with response cost as an intervention to reduce stereotypic behavior for a young man with ASD. Noncontingent reinforcement alone did not produce clinically significant reductions in vocal stereotypy, but when response cost was added; an immediate and significant decrease was observed. In another study, a treatment package of noncontingent attention, contingent demands and response cost effectively reduced vocal stereotypy in an individual with Down’s syndrome and ASD (Athens et al. 2008). Additionally, low levels of vocal stereotypy were maintained as noncontingent attention was faded, and response cost was rarely required. In a study involving two children with ASD, noncontingent auditory stimulation was used to successfully reduce vocal stereotypy (Saylor, Sidener, Reeve, Fetherston & Progar, 2012). The music condition used in this study was
the most effective and most socially acceptable at decreasing vocal stereotypy (compared to listening to their recorded vocal stereotypy and white-noise conditions), reducing vocal stereotypy levels approaching near zero.

Antecedent cues can be effective in reducing stereotypy. Doughty, Anderson, Doughty, Williams and Saunders (2007) effectively demonstrated that through the use of an antecedent cue, three subjects displayed reduced levels of stereotypy during the punishment condition, but continued to engage in stereotypy during the nonpunishment condition. Latency measures demonstrated that the antecedent stimulus served as the discriminative stimulus for stereotypy suppression; the punishment procedure itself was not the primary cause for suppression. In an extension of this study, Anderson et al. (2010) used two of the same subjects, and they were taught to mand for 20s of a nonpunishment condition. Manding was also brought under stimulus control using the antecedent cue in the punishment condition; manding only occurred when the antecedent cue for the punishment condition was present.

Conroy, Asmus, Sellers and Ladwig (2005) used a visual cue card to reduce stereotypic behavior for a young boy with ASD in a public school setting. The reduction was accomplished by cueing the student as to when it was appropriate to engage in stereotypy versus when it was inappropriate. In this way, the subject was provided with a visual cue when it would not be problematic for him to engage in stereotypy, which has highly valid social consequences. In addition, this intervention was successfully transferred to the teacher assistant who was working with the student daily in a public school setting.

The purpose of the present study was to evaluate the effects of an antecedent and consequence based treatment package, specifically, a visual cue card and opportunity to trade-in,
on vocal stereotypy of a student with ASD. Part of the treatment package included providing him with the opportunity to earn “trade-in” time during which he could freely engage in vocal stereotypy contingent on completing 75% of the non-stereotypy sessions.

**Method**

**Participant & Setting**

The participant was a 15-year-old boy with a diagnosis of an ASD. He was enrolled in a six-hour day school for children with ASD or behavior disorders. His student-to-staff ratio was 1:1 for three hours per day and 2:1 for the remaining three hours. He has demonstrated the ability to wait for delayed access to reinforcement in previous school placements. The student communicates vocally and engages in high rates of vocal stereotypy. Teachers reported that the levels of vocal stereotypy were distracting to the student, classmates, and teachers, and he required multiple prompts to remain on task during academic sessions. Other students would say “Stop movie talking!” His parents reported the behavior was disruptive to other family members at home. For these reasons, an intervention targeting vocal stereotypy was pursued for this student.

All sessions were conducted within the school building. A variety of educational materials (e.g., books, worksheets, pens, ruler, and calculator) were present on the student’s desk and workspace. No attempts were made to simplify or alter the typical school setting, and the materials present during different sessions were not always the same. Each session lasted five minutes, and sessions were conducted between one and three times per school day. Due to the applied nature of the present study, more sessions were conducted than are included in this research—no attempt was made to control which sessions were included. The student was
presented with multiple red-card opportunities (intervention condition) throughout the six hour school day (up to 12 per day).

A laminated visual cue card was used during the treatment phase. The card was 9x10 cm, red on one side, and green on the other. In addition, the student was given a white card that was also 9x10 cm and contained a printed grid of 12 squares on it. The student used a dry-erase marker to record a check on the gridded white card following a verbal cue from a teacher. The checks were delivered when the student successfully completed a five-minute session without vocal stereotypy during the red card condition.

