

January 01, 2010

Effects of sensory integration on behaviors maintained by automatic reinforcement

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Recommended Citation

Kopacz, Katarzyna A., "Effects of sensory integration on behaviors maintained by automatic reinforcement" (2010). *Applied Behavioral Analysis Master's Theses*. Paper 27. <http://hdl.handle.net/2047/d20000278>

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Running Head: Sensory Integration

**Effects of Sensory Integration On Behavior
Maintained by Automatic Reinforcement**

A Thesis Presented

By

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In fulfillment of the requirements

For the degree of

Master of Science

In the field of

Applied Behavior Analysis

Northeastern University

Boston, Massachusetts

2010

NORTHEASTERN UNIVERSITY

Bouve College of Health Sciences Graduate School

Thesis Title: Effects of Sensory Integration on Behaviors Maintained by Automatic Reinforcement.

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Acknowledgements

The author would like to thank the members of her thesis committee, William Ahearn, Richard Graff, and Eileen Roscoe. She would also like to thank the New England Center for Children for its dedication to research and helping all the individuals with autism. She would also like to express gratitude to Kathy Clark and Jackie Potter for their support in conducting sessions and scoring interobserver agreement.

Table of Contents

Abstract5

Acknowledgments.....3

Introduction.....6

Method.....17

 1. Participants

 2. Setting and Materials

 3. Response Measurement

 4. Pre-Treatment Analysis

 5. Sensory Diet Treatment

Results.....22

Discussion.....23

References.....26

Figures.....32

Abstract

Sensory integration implies that a number of the characteristics of autism are caused by poor sensory integration. Sensory integration refers to theoretical integration and interpretation of sensory stimulation from the environment by the brain. It proposes that in order for an individual to be able to function properly in the environment, he has to be able to organize all the sensations he experiences. From a behavioral perspective, some sensory integration treatments may be effective by abolishing the reinforcing sensory consequences of responses maintained by automatic reinforcement (e.g., stereotypy and self-injury). One individual who exhibited vocal stereotypy was exposed to a form of sensory integration therapy referred to as the sensory diet. Prior to treatment a functional analysis was conducted in attempt to identify the function of the individuals' behavior. The subject displayed a pattern of responding suggesting that his behavior was maintained by sensory consequences produced by the behavior. Following the assessment, the sensory diet procedure was implemented in an ABAB design to determine whether sensory integration would have an abolishing effect on vocal stereotypy. The data showed that the sensory diet had no effect on vocal stereotypy maintained by automatic reinforcement. The data do not support the notion that sensory integration has a positive impact on vocal stereotypy.

Effects of sensory integration on behavior maintained by automatic reinforcement

The term automatic reinforcement has been applied in developmental research to describe behavior that is not dependent on social reinforcement. Vollmer (1994) wrote that Skinner referred to automatic reinforcement as a “general class of behavior that might include anything from shooting a basketball to scratching one’s head.” For Skinner (1957), automatic reinforcement can be either a primary or secondary reinforcer.

A primary reinforcer, sometimes called an unconditioned reinforcer, is a stimulus that functions as a reinforcer even though the organism has had no particular learning history with that form of stimulation. Stimuli such as food, water, and sexual stimulation function as primary reinforcers. Primary reinforcers are readily identified and most people react similarly to the primary reinforcers when they are contingently arranged. Another type of reinforcer is the conditioned reinforcer, sometimes called a secondary reinforcer. Conditioned reinforcers are previously neutral stimuli that have acquired the capability to function as a reinforcer through pairing with one or more primary reinforcers or other conditioned reinforcers (Cooper, Heron, & Heward, 2007). A conditioned reinforcers are thought to lose their reinforcing efficacy when they are no longer paired with backup reinforcers. With individuals with autism repetitive self-stimulatory behaviors such as hand flapping, head rolling, body rocking, and hair twirling may produce sensory stimulation that functions as automatic reinforcement. The response product that functions as automatic reinforcement is likely an unconditioned reinforcer (Smith, Michael, & Sundberg, 1996).

For some individuals, problem behavior appears to be maintained by automatic reinforcement (Vollmer, 1994). The term has been used to describe reinforcement that is produced independent of the social environment (Vaughan & Michael, 1982). The term automatic does not specify whether behavior is maintained by positive or negative reinforcement contingencies (Vollmer). That is, automatic reinforcers can either serve as positive or negative reinforcers. Such responses develop independent of social consequences and are referred to as automatic because the behavior is maintained by the sensory consequence produced by engaging in the response. The specific source of reinforcement is often difficult or impossible to identify, manipulate, or control (Vollmer). When reinforcers maintaining a behavior are not within the control of the experimenter, behavior is particularly difficult to assess and treat. The development of treatment is often difficult because many behavioral interventions involve manipulations of the social environment, an approach that may be functionally irrelevant in the case of automatic reinforcement.

