

ON THE RELATION BETWEEN  
OBJECT MANIPULATION AND STEREOTYPIC  
SELF-INJURIOUS BEHAVIOR

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Results from a number of studies have shown an inverse relationship between stereotypic behavior and object manipulation. The purposes of this study were to determine whether techniques similar to those used previously (prompting and reinforcement) would be effective in increasing object manipulation under both prompted and unprompted conditions, and to ascertain whether increases in object manipulation would result in decreases in stereotypic self-injurious behavior (SIB). Two individuals with developmental disabilities who engaged in SIB maintained by automatic reinforcement participated. Results showed that object manipulation increased from baseline levels when experimenters prompted participants to manipulate leisure items, but that object manipulation was not maintained under unprompted conditions, and rates of SIB stayed within baseline levels. We then attempted to increase object manipulation further by (a) reinforcing object manipulation, (b) blocking SIB while reinforcing manipulation, and (c) preventing SIB by applying protective equipment while reinforcing object manipulation. Reinforcing object manipulation alone did not affect levels of object manipulation. Blocking effectively reduced attempts to engage in SIB for 1 participant but produced no increase in object manipulation. When the 2nd participant was prevented from engaging in SIB through the use of protective equipment, rates of object manipulation increased dramatically but were not maintained when the equipment was removed. These results suggest that stimulation derived from object manipulation, even when supplemented with arbitrary reinforcement, may not compete with stimulation produced by stereotypic SIB; therefore, direct interventions to reduce SIB are required.

DESCRIPTORS: self-injurious behavior, stereotypy, object manipulation, functional analysis, differential reinforcement, response blocking, protective equipment

Many persons with developmental disabilities engage in repetitive behaviors that persist in the absence of social reinforcement. These behaviors, referred to collectively as *stereotypy*, are said to be maintained by automatic reinforcement (Vaughan & Michael, 1982) to the extent that they directly produce their own reinforcing consequences. Examples of such behavior often consist of rhythmic movements such as body rocking or hand flapping (Lovaas, Newsom, & Hickman, 1987). Because the reinforcers that maintain such behavior are difficult to identify and manipulate, researchers typical-

ly conclude that automatic reinforcement is a source of maintenance when results of a functional analysis show behavioral persistence in the absence of social reinforcement or relatively high or undifferentiated levels of responding across conditions (Iwata et al., 1994; Vollmer, 1994). To the extent that self-injurious behavior (SIB) such as hand-mouthing (Goh et al., 1995) or pica (Piazza et al., 1998) shows these properties, it also can be considered a form of stereotypy under certain conditions.

In several studies, an inverse relationship has been observed between stereotypy and an appropriate alternative behavior, object manipulation. For example, Davenport and Berkson (1963) presented novel leisure items to 24 individuals who had been diagnosed with severe mental retardation and found

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that those who engaged in high rates of stereotypy manipulated the objects less frequently than did those whose rates of stereotypy were low. In a subsequent study, Berkson and Mason (1964) again observed that stereotypy was negatively correlated with object manipulation. They also found that handing leisure items to the individuals while talking to them reduced stereotypy and increased object manipulation.

In other studies, supplementary procedures were used to increase object manipulation. Horner (1980) compared frequencies of adaptive and maladaptive behaviors exhibited by 5 girls across several "enriched environment" conditions. Although increases in adaptive behavior were observed in all conditions in which leisure materials were present, the greatest increases were seen when object manipulation was prompted and reinforced. Rates of maladaptive behavior remained fairly stable across all conditions except during the condition in which therapists prompted and reinforced object manipulation. In another study, Favell, McGimsey, and Schell (1982) treated the SIB of 6 participants by providing alternate activities that produced sensory stimulation similar to that apparently obtained from engaging in the target behaviors. For example, 1 individual who chewed and sucked on his hands was given large, soft items that could be mouthed. SIB decreased substantially when participants had access to these items and decreased even further when object manipulation was reinforced. Singh and Millichamp (1987) used verbal and physical prompts to teach 8 participants with profound mental retardation to play independently. They observed that inappropriate play decreased slightly and that stereotypy decreased to very low levels when appropriate play increased. Other researchers have used similar methods and obtained somewhat similar results (Lockwood & Bourland, 1982; Wehman, 1977).

