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Reduction of Stereotypy in Adolescents with Autism Using Visual and Auditory Cues

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Abstract

Reducing stereotypy is the goal of many interventions for students with autism. Ideally, the interventions are not intrusive and inexpensive. Three adolescent males diagnosed with autism were recruited based on their levels of stereotypy and lack of success with other interventions. The current study used an alternating treatment embedded within an ABAB design to look at the use of visual and auditory cues in attempt to alter stereotypical behaviors. The first treatment included verbal reprimands paired with the visual cue of a red card and presented contingent on stereotypy. In the second treatment, a green card was shown and there were no social consequences for stereotypy. For all participants, stereotypy was decreased in the red card condition. The results offer a more socially acceptable intervention to stereotypy that can easily be implemented across settings, including vocational placements.

Keywords: autism, stereotypy, adolescents, visual and auditory cues

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Reduction of Stereotypy in Adolescents with Autism Using Visual and Auditory Cues

Literature Review

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by impaired communication and social interactions as well as repetitive behaviors. The Diagnostic and Statistical Manual of Mental Disorders Fifth Edition specifies five areas of criteria for diagnosing ASD. First, requires that there be persistent deficits across various contexts of social communication and interaction. Second, pertains to restricted and repetitive patterns of behavior, interests, or activities. Third, specifies that the first two symptoms be present during early development. Fourth, the symptoms need to cause significant impairment of functioning, whether it is social, occupational, or other. Fifth, the symptoms are not better explained by another diagnosis, such as intellectual disability. Furthermore, the severity of a diagnosis is determined by the level of support the social communication and repetitive behaviors require (The American Psychiatric Association, 2013).

The topography of stereotypy varies greatly across individuals with ASD, manifesting in dozens of response forms from body rocking to hand flapping to repeating words or phrases. This variability has led to some debate amongst researchers about what is and what is not stereotypy. To address this problem, Berkson (1983) created a systematic way of categorizing stereotypy. He laid out the following criteria: (a) is the behavior voluntary; (b) does the behavior vary; (c) does the behavior continue over several months; (d) does the behavior change when the environment changes; and (e) is the behavior uncharacteristic of the individual's age. By crosschecking these criteria with a behavior thought to be stereotypy, researchers now have a way of deducing if a behavior is stereotypy or merely a tic or a phase.

Researchers agree that stereotypy is typically automatically reinforced (Berkson, 1983; Lovaas, Newson, & Hickman, 1987; Rapp & Vollmer, 2005). That is, an individual engages in stereotypy and continues to do so because of the stimulation it creates. Therefore, the behavior serves as its own reinforcer. For example, an adolescent with ASD might repeat a phrase from a movie, thereby engaging in vocal stereotypy, because doing so produces auditory stimulation. The vocal stereotypy is automatically reinforced because the auditory stimulation is produced directly by the stereotypy.

Automatically reinforced behaviors pose a challenge to clinicians, teachers, and other caregivers because they cannot directly observe, measure, or manipulate the reinforcing event (Groskreutz, Groskreutz, & Higbee, 2011; Rapp, 2006). Therefore, it is difficult to implement interventions to decrease stereotypy; however, it is no less important to determine effective interventions. As posed by Dunlap, Dyer, and Koegel (1983), stereotypical behaviors can become a hindrance to achievement for when a student is engaging in stereotypy, they are not engaged with the educational setting and are not learning. In addition, stereotypy can be socially stigmatizing (Jones, Wint, & Ellis, 1990; MacDonald et al., 2006), as it often involves behaviors that are outside of social norms.

Researchers have implemented various behavioral interventions that aim to decrease stereotypical behaviors. Rapp and Vollmer (2005) did a review of the treatment literature and found that interventions include antecedent manipulations and consequent manipulations (i.e. sensory extinction, displacement of reinforcement, differential reinforcement, and punishment and inhibitory stimulus control).

As described by Rapp and Vollmer (2005), an antecedent intervention is when the environment is manipulated before the individual engages in problem behavior; thereby, creating

circumstances in which the individual engages in non-problematic behavior. Various studies have been conducted using antecedent manipulations as an intervention to treat stereotypy (for a review, see Rapp & Vollmer, 2005), which altered the environment in a wide range of ways, including vigorous exercise and environment enrichment (e.g. access to preferred items and activities). Several studies have successfully decreased stereotypical behaviors by providing noncontingent access to preferred items (Piazza, Adelinis, Hanley, Goh, & Delia, 2000) and auditory stimulation (Rapp, 2007), indicating that environmental enrichment is a promising treatment for stereotypy. Although promising, these antecedent intervention methods are impractical when considering non-therapeutic environments, such as the public or vocational settings, as vigorous exercise and auditory stimulation would draw unwanted attention.