Vollmer (1994) indicated that behavior maintained by automatic reinforcement must follow certain criterion such as: the behavior should persist in the absence of other stimulation (e.g., the alone condition of a functional analysis), social consequences do not maintain the behavior, access to the behavior should function as a reinforcer, and, when the automatically reinforced behavior is blocked it will result in response suppression. Furthermore, Vollmer stated that if functional analysis shows that a behavior occurs more often in the alone condition, it may be concluded that such behavior may be decreased by simply enriching the environment that the subject is in. Iwata, Dorsey, Slifer, Bauman, and Richman (1982) stated that when barren environment functions as an establishing operation, we could conclude that the

consequences of the behavior serve the function of automatic positive reinforcement because the behavior is producing stimulation of certain type.

A considerable amount of research conducted over the past years implies that stereotypic behavior tends to be maintained by the sensory consequence produced by engaging in the response. Though it has been suggested that stereotypy serves no function (Bodifish, Symons, Parker & Lewis 2000), a considerable amount of research conducted over the past years implies that stereotypic behavior tends to be maintained by the sensory consequence produced by engaging in the response (Rincover, 1978; Iwata 1994; Rapp, 2007).

Previous research implies that stereotypic behavior tends to be maintained by automatic reinforcement (Vollmer, 1994). That is, the sensory consequence produced by engaging in the response is the functional reinforcer. Stereotypic behavior consists of repetitive behavior that has no apparent function in the environment. Examples of such behavior include 'rocking, hand waving, and head waving (Kaufman & Levitt, 1964), mouthing or rubbing parts of one's body (Berkson & Mason, 1964), and mouthing or spinning objects (Hutt & Hutt, 1965).

Ahearn, Clark, MacDonald and Chung (2007) examined the non-contextual vocalizations of four children diagnosed with autism. For each of the participants, it was found through functional analysis that vocal stereotypy was likely maintained by sensory consequences produced by the behavior. Following the functional assessment, a response redirection procedure was used to determine whether stereotypy could be successfully redirected. The procedure consisted of issuing a series of vocal demands contingent on any vocal stereotypy, and continuing these vocal demands until the child successfully complied with three of them while not engaging in vocal stereotypy. For each individual the response/redirection procedure

produced levels of vocal stereotypy that were lower than those in baseline. Also an increase in appropriate communication was detected for 3 of the 4 participants.

A large number of studies have been conducted to identify stimuli that effectively compete with the problem behavior (e.g., Ahearn et al., 2005., Vollmer, Marcus, & LeBlanc, 1994). Piazza, Adelinis, Hanley, Goh and Delia (2000) evaluated the effects of providing access to matched stimulation non-contingently on problem behavior that was maintained by automatic reinforcement. Three children participated in the study. All three exhibited problem behavior that was automatically reinforced. Preference assessments were used to identify preferred leisure items that did or did not match the hypothesized sensory consequences of the problem behavior. Each participant was given non-contingent access to either highly-preferred matched or highly-preferred unmatched items. Results suggested that providing access to items that matched the hypothesized sensory consequences of aberrant behavior may be more effective than providing access to unmatched stimuli. Falcomata, Roane, Hovanetz, Kettering, and Keeney (2004) examined the utility of a procedure consisting of noncontingent reinforcement (NCR) with and without response cost in the treatment of inappropriate vocalizations maintained by automatic reinforcement. Following the functional analysis a treatment phase was implemented. The treatment consisted of comparison of baseline and two treatment conditions, NCR and NCR plus response cost. Noncontingent reinforcement is a procedure where stimuli with known reinforcing properties are presented independent of behavior (Cooper, Heron & Heward, 2007). In the study a functional analysis was conducted first to identify the reinforcer that maintained inappropriate vocalizations. Following the functional analysis, a phase of consecutive alone sessions was implemented to evaluate further the occurrence of the target behavior. The treatment analysis consisted of comparison of baseline and two treatment conditions, NCR and NCR plus response

cost. Baseline sessions were similar to the alone sessions for functional analysis, except that the therapist was present and a preferred item was placed in the room. During baseline the participant was not allowed to use the preferred item even though it was present. During NCR condition, the participant was given continuous access to the preferred item, and the therapist provided no consequences for occurrences of the target behavior. Although levels of inappropriate vocalizations decreased below baseline levels during NCR, the observed reduction was not clinically significant. Therefore, a response cost component was introduced to the NCR condition. In this condition the participant lost access to the preferred item for 5 s contingent on inappropriate vocalizations. In this study the use of response cost reduced the occurrence of the automatically reinforced behavior. The results of this study are similar to those in a previous study done by Mason and Iwata (1990) and suggested that for some individuals the loss of preferred stimuli may compete with engagement in automatic reinforced problem behavior.

