

*TREATING STEREOTYPY IN ADOLESCENTS DIAGNOSED WITH  
AUTISM BY REFINING THE TACTIC OF “USING STEREOTYPY  
AS REINFORCEMENT”*

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Use of automatically reinforced stereotypy as reinforcement has been shown to be successful for increasing socially desirable behaviors in persons with intellectual disabilities (Charlop, Kurtz, & Casey, 1990; Hanley, Iwata, Thompson, & Lindberg, 2000; Hung, 1978). A component analysis of this treatment was conducted with 3 adolescents who had been diagnosed with autism, and then extended by (a) progressively increasing the quantitative and qualitative aspects of the response requirement to earn access to stereotypy, (b) arranging objective measures of client preference for contingent access to stereotypy compared to other relevant treatments for their automatically reinforced stereotypy, and (c) assessing the social validity of this treatment with other relevant stakeholders. Implications for addressing stereotypy and increasing the leisure skills of adolescents with autism are discussed.

*Key words:* autism, automatic reinforcement, differential reinforcement, engagement, leisure skills, play, social validity, stereotypy

Persons who have been diagnosed with an autism spectrum disorder (ASD) often engage in repetitive acts that appear to serve no useful

function (Goldman et al., 2008). These repetitive acts are collectively referred to as *stereotypy* due to the formal similarity and the periodicity with which they are emitted. Reducing the level of stereotypy can be difficult (Singer, 2009), especially when the responses are maintained by automatic reinforcers (i.e., reinforcers that are a direct result of the behavior; Vollmer, 1994).

Although punishment is sometimes necessary during intervention for socially mediated problem behavior (Fisher et al., 1993; Hagopian, Fisher, Sullivan, Acquistio, & LeBlanc, 1998), there has been a noticeable trend towards the use of reinforcement-based interventions since the advent of functional analysis (Pelios, Morren,

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Tesch, & Axelrod, 1999). Applications of interventions based on differential reinforcement (DR) are particularly common; with these treatments, the reinforcer used is that which was found to maintain the problem behavior (E. G. Carr & Durand, 1985; Tiger, Hanley, & Bruzek, 2008). A similar trend is not evident in the literature on the treatment of automatically reinforced problem behavior in general or for stereotypy in particular. Several practical and conceptual barriers have prohibited the adoption of function-based DR procedures in the treatment of automatically reinforced stereotypy.

Barriers that most likely hinder the adoption of function-based treatments for automatically reinforced problem behavior include the difficulty in disrupting the response–reinforcer relation and the difficulty in controlling the delivery of or access to the automatic reinforcer for more socially acceptable behavior. Despite these barriers, efficacious outcomes of function-based interventions have been reported (e.g., Hanley, Iwata, Thompson, & Lindberg, 2000; Lindberg, Iwata, & Kahng, 1999). Functionally equivalent alternative responding may be generated by using a participant's own automatically reinforced stereotypy to strengthen a more desirable response alternative (Charlop, Kurtz, & Casey, 1990; Hanley *et al.*, 2000; Hung, 1978; Wolery, Kirk, & Gast, 1985). For instance, Hung (1978) increased appropriate speech in two children with an ASD by providing tokens for appropriate speech that could be traded in for 2 min of access to their own motor stereotypy. Charlop *et al.* (1990) found that providing access to children's own problem behavior was a more effective reinforcer than providing edible items when attempting to increase correct responding on academic tasks.

Because blocking or restricting access to stereotypy and its direct reinforcers is a necessary prerequisite to using stereotypy as reinforcement, Hanley *et al.* (2000) conducted a component analysis of the procedure to determine the effects of blocking independent of the reinforcement contingency for three individuals who engaged in

high levels of stereotypy. These authors first provided access to leisure activities, added prompting to contact the leisure activities, then restricted access to stereotypy via response blocking. They added DR of activity interaction with brief access to the participants' own stereotypy only when treatment goals were not achieved with other components. Two of the three participants did not require the DR component to achieve low levels of stereotypy and high levels of item interaction, suggesting that restricted access to stereotypy was the key component of this treatment (these results are similar to those of Koegel, Firestone, Kramme, & Dunlap, 1974). However, the DR component was necessary for similar results to be realized with the third participant.

The Hanley *et al.* (2000) study requires replication for several reasons. First, the treatment shows promise because it appears to be the only function-based treatment for automatically reinforced stereotypy in which the maintaining reinforcer is also provided. Second, additional replications are necessary to determine the general probability with which each of the four components of this intervention is necessary. Prior research has demonstrated the effects of each of the four components on stereotypy (e.g., free access to activities, Roscoe, Iwata, & Goh, 1998; prompting leisure activity, Lindberg *et al.*, 1999; blocking stereotypy, Thompson, Iwata, Conners, & Roscoe, 1999; and DR, Charlop *et al.*, 1990), but no studies have evaluated the combinations of those interventions or the importance of individual components in a treatment package. Third, the long-term effects of this intervention have not yet been evaluated; therefore, it is important to evaluate its longer term impact. Hanley *et al.* did show that stereotypy neither increased in baseline contexts following intervention (indicative of a rebound effect of treating stereotypy) nor decreased during baseline (indicative of desirable generalization). Nevertheless, both possible outcomes need further examination. Fourth, it is important to

evaluate a longer term application of the contingency while the reinforcement requirement is increased to determine if more complex leisure skills will develop.

