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EVALUATION OF SATIATION-RESISTANT HEAD ROCKING

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The persistent head rocking of a woman diagnosed with profound mental retardation was examined during three separate assessments. First, a functional analysis demonstrated that head rocking was maintained independent of social consequences. Next, an antecedent assessment revealed that exposure to alternative sources of stimulation reduced head rocking, but only when the stimulation was being provided. A third assessment, which consisted of an enriched environment, replicated the findings of the first two assessments. Across all three assessments, head rocking persisted at extremely high rates when alternative stimulation was unavailable and returned to high levels immediately following the removal of alternative sources of stimulation. An environmental enrichment (EE) intervention, which was based on the results of the functional analysis and antecedent assessment, resulted in a 70% reduction in the occurrence of the head rocking. In addition, a social validity assessment revealed that the participant's caregivers rated the EE intervention as both effective and socially acceptable. The particular challenges that satiation-resistant aberrant behavior presents for behavior analysts are addressed. Specific suggestions for research on intervention strategies for persistent aberrant behavior are also provided. Copyright © 2000 John Wiley & Sons, Ltd.

Aberrant behavior that is maintained in the absence of social contingencies is usually sensitive, at least momentarily, to the effects of satiation. For example, individuals who watch television or read (both automatically reinforced behaviors) generally refrain from engaging in these activities for at least a short period of time following the activities. However, some automatically reinforced behaviors persist at high rates over extended periods of observation. Further, these behaviors may reemerge immediately after the individual is exposed to alternative sources of stimulation. The purpose of the present study was to illustrate an evaluation of persistent head rocking, which might be useful for future research or clinical efforts with similarly persistent automatically reinforced aberrant behaviors.

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METHOD

Participant and Setting

Jana was a 30-year-old female diagnosed with profound mental retardation and visual impairment. Jana had 10 to 15 mands in her repertoire and was ambulatory with the aid of a walker. Jana's target behavior was repetitive, bilateral head rocking that was forceful and rapid, involving her head, neck, and shoulders. Although a formal descriptive assessment of the target behavior was not conducted, informal observations suggested that the head rocking occurred across settings and activities. The head rocking interfered with Jana's learning and social interaction, and Jana's physician had noted that the movement might eventually cause muscular problems. Sessions were 10 min in length and were conducted in a bedroom at Jana's group home.

Dependent Measure and Data Collection

Head rocking was defined as "horizontal movement of the head that crosses the mid-line". Data were recorded as percentage of 6 s intervals within a 10 min session in which the target behavior occurred, using a partial-interval recording method. Two independent observers recorded data simultaneously during 34% of sessions. Interobserver agreement (IOA) on the occurrence of head rocking was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. An occurrence agreement was defined as both observers recording at least one behavior during a given interval. IOA (occurrence + nonoccurrence) for head rocking averaged 98.7% (range, 97% to 100%). Procedural integrity (e.g., attention delivery) data were also collected during 50% of relevant sessions and averaged 99.5% (range, 98% to 100%). IOA on procedural integrity data was calculated for 23% of relevant sessions and averaged 99.5% (range, 98% to 100%).

Procedure and Experimental Design

Functional analysis

The multielement functional analysis conditions were based on the procedures described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994). One to five sessions were conducted per day, one to three days per week. The functional

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analysis consisted of four conditions: demand, attention, no interaction, and control. In the demand condition, Jana was instructed to complete a series of preacademic and self-care tasks using a three-step prompting procedure consisting of sequential verbal, gestural, and physical prompts. The therapist removed the task materials and ended the instructional sequence for 30 s contingent on the occurrence of head rocking. During the attention condition, Jana was given moderately preferred items (according to caregiver report) and attention was provided in the form of a verbal reprimand (e.g., "Don't do that") if head rocking occurred. During the no interaction condition, the therapist remained in the room with Jana but did not interact with her. During the control condition, Jana was given highly preferred items. The therapist praised Jana once every 30 s. When the results of the multielement analysis were determined to be undifferentiated, three consecutive no-interaction sessions were conducted to assess behavioral persistence in the absence of social contingencies (Vollmer, Marcus, Ringdahl, & Roane, 1995).