Thus, mere access to leisure materials has been effective in reducing stereotypy in some studies, whereas additional interventions have been required in other studies. Although this discrepancy might be attributed to a number of procedural variations across studies, one factor that may account for the difference in findings is the extent to which object manipulation already existed in participants' repertoires and competed with stereotypy. That is, if stereotypic behavior occurs at high rates when an individual has no access to leisure activities (i.e., during the alone condition of a functional analysis) but occurs at low rates when leisure materials are available (during the play condition of a functional analysis), treatment might simply consist of noncontingent access to leisure materials. By contrast, when stereotypy occurs at high rates across assessment conditions (i.e., during alone and play conditions), intervention strategies are not immediately apparent because access to leisure items either does not occasion object manipulation or does not compete with stereotypy. This account is somewhat speculative, because functional analyses of the target behaviors were not conducted in the studies described above. However, some support for this conclusion can be found in recent studies, in which results obtained during treatment consisting of noncontingent access to leisure materials, supplemental reinforcement, or response blocking were consistent with data obtained during assessment conditions (e.g., Ringdahl, Vollmer, Marcus, & Roane, 1997; Shore, Iwata, DeLeon, Kahng, & Smith, 1997).

The purposes of this study were to determine whether techniques similar to those described by Singh and Millichamp (1987) would be effective in increasing object manipulation in individuals whose functional analyses suggested that access to leisure materials did not readily compete with SIB, and to ascertain whether increases in object ma-

nipulation would result in decreases in SIB. In the Singh and Millichamp study, data on object manipulation were taken during intervals immediately following those in which the therapist had prompted the participant to play, and maintenance data were collected while prompting remained in effect. In the present study, data on object manipulation and SIB were taken under both prompted and unprompted conditions. Finally, although our initial objective was to extend the findings of the Singh and Millichamp study through procedural variation, additional interventions aimed at directly reducing SIB were implemented when attempts to increase object manipulation produced negligible reductions in SIB.

## METHOD

### *Participants and Setting*

Two individuals who lived in a state residential facility for persons with developmental disabilities and who engaged in SIB participated. Ronald was a 33-year-old man who had been diagnosed with profound mental retardation and profound vision and hearing loss. He frequently engaged in head and body hitting and banging. Jim was a 46-year-old man who had been diagnosed with profound mental retardation and who engaged in head and face picking. Neither individual displayed reliable instruction-following behavior or any recognizable means of communication.

All sessions were conducted at a day program located on the grounds of the facility. Sessions lasted 15 min and were conducted two to three times per day, 4 days per week.

### *Response Measurement and Reliability*

The primary dependent variables were SIB and object manipulation. Ronald's SIB was defined as striking his head or body with his hands or arms or striking his head or body against any hard surface. Jim's SIB was

defined as rubbing or pressing his fingers or objects against his head or face. Object manipulation was defined as physical contact with (e.g., touching, holding) a leisure item.

Data were collected on handheld computers during continuous 10-s intervals and were summarized as either percentage of intervals during which responding occurred (Ronald's SIB and both individuals' object manipulation) or number of responses per minute (Jim's SIB). Data were also collected on therapists' implementation of treatment procedures.

Interobserver agreement was assessed by having a second observer independently collect data during 29% and 28% of Ronald's and Jim's sessions, respectively. Observers' records were compared on an interval-by-interval basis. Agreement coefficients for data on Ronald's SIB and both participants' object manipulation were calculated by dividing the number of intervals containing agreements by the total number of intervals and multiplying by 100%. An interval was considered an agreement if both observers scored either the presence or absence of behavior. Agreement for data on Jim's SIB was calculated by dividing the smaller number of responses by the larger number of responses for each interval and averaging these values across the session. Mean agreement scores were 86.9% (range, 58.1% to 100%) and 90.3% (range, 74.7% to 100%), respectively, for Ronald's and Jim's SIB; and 88.1% (range, 75.0% to 100%) and 92.5% (range, 72.1% to 100%), respectively, for Ronald's and Jim's object manipulation.