The main purpose of this study was to replicate the component analysis conducted by Hanley et al. (2000) to determine if all components (e.g., activities, prompting, blocking, and DR) of the treatment package are necessary to increase functional leisure skills in adolescents with autism. The present study extends Hanley et al. by (a) generating more complex use of leisure items by progressively increasing the quantitative and qualitative aspects of the response requirement to earn access to stereotypy, (b) using procedures described by Hanley (2010) to assess participants' preferences for the treatment package compared to other treatment components that have been used for reducing automatically reinforced stereotypy, and (c) assessing the social validity of the treatment goals, procedures, and effects with other relevant stakeholders.

## GENERAL METHOD

### *Participants, Settings, and Preassessments*

Three boys who had been diagnosed with ASD participated. Caregiver report and informal observations suggested that none of them exhibited any independent leisure skills and that each engaged in disruptive levels of motor stereotypy throughout the day across a variety of activities and settings despite the availability of preferred leisure items. Jon was 14 years old, Patrick was 16 years old, and Edward was 14 years old at the start of the study. Previously unsuccessful treatments included response restriction and redirection (Ahearn, Clark, MacDonald, & Chung, 2007), response blocking alone, free access to stimuli (e.g., toys, music), and loss of stimuli (i.e., time-out) contingent on an occurrence of motor stereotypy. Because their stereotypy occurred almost continuously and therefore interfered with learning academic concepts and daily life skills and precluded meaningful social relationships, finding a treat-

ment that would decrease stereotypy and increase some adaptive behavior was a priority.

All sessions occurred in the participants' school classroom or vocational room. The work area was approximately 2 m by 2 m and was equipped with a table and chair. Activity materials included in the study were unavailable to the participants outside the session. All sessions were videotaped. Treatment component analysis sessions lasted 10 min for Jon, and all other sessions across all participants and assessments lasted 5 min. Terminal-link duration during the treatment preference assessment was 2 min. Sessions were conducted one to eight times per day, 3 to 5 days per week with each participant.

Informal interviews with staff and informal direct observations suggested that the participants' stereotypy produced its own reinforcement. A functional analysis was conducted based on the procedures described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994). The results showed high rates of stereotypy during the alone conditions for all participants, suggesting that stereotypy was maintained by automatic reinforcement and was not sensitive to social events as reinforcers. We also conducted a competing items assessments (Derby et al., 1995; Piazza, Fisher, Hanley, Hilker, & Derby, 1996) to determine if effective leisure items could be identified (i.e., those that would provide a type of automatic reinforcement that would compete effectively with that which the participants derived from engaging in stereotypy). Both engagement with the items and stereotypy occurred at consistently high levels across assessed items for all participants. We selected three or four items for subsequent analyses based on their potential to develop into more complex and developmentally appropriate leisure skills.

### *Response Measurement and Reliability*

We used a handheld computer to measure motor stereotypy, simple engagement (SE), generic functional engagement (GFE), specific functional engagement (SFE), and selections

made by the participant during preference assessments. We used duration recording for SE and report these data as a percentage. We used frequency recording for stereotypy, all forms of functional engagement, prompts, and number of access periods earned, and report these data as responses or events per minute. We measured stereotypy throughout each session, but collected and reported separately on stereotypy that occurred during the session when the participant was at the table and that which occurred during periods of access. We measured selections made during preference assessments and report these data as a number per session.

All participants' stereotypic topographies included hand flapping or waving, finger tapping or flicking, and body rocking. Jon and Patrick also engaged in ear holding or twisting, spit play, jumping, body or object pressing, mouthing, and spinning objects in a nonfunctional manner. Patrick also positioned or contorted his hands in front of his face. We measured these behaviors across all analyses. We also defined and scored each behavior individually; a behavior ended and a new instance was scored if the behavior ceased for a minimum of 1 s or there was a minimum of a 1-in. separation from the participant's body for behaviors such as mouthing, ear holding, and so on.

After the introduction of the blocking procedure, we scored and reported all blocked stereotypy attempts as stereotypy. We defined *blocking* as an interruption of a stereotyped act or a 1-s hands-down procedure contingent on the participant's attempt to engage in stereotypy. An interruption consisted of the therapist moving her hands to disengage the participant's stereotypy (e.g., for mouthing or ear twisting) or placing her hands on the participant's shoulders to interrupt stereotypy (e.g., for body rocking or jumping). *Hands down* was defined as the therapist physically guiding the participant's hands to lie flat on the table or immobilizing the participant's hands for approximately 1 s (e.g., for hand flapping or finger tapping). It was

possible that stereotypy could occur with one hand while the other was blocked, in that many topographies of stereotypy occurred quickly. For this reason, we did not deduct blocking time from overall session time.

*Simple engagement* was defined as touching any of the materials present during the session. If the participant engaged in stereotypy with or while holding a toy, both stereotypy and SE were recorded. *Generic functional engagement* was defined as manipulation of an activity as intended or designed (with one or both hands; defined distinctly for each set of materials). *Specific functional engagement* was defined as emission of a particular response germane to each activity, which was determined prior to the analysis. During the analysis of procedures for generating more complex leisure engagement, *prompted SFE* was defined as emission of a particular response immediately after or with any form of therapist assistance. Prompted SFE included the therapist providing hand-over-hand assistance, light guidance, a point cue, verbal instruction, or any combination of the aforementioned prompts. (See Supporting Information online on *Wiley Online Library* for definitions of engagement manipulations for each activity included in the study.)

*Prompts* were defined as (a) the therapist manually guiding the participant to contact one of the available activities or (b) a model, point cue, or verbal prompt (e.g., "that one!"). We defined *access* as being removed at least 30 cm from the table for 30 s of no prompting and no blocking of stereotypy. All topographies of stereotypy were allowed to occur during an access period. The therapist physically pulled or turned the participant's chair away from the table to make the access period clearly different from the rest of the session.