Researchers have also investigated sensory extinction for automatically reinforced behaviors and they have explored the role environment plays in self-stimulation (Rincover, Cook, Peoples, & Packard, 1979). In the Rincover et al. study, the topography of problem behavior for each child was observed in order to develop a hypothesis about sensory consequences that could be responsible for maintaining the behavior. Then, a sensory extinction procedure was created based on this hypothesis wherein preferred objects were removed in order to see the participant's reactions. Afterward the participants played with toys that had similar consequences (which were observed to be highly reinforcing during sensory extinction) to the toys used during the sensory extinction procedure, and once again behavior was evaluated. It was reported that the first participant was stimulated by sounds during assessment. When auditory feedback was removed when carpeting was installed atop the table, stereotypy was near

zero for 17 consecutive sessions. The participant played with a music box during treatment at an average of 81% of the time and ignored other toys. The second participant in this study was stimulated by touch. A small vibratory mechanism was taped to the back of a child's hand, generating a low intensity, high frequency pulsation. When proprioceptive feedback was removed; stereotypy was immediately reduced to zero. The participant played with toys that provided proprioceptive stimulation at an average of 77% of the time, and ignored other toys. Stereotypy was maintained at low rates of behavior that averaged 18% across seven sessions. The third participant was stimulated by tangible items. The participant constantly picked feather, lint or a small string and then threw it in the air and waver hands vigorously trying to keep it afloat. This suggested that visual consequences may have reinforced the hand movement. When visual feedback was removed, stereotypy decreased from a 68% to near zero rates. The participant played with bubbles during treatment and ignored other toys. Stereotypy was maintained near zero rates. The fourth participant was stimulated by multiple sensory events. The self-stimulation consisted of finger flapping. When visual feedback was removed, stereotypy decreased to an average of 77%. When visual and proprioceptive feedback were removed, stereotypy decreased to a mean of 34%. Rincover et al. suggested that better methods and treatments may be necessary to design effective interventions for individuals whose stereotypy behavior is supported by multiple senses. Overall, this study suggests that stereotypic behaviors can decrease if programming is created on the basis of sensory reinforcement.

Vollmer (1994) states that manipulating motivating operations can be an effective option for treatment for automatically-reinforced behavior. According to Vollmer, altering motivating operations can be accomplished by response competition, enriching the environment or by matched forms of stimulation. Establishing operation refers to an event that alters the

reinforcing efficacy of a stimulus as reinforcement (Michael, 1982). Satiation and deprivation are two examples of motivating operations. Satiation is the opposite of deprivation. The more frequently a person has received a particular reinforcement in the recent past, the more satiated she is. Deprivation is the frequency with which a person has received a particular reinforcement. The less frequent the reinforcer, the more deprived the person is. Vollmer and Iwata (1991) illustrated in their study that food, music and social praise were more potent as positive reinforcement when a short period of deprivation preceded skill acquisition training session.

According to Vollmer, differential reinforcement procedures can be used to reduce automatically-reinforced problem behavior. When differential reinforcement is used reinforcement is delivered contingent on appropriate behavior (Vollmer 1994).

Kennedy et al. (2000) studied behavioral functions associated with stereotypical responses for students with autism. In Study 1, functional analyses were conducted for 5 individuals. For all participants, stereotypy occurred across all assessment conditions, suggesting that the behavior is maintained by automatic reinforcement. In the second study the stereotypy of one of the individuals was further analyzed on a function by function base. Alternative responses were taught to be student using functional communication training (FCR). The results of the study showed that similar topographies of stereotypy were reduced only when differential reinforcement contingences for alternative form of communication were implemented for specific response-reinforcer relation.

Sensory Integration

It has been suggested that individuals with autism display problem behavior due to poor sensory integration (Ayres, 2005) The child with autism shows many of the symptoms of poor sensory processing that are seen in the child with minimal brain dysfunction and his interactions

with the physical environment are corresponding poorly (Ayres, 2005). However, a child with autism has additional problems. A child with autism is often described as being “in a world of his own”, and he usually does not want others to intrude. If he learns to speak, his speech tends to be limited. Some children with autism display too little emotion. Others become very emotional, have tantrums and become aggressive.

According to Ayers et al. (2005), there are three aspects of poor sensory processing that occur in children with autism. One, sensory input is not being registered correctly in the child’s brain, and so he pays little attention to his environment, while at other times he overreacts. Two, he may not modulate sensory input well and so he may be gravitationally insecure or tactilely defensive. Three, the part of his brain that makes him want to do things, especially new or different things, is not operating normally, and so he has little interest in doing things that may be useful in his life. The objective therapy for the autistic child is to improve the sensory processing so that more sensations will be more effectively “registered” and modulated, and to encourage the child to form simple adaptive responses as a means of helping him to learn to organize his behavior (Ayers).