Whereas antecedent manipulations deal with altering the environment before problem behavior occurs, consequent manipulations deal with altering the environment after the problem behavior occurs. There are several types of consequent manipulations, including sensory extinction, displacement of reinforcement, differential reinforcement, and punishment and inhibitory stimulus control.

Sensory extinction is the process by which stereotypy is eliminated by blocking or reducing the reinforcing effects of the stereotypy (Rapp & Vollmer, 2005). For instance, if a child with ASD engages in a stereotyped behavior for tactile stimulation, researchers might attempt to diminish that stimulation by having the student wear a glove. Although several studies using sensory extinction showed reductions in stereotypy, the effect was limited to when the response product was being blocked and did not have long-term effects (Rapp & Vollmer, 2005). Further, the implementation of sensory extinction often requires the use of socially stigmatizing materials, such as gloves; thereby, rendering it an unappealing treatment.

Another consequent manipulation, displacement of reinforcement, is when researchers provide contingent reinforcement for stereotypy (Foxx & McMorrow, 1983; Neisworth, Hunt, Gallop, & Madle, 1985; Schmid, 1986). For this intervention, if a participant engaged in hand flapping, the researchers would provide a preferred edible (e.g. chip). After this contingent reinforcement phase, the researchers placed the stereotypy on extinction and stopped reinforcing the stereotypy. The results of these studies are varied, in that some participants showed gradual decreases in stereotypy during the extinction phase, whereas others showed immediate decreases. Further, some participants showed a maintained reduction in stereotypy following the extinction phase, whereas others immediately returned to baseline levels. Conflicting results indicate that further research in the area of displacement of reinforcement is necessary.

Researchers have implemented multiple forms of differential reinforcement to decrease stereotypy, including differential reinforcement of other behavior, differential reinforcement of alternative behavior (Charlop, Kurtz, & Casey, 1990), and differential reinforcement of low rate behavior (Singh, Dawson, & Manning, 1981). The principle of differential reinforcement is that when appropriate behaviors are reinforced they will increase, thus occupying the time previously spent engaging in stereotypy; consequently, decreasing the inappropriate behavior. The results of these studies show that differential reinforcement is effective in decreasing stereotypy. For example, Charlop, Kurtz, and Casey (1990) were successful using participants' stereotypy as a reinforcer for appropriate behaviors. The concept of using stereotypy, an automatic reinforcer, as a reinforcer for appropriate behavior is intriguing.

In regards to the final consequent manipulation, Rapp and Vollmer (2005) state: "Punishment involves the presentation of aversive stimulation that inhibits stereotypy and its product(s), alters the stimulation generated by stereotypy, or a combination of both processes"

(p. 541). Examples of these interventions include response blocking or interruption (Ahearn, Clark, MacDonald, & Chung, 2007), overcorrection, auditory stimulation (Rapp, Miltenberger, & Long, 1998), and inhibitory stimulus control (Rapp, Patel, Ghezzi, O'Flaherty, & Titterington, 2009). Although researchers have been successful in using these interventions to treat stereotypy, the use of punishment with this population has come under public scrutiny (Rapp & Vollmer, 2005) and the implementation of the interventions are cumbersome and time consuming for clinicians (Lanovaz & Sladeczek, 2012). There is a need to refine these interventions so that they remain effective, while also publically and socially acceptable and easy to implement.

Of the previously mentioned interventions, environment enrichment, differential reinforcement, punishment, and inhibitory stimulus control are the most promising. Although the literature on stereotypy is robust, there is little to no research that specifically addresses stereotypy in adolescents with ASD. The insufficiency of the literature is concerning because this particular population faces a unique set of concerns, such as increased exposure to the community via vocational training. When considering adolescents with ASD who are entering the workforce, it is important to take into account the extent to which the treatment for stereotypy interrupts their ability to access the workplace and coworkers. Specifically, although environment enrichment is an effective strategy, it may not be feasible to do so at a job site (e.g. provide preferred music). Similarly, although differential reinforcement is an effective strategy, it may not be feasible to provide it at the rate necessary to decrease stereotypy while the adolescent is working and doing so has the potential to draw unwarranted attention. Therefore, it is necessary to develop interventions that are feasible to implement with adolescents with ASD in the workplace. These treatments should be discrete, easy to implement, and effective.