A second observer independently collected data using a handheld computer. We calculated interobserver agreement by dividing each session into 10-s bins and comparing the two observers' scores for each bin, dividing the number of agreements by the total number of agreements

plus disagreements, and then converting the result to a percentage. A second observer collected interobserver agreement data for stereotypy, all forms of functional engagement, prompts, the number of access periods earned per session, stereotypy during access, selections, item positioning during all preference assessments, and selection of the videos that were included in the social validity assessment with relevant stakeholders. Interobserver agreement data were collected for a minimum of 20% of sessions in each condition across all analyses for all participants; mean agreement was always above 80%.

### Overview

After functional analyses and competing items assessments, a treatment component analysis was conducted to determine intervention components necessary to increase functional play behavior and to decrease stereotypy. The subsequent analysis of procedures for generating more complex play focused on increasing the amount and complexity of specific forms of functional engagement. We then conducted an assessment to determine the clients' preference for various treatments commonly used to treat stereotypy, and ended with a social validity assessment with other relevant stakeholders to assess the social acceptability of the treatment goals, implemented procedures, and the effects of treatment.

## TREATMENT COMPONENT ANALYSIS

### Procedure

The treatment component analysis systematically added treatment components and used a multielement design in which sessions with the treatment package were rapidly alternated with sessions in which there were no programmed contingencies. Patrick experienced activities-only sessions followed by sessions in which all intervention components were present. The activities-only condition was rapidly alternated with the treatment package sessions to determine

the effects of the additional components beyond access to the activities themselves.

*Activities only.* This condition served as the primary baseline. All activities identified via the competing items assessment (i.e., stamps and a stamp pad, Interstars, linking rings, and stringing beads for Jon; stringing beads, Megabloks, and a shape sorter for Patrick and Edward) were present on the table and available to the participant each session. The therapist stood approximately 1 m away from the participant but provided no programmed consequences for any behavior.

*Activities plus prompting.* The therapist prompted (via manual guidance, a model, point cue, or verbal cue) the participant to engage in GFE every 30 s. If the participant was already engaging in GFE, the therapist waited until the next 30-s interval.

*Activities plus prompting plus blocking.* Procedures were identical to those in the previous condition, except the therapist stood behind the participant and interrupted stereotypy or delivered a 1-s hands down, as described above in the response measurement section, contingent on attempts to engage in stereotypy.

*Activities plus prompting plus blocking plus DR of GFE.* In addition to activities, prompting, and blocking as described above, the therapist introduced differential reinforcement of alternative behavior (DRA) and differential reinforcement of other behavior (DRO). The therapist provided 30-s periods of access to stereotypy contingent on the completion of a GFE response requirement in the absence of stereotypy. The initial fixed-ratio (FR) schedule of reinforcement was 1 and was increased to an FR 2 by the end of the assessment for Jon and Edward and to an FR 10 for Patrick.

### Results and Discussion

*Jon.* Stereotypy persisted to the exclusion of GFE during the activities-only baseline (Figure 1). The addition of prompts did not produce a sufficient increase in GFE or decrease in stereotypy; therefore, blocking was