Antecedent assessment

The purpose of this phase was to examine the relationship between head rocking and various antecedent conditions. Four conditions were conducted in a multielement fashion. The conditions were based on hypotheses (which were derived from caregiver report) of the variables that were maintaining the head rocking. During the reduced-light condition, minimal light was present in the room while Jana was observed. Jana received no social interaction during this condition. The purpose of this condition was to examine the hypothesis that head rocking was correlated with visual stimulation. A reduction in the level of head rocking during this condition, possibly because of sensory extinction, would suggest that visual stimulation was correlated with behavior maintenance. During the noise condition, a stereo was played in the session room while Jana was observed (i.e., Jana did not receive social interaction). The purpose of this condition was to examine the hypothesis that the target behavior was correlated with auditory stimulation. A change in the level of head rocking in the presence of a fixed sound source would suggest that auditory stimulation was correlated with behavior maintenance. A licensed massage therapist suggested that the head rocking was stimulating Jana's neck and upper back muscles. Therefore, during the massage condition, Jana was provided with a neck and upper back massage for the entire session. The massage therapist was careful not to physically prevent the target behavior from occurring. Other than the massage, Jana received no social interaction during this condition. The purpose of this condition was to examine the hypothesis that the target behavior was related to tactile or

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kinesthetic stimulation. During the no-interaction condition, which served as a methodological control, Jana was merely observed. No items were available and there were no programmed consequences for head rocking.

Enriched environment assessment

The purpose of the enriched environment (EE) assessment was to further analyze the persistence of head rocking, this time in the presence of multiple stimuli. The effects of this assessment were examined using an ABA reversal design with a multielement EE phase.

The baseline conditions consisted of no-interaction sessions, as described above. Two EE interventions were then conducted in a multielement format. The first EE intervention involved noncontingent access to a toy flashlight, music, and a vibrating pen. The vibrating pen was utilized because Jana interacted with it by applying it to her neck, which provided vibratory and/or kinesthetic stimulation to her shoulders and neck. This stimulation was hypothesized to be somewhat similar to the stimulation produced by the shoulder and neck massage conducted in the antecedent assessment (at least in the sense that the two types of stimulation affected the same area of the body). The toy flashlight and music were utilized because Jana's caregivers reported, via an unstructured interview, that these were preferred items (i.e., Jana frequently interacted with these items). In the second EE intervention, Jana was given noncontingent access to these same stimuli; however, the vibrating pen did not vibrate (the batteries were removed). The purpose of this second EE intervention was to examine the role of stimulation applied to the neck separate from the effects of other properties of these three stimuli. Jana was given the stimuli at the beginning of the sessions and received no therapist interaction during these sessions. There were no programmed consequences for head rocking during these sessions.

RESULTS AND DISCUSSION

The top panel of Figure 1 depicts the results of the functional analysis. Jana's head rocking occurred at high levels during each of the test conditions ($M = 89.8\%$ for escape, 85.8% for attention, 89.6% for no interaction, and 84.0% for control). Head rocking also persisted during the consecutive no-interaction sessions ($M = 93.6\%$). These data suggest that Jana's head rocking, if an operant, was maintained by automatic reinforcement. Further, the data also suggest that the head rocking appears to be almost completely insensitive to satiation to the source of stimulation that it produces.