### *Functional Analysis*

Participants were exposed to four assessment conditions (alone, attention, demand, and play) in a multielement functional analysis based on procedures described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994). In the alone condition, no social consequences were placed on SIB, and

the participant did not have access to leisure materials. This condition was designed to determine whether SIB persisted in the absence of social consequences. During the attention condition, the participant had access to leisure materials, and the experimenter ignored the participant except to express concern each time the participant engaged in SIB. This condition was designed to determine whether the participant's behavior was maintained by positive reinforcement in the form of attention. During the demand condition, the experimenter initiated instructional trials on a fixed-time (FT) 30-s schedule using a series of graduated prompts and allowed the participant to escape the trial contingent on SIB. This condition was designed to determine whether SIB was maintained by negative reinforcement in the form of escape from demands. During the play condition, the participant had access to leisure materials, and the experimenter delivered attention to the participant on an FT 30-s schedule. This condition was a control for the other test conditions.

Figure 1 shows levels of SIB across functional analysis conditions for both participants. Ronald's data were undifferentiated and contained a number of overlapping data points. In addition, his SIB persisted during a series of alone conditions, suggesting that the behavior was maintained by automatic reinforcement. Results of Jim's functional analysis showed that rates of SIB were higher in the attention condition, suggesting sensitivity to social reinforcement. However, relatively stable rates of SIB occurred across all conditions. This pattern of responding seemed consistent with behavior maintained by automatic reinforcement because (a) the behavior persisted in the alone condition, indicating that behavior was maintained independent of environmental context; (b) the behavior persisted in the play condition, despite the noncontingent attention that was available; and (c) a comparison of data from

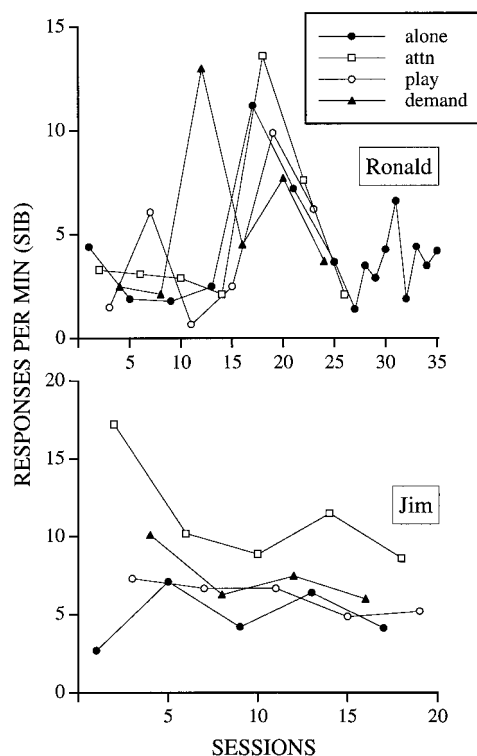


Figure 1. Number of responses per minute of SIB exhibited by Ronald (top panel) and Jim (bottom panel) across functional analysis conditions.

the alone and play conditions showed no differentiation. The assumption that Jim's SIB was maintained by automatic reinforcement served as the basis for his treatment in this study.