Response Measurement & Reliability

This author collected data from video recordings of sessions. The dependent variable was the participant’s rate of vocal stereotypy, defined as repetitive, contextually unrelated vocal expressions. Examples included direct quotes from movies or television shows. Non-examples of vocal stereotypy included the student talking to teachers or other students about movies or TV shows, including such direct quotes and contextually appropriate use of single direct movie quotes (e.g. saying “Come on snake eyes” while playing a dice game). Data was collected using a 1-min partial interval recording system. If the student engaged in vocal stereotypy during the interval, a “+” was recorded in the corresponding box of the data sheet. If no vocal stereotypy occurred during that interval, a “−” was recorded in the corresponding box of the data sheet. Thus, five marks were recorded during each five minute session.

Interobserver agreement was assessed by having a second observer, who was familiar with the student and aware of the purpose of the study, collect data from video recordings of sessions during 40% of sessions. Observers’ records were compared on an interval-by-interval
basis, and an agreement was scored for each interval in which the two observers both scored either the occurrence or non-occurrence of vocal stereotypy. Agreement percentages were calculated by dividing the number of agreement intervals by the total number of intervals and multiplying by 100%. Mean agreement scores for the occurrence of stereotypy across both red card and green card conditions were 95.6%, with a range from 80-100%.

Treatment integrity was assessed by having a second observer collect data from video recordings of sessions during 40% of sessions. Observers recorded whether the red card or green card was within view at all times, whether the timer was set and started at the beginning of red card sessions, and whether the teacher gave the correct verbal prompt of having earned or not earned a check (either at the end of the session or when vocal stereotypy occurred during that red card session). Percentage of treatment integrity was calculated by dividing intervals in which procedure was followed by total number of intervals and multiplying by 100%. Treatment integrity was measured at 91.7% across sessions.

Procedure

**Baseline.** During baseline sessions the regular teaching and school activities were not modified; each session lasted five minutes. Baseline sessions were run until a clear increasing trend was observed. There were no programmed consequences for vocal stereotypy during baseline, and no visual cue was used. Sessions occurred across different activities the participant was exposed to throughout the school day, including academic tasks, vocational tasks, and leisure activities. Vocal stereotypy was ignored throughout baseline, or redirected by teachers through verbal redirection to task when it was interfering with his progress on programs. Examples of redirections heard included, “Stay focused” and “Are you ready to work?” There were no direct
comments regarding his stereotypy (for example, no teacher said, “No more movie talking” or “It’s time to stop movie talking.”).

Treatment. Following baseline, the treatment phase was conducted, beginning with a verbal description of the contingency to the student. Due to the student’s developmental level and the fact he communicated vocally, the contingencies were verbally explained to him before the first session. Answers to questions or clarification were given to the student when he requested it throughout the experiment. Before beginning the first session, the student confirmed that he understood the program by answering simple questions about the program and indicated his excitement about beginning to earn checks and not engage in movie talk when the red card was present.

During the red card condition, the visual cue of a red card was placed within 46 cm of the student and within his direct line of sight. As explained to him before the first session, the red card condition signaled the no-stereotypy condition. The student was presented with the question “Ready for red card?” or “Ready for five minutes of no movie talk?” before each red card condition began. Generally, the student verbally agreed or acknowledged the statement before the timer was started. If vocal stereotypy occurred during red card condition, the teacher verbally reviewed with the student that he should have no movie talk during the red card. The student could request to try to earn his check again during that activity, at which time the timer was reset for another five minutes; he could only request to “retry” once per activity. This meant that the student had two opportunities to earn a check during each red-card session. If he did not engage in vocal stereotypy for five minutes, he could not request another opportunity until the next designated red-card condition. He frequently requested opportunities to earn additional checks outside of designated red-card sessions. The student followed a daily written schedule
and red-card sessions were denoted on the schedule by having an asterisk (*) next to the activity name. During the green-card condition, the green-card visual cue was used, no timer was set and there was no opportunity for the student to earn checks. The green-card condition was effectively identical to the baseline phase but with the addition of the visual cue. The green-card condition signaled that it was an appropriate time to engage in vocal stereotypy.