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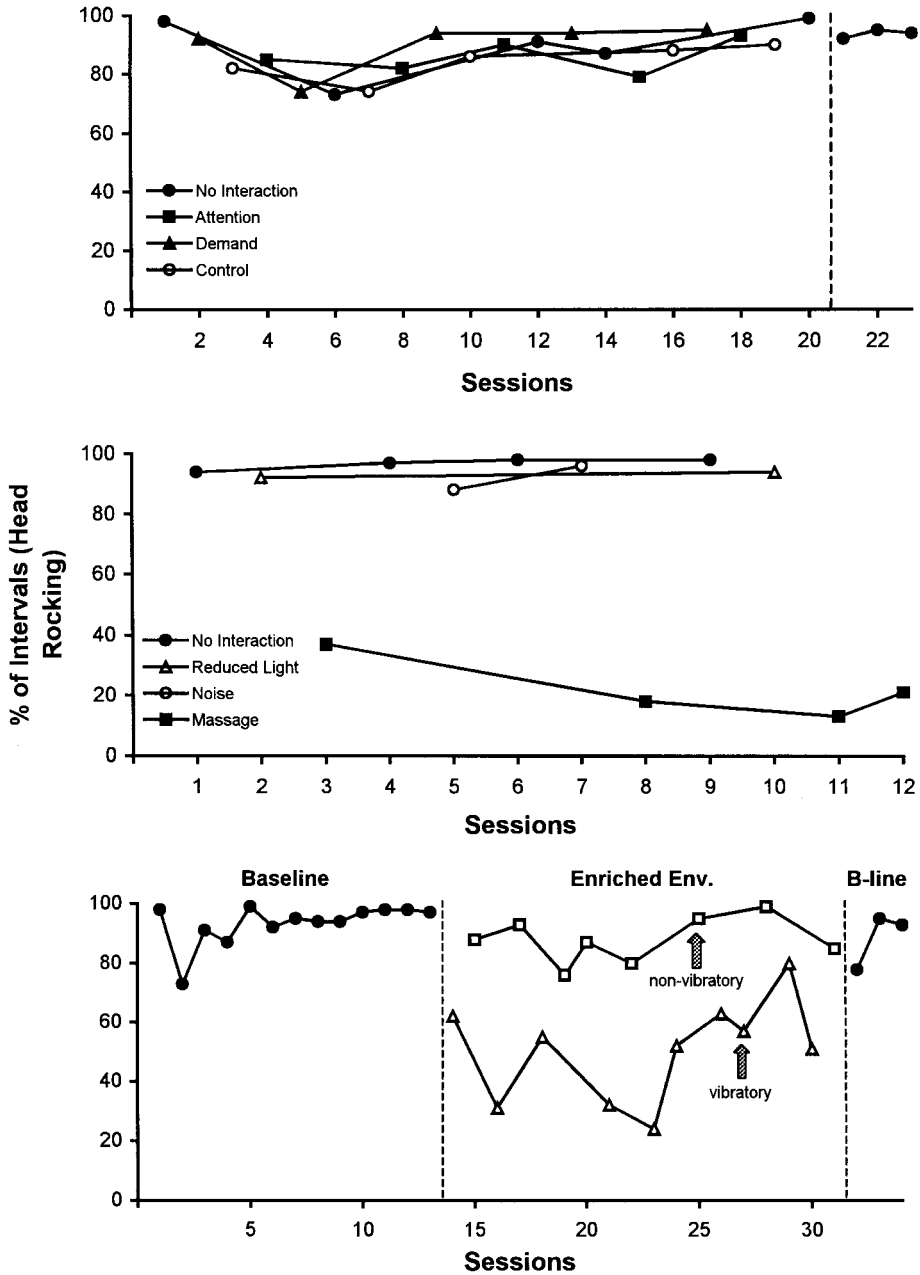

Figure 1. Percentage occurrence of head rocking during functional analysis (top panel), antecedent assessment (middle panel), and baseline and environmental enrichment conditions (bottom panel).

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The middle panel of Figure 1 depicts the results of the antecedent assessment. Jana's head rocking occurred at high levels during all of the conditions, except for the massage condition ($M = 93.0\%$ for reduced light, 92.0% for noise, 22.3% for massage, and 96.8% for no interaction). These data suggest that Jana's head rocking was reduced by an alternative source of stimulation. However, head rocking was reduced only when this stimulation was provided. Head rocking returned to high levels immediately after the massage was removed. For example, during sessions 4 and 9 (no interaction), which were run immediately after sessions 3 and 8 (massage), head rocking returned to high levels.