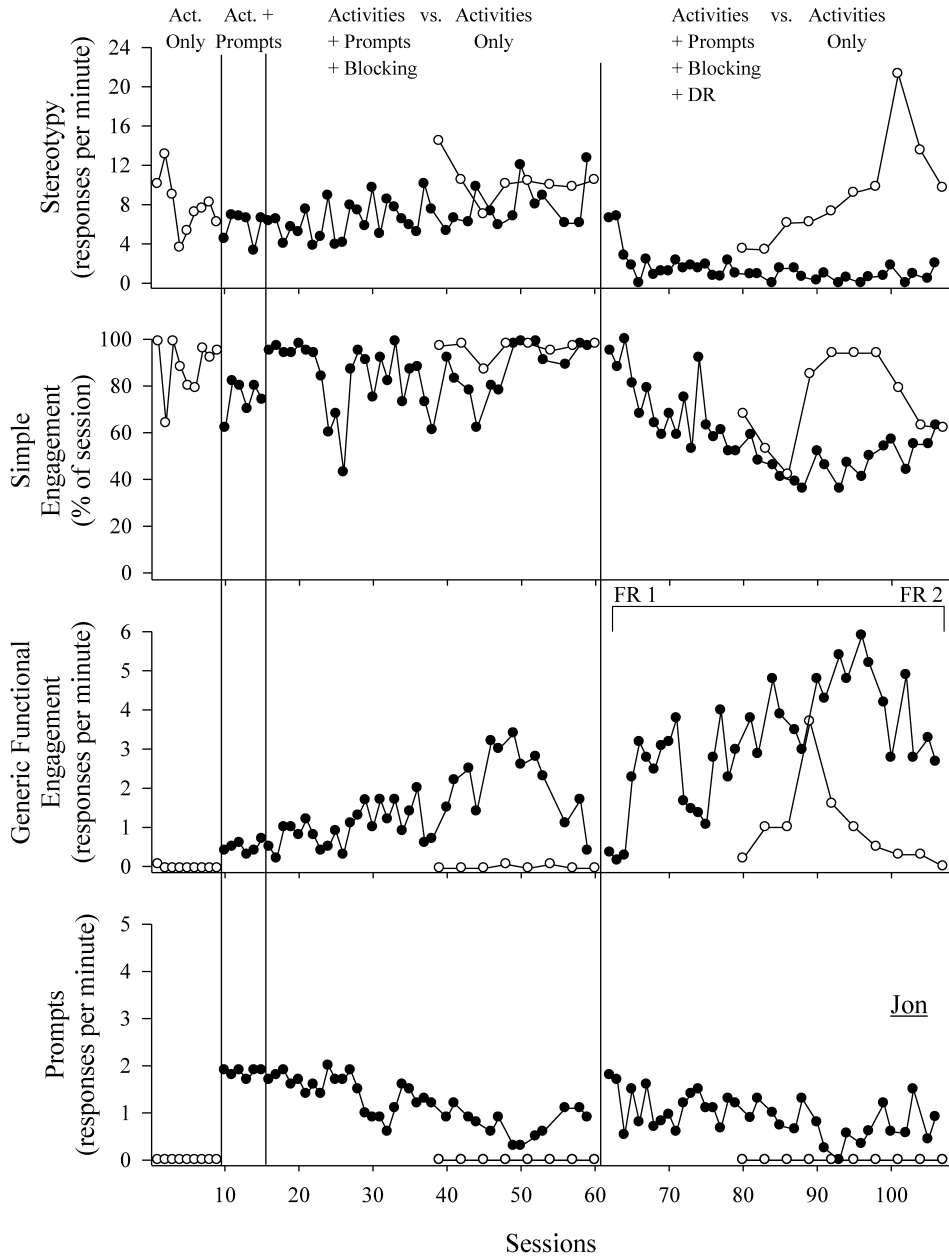


Figure 1. The top panel depicts stereotypy, the second panel depicts simple engagement, the third panel depicts independent and prompted generic functional engagement, and the bottom panel depicts prompts across activities-only and treatment sessions of the treatment component analysis for Jon. The bracket denotes the increasing fixed-ratio (FR) requirement.

added as a treatment component. GFE initially increased but then decreased. Stereotypy was on a slight increasing trend throughout the blocking condi-

tion (i.e., no reduction in stereotypy was observed).

The persistent high level of stereotypy observed after blocking was introduced could

have been an effect of extinction (i.e., an extinction burst) and potentially would have decreased over time. It also is possible that therapists did not block all instances of stereotypy, resulting in an intermittent schedule of automatic reinforcement and, thus, an increase in stereotypy. As a final consideration, the persistent level of stereotypy could have been due to a particularly strong motivation to obtain reinforcement. As shown in the previous conditions, the reinforcement derived from engaging in the leisure materials did not effectively compete with the reinforcement derived from engaging in stereotypy. When we introduced blocking, Jon had no opportunity to earn or obtain the stereotypy as reinforcement, which may have strengthened the establishing operation for that particular event.

This last explanation appears to be the most plausible because stereotypy immediately decreased and remained low after the therapist introduced the DR component for GFE. In addition, GFE steadily increased when we added DR and thinned the schedule of reinforcement to FR 2. Prompts also decreased as GFE increased. This result shows that improvements in GFE were not an exclusive function of prompting and also that the DR contingency played a major role in increasing GFE and decreasing stereotypy. Jon earned an average of 10 30-s access periods per session (range, 1 to 15), and stereotypy during access averaged 7 responses per minute (range, 0 to 14). The number of access periods earned per session gradually increased across the condition. Jon appropriately engaged with the materials in the absence of stereotypy for about half of the total session duration, and the other half of the session was spent engaging in high rates of stereotypy during the access periods. It could be hypothesized that the opportunity to engage in stereotypy during the access periods abolished, to some extent, the automatic reinforcers gained via stereotypy.

Increases in GFE and decreases in stereotypy occurred only when all treatment components

were present. The reintroduction of the activities-only sessions verified that the DR contingencies accounted for the changes in responding because stereotypy returned to baseline levels and GFE typically remained at near zero when no programmed consequences were in place. The activities-only sessions conducted during the blocking and DR phases also showed that neither a rebound effect (i.e., subsequent increase in stereotypy after successful treatment) nor desirable generalization (low levels of stereotypy and high levels of GFE observed without therapist involvement) was observed, both of which are consistent with results of Hanley et al. (2000).

*Patrick.* During the activities-only condition, Patrick engaged in moderate levels of GFE, but also engaged in moderate and variable levels of stereotypy (see Figure 2). The treatment package was associated with an initial decrease in GFE, which quickly recovered and continued on a steady overall increasing trend throughout the condition. Patrick eventually emitted 10 GFE responses to earn a single 30-s access period. He earned an average of 5 access periods per session (range, 3 to 7), and stereotypy during access averaged 10 responses per minute (range, 3 to 18). Similar to the pattern observed with Jon, these data highlight that Patrick independently engaged with the leisure materials without stereotypy for about half of the session and engaged in high rates of stereotypy during the earned access periods for the other half of the session. Alternation of the activities-only sessions with the treatment condition further showed that the treatment was necessary to maintain low levels of stereotypy while increasing GFE.