Rapp, Patel, Ghezzi, O'Flaherty, and Tetterington (2009) were successful in utilizing discrete manipulatives to establish stimulus control over vocal stereotypy displayed by young children with autism. The purpose of the current study is to extend the literature on the use of discrete manipulatives and stimulus control of stereotypy and intends to answer the following question: Does the use of visual and auditory cues alter stereotypical behaviors in adolescents with autism?

Method

Participants

Three adolescents with severe communication and behavioral needs participated in this study. Students were recruited for the study if they received one-on-one instructional time, had a diagnosis of autism, and engaged in stereotypical behaviors that were an impediment to learning, based on teacher-report. The three participants selected in the study were Alex, Luke, and Manny. Each participant was assigned a pseudonym to ensure confidentiality and anonymity.

Alex was a 17 year-old male Hispanic/Latino adolescent with a primary diagnosis of autism and a secondary diagnosis of intellectual disability. He communicated verbally, speaking in up to five word sentences. Alex engaged in several stereotypical behaviors characterized by holding his eyes closed for more than one second, slowly moving his head from left to right, humming to himself, and repeating statements such as "Bizon," "Bye you ready," or "Shh."

Luke was an 18 year-old male Romanian adolescent diagnosed with autism. He communicated verbally as well, speaking in up to 10 word sentences. Luke's stereotypical behaviors consisted primarily of repetitive phrases or sounds combined with repetitive arm movements.

Manny was a 17 year-old male Hispanic/Latino adolescent diagnosed with autism. He also communicated verbally, speaking in sentences of up to seven words. Manny's stereotypical behaviors included tapping pictures and repeating phrases or sounds provided in movies and television shows.

Setting

The participants for this study were recruited from a nonpublic school that serves 50 children and young adults with disabilities. The school uses applied behavior analysis techniques and has a one-to-one student to teacher ratio. All sessions took place at the school during normal school hours. The participants were removed from their classroom and taken to a secluded room with a two-way mirror. The room was furnished with one desk, one chair for the participant, one chair for the experimenter, an analog clock on one wall, and a bin with necessary teaching materials.

Apparatus and Materials

1.   Red Card (RC) – 4 x 6 inch solid red laminated card

2.   Green Card (GC) – 4 x 6 inch solid green laminated card

3.   2 Presto 04213 Electronic Digital Timers

4.   Partial interval data sheets

5.   Participants current IEP goal data sheets and teaching materials

6.   Participants current behavior contracts and token economy systems

Dependent variable

The dependent variable was the percentage of time engaged in stereotypical behaviors during 5-minute treatment sessions. If a participant engaged in stereotypical behaviors at any time during a 15-second interval, the experimenter marked a 1 in the interval box. If a participant

did not engage in stereotypical behaviors during a 15-second interval, the experimenter marked a 0 in the interval box. At the end of each treatment session, data was converted into a percentage by dividing the total number of intervals during which the participant engaged in stereotypical behaviors by the total number of intervals.

Independent variable

Visual and auditory cues during 5-minute treatment sessions were used. Red and green cards signaled the visual and auditory cues. The red card signaled that stereotypy would be addressed with the verbal reprimand, "Red card: quiet mouth and hands down", on a continuous schedule. The green card signaled that engaging in stereotypy would have no social consequence.

Research Design and Procedures

This study was conducted using an alternating treatment embedded within an ABAB design. Participants entered treatment once their baseline data were stable and not moving in a countertherapeutic direction. Participants returned to baseline when data showed a decrease of at least 10% from the baseline mean across two consecutive sessions for one or both types of cues, as signaled by the appropriately colored card. During both the red card and green card conditions, the experimenter engaged the participants in deskwork and leisure activities that were part of their typical school day.

Baseline. During baseline, no visual or auditory cues were present and the stereotypical behaviors of all participants had no social consequences. While conducting baseline sessions with Luke, an issue of baseline stabilization arose because work trials were presented that had a history of reinforcement paired with non-stereotypical behaviors (e.g. quiet mouth, still body).

The decision was made to avoid presenting these particular work trials during all baseline and treatment sessions, so as not to interfere with the efficacy of the independent variable.

Treatment. Each participant underwent 5-minute treatment sessions. These sessions consisted of either a red card or a green card condition, determined by quasi-random selection. During the red card condition, the red card was presented to the participants at the beginning of the session and the experimenter said, "Red card: quiet mouth and hands down." For any subsequent episode of stereotypy, the red card was shown to the participant again and the auditory cue, "Red card: quiet mouth and hands down," was repeated. During the green card condition, the green card was presented to the participants at the beginning of the session and the experimenter said, "Green card. *Student name* time." During this condition, the students were allowed to engage in stereotypy without interference and with no social consequence.