#### *Preference Assessments*

Ronald's preference for food and leisure items was assessed using a variation of procedures developed by Pace, Ivancic, Edwards, Iwata, and Page (1985). These procedures were used (instead of the paired-choice assessment used to identify Jim's preferences) to accommodate Ronald's profound vision and hearing loss. Ten food items were assessed by presenting them singly, 10 times each. Because Ronald could not see an item placed in front of him, the experimenter placed a food item in Ronald's hand at the beginning of each trial, and later calculated

the percentage of trials in which he consumed the item within 30 s. Ronald rapidly consumed the food items on almost all of the trials, so chocolate chip cookies and plain M&Ms® were selected as potential reinforcers (both items were consumed during 100% of the trials). Ten leisure items were assessed in a similar manner. At the beginning of each trial, the experimenter physically guided Ronald to manipulate the leisure item. Ronald was then given free access to the leisure item for 5 min, and the experimenter recorded the duration of item manipulation. Ronald manipulated all of the items for at least short periods of time (range, 6.7% to 48.3% of the trial duration); the top four items (a piece of rabbit fur, a scented rubbery substance called Gak®, a stuffed animal, and a ball) were selected for use during treatment because they were associated with the highest levels of object manipulation (48.3%, 43.3%, 34.9%, and 33.3% of the trial duration, respectively).

A paired-choice assessment (Fisher et al., 1992) was used to identify Jim's food and leisure-item preferences. Ten food and 10 leisure items were presented in separate assessments. Each stimulus was paired with every other stimulus in a randomized order, for a total of 45 food presentations and 45 leisure-item presentations. On each trial, the therapist placed two stimuli in front of Jim and prompted him to choose. If Jim touched one of the stimuli, he was allowed to consume the food item or interact with the leisure item for 30 s, and the other item was removed. Attempts to approach both stimuli simultaneously were blocked. Jim's two most preferred food items were chocolate chip cookies and potato chips (selected on 100% and 66.7% of the trials, respectively), and his four most preferred leisure items were a bucket of blocks (66.7% selection), a Connect 4® game (22.2% selection), an electronic musical instrument called a Rap Pad®

(22.2% selection), and a set of large Legos® (22.2% selection).

#### *Experimental Design and Treatment Procedures*

A multiple baseline across subjects design was initially used to assess the effects of leisure training on object manipulation and SIB. Additional treatment procedures were implemented subsequently to increase object manipulation, decrease SIB, or both.

*Baseline.* The participant sat at a table on which the top four preferred leisure items were located. Ronald's experimenter began the session by briefly guiding him to touch the items on the table in front of him; Jim's experimenter instructed him to play with the items. Thereafter, the experimenter stood behind the participant but did not prompt the individual to manipulate the items and did not deliver any consequences for object manipulation or SIB.

*Leisure training.* Each participant's top four leisure items were available in this and in all subsequent leisure training conditions. The experimenter initiated a three-prompt sequence on an FT 30-s schedule, unless the individual was already manipulating an item at the beginning of an interval. Ronald's experimenter began the sequence with a touch prompt to Ronald's elbow. If Ronald did not begin manipulating one of the four leisure items within 5 s, the experimenter lifted Ronald's arms out in front of him. If Ronald did not touch an item within 5 s of the touch prompt, the experimenter physically guided him to manipulate a leisure item. Jim's experimenter began the prompt sequence by pointing to a leisure item and instructing him to manipulate it. The second prompt involved picking up a leisure item and manipulating it while repeating the instruction, and the third prompt consisted of physically guiding him to manipulate the item.

*Leisure training with positive reinforcement.* Prompt sequences continued as in the pre-

vious condition. In addition, Ronald and Jim received preferred food items contingent on independent leisure-item manipulation. At the beginning of this phase, participants were required to manipulate an item for 1 s to receive a preferred food item. The duration of item manipulation required for reinforcement increased each time the participant received 10 reinforcers per session for three consecutive sessions.

*Leisure training with positive reinforcement and response blocking.* Experimenters continued to deliver prompts and reinforcement for object manipulation. In addition, attempts to engage in SIB were blocked but were scored as occurrences of SIB for the purpose of data collection.

*Leisure training with positive reinforcement and protective equipment (Jim only).* Jim wore arm splints to prevent SIB. The splints restricted arm movement so that Jim could not touch his head and face, but they did not prevent him from manipulating leisure items. The experimenter continued to deliver prompts and reinforcement for object manipulation.