According to Ayers et al. (2005), the central idea of the sensory integration therapy is to provide and control sensory input in a way where the child spontaneously forms the adaptive responses that integrate those responses. Sensory integrative therapy is a specialty of occupational therapy, a profession that has emphasized understanding of human behavior from a neurobiological viewpoint. Most activities in sensory integration therapy are said to be purposeful, since the child has a goal in doing them. Doing such activities is the best way to improve human functioning when the problem lies in the way the brain is working. In order for the therapy to be effective a skilled therapist and large room with special equipment is required.

The therapy is most effective when the child directs his own actions while the therapist unobtrusively directs the environment. Integration most often occurs when the child wants the stimulus and initiates an activity to get those sensations.

Typically, sensory integration therapy is delivered in one-to-one sessions over extended periods of time (Ayers, 1972). Furthermore, Ayers explains why sensory integrative therapy (SI) is putatively effective. She says that because child brain is young it is flexible and capable of natural change. Sensory diet is a common SI treatment method where exposure to sensory items is provided during the day (Wilbarger, 1991). Sensory integration occurs in the nervous system and the main task of our central nervous system is to integrate the senses. In order to assume that this therapy alone was responsible for any apparent changes in the child, the changes would first need to be documented over time by objective methods. It would be also necessary to conduct controlled experiments to rule out several plausible alternatives to the possibility that SI per se produced the changes: placebo effects, maturation; the potential reinforcing effects of sensory stimulation, motor activities, and adult attention; escape from demands; and other potential treatments.

However, observation that a child likes an activity is not sufficient evidence that the activity is producing significant, lasting changes in the child's brain and or behavior, or any short-term benefits other than momentary pleasure. Most studies reporting that SI is effective, lack necessary controls to permit any alternative explanation to be ruled out (Bright, Bittick, & Fleeman, 1981; Lemke 1974; Wells & Smith, 1983). Many lack operational definition of the critical variables as well as objective measurement procedures and controls for observer bias.

Lemke (1974) suggested that stereotypic behavior and self-injurious behavior seen in developmentally disabled individuals may be a reflection of poor sensory-motor integration. To

support this statement Lemke presented an uncontrolled case study where multiple forms of stimulation were applied to an individual who exhibited self-injurious behaviors. The multiple forms of stimulation included: finger massage and ice to the mouth, quiet talk, tooth brushing, towel massage to the arms, patty cake, feet slapping, and body rolling. Unfortunately no quantitative data were presented, however the author noted that the subject was freed from restraint and learned to hold a toy in each hand, (one toy was mouthed the other was banged).

In another case study, Bright et al. (1981) administered tactile, vestibular, and social stimulation. It was reported that their subject's frequency of SIB decreased during treatment sessions. Physiological stimulation was presented concurrent with other events, most notably noncontingent social stimulation, that alone may have been responsible for reported changes in behavior.

Wells and Smith (1983) studied the use of sensory integration to reduce SIB with four participants. SIB was assumed to be maintained by automatic reinforcement, however no functional analysis was conducted. Sensory integration treatment consisted of rocking in a hammock or chair, vibrator or massage, rolling on therapy ball, rolling large bolster over legs, back and shoulders. Results showed large decrease in SIB for all four participants. Although these results are good, this study, like many others lacked scientific rigor.

Well controlled studies conducted by Dura, Mulick, and Hammer (1988), and Mason and Iwata (1990) found that SI was ineffective or no more effective than other treatments. Mason and Iwata (1990) studied the effects of sensory integration therapy on the self-injurious behavior of three children with profound disabilities. Prior to the treatment, a functional analysis baseline was conducted to identify what maintained the participants' problem behavior. Three individuals who exhibited self-injurious behavior (SIB) were exposed to SI. One subject's SIB appeared to

be an attention-getting response (maintained by positive reinforcement), which varied subsequently as a function of attention being either withheld or provided noncontingently during SI. The second subject displayed a pattern of responding suggestive of stereotypic SIB (maintained by automatic reinforcement), which paradoxically increased during SI. The third subject's SIB appeared to function as an escape response (maintained by negative reinforcement), and his behavior during SI was similar to that observed during baseline sessions in which demands were not present. The SIB of all 3 subjects later was reduced when functionally-appropriate behavioral interventions were applied. The data presented questions about the active components of SI and the functional types of SIB for which it might be appropriate. These questions that were presented are; , what are the effects of SIT as a treatment for SIB? Is it limited to the stereotypic function of SIB for which SIT was design? What are the active components of therapy? How would these components affect SIB that is maintained by environmental events?