A key component of the treatment phase was the student’s opportunity to trade in his earned checks for break time once or twice per day. Following a red-card session in which he did not engage in vocal stereotypy, the student was instructed to “give himself a check” using a dry-erase marker on the white card with boxes. He was required to pass the contingency a minimum of 75% of the time. He was able to trade in twice during his school day, at 11:50 a.m. and 2:50 p.m., for ten minutes each time. Activities were isolated for use during trade-in time. Any other activities of his choice were also available for him to engage with during trade-in times. Isolated activities included watching movies, using arts and crafts materials, and using neon dry-erase markers. The activities were chosen by the student through verbal preference assessment at the time of the trade-in. He was also allowed to engage in vocal stereotypy with no redirection or programmed consequence during trade-in periods, while engaging in the activity of his choice.

An alternating treatment design was used because it would quickly reveal which condition was most effective (Cooper, Heron, & Heward, 2007). Red-card (no stereotypy) and green-card (stereotypy) antecedent-based conditions coupled with the consequences for accumulating checks during the red-card condition were rapidly alternated to examine the effects on vocal stereotypy. The order of the sessions were assigned using a computer-generated randomizer so that the order was not repeated.
Follow-up Probes. Ten, eleven, and twelve weeks following the end of the treatment, follow-up probes were conducted to test if the effects of the treatment package were maintained over time. It should be noted that the red and green card program was still being used in the classroom, and had been expanded for longer time periods (instead of 5-minute sessions, the red-card was presented for the duration of entire activities, lasting up to 25 minutes). At the time of the current writing, the student was using red card for variable periods of time based on length of activities. For example, an entire activity was designated as “red-card,” instead of just five minutes as had been used during this study. If the red-card activity lasted 12 minutes, he was required to have no vocal stereotypy (still allowing for one warning opportunity) for the entire 12 minutes to earn a check. In this later version of the behavioral program, the student had success maintaining periods of no vocal stereotypy for over 25 minutes during red-card conditions.

Results

Results are depicted in Figure 1. Variable and high rates of stereotypy were observed during baseline (range 0-80%) with an increasing trend in the final three data points. Implementation of the red-card condition resulted in an immediate decrease in vocal stereotypy to 0%, and absence of vocal stereotypy was sustained throughout the intervention during the red-card condition, with one instance of low levels (20%) of stereotypy during a follow-up probe. The green-card condition mirrored results observed during baseline, with highly variable levels of vocal stereotypy, ranging from 0-100%. The first three data points in the green-card condition are 100%, indicating a clear and immediate discrimination between conditions. Variability in the green-card condition could indicate a lack of discrimination between the two conditions; however, the variability was similar to the levels observed during baseline.
Follow-up probes indicate that the intervention remained effective with results similar to those observed during intervention. The one data point of 20% vocal stereotypy during the follow-up probes looks more concerning than it is when you examine the entire set of data, including those not included in the present study. This data point was not the first time the student engaged in stereotypy during the red-card condition, it is simply the only instance that was captured through the data set included for use in this study.

**Discussion**

The findings on the effectiveness of an antecedent-based intervention coupled with a delayed consequence opportunity using a visual cue card replicated findings that this technique can be successful in decreasing vocal stereotypic behavior in a classroom setting (Conroy et al., 2005). This intervention was relatively straightforward to implement, and would be easily applicable for teachers or therapists who do not have a strong understanding or background in applied behavioral analysis. The current study adds to a body of knowledge that is useful for behavior analysts who are working in settings with limited training opportunities, limited staffing, or lack of other resources.