#### *Probe Sessions*

Separate probes were conducted, using procedures identical to those in effect during baseline, to determine whether increases in object manipulation would be maintained in the absence of prompting or reinforcement. Probes were conducted following every three to five leisure training sessions throughout all of Ronald's training phases. A similar schedule was followed for Jim, with the following exceptions. Probes were not conducted during Jim's response blocking phase because the procedure had little effect on his level of prompted object manipulation and his SIB during training sessions; probes were not conducted during the protective equipment phase because Jim's increased level of object manipulation quickly reversed when protective equipment was removed, even

when prompting was still in effect. Nineteen probe sessions were conducted for Ronald, and 20 probe sessions were conducted for Jim.

## RESULTS

Figure 2 shows the percentage of intervals in which object manipulation occurred, as well as data on SIB (percentage of intervals for Ronald, responses per minute for Jim). During most baseline sessions, Ronald and Jim engaged in little or no object manipulation. Ronald and Jim manipulated leisure materials during a mean of 8.1% (range, 0% to 45.5%) and 3.3% of intervals (range, 0% to 12.9%), respectively. Immediate and large increases in object manipulation were observed for both participants when the prompting sequence was initiated. It should be noted, however, that a 33% level of object manipulation was possible merely as a function of the prompting procedures. That is, if participants did not independently touch leisure items, they were physically prompted to do so every 30 s (i.e., during every third interval). Ronald's object manipulation increased to above 80% briefly when food reinforcement was added but decreased again and remained fairly stable across all subsequent conditions. His mean level of object manipulation across all training conditions was 51.2% (range, 30.2% to 91.9%). Jim's object manipulation began to increase above 33% during the first leisure training phase, but decreased and showed no consistent increase during either the food reinforcement or the response blocking phases ( $M = 37.4%$ ; range, 31.1% to 70.9%). When Jim wore arm restraints that prevented SIB, object manipulation increased substantially ( $M = 78.6%$ ; range, 62.2% to 95.6%) but was not maintained when the arm restraints were removed.

During baseline, both participants engaged in moderate to high levels of SIB.