From a behavioral perspective, SI may be effective by abolishing the reinforcing sensory consequences of automatically reinforced behavior (Laraway, Snyckerski, Michael, & Poling, 2003). Abolishing operations make reinforcement and punishers less effective. For example; food ingestion decreases the effectiveness of food as reinforces.

The purpose of the present study was to identify behaviors maintained by automatic reinforcement and determine if sensory integration had any impact on behaviors that are maintained by sensory consequence. It is important to evaluate if Sensory Integration Therapy is effective for treating automatically maintained stereotypy. In this study an individual was exposed to a sensory diet where items that were shown to compete with stereotypy were

provided at specific times during the school day. Vocal stereotypy was measured twice a day; in the morning and in the afternoon.

Method

Participant

The participant, Daniel, was a 21-year-old male, who had been diagnosed with an autism spectrum disorder. He was a residential student in New England Center for Children in Southborough, Massachusetts. The participant had both receptive and expressive language skills but he exhibited vocal stereotypy that interfered with his educational and social activities.

Setting and Materials

All sessions were conducted in a research room (1.5 m by 3 m) equipped with wide-angle video camera, microphone, video recording equipment. The room was equipped with a one-way mirror to permit unobtrusive observation. A questionnaire and risk-assessment form was requested from the participant's specialist prior to the sessions. All sensory integration treatment sessions were conducted in the participant's classroom.

During the competing-items assessment, sensory items (harmonica, straw, bubbles 1, bubbles 2, whistle 1, whistle 2, face massager, balloon) recommended by an Occupational Therapist trained in sensory integration were evaluated. The items shown to compete with the target behavior during the competing items assessment were included in the sensory integration analysis.

Response Measurement and Interobserver agreement

Response definitions were developed by observing the subject. Vocal stereotypy response was defined as follows: Any vocalization where Daniel engages in self-talk outside of

his designated pacing time at a conversation level or at a whisper level and any non-functional humming vocalization. *Examples:* Daniel is sitting at a table with his teacher talking to himself and making no effort to communicate with his teacher. Daniel is humming to himself and is clearly not humming a tune or humming along with a song. *Non-examples:* Daniel says, “Excuse me”, to his teacher to engage in a conversation. The radio is playing and Daniel is dancing and singing or humming along.

Item engagement was defined as hand-to-hand item contact and was measured using momentary-time sampling using 10-s intervals with 2-s observation period.

All functional analysis conditions were 5 min. Data on vocal stereotypy were collected using 10-s momentary time sampling. At the end of each 10 s interval, an observation of 2 s occurred during which the occurrence or non-occurrence of vocal stereotypy was recorded.

Interobserver agreement data were collected during at least 33% of all sessions throughout the study. For all sessions mean agreement was calculated by dividing the number of intervals with agreements by the total number of intervals with agreements plus disagreements, then multiplying this number by 100%. Mean total agreement for functional analysis sessions was 95% (range from 90%-100%)

During the competing items assessment, data were collected on vocal stereotypy and item engagement using a 10-s momentary time sample. Based on the results of this assessment, items were chosen for the treatment phases. Mean total agreement for competing items assessment sessions was 99.4% (range from 94%-100%) for vocal stereotypy and 91.8% for engagement (range 86%-100%).

Data were taken during sensory integration treatment on participant’s vocal stereotypy using 10-s momentary time sampling (2-s observation periods). Mean total agreement for vocal

stereotypy during baseline was 95% (range 90%-100%). Mean total agreement for vocal stereotypy during treatment was 90% (range 86%-100%).

Pre-treatment Analyses

Functional Analysis

A functional analysis based on the procedures described by Iwata et al. (1982/1994) was conducted and included the following conditions: social attention, demand, and alone. Three conditions (alone, attention and demand) were conducted in each functional analysis in the following order: alone, alone attention, alone, alone, demand. Sessions were 5min and a multielement design was used.

Attention. This condition assessed behavioral sensitivity to positive reinforcement in the form of attention. The participant and the therapist were in a room where the participant has access to preferred stimuli. The therapist told the student “here are some toys to play with, I need to go do some work.” If the participant emitted other behaviors rather than the target behavior, he was ignored. If he emitted the target behavior the therapist delivered attention for about 5 s and stated, “don’t do that Dan”.

Demand. This condition assessed sensitivity to negative reinforcement in the form of escape from task demands. The participant was presented with continuous demands. If no response occurred for 5 s, the therapist modeled the correct response, followed by a manual guidance. If the participant performed the desired task, the therapist delivered praise. If the target behavior occurred during demand presentation, the therapist stated, “Ok, you don’t have to” and removed task materials for 15 s. If any other behavior was emitted, the therapist acted as if the behavior had not occurred.