This study utilized a treatment package which included the opportunity for the student to earn checks, and a delayed 10 minute trade-in, if he successfully maintained low to zero rates of vocal stereotypy during 75% of red-card conditions. Therefore, it is not easily determined how stimulus control was developed: by the antecedent cue card, by verbal instruction, or by earning a delayed trade-in opportunity. No attempt was made to isolate which component of the treatment package was the most effective. This type of treatment package is relatively common in school settings, where multiple components are implemented when beginning a “behavior
plan” as a whole, and they are often viewed as more socially valid if the student is earning a “reward” for demonstrating control over their behavior.

Verbal instruction to the student may have been an essential part of developing stimulus control by making the participant aware of what the two visual cue cards represented before he accessed the conditions and the reinforcement contingency. However, because verbal cues were used during treatment, it is unclear whether the visual cue card alone, without reminders, would have been effective in reducing vocal stereotypy.

The results demonstrated in this study are also significant from a social perspective. During baseline, the student was not able to appropriately interact with his peers because he was continually engaging in vocal stereotypy, and other students often asked him to stop “movie talking.” Providing him with a visual cue card, that allowed him to know when it was appropriate to engage or not engage in vocal stereotypy, created the opportunity to engage in other, more socially appropriate behaviors during red-card times. Using a visual cue card versus a verbal cue allowed the student to not need a teacher present to remind him of the contingency.

Anecdotally, the student’s parents reported that there has been some generalization to the home setting. An evening worker has been implementing an activity based program to reduce vocal stereotypy, and his parents reported that he is demonstrating success with that program. The evening worker uses a verbal cue to indicate when the student can or cannot engage in vocal stereotypy, and following successful completion of an activity without vocal stereotypy, he is allowed to engage in five minutes of computer time. His parents also reported that they are very pleased with the success he is having at school with the use of the red-card program.
There are some limitations of the current study which should be noted when interpreting the results. The sample size of only one participant limits the generality of findings. This participant presented a relatively unique profile in that he was able to delay access to reinforcing conditions, and could understand verbal directions. Although it is assumed through interviews and direct observation that the participant’s vocal stereotypy was maintained by automatic reinforcement, no functional analysis or identification of the reinforcing function of the vocal stereotypy was conducted.

Another limitation is that the current study did not use a formal procedure to determine which sessions should be videotaped and included in the present study. No control was used for order of sessions; therefore the data may be confounded. Unfortunately, this is a result of the study being conducted in an applied setting where staffing and other factors often dictated when someone was available to video record the student.

Another possible limitation is the fact that no formal preference or reinforcer assessment was completed to determine if items for which the student could trade in were in fact reinforcing. The student’s preferences were not directly assessed during trade-in times but were generated from verbal suggestions from his parents, teachers and from the student himself. However, it can be assumed that earning checks and the resulting trade-in time or the item traded in for was reinforcing because the student continued to engage in low levels of vocal stereotypy during the red-card condition. This demonstrates that positive reinforcement was in effect. The likelihood of his engaging in no vocal stereotypy during red-card conditions increased after the contingency was verbally explained to him.
Future research about this type of intervention package on vocal stereotypy should include more participants to verify if results can be generalized across subjects. Expansion to other types of stereotypy (such as motor) would provide additional support for this type of intervention being used across multiple topographies of stereotypy. Evaluating whether educational outcomes improved as a result of decreasing vocal stereotypy would give credence to the need to use stereotypy reducing treatments to increase educational gains in students with ASD.

Breaking down the treatment package and assessing individual components to determine the most effective component could make future research easier to implement because only the most effective or most salient pieces of the treatment package would need to be used, instead of including the entire treatment package.
References


Figure Captions

Figure 1. Percentage of vocal stereotypy
Figure 1. Percentage of vocal stereotypy per 5-min session