

*TOWARD AN EMPIRICAL METHOD FOR IDENTIFYING MATCHED  
STIMULATION FOR AUTOMATICALLY REINFORCED  
BEHAVIOR: A PRELIMINARY INVESTIGATION*

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The effects of noncontingent matched stimulation (NMS) and response blocking on a boy's stereotypic behavior were evaluated using a multiple schedule that contained three 15-min components (preintervention, intervention, and postintervention). Results showed that stereotypy was always higher after response blocking than before response blocking and was always lower after NMS than before NMS. These results suggest that response blocking may have produced deprivation for the product of stereotypy and that NMS may have provided stimulation that was similar to the product of stereotypy.

DESCRIPTORS: automatic reinforcement, multiple schedule, noncontingent reinforcement, response blocking, stereotypy

Several studies have shown that various forms of automatically reinforced problem behavior have decreased when noncontingent access to preferred items is provided. For example, Piazza, Adelinis, Hanley, Goh, and Delia (2000) showed that providing preferred objects that generated stimulation that was matched to the overt products of stereotypy typically produced more pronounced reductions in automatically reinforced behavior than providing unmatched preferred objects. However, it is not known whether the matched preferred items compete with or substitute for the stimulation generated by automatically reinforced behavior. Given that the consequences of automatically reinforced behavior occur within the individual, direct manipulation of the reinforcing event is difficult. Nonetheless, changes in motivating operations may be indirectly measured by evaluating the amount of time allocated to automatically reinforced behavior before and after the competing stimulation is provided. The purpose of the present study was to use a multiple schedule to determine if stereotypy increased during the component that followed

either noncontingent access to matched stimulation (NMS) or response blocking with no alternative stimulation. Increased stereotypy during the postintervention component may indicate that the intervention imposed deprivation for stimulation generated by stereotypy (i.e., stimulation that was not substitutable). Conversely, unchanged or decreased levels of stereotypy (relative to the preintervention component) may indicate that the intervention provided stimulation that was similar to the product of stereotypy.

## METHOD

### *Participant, Setting, and Data Collection*

Ryan was a 9-year-old boy who had been diagnosed with autism and mental retardation. Although he exhibited several forms of stereotypy, he allocated most of his time to object tapping (data available from the author). Object tapping was defined as contact of a finger or hand to a surface (e.g., table, chair) with simultaneous movement that generated an audible product. Because Ryan typically tapped chairs and tables whenever he was sitting, this behavior often interfered with his academic programming.

All sessions took place in a room (5 m by 6 m) located in a short-term residential facility. A trainer was present for each session. Sessions

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were conducted 1 to 2 days per week, and each session was 45 min in duration. The primary observer was seated behind a one-way window and collected data using a handheld computer. The duration of object tapping was scored and then converted to percentage of time. A second observer scored 29% of the sessions from videotapes. Interobserver agreement was calculated using the average agreement within 10-s intervals method wherein data collected by the primary and secondary observers were compared in 10-s bins. For each bin, the smaller number was divided by the larger number and then multiplied by 100%. Percentages for each bin were then totaled and divided by the total number of bins. The mean agreement score for object tapping was 97%.

### *Design and Procedure*

Ryan's preference for objects was evaluated during three 30-min stimulus preference assessments (e.g., Roane, Vollmer, Ringdahl, & Marcus, 1998). For each session, the same 10 items were available. These items were pre-selected by the author to provide an array of items with combinations of auditory, visual, and tactile stimulation. The four items that Ryan manipulated for the highest percentage of time were used in the NMS component.

The separate effects of NMS and response blocking on stereotypy were evaluated using a multiple schedule that was conducted three times for each intervention. Similar to the method used by Simmons, Smith, and Kliethermes (2003), sessions were always conducted in a three-component sequence comprised of 15 min of baseline (pre-NMS or pre-response blocking), 15 min of intervention (either NMS or response blocking), and 15 min of baseline (post-NMS or post-response blocking). The effects of NMS on stereotypy were first evaluated during three 45-min sessions. After the NMS evaluation, a control session, which included two 15-min components of preintervention followed by 15 min of NMS, was conducted. The control session was

conducted to evaluate whether stereotypy increased or decreased relative to the first pre-NMS component during the second 15-min component without intervention. Subsequently, three 45-min sessions were conducted to evaluate the effects of response blocking on stereotypy. During the preintervention component, Ryan was seated at a table that was devoid of materials or toys. A trainer sat by the door (approximately 3 m from Ryan) and provided no social consequences for Ryan's behavior. The trainer's location was the same across all components except response blocking. This component was conducted before an intervention was implemented. During the intervention component, either NMS or response blocking was implemented. When NMS was implemented, Ryan was provided continuous access to four matched toys. The toys were a musical keyboard (pressing a key produced tones), a letter board (pressing a button produced a spoken letter of the alphabet), a phonics board (pressing a button produced various combinations of sounds), and a toy radio (pressing a button produced a 10- to 15-s song), each of which contained potential sources of tactile and audio stimulation. When response blocking was implemented, no toys were present and a trainer, who sat next to Ryan, placed but did not hold Ryan's hands in his lap contingent on object tapping. The postintervention component was the same as the preintervention component except that it was always conducted after an intervention (NMS or response blocking) component. This component evaluated the extent to which stereotypy increased (relative to preintervention component levels) following intervention with NMS and response blocking. Thus, the presence of toys during NMS and the location of the trainer during response blocking signaled the intervention components.