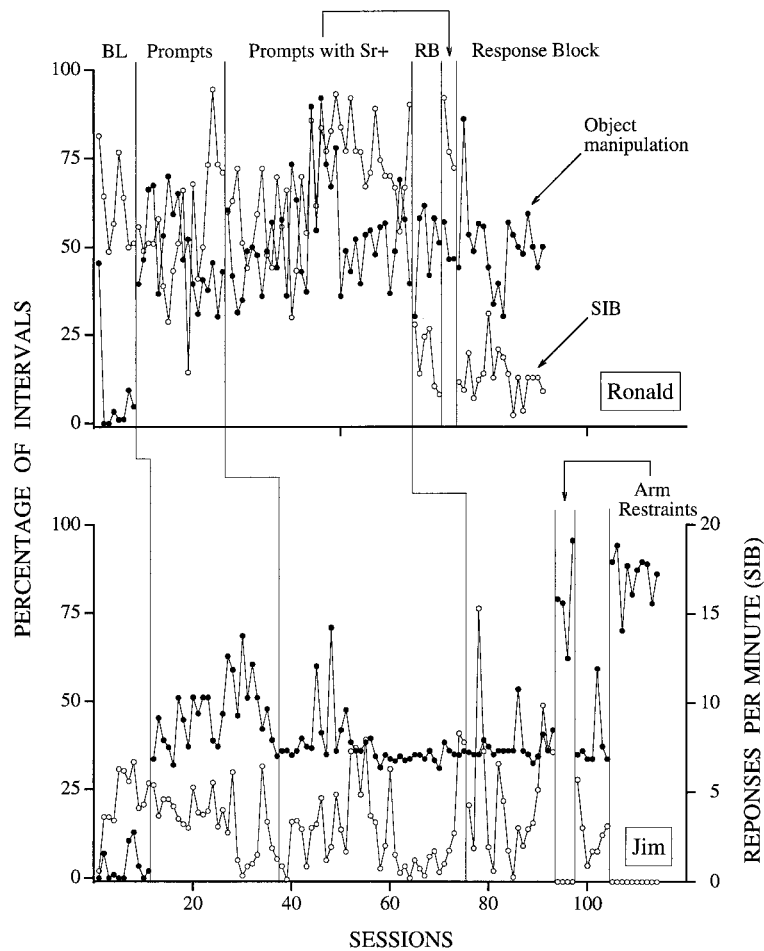


Figure 2. Object manipulation and SIB exhibited by Ronald (top panel) and Jim (bottom panel) during baseline (BL) and treatment conditions. Data are presented as percentage of intervals of object manipulation (Ronald and Jim) and SIB (Ronald) and as number of responses per minute of SIB (Jim).

Ronald's mean percentage of intervals with SIB during baseline was 61.7% (range, 48.8% to 81.4%); Jim's mean baseline level of SIB was 4.5 responses per minute (range, 0.6 to 6.7). Prompting of object manipulation, alone and with reinforcement, had little effect on SIB, although a temporary decrease was observed in Jim's SIB during the prompting plus reinforcement condition. The addition of response blocking produced a large decrease in Ronald's SIB ( $M = 13.2\%$ ; range, 2.3% to 31.0%) but had no effect on Jim's SIB ( $M = 4.7$  responses per minute; range, 0.3 to 15.3). Jim's SIB dropped to zero during the protective equip-

ment phase because the arm splints prevented him from touching his head and face. However, Jim's SIB returned to baseline levels when the restraints were removed.

Figure 3 shows mean levels of object manipulation and SIB during probe sessions in comparison with data from baseline and training sessions. (Data from Jim's response blocking and restraint conditions were excluded because probes were not conducted during those phases.) These data show that neither participant manipulated leisure items as frequently during unprompted probe conditions as he did during training conditions (left panels), although Jim's object manipu-

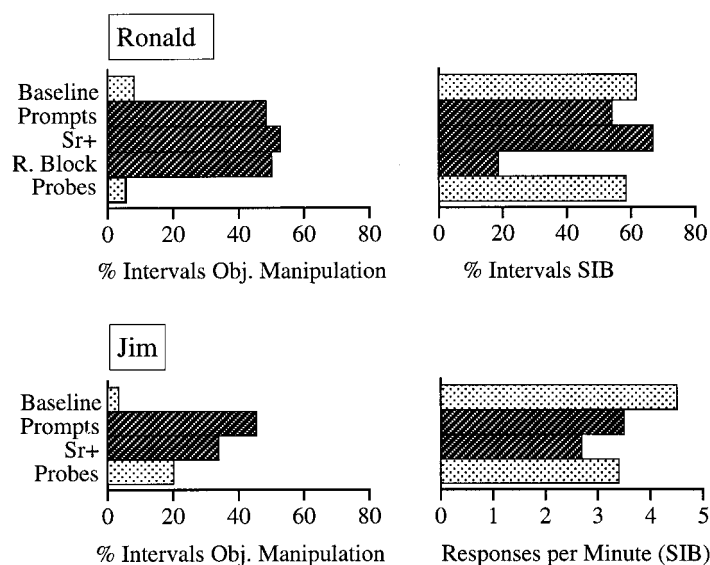


Figure 3. Mean levels of object manipulation and SIB during baseline, treatment conditions (Prompts, Sr+, R. Block), and probe sessions. Probe sessions were interspersed throughout treatment conditions.

lation during probes increased noticeably relative to that observed during baseline (lower left panel). These data also show that increases in object manipulation during training conditions were not highly correlated with decreases in SIB.