*Edward.* During the activities-only condition, stereotypy occurred between 0.2 and 3.0 responses per minute and GFE occurred only during the first two sessions (Figure 3). With the introduction of prompting, the level of stereotypy did not change significantly, but GFE did increase slightly. When blocking was introduced, stereotypy increased and GFE decreased. The increasing trend in stereotypy was similar to that

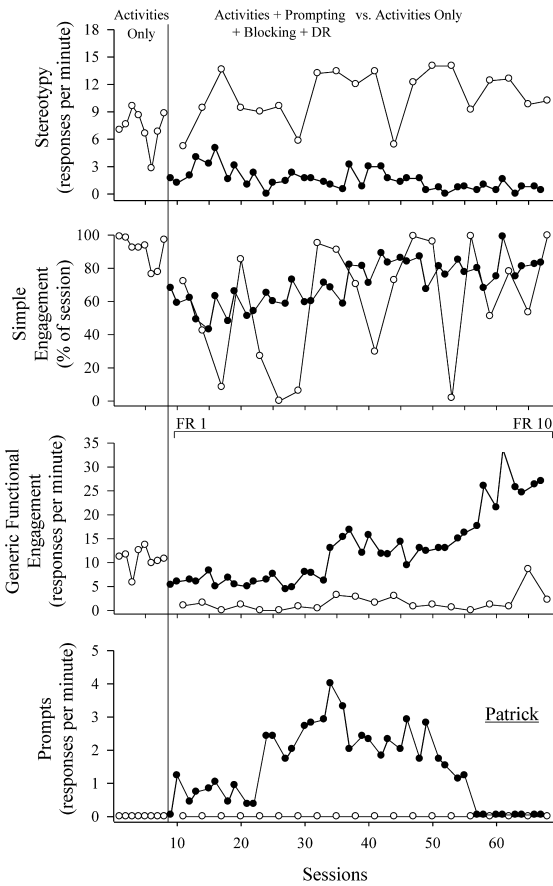


Figure 2. The top panel depicts stereotypy, the second panel depicts simple engagement, the third panel depicts independent and prompted generic functional engagement, and the bottom panel depicts prompts across activities-only and treatment sessions of the treatment component analysis for Patrick. The bracket denotes the increasing fixed-ratio (FR) requirement.

observed for Jon. Once again, it appeared that restricting access to stereotypy through response blocking increased Edward's motivation to obtain the reinforcement produced by engaging in stereotypy. With the addition of the DR component, stereotypy immediately decreased to near zero and remained low throughout the condition. (Edward also engaged in stereotypy during the majority of access periods earned, although the video footage was lost for the treatment component analysis sessions. Evidence

of his rates of stereotypy during access will be available in the subsequent analysis.) GFE increased to a level much higher than in previous conditions. The FR requirement to earn an access period was increased from FR 1 to FR 2 by the end of the condition. The reintroduction of activities-only sessions further confirmed that the DR component was necessary to achieve low levels of stereotypy and increases in GFE.

The results of the treatment analyses with all three participants support the findings of prior studies. First, numerous studies have demonstrated that the mere presence of toys is usually not an effective treatment for automatically reinforced behavior and that additional treatment components are necessary to decrease problem behavior and increase more desirable responses (e.g., J. E. Carr, Dozier, Patel, Adams, & Martin, 2002; Koegel et al., 1974; Lindberg et al., 1999; Tarbox, Wallace, & Tarbox, 2002). Provision of free access to activities was not an effective treatment for any of the participants.

If the presence of leisure materials does not result in decreases in problem behavior and increases in functional engagement, prior research has suggested that the addition of prompts to engage with the toys may facilitate behavior change (e.g., Britton, Carr, Landaburu, & Romick, 2002; Lindberg et al., 1999). However, the addition of prompts was insufficient for desirable behavior changes for any participants, a finding similar to that of Hanley et al. (2000).

Response blocking decreased problem behavior and increased alternative behavior for two of the three participants in Hanley et al. (2000). J. E. Carr et al. (2002) also observed that noncontingent reinforcement and response blocking alone were both ineffective in decreasing automatically reinforced object mouthing, but when combined, acceptable levels were quickly achieved (see also Tarbox et al., 2002). The addition of response blocking in the present analysis did not, however, decrease stereotypy. In