Procedural fidelity. A second observer who was trained in all aspects of the experiment (e.g. operational definitions, partial-interval data collection, treatment sessions, etc.) observed at least 33% of all experimental sessions using a checklist of required items (Appendix A). There was procedural fidelity of 100% for all observed sessions.

Interobserver agreement (IOA). IOA data was collected for at least 33% of all baseline and treatment sessions. IOA was calculated by adding the total number of agreements and disagreements, as recorded by the researcher and an independent observer, then dividing the total number of agreements by that sum and multiplying by 100. For Alex, there was a mean IOA agreement of 96% (R = 93-99%); for Luke, 97% (R = 92-100%); and for Manny, 90% (R = 90-92%).

Social validity. The significance of reducing stereotypical behaviors was determined by surveying teachers at the participants' school. The survey consisted of the following questions:

1.   Does $\overline{\textit{student name}}$ engage in stereotypical behaviors?   Yes   No

2.   If yes, does their stereotypy interfere with the student's or their classmate's ability to

        learn?   Yes   No

3.   Would reducing their stereotypy benefit the student?   Yes   No

All surveyed indicated "yes" for all questions and all participants.

Results

This study includes three figures. All figures have an x-axis of sessions and the y-axis shows the percentage of stereotypy displayed. All figures have a y-axis of percentage of stereotypy and an x-axis of sessions. Figure 1 shows the results of the treatment evaluation for Alex. In the initial baseline phase, Alex engaged in high percentages of stereotypy (M = 77%, R = 65-85%). In the first treatment phase, stereotypy decreased during both red card (M = 33%, R = 15-45%) and green card (M = 25%, R = 20-30%) conditions. In the return to baseline phase (M = 57%, R = 40-70%), Alex's percentages of stereotypy increased from the treatment phase, but did not return to original baseline levels. During the final treatment phase, percentages of stereotypy for the red card (M = 17%, R = 15-20%) and green card (M = 47%, R = 40-55%).
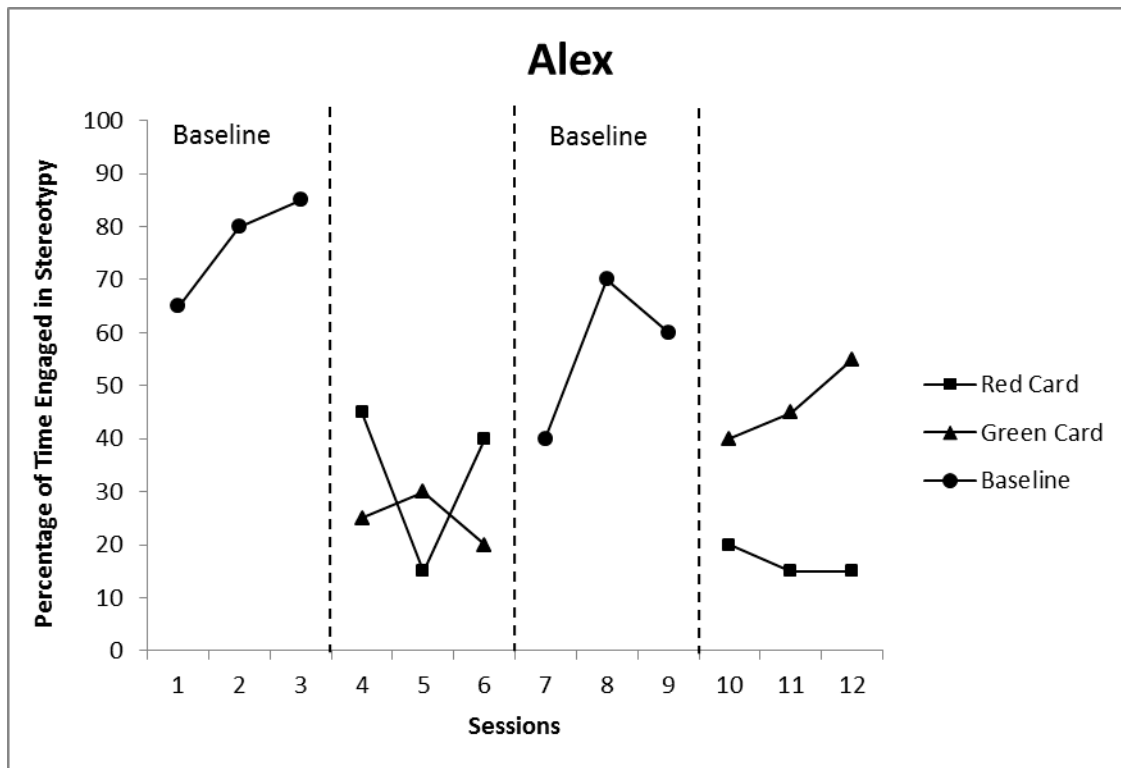
Figure 1. Percentage of time Alex engaged in stereotypy across baseline and treatment phases during the red card and green card conditions.