## DISCUSSION

Results obtained in this study suggest that an inverse relationship between object manipulation and stereotypic behavior, which has been observed in a number of previous studies, may not be a routine occurrence. We attempted to increase the ratio of object manipulation to stereotypic SIB seen during baseline in a number of ways. First, we prompted participants to obtain the reinforcement inherent in manipulating various leisure items for which they had previously shown preference. Although object manipulation increased for both participants, it was heavily influenced by prompting and resulted in no decrease in SIB. Therefore, we next provided additional reinforcement for object manipulation in the form of access to preferred edible items. When this procedure

was ineffective, object manipulation continued to be prompted and reinforced, but SIB also became a direct focus of intervention. Response blocking decreased Ronald's level of SIB dramatically, but his level of object manipulation remained unchanged. Response blocking failed to decrease Jim's SIB, so we used protective equipment to prevent him from receiving reinforcement for SIB. When Jim was no longer able to engage in SIB, he began to manipulate leisure items for longer periods of time. Jim's data suggest that the reinforcer obtained from SIB was preferred over reinforcers obtained from object manipulation; he engaged in high levels of object manipulation only when reinforcement for SIB was unavailable.

These results were consistent with the finding reported by Davenport and Berkson (1963) that individuals who engage in high rates of stereotypy may manipulate objects less frequently than those who engage in low rates of stereotyped behaviors. That is, both of our participants engaged in high rates of stereotypy and low rates of object manipulation during baseline. The finding that Jim's



level of object manipulation increased when his stereotypic behaviors were suppressed during the arm restraint phases is also consistent with results indicating that, for some individuals, object manipulation may not increase unless stereotypy is directly reduced through response blocking (Vollmer, Marcus, & LeBlanc, 1994) or punishment (Koegele, Firestone, Kramme, & Dunlap, 1974). However, Ronald's data did not follow this pattern: Even when stereotypy was suppressed via response blocking, his object manipulation did not increase above that seen in previous training phases.

These results are also noteworthy because they did not replicate findings reported in a number of studies, in which stereotypic behaviors decreased when leisure items were made available (Berkson & Mason, 1964; Favell et al., 1982; Shore et al., 1997), when object manipulation was prompted (Singh & Millichamp, 1987), or when object manipulation was prompted and reinforced (Greer, Becker, Saxe, & Mirabella, 1985; Horner, 1980; Lockwood & Bourland, 1982; Wehman, 1977). Our failure to observe an inverse relationship between object manipulation and stereotypy may have been a function of procedural differences across studies. For example, the alternate activities selected by Favell et al. provided sensory stimulation similar to that which apparently maintained the target behaviors of their participants. By contrast, although we made a reasonable attempt to assess Ronald's and Jim's leisure preferences and incorporated preferred leisure items into treatment, no attempt was made to match the stimulation obtained from leisure items with that produced by their topographies of SIB. Although our preference assessments were limited, it is noteworthy that in many of the other studies that have shown an inverse relation between object manipulation and stereotypy, no preference assessment was conducted (e.g., Horner; Lockwood & Bour-

land; Singh & Millichamp). Another procedural difference was that Singh and Millichamp conducted hour-long training sessions with a group of 8 women, whereas we conducted 15-min individual sessions. Perhaps group sessions were more effective because the participants could observe others engaging in object manipulation for longer periods of time. Singh and Millichamp also delivered slightly longer but more infrequent prompts than we did in the present study. It is unknown whether these procedural variations may account for the different results.

Another reason we may not have observed an inverse relationship between object manipulation and stereotypy was that we never obtained high enough levels of independent object manipulation. By the end of training, participants in the Singh and Millichamp (1987) study manipulated leisure items during an average of 87% of the observation intervals. By contrast, Ronald and Jim engaged in unprompted object manipulation during an average of 5.6% (Ronald) and 20.12% (Jim) of the intervals during the probe sessions. It must be noted, however, that probe data in the Singh and Millichamp study were taken during intervals immediately following those in which prompts had been delivered; by contrast, our probe data were taken during separate sessions under baseline conditions.