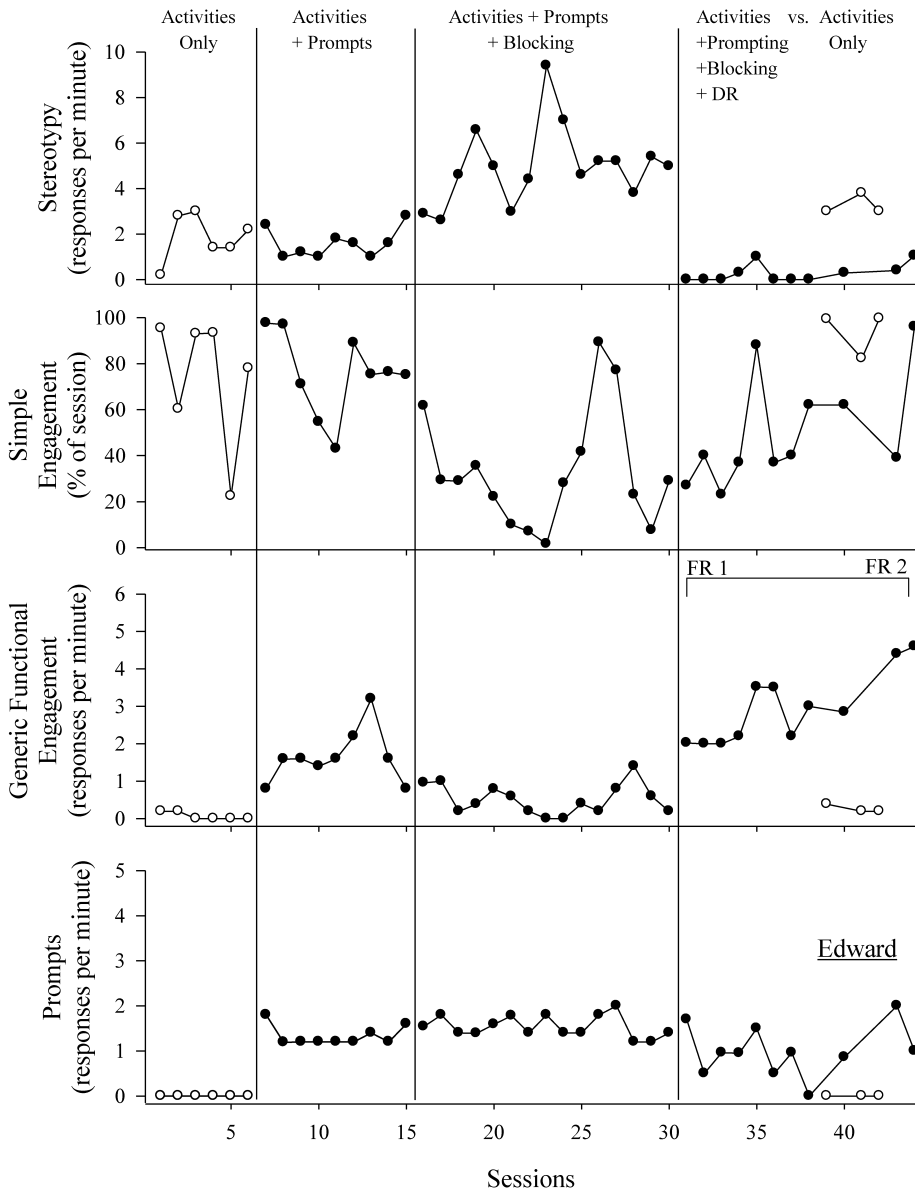


Figure 3. The top panel depicts stereotypy, the second panel depicts simple engagement, the third panel depicts independent and prompted generic functional engagement, and the bottom panel depicts prompts across activities-only and treatment sessions of the treatment component analysis for Edward. The bracket denotes the increasing fixed-ratio (FR) requirement.

fact, this component actually resulted in increases for two participants. Although inconsistent with the results of J. E. Carr et al. and Tarbox et al., other studies also have demonstrated unsatisfactory effects of response blocking (e.g., Hanley

et al.; see DeLeon et al., 2011, for further discussion). It is important to note, however, that although response blocking was not effective on its own, it was a necessary component of the current treatment package because access to the

automatic reinforcer had to be restricted via blocking before it could function as a reinforcer for engagement.

Lang *et al.* (2010) provided additional support for restricting access to stereotypy and providing it at certain points during treatment. During their treatment sessions, play was prompted and instances of stereotypy were redirected to play. Prior to some sessions, participants were allowed to engage in stereotypy for a brief period. Results showed less stereotypy during treatment sessions that followed the period of brief access to stereotypy. The authors hypothesized that access to stereotypy before sessions had an abolishing effect and thus resulted in lower levels of stereotypy during the subsequent treatment sessions. Perhaps in the present analysis, restriction of access to stereotypy during the full treatment sessions (through response blocking) created a sufficient state of deprivation, increasing the value of the automatic reinforcer and the stereotypy that produced it (e.g., Lang *et al.*). It is plausible that intermittent access to automatic reinforcers during the full treatment reduced the value of the automatic reinforcers during the teaching portion of the sessions and would help explain why stereotypy abated and response blocking was more effective under these conditions.

The present results highlight the importance of manipulating antecedent and consequent events for both the stereotypy and the alternative behavior. The antecedent manipulation for stereotypy was the presence of activities, and the consequent manipulation was response blocking. The antecedent manipulation for the alternative behavior (play) was prompting by the therapist, and the consequent manipulation was DR using access to stereotypy as the reinforcer. Decreases in problem behavior and increases in alternative behavior were observed only when all event manipulations were present. The efficacy of this treatment package also illustrates that it is possible and often necessary to implement a function-based and reinforcement-based treat-

ment for automatically reinforced problem behavior.

#### GENERATING MORE COMPLEX LEISURE SKILLS

##### *Procedure*

Before this analysis, Jon and Edward had experienced analyses of different contingency arrangements and reinforcement schedule thinning. The procedures that resulted in slightly better outcomes with Jon included a DRA plus DRO schedule of reinforcement, access periods without materials, and response marking (i.e., a “thumbs up” paired with a monotone “good” or “yes” for each instance of SFE). For Edward, DRA only, access periods with materials available, and no response marking resulted in optimal effects. We then incorporated these most effective contingency arrangements into the shaping procedure for more complex SFE. We conducted baseline sessions with activity materials present to determine whether SFE would eventually occur in the absence of the treatment, but we did not incorporate any programmed prompting or consequences. The treatment for Jon included materials from the Interstars activity, prompting of SFE, blocking of stereotypy, response marking for each SFE response until he earned access, and a DRA plus DRO schedule of reinforcement. In the DR component, Jon had to meet the SFE response requirement with no occurrence of stereotypy. The treatment for Edward included access to Megabloks, prompting SFE, blocking stereotypy, no response marking, and a DRA that involved access periods with materials present. Sessions were conducted in blocks of four, with three treatment sessions followed by a baseline session.

*Jon.* Jon’s terminal goal included building two cubes with the Interstars activity. Materials included eight i-bars and four t-bars, and the terminal goal required 10 responses. The SFE requirement began with Jon connecting one i-bar vertically on any corner of a t-bar to earn access. The GFE responses no longer resulted in access

and were ignored. Both prompted and independent responses could fulfill the response requirement for the schedule.