The bottom panel of Figure 1 depicts the results of the enriched environment assessment. During baseline, Jana's level of head rocking was high ($M = 93.4\%$). Jana's level of head rocking remained high in the EE condition that did not include vibration ($M = 87.9\%$), but decreased in the EE condition that did include vibration ($M = 50.7\%$). Head rocking persisted during a brief reversal condition ($M = 88.7\%$).

The EE assessment replicated and extended the findings of the previous two assessments. The two baseline conditions and the non-vibratory EE condition demonstrated that the behavior occurred almost continuously (i.e., it was insensitive to satiation to the source of stimulation that it produced). The vibratory EE condition extended the results from the massage condition of the antecedent assessment phase by demonstrating behavioral reduction in the presence of a different stimulus that produced neck stimulation. Levels of head rocking did decline when Jana was exposed to an alternative source of stimulation. As with the previous assessment, though, head rocking increased immediately after the alternative source of stimulation was removed.

At the conclusion of these assessments, Jana was exposed to an EE intervention based on the information gathered during the evaluations. The intervention consisted of noncontingent simultaneous access to the vibrating pen and a vibrating tube. Follow-up data collected in a variety of settings approximately one month after the implementation of the intervention indicated that when Jana had access to the EE items, her head rocking was reduced by nearly 70% from baseline levels. Additionally, a social validity assessment of the EE intervention was conducted. Jana's caregivers rated questions regarding the efficacy and acceptability of the intervention on a five-point Likert scale. Jana's caregivers rated the EE intervention as both effective and socially acceptable.

This study illustrates a case of extremely persistent stereotypic head rocking, as demonstrated by the nearly continuous occurrence of this behavior throughout our assessments. Although head rocking was reduced when Jana was exposed to alternative sources of stimulation, it reemerged immediately after those sources of stimulation became unavailable. The current data suggest that some

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automatically reinforced aberrant behaviors possess a property (i.e., resistance to satiation) that is not commonly seen with socially reinforced aberrant behaviors or other automatically reinforced behavior. Few socially reinforced aberrant behaviors occur on such a continuous basis. In addition, with socially reinforced behaviors, researchers have been able to present, for example, attention or escape from aversive stimuli on an intermittent basis and still obtain treatment effects (e.g., Vollmer *et al.*, 1998). Other automatically maintained behaviors (e.g., rumination) may also be treated by providing intermittent alternative stimuli (e.g., Wilder, Draper, Williams, & Higbee, 1997). Exposure to these stimuli presumably produces a momentary satiation effect, as aberrant behavior is unlikely to occur for some time after this exposure.

The treatment of extremely persistent aberrant behavior presents a particularly difficult challenge for applied behavior analysts. As demonstrated in the present study, the effects of EE on satiation-resistant aberrant behavior are limited if they exert an influence only when an individual is exposed to the alternative sources of stimulation. Further research on the treatment of persistent aberrant behavior is clearly needed. One line of research that appears promising is the manipulation of response effort for persistent aberrant behavior, utilized alone, or perhaps in combination with the provision of alternative stimuli (e.g., Irvin, Thompson, Turner, & Williams, 1998). Another promising direction involves identifying a controllable dimension of the reinforcer for automatically maintained aberrant behavior (e.g., Kennedy & Souza, 1995). If a specific source of reinforcement can be implicated, stimuli that provide stimulation similar to that produced by the aberrant behavior (i.e., matched stimuli) can be utilized in an EE intervention. Matched stimuli may produce satiation for the source of stimulation produced by the aberrant behavior more readily than unmatched stimuli, possibly making the provision of matched stimuli on an intermittent basis a viable treatment approach.

One limitation of this study is that preferred items were not identified via a stimulus preference assessment. It is possible that highly preferred items, delivered noncontingently or as a component of a differential reinforcement contingency, may have reduced persistent head rocking (e.g., Ringdahl, Vollmer, Marcus, & Roane, 1997). Future evaluations of the assessment and treatment of persistent aberrant behavior should include formal preference assessments.

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