Figure 2 shows the results of the treatment evaluation for Luke. In the initial baseline phase, Luke engaged in an increasingly high percentage of stereotypy (M = 63%, R = 40-80%). In the first treatment phase, stereotypy decreased during both red card (M = 0%, R = 0-0%) and green card (M = 23%, R = 15-35%) conditions. In the return to baseline phase (M = 58%, R = 45-80%), Luke's percentages of stereotypy increased from the treatment phase. During the final treatment phase, percentages of stereotypy during the red card condition (M = 10%, R = 5-15%) decreased from that of the baseline phase and percentages during the green card condition (M = 37%, R = 15-50%).
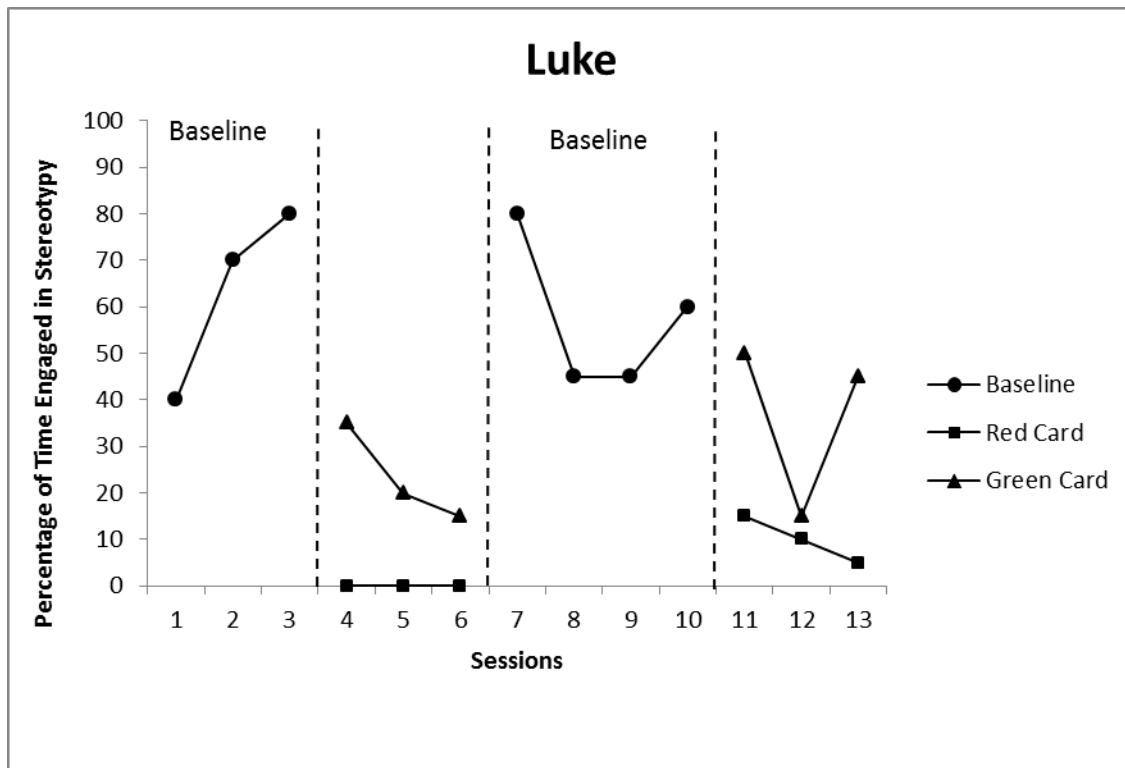
Figure 2. Percentage of time Luke engaged in stereotypy across baseline and treatment phases during the red card and green card conditions.