Alone. This condition assessed whether the target behavior was sensitive to non-social consequences or automatic reinforcement. The participant was alone in a room without any materials. No social consequences were delivered.

Results of the functional analysis for Daniel are depicted in Figure 2. Data indicated undifferentiated results across conditions in the multielement phase, suggesting that vocal stereotypy was maintained by automatic reinforcement (see Figure 2).

Phase I

Competing Item Assessment

A competing items assessment was conducted in order to identify items that provided competing sensory consequences (Piazza et al., 2000). The items included in the assessment were identified by an occupational therapist who consulted with a therapist trained in Sensory Integration. The eight items evaluated were harmonica, straw, bubbles, frog bubbles, whistle 1, whistle 2, face massager, and red balloon. At the beginning of every 5-min session, the therapist presented the participant with one item and stated, “you may play with this item if you want”. The competing item assessment consisted of 20 sessions. During the first 10 sessions, the order of the items was randomized. During the second series of 10 sessions, the items were presented in a different order. All of the sessions were videotaped for the purpose of data collection. The data were collected using momentary-time sampling.

Sensory Diet Treatment

Experimental Design

In this study, a sensory diet treatment was evaluated using an ABAB design (A was baseline; B was 10 min per hour, for 6 hours a day, of sensory diet exposure). This design

allowed us to determine whether the sensory diet treatment would have any long term abolishing effects on vocal stereotypy.

Baseline.

During this condition, the participant was alone in the therapy room for 10 min. The participant received no attention and had no access to toys during baseline sessions. No consequence for the target behavior was delivered. These sessions were conducted at the beginning and at the end of the school day.

Sensory Integration Treatment.

During this condition, the participant was provided therapist presented “sensory diet” items continuously for 10 min at the beginning of each hour for 6 hours in the participant’s classroom. The items delivered were those identified as competing with the target behavior during the competing items assessment. The items were harmonica, face massager, two different types of whistles, two different types of bubbles, straw and red balloon. The therapist remained in the room but did not interact with the participant.

Upon completion of the “sensory item” treatment, 10-min alone sessions were conducted in the research room in order to measure stereotypy as in baseline. Momentary time sampling was used to collect the data. Target behavior was the same as in the baseline phase and was defined as any vocalization where Daniel engaged in self-talk outside of his designated pacing time at conversational level or at whisper level and any non-functional vocalization.

Results

Results for Dan’s sensory integration evaluation are shown in Figure 3. Baseline data shows Dan’s vocal stereotypy was rather variable and high with a mean of 40.8 % (range, 8%-

83%) during the morning session and a mean of 40% (range, 15%-100%) during the afternoon session. During treatment sessions, Dan's vocal stereotypy remained unchanged from the baseline condition. His vocal stereotypy continued to be high and variable with a mean of 32% (range, 7%-97%) during the morning session and a mean of 31.2% (range, 5%-87%) during the afternoon, indicating that the treatment did not have any effect. Upon a return to baseline, vocal stereotypy continued to be high and variable with a mean of 34.7% (range, 4%-67%) in the morning and a mean of 43% (range, 7%-97%) in the afternoon. Upon return to treatment, levels of vocal stereotypy were similar to those observed in the previous conditions with a mean of 40.2% (range, 40%-73%) in the morning and with a mean of 39.7% (range, 5%-97%).

Discussion

The results of several studies (Bright et al., 1981; Dura et al., 1988; Lemke, 1974; Wells & Smith, 1983) have shown that sensory integration therapy may be a potential treatment for behaviors that are maintained by automatic reinforcement. However, that conclusion was reached through data collected using inadequate experimental techniques. Only Dura et al. used procedures in which he attempted to control for all the necessary variables. A closer examination of this research lead one to believe that there is a need for additional subject selection criteria and control procedures, especially because the specific source of reinforcement is often difficult or impossible to identify, manipulate or control (Vollmer, 1994). It is difficult to assess and treat behavior that is maintained by automatic reinforcement because the reinforcers are not within the control of the experimenter. Refining behavioral treatment for automatically reinforced behavior is often difficult because most interventions involve manipulating the social environment, an approach that may be functionally irrelevant in the case of automatic reinforcement. If stereotypy is maintained by automatic reinforcement, a more appropriate treatment that could be

considered is differential reinforcement of an alternative behavior that may compete with the target behavior.