## RESULTS AND DISCUSSION

Figure 1 shows the percentage of time Ryan displayed object tapping across the NMS,

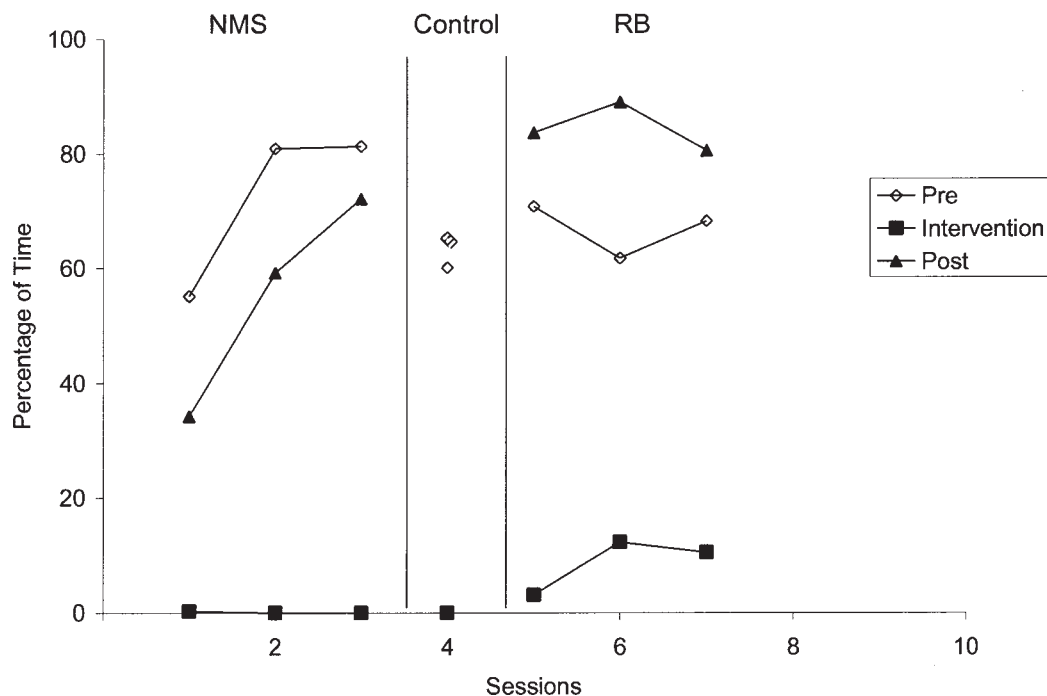


Figure 1. Percentage of time Ryan engaged in object tapping across three sessions of noncontingent matched stimulation (NMS), a control session (preintervention, preintervention, and NMS), and three sessions of response blocking (RB). The shadowed data point in Session 4 denotes the second preintervention component of the control session.

control, and response blocking sequences. During the NMS sequences, object tapping was always higher in the preintervention component ( $M = 72\%$ ) than in the postintervention component ( $M = 55\%$ ) and object tapping was near zero in the intervention component ( $M = 0.1\%$ ). In the control sequence, levels of object tapping were similar in the first and second preintervention components, suggesting that object tapping did not decrease during the second component without intervention, and was at zero in the NMS component. During the response-blocking sequences, levels of object tapping were always higher in the postintervention component ( $M = 84\%$ ) than in the preintervention component ( $M = 67\%$ ) and were low during the response-blocking component ( $M = 9\%$ ).

Relatively lower levels of stereotypy observed in the post-NMS component suggest that

manipulation of matched objects produced stimulation that was functionally similar to stimulation generated by stereotypy. Conversely, increased stereotypy during the post-response blocking component suggests that deprivation for stimulation produced by stereotypy was imposed. Simmons et al. (2003) showed that the effects of noncontingent reinforcement extended into the postintervention component, thus functioning as an abolishing operation. The results of the present study extend those of Simmons et al. by showing increased stereotypic behavior in the postintervention component that followed an intervention with no alternative stimulation. Perhaps most important, the current study provides a method for evaluating the extent to which stimulation provided during noncontingent reinforcement competes with or substitutes for (i.e., functionally matches) the

stimulation produced by automatically reinforced behavior.

The most significant limitation to this study was that Ryan's behavior was not evaluated in the presence of unmatched preferred objects. Nevertheless, evaluation of the postintervention effects of response blocking allowed for stereotypy to be observed following intervention that did not include items with a putative sensory match. In addition, a functional analysis of stereotypy was not conducted; however, results from other studies suggests that stereotypy would have likely abated across sessions if supported only by social consequences (e.g., Worsdell, Iwata, Conners, Kahng, & Thompson, 2000). Finally, the postintervention effects of NMS were not replicated following the implementation of response blocking. Future research should evaluate this method with other automatically reinforced behavior while considering these limitations.

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