Figure 3 shows the results of the treatment evaluation for Manny. In the initial baseline phase, Manny engaged in a high percentage of stereotypy (M = 93%, R = 75-100%). In the first treatment phase, for the red card (M = 58%, R = 45-70%) condition and for the green card (M = 75%, R = 60-100%) condition were differentiated. In the return to baseline phase (M = 90%, R = 75-100%), Manny's percentages of stereotypy increased from the treatment phase. During the final treatment phase, percentages of stereotypy during the red card condition (M = 33%, R = 15-50%) decreased from that of the baseline phase and percentages during the green card condition (M = 82%, R = 60-100%) remained close to that of the baseline phase.
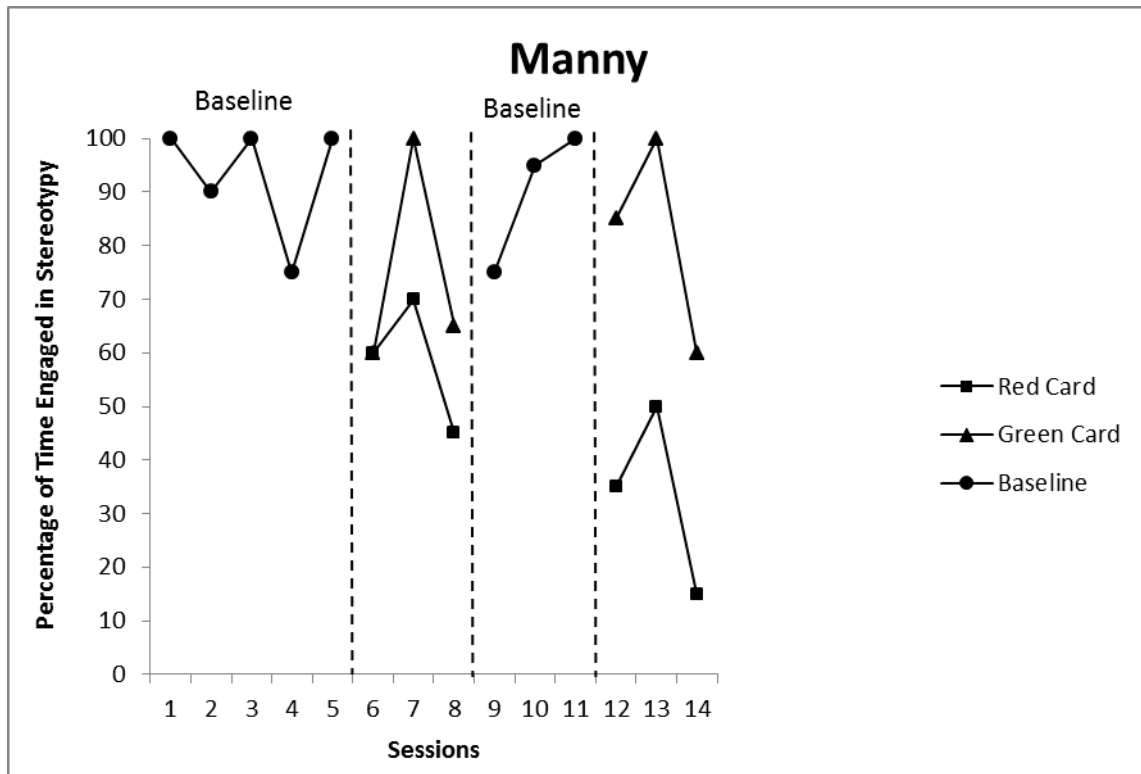
Figure 3. Percentage of time Manny engaged in stereotypy across baseline and treatment phases during the red card and green card conditions.

Discussion

The purpose of this research was to determine if visual and auditory cues alter stereotypical behaviors in adolescents with autism. The results for Alex, Luke, and Manny suggest that visual and auditory cues have an effect on stereotypy, as stereotypy was decreased for all three during treatment sessions with the red card. Thus, a functional relationship between the use of visual and auditory cues and stereotypy was demonstrated and replicated twice.

The percentage of non-overlapping data (PND) was calculated for the red card conditions in both intervention phases for Alex, Luke, and Manny. It was only calculated for red card conditions, and not green card conditions, because it is with the red card intervention that a decrease in stereotypy is likely to occur. PND was calculated by identifying the lowest baseline point, counting the number of intervention points below the lowest baseline point, dividing that

count by the total number of intervention data points, then multiplying the quotient by 100 to

determine the percentage. The PND for each participant are further discussed below.