In the present study, the data obtained during sensory integration therapy raised questions about the effectiveness of this treatment for reducing automatically reinforced vocal stereotypy. The results showed that the sensory diet treatment was ineffective in reducing the participant's vocal stereotypy during both AM and PM sessions. Also, if sensory integration treatments were effective, general levels of stereotypy would be lower during treatment phase than during baseline. Even though the participant was given access to sensory diet items for a much longer duration than that typically used during actual sensory integration treatment, levels of stereotypy did not decrease. From a behavioral perspective it was hypothesized that the sensory integration treatment would work by abolishing the reinforcing sensory consequences of the stereotypy. The sensory items were chosen in order to provide competing sensory stimulation to the target behavior; however, there was no effect on levels of vocal stereotypy even when empirical analysis was used to select these items. The individual was given access to the items for the first 10 min of every school hour (6 hours) and no changes in vocal stereotypy were observed. Therefore, our findings suggest that access to a typical sensory diet, which is usually considerably less than 10 min of every hour for 6 school hours, would not be an effective treatment for treating stereotypy in children with autism.

The results of the study also showed that when the participant was no longer engaged with the sensory diet items, levels of vocal stereotypy returned to levels similar to baseline. The results also suggest that the individual satiated quickly on the sensory diet items, which may be problematic because the items would have to be replaced often in order for the treatment to be effective. It can be concluded that the sensory diet did not serve as an abolishing operation. The

results of the study also show that sensory diet treatment had no long term or lasting effects on stereotypy.

This present study contains several limitations. First, only one student participated in this study, and only vocal stereotypy was examined. The effects of sensory-integration condition would have been strengthened by including additional subjects. It is possible that longer or more frequent sessions or different sensory diet materials may have yielded different findings.. Future research should concentrate on extending and improving methodology in the areas of subject selection, assessment of behavioral function and component analysis. It is important that future research continues to evaluate interventions (e.g., differential reinforcement or response blocking) for individuals with automatically reinforced problem behavior.

In summary, the data from this study and other studies suggest that sensory integration therapy is not generally effective as a treatment for behaviors maintained by automatic reinforcement and that its effects may depend on the relationship between response topography and the type of stimulation provided during treatment.

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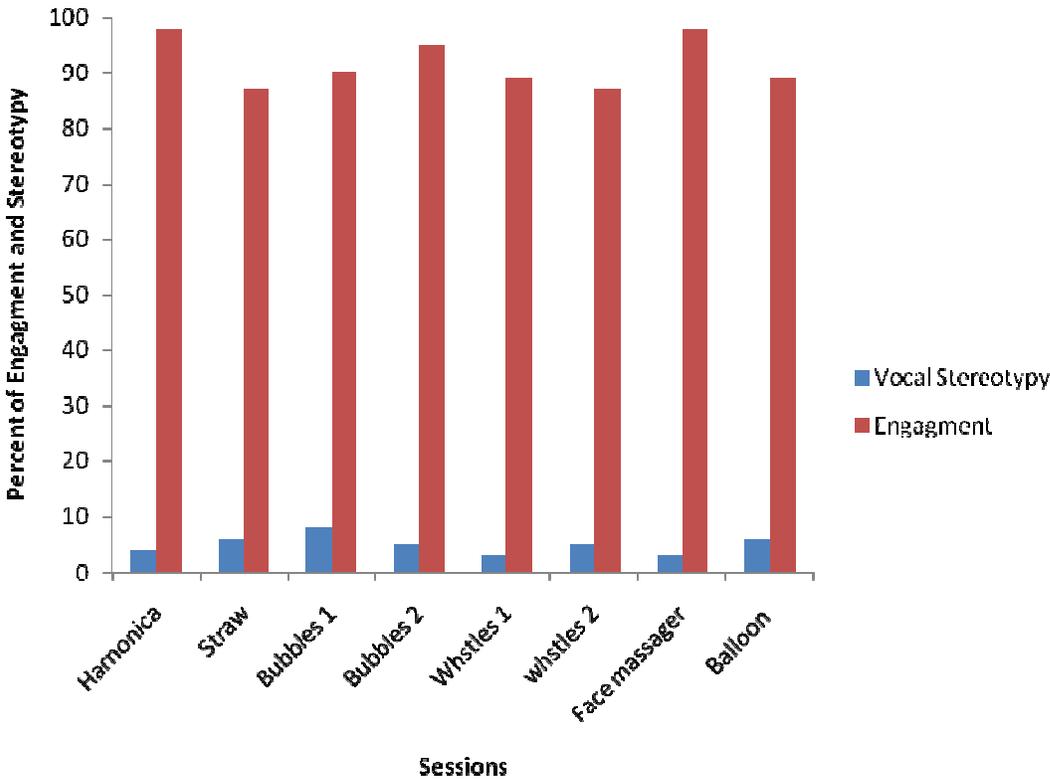


Figure 1. Percentage of intervals with engagement and vocal stereotypy during the Competing Item Assessment.