Prompt fading occurred in each session dependent on the levels of SFE and stereotypy. The fading procedure was similar to a most-to-least model in which the most intrusive prompts (e.g., hand-over-hand guidance) were provided initially and were faded to less intrusive prompts (e.g., point cue). If Jon initiated a response, the therapist allowed 3 to 5 s for independent responding to occur. The criteria to increase the response requirement consisted of four nonconsecutive sessions with stereotypy lower than 1.6 responses per minute, SFE above 3.0 responses per minute, and a maximum of one prompt per session. The planned steps in thinning the schedule were an increase by one response through FR 5 (i.e., one cube constructed), and then an FR 10 (i.e., two cubes constructed) was arranged.

*Edward.* The SFE targeted with Edward included building two Megabloks houses comprised of six responses each for a total of 12 responses. The FR requirement began at an FR 1 with a planned increase by one response through FR 6 (i.e., one house constructed), then an FR 12 (i.e., two houses) was arranged. We implemented most-to-least prompting and faded in the session as described for Jon. The criteria to increase the FR requirement by one response included four nonconsecutive sessions with stereotypy below 1.0 responses per minute, SFE above 1.3 responses per minute, and a maximum of one prompt per session.

### *Results and Discussion*

*Jon.* Stereotypy occurred more often than SFE during the first four sessions (Figure 4), but it quickly decreased while independent SFE increased and remained high throughout the analysis. Prompted SFE remained low throughout the analysis, and any increases typically coincided with increases in stereotypy. Jon earned a total of 402 access periods across 97 treatment

sessions, averaging four access periods per session (range, 0 to 9) while stereotypy averaged 6 responses per minute (range, 0 to 15) and the terminal response requirement of FR 12 was met. The baseline sessions showed much higher and variable levels of stereotypy and zero instances of SFE throughout the analysis. These baseline sessions further validate that the treatment package was necessary to decrease Jon's stereotypy and increase more complex and specific forms of functional engagement.

*Edward.* The introduction of treatment was associated with an increasing trend in SFE (Figure 5); responding then decreased and stabilized as the schedule was thinned. Stereotypy remained low and steady throughout the analysis, occurring in a little more than half of the treatment sessions. Edward earned a total of 267 access periods across 64 treatment sessions, with an average of four access periods per session (range, 0 to 8). The rate of stereotypy during access periods averaged 3 responses per minute (range, 0 to 10). Edward met the terminal response goal of building two Megabloks houses. During baseline sessions, stereotypy occurred between 0.2 and 5.6 responses per minute, with the majority of sessions around 3 responses per minute. Unlike Jon, Edward engaged in SFE during some of the baseline sessions, suggestive of generalization of leisure skills.

For these two participants, any automatic reinforcement produced by engaging in the activity was not more valuable than that produced by engagement in stereotypy. The lack of consistent SFE during ongoing baseline sessions (i.e., activities available but no programmed contingencies) suggests that the treatment package was necessary to decrease stereotypy and increase functional engagement, but the reinforcers for the more complex alternative behavior did not effectively substitute for or compete with those provided via stereotypy. Although the activities were not age appropriate for either participant, the leisure repertoires were more complex by the end of the analyses.