Although our findings were discrepant with much of the research on the relation between object manipulation and stereotypy, they were consistent with other findings indicating that aggressive or self-injurious behavior may decrease under differential reinforcement procedures only when the reinforcers maintaining the target behavior are no longer available. For example, in a recent large-scale analysis of the effects of functional communication training (FCT; a variation of differential reinforcement of alternative behavior), Hagopian, Fisher, Sullivan, Acquisto, and LeBlanc (1998) found that FCT

produced clinically significant reductions in none of 21 cases unless it was combined with either extinction or punishment. In another study, Mazaleski, Iwata, Vollmer, Zarcone, and Smith (1993) implemented differential reinforcement of other behavior (DRO) with and without extinction to treat the SIB of 2 individuals whose behavior was maintained by attention and observed that SIB remained at baseline levels when DRO was implemented without extinction. Results of these and other studies (e.g., Shirley, Iwata, Kahng, Mazaleski, & Lerman, 1997; Wacker *et al.*, 1990) suggest that extinction is an important component of treatments designed to decrease the frequency of maladaptive behaviors.

The present results also replicated those reported by Ringdahl *et al.* (1997), who found that free access to leisure items was an ineffective treatment for individuals who spent more time engaging in SIB than manipulating objects during the preference assessment. We also extended their procedures by evaluating the relation between object manipulation and stereotypic SIB when object manipulation was prompted and then explicitly reinforced.

The absence of an inverse relationship between object manipulation and stereotypy should not be surprising. Because the reinforcers for stereotypy and object manipulation are available concurrently, one might expect an individual to continue engaging in both responses to some degree. Allocation between two concurrently available responses is proportional to the ratio of reinforcement obtained for those responses (Herrnstein, 1970) and may be affected by a variety of both quantitative and qualitative differences between the two options (Green & Freed, 1993). Thus, even when additional reinforcement, such as edible items or praise, is delivered contingent on an alternative behavior, it may be difficult to compete with reinforcers produced by stereotypic behavior

unless the behavior itself is blocked or prevented. Although response blocking and physical restraint are not ideal treatments, less restrictive treatments using alternative reinforcers were not identified in this analysis.

Future studies should concentrate on developing reinforcement-based interventions for behaviors that persist in the absence of social reinforcement. This is especially true for behaviors that occur at high rates during all functional analysis conditions, because undifferentiated assessment results suggest that few sources of reinforcement might compete successfully with stereotypy. Data from a recent study (Piazza *et al.*, 1998) suggest that, through a series of fine-grained assessments, it may be possible to identify preferred objects or activities whose stimulus properties match those produced by stereotypic behavior. Extensions of this methodology may be helpful in identifying the conditions under which object manipulation is more reinforcing than stereotypy. In addition, researchers might determine whether certain behavioral characteristics are predictive of success during object manipulation training. For example, manual dexterity, motor imitation, instruction following, or the existence of pretreatment stereotypies involving object manipulation might facilitate acquisition of leisure skills. If certain abilities are, in fact, predictors of successful treatment, therapists may need to establish these skills before attempting to decrease SIB through leisure training. Individuals who do not manipulate leisure materials even after extensive training may need long-term continuous access to leisure items before they learn to obtain reinforcement from manipulating such items. Future research should investigate the effect of long-term exposure to leisure materials on levels of object manipulation. In the meantime, some individuals who engage in high rates of stereotypy may require direct intervention aimed at de-

creasing stereotypy before improvements in adaptive behavior are obtained.

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### STUDY QUESTIONS

1. What outcomes of a functional analysis typically suggest that behavior may be maintained by automatic reinforcement?
2. After conducting functional analyses of the participants' SIB, the authors conducted additional assessments to identify preferred leisure items and preferred foods. What outcome of the functional analysis (not observed with these participants) would have eliminated the need to conduct the additional assessments?
3. How did the preference assessments differ for the 2 participants?
4. Describe the treatment procedures used in the study.
5. Summarize the effects of each intervention on object manipulation and SIB, and the observed relation between the two responses.
6. Given the manner in which prompting was used during leisure training, what must be taken into account when examining the data on object manipulation in Figure 2?
7. What was the purpose of the probe sessions and what results were obtained?
8. What responses did the authors suggest as potential predictors of object manipulation and why did they choose these specific behaviors?

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