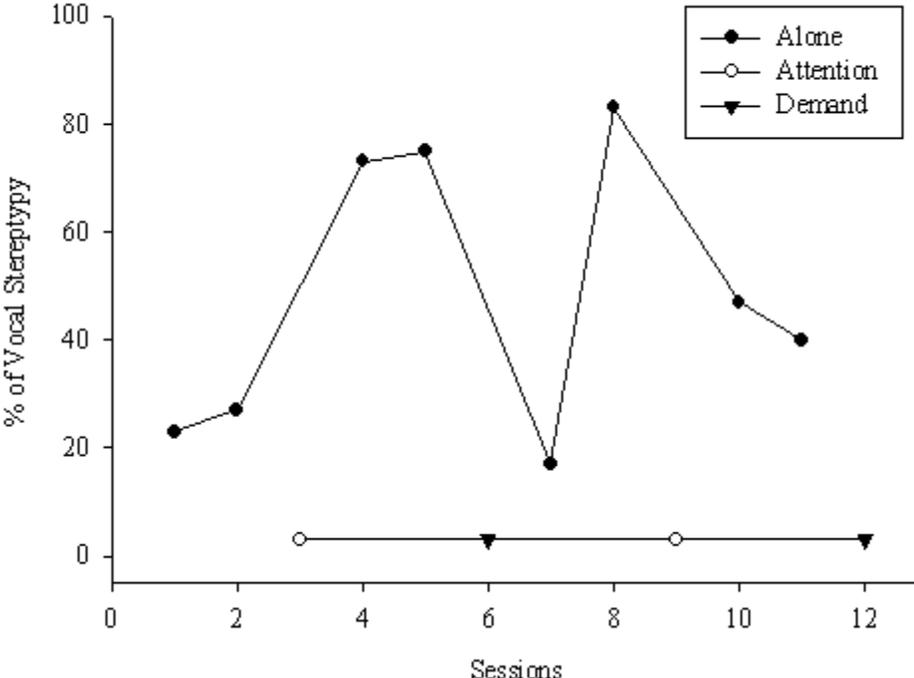


Figure 2. Percentage of intervals with vocal stereotypy during the multi-element and series of alone sessions.

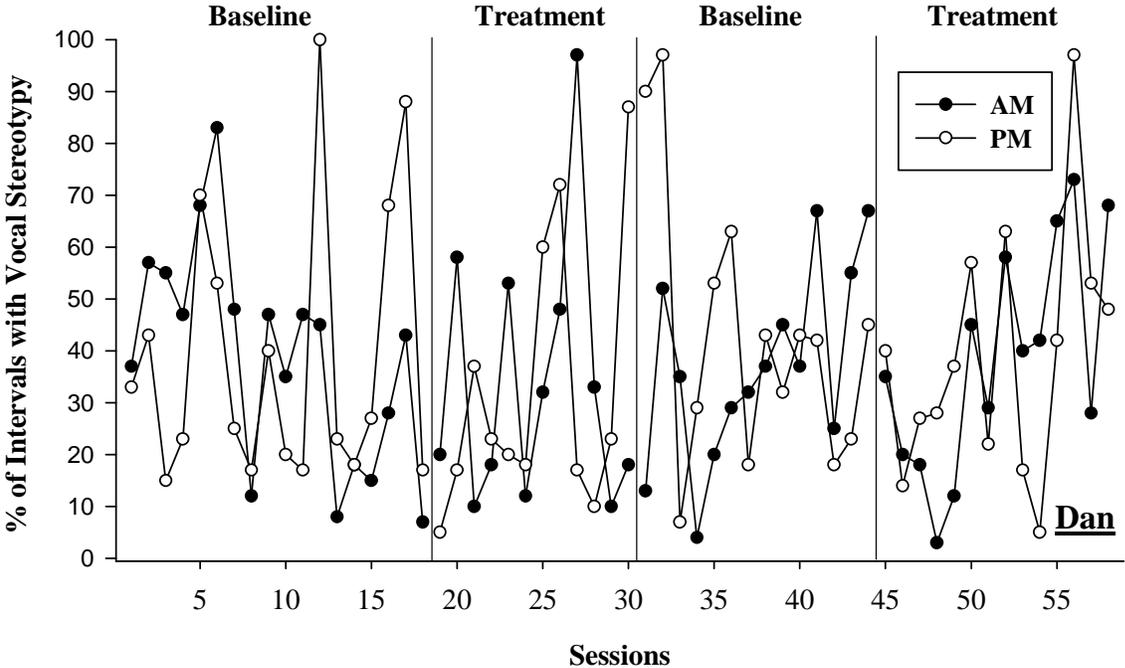


Figure 3. Percentage of intervals with vocal stereotypy during the treatment.