Alex's data show a functional relationship between the use of visual and auditory cues

and stereotypy. The PND for Alex's red card intervention phases = 100%, indicating a very

effective intervention. During the initial intervention phase, Alex demonstrated a decrease in

stereotypy, as compared to baseline percentages, in both red and green card conditions. In fact,

except for one session, percentages of stereotypy were lowest during green card conditions. This

is unexpected, as during the green card conditions, there were no verbal reprimands for

stereotypy and Alex was permitted to engage in stereotypy without interruption. Conversely,

during the final intervention phase, Alex engaged in the lowest percentages of stereotypy during

the red card conditions. This is expected, as during the red card conditions, every instance of

stereotypy is presented with a verbal reprimand. The dichotomy between Alex's initial and final

intervention phases is compelling and suggests the possibility that Alex's stereotypy serves dual

functions of attention (supporting lower percentages of stereotypy during green card conditions)

and automatically reinforcing (supporting lower percentages of stereotypy during green card

conditions).

Luke's data also show a functional relationship between the use of visual and auditory

cues and stereotypy. The PND for Luke's red card intervention phases = 100%, indicating a very

effective intervention. Luke's data are the most auspicious, showing the greatest reduction in

stereotypical behaviors. During Luke's daily programming, outside the scope of the current

research, he had been receiving behavioral instruction that targeted his stereotypical behaviors

during discrete academic programs. When these academic programs were presented, Luke was

verbally cued to engage in whole-body-listening and was taught to engage in behaviors

incompatible with his stereotypy for the duration of the work trial. Contingent on whole-body-listening, Luke earned access to a primary reinforcer of his choosing (e.g. Cheetos). This was the only time across Luke's school day that primary reinforcers were used. As such, engaging in whole-body-listening was conditioned as a behavior with a history of reinforcement paired with non-stereotypical behaviors. Although the academic programs used during these behavioral instruction times were not used when conducting baseline and treatment sessions for the current research, the history of reinforcement is a non-disputable fact.

As Alex and Luke, Manny's data also show a functional relationship between the use of visual and auditory cues and stereotypy. Manny's PND for red card intervention phases = 100%, indicating a very effective intervention. Data show that during the initial intervention phase, Manny engaged in stereotypy during 60% of both the first green and red card sessions. This overlap could have occurred because the red card was the first intervention condition presented to Manny. Therefore, a history of verbal reprimands in response to stereotypy was established; thereby, possibly affecting Manny's likelihood of engaging in stereotypy in the green card condition that followed.

Aside from the first red card condition for Luke, stereotypy was never completely extinguished across all red card conditions. This is congruent with the findings of Rapp, Patel, Ghezzi, O'Flaherty, and Titterington (2009) and indicates that the visual cue alone does not affect stereotypy. Rather, stimulus control is maintained when the visual cue is paired with a verbal cue. Alternatively, stereotypy is brought under stimulus control upon the first instance of the verbal cue being presented as a verbal reprimand contingent upon stereotypy (signaling the likelihood of further verbal reprimands).

For all participants, it is interesting to note that stereotypy decreased during both red and green card conditions, even though no verbal reprimand was presented during the green card sessions. If during the first treatment phase, the initial condition presented was the red card, then it could be argued that the participants learned to anticipate verbal reprimands contingent upon engaging in stereotypy; thus, creating a history of learning that altered their engagement in stereotypy regardless of the treatment condition. However, the red card was the initial condition for only Manny.

The most significant limitation to this study was that a functional analysis of stereotypy was not conducted for any of the participants. The research was run assuming stereotypy for Alex, Luke, and Manny was automatically reinforced. Although researchers generally accept that stereotypy is automatically reinforced (Berkson, 1983; Lovaas, Newson, & Hickman, 1987; Rapp & Vollmer, 2005), other functions of stereotypy are possible (e.g. attention or escape). Considering Alex's contrasting percentages of stereotypy during green conditions, a functional analysis to determine what was maintaining his stereotypy would have been very telling.

Never the less, the results of this study have significant implications for adolescents with autism and educators because stereotypy was decreased for all participants using a discrete and easy to implement method. Rather than needing cumbersome or socially stigmatizing materials, all that is required are a red and green card. These are easy for educators to make and can easily be transported to vocational placements. When at such placements, the cards can be discretely kept in a pocket and taken out only when needed. The verbal cues are easy to remember and quick to deliver, adding to the ease of implementation for the educator.

Although these results are promising, future research is needed to determine the reduction of stereotypy across both red and green card conditions. In light of the disparity of Luke's results

compared to Alex's and Manny's, future research should look at the effects of pairing the green

card condition with primary, or other potent, reinforcers.

References

Ahearn, W. H., Clark, K. M., MacDonald, R. P., & Chung, B. I. (2007). Assessing and treating vocal stereotypy in children with autism. *Journal of Applied Behavior Analysis, 40,* 263-275. doi: 10.1901/jaba.2007.30-06

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorder* (5th ed.). Washington, DC: APA.

Berkson, G. (1983). Repetitive stereotyped behaviors. *American Journal of Mental Deficiency, 88,* 239-246.

Charlop, M. H., Kurtz, P. F., & Casey, F. G. (1990). Using aberrant behaviors as reinforcers for autistic children. *Journal of Applied Behavior Analysis*, *23*, 163-181.

Dunlap G., Dyer K., Koegel R. L. (1983). Autistic self-stimulation and intertrial interval duration. *American Journal of Mental Retardation, 88*, 194-202.

Foxx, R. M., & McMorrow, M. J. (1983). The effects of continuous and fixed ratio schedules of external consequences on the performance and extinction of human stereotyped behavior. *Behaviour Analysis Letter, 3*, 371-379.

Groskreutz, M. P., Groskreutz, N. C., & Higbee, T. S. (2011). Response competition and stimulus preference in the treatment of automatically reinforced behavior: A comparison. *Journal of Applied Behavior Analysis, 44*, 211-215. doi: 10.1901/jaba.2011.44-211

Jones, R., Wint, D., & Ellis, N. (1990). The social effects of stereotyped behaviour. *Journal of Intellectual Disability Research, 34*, 261-268.

Lanovaz, M. J., & Sladeczek, I. E. (2012). Vocal stereotypy in individuals with autism spectrum disorders: A review of behavioral interventions. *Behavior Modification, 36*, 146-164. doi: 10.1177/0145445511427192

Lovaas, I., Newsom, C., & Hickman, C. (1987). Self-stimulatory behavior and perceptual reinforcement. *Journal of Applied Behavior Analysis, 20*, 45-68.

MacDonald, R., Green, G., Mansfield, R., Geckeler, A., Gardenier, N., et al. (2007). Stereotypy in young children with autism and typically developing children. *Research in Developmental Disabilities, 28*, 266-277. doi:10.1016/j.ridd.2006.01.004

Neisworth, J. T., Hunt, F. M., Gallop, H. R., & Madle, R. A. (1985). Reinforcer displacement: A preliminary study of the clinical application of the CRF/EXT effect. *Behavior Modification, 9*, 103–115.

Piazza, C. C., Adelinis, J. D., Hanley, G. P., Goh, H. L., & Delia, M. D. (2000). An evaluation of the effects of matched stimulus on behaviors maintained by automatic reinforcement. *Journal of Applied Behavior Analysis, 33*, 13-27. doi: 10.1901/jaba.2000.33-13

Rapp, J. T. (2006). Toward an empirical method for identifying matched stimulation for automatically reinforced behavior: A preliminary investigation. *Journal of Applied Behavior Analysis, 39*, 137-140. doi: 10.1901/jaba.2006.37-05

Rapp, J. T. (2007). Further evaluation of methods for identifying matched stimulation. *Journal of Applied Behavior Analysis, 40*, 73-88. doi: 10.1901/jaba.2007.142-05

Rapp, J. T., Patel, M. R., Ghezzi, P. M., O'Flaherty, C. H., & Titterington, C. J. (2009). Establishing stimulus control of vocal stereotypy displayed by young children with autism. *Behavior Interventions, 24*, 85-105. doi: 10.1002/bin.276

Rapp, J. T., Vollmer, T. R. (2005). Stereotypy I: A review of behavioral assessment and treatment. *Research in Developmental Disabilites, 26*, 527-547. doi: 10.1016/j.ridd.2004.11.005

Singh, N. N., Dawson, M. J., & Manning, P. (1981). Effects of spaced responding DRL on the stereotyped behavior of profoundly retarded persons. *Journal of Applied Behavior Analysis, 14*, 521–526.

Schmid, T. L. (1986). Reducing inappropriate behavior of mentally retarded children through interpolated reinforcement. *American Journal of Mental Deficiency, 91*, 286–293.

Appendix A

Checklist of Required Materials

Timer set for 15 seconds

Timer set for 5 minutes

Interval data sheet

Red and Green Cards

Student materials (e.g. data sheet, behavior contracts, motivational systems, etc.)