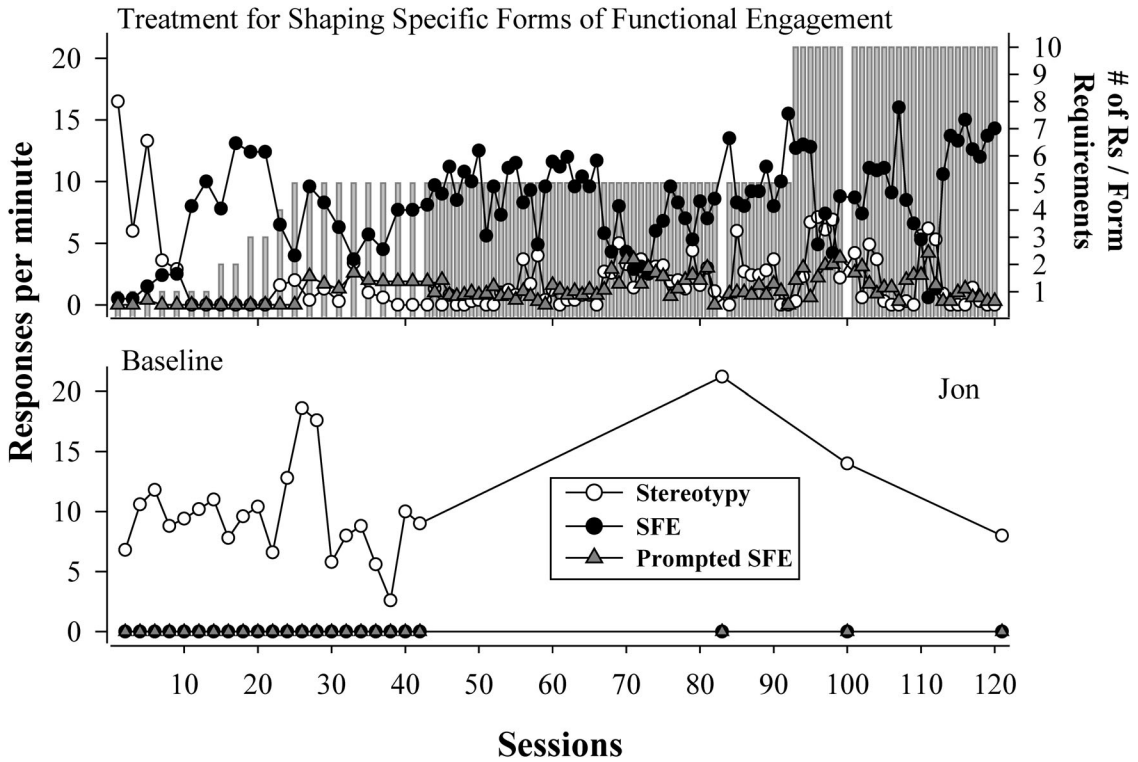


Figure 4. Stereotypy, independent SFE, and prompted SFE during treatment (top) and baseline sessions (bottom) for Jon. The gray bars, plotted on the secondary y axis (top), depict the increasing response requirement for SFE (specific functional engagement).

SOCIAL VALIDITY ASSESSMENT

*Procedure*

Social validation of the treatment procedures was assessed via a treatment preference assessment with the three participants using a concurrent-chains procedure (Hanley, 2010). It also was assessed with other stakeholders by arranging for them to watch brief videos of baseline and treatment and then respond to a questionnaire.

During the treatment preference assessment, a long table was divided into three equal sections and marked with blue tape (with the exception of Patrick; see description below). We placed a chair in the middle of each section with a colored card on the back of each chair to represent the initial link. We selected three colors for each participant

based on the results of a paired-stimulus color preference assessment (Luczynski & Hanley, 2009). The colors selected for inclusion were neither highest nor least preferred. The therapist presented the color cards, said “touch the color card of the table you’d like to sit at,” and allowed the participant to select one of the colored cards, sit down at the table, and experience the associated terminal link.

*No differential consequences.* Before assigning each color a differential consequence in the form of different treatments, we conducted sessions in which all selections resulted in delivery of the same small edible item. We did this to determine if a color bias was evident.

*Differential consequences.* After undifferentiated responding occurred, we randomly assigned each color to a treatment. The first treatment

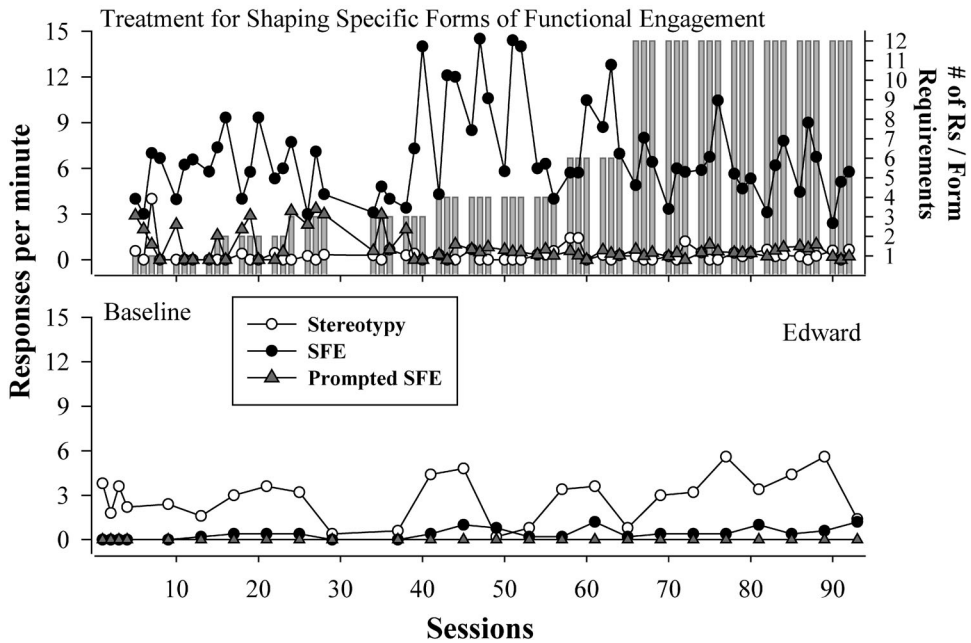


Figure 5. Stereotypy, independent SFE, and prompted SFE during treatment (top) and baseline sessions (bottom) for Edward. The gray bars, plotted on the secondary *y* axis (top), depict the increasing response requirement for SFE (specific functional engagement).

included enriching the environment with activities. The second included physically blocking instances of stereotypy with no activities present. The third included activities, prompting functional engagement every 30 s if the participant was not already engaged, blocking stereotypy, and providing 30-s access to the participant’s own stereotypy for appropriately engaging with the activities (i.e., the full treatment). We included these three treatments because they are commonly used for treating motor stereotypy and because the participants had previous experience with each of them.

We conducted six trials per session and randomly assigned and rotated the position of the colored cards across sessions but not trials. The colored cards on the backs of the chairs also had photos representing the treatment that would be experienced during the terminal link. We conducted Patrick’s sessions in three similarly sized research rooms at his school. We placed the colored cards with photos on the frame of each

doorway. When Patrick made a selection (i.e., touched the picture), he entered the room, sat at the table, and experienced the terminal-link treatment associated with that color.

Before each session, the therapist briefly described the experience for each terminal link while she pointed to the corresponding chair. We used both concurrent-chains and reversal designs to evaluate the control of initial-link responding by the contexts arranged in the terminal links.

A second social validity assessment was conducted with stakeholders relevant to Jon and Edward. We invited two teachers who worked with the participants on a daily basis, clinical case supervisors, and executive clinical supervisors to participate. After gaining written consent, we invited the stakeholders to watch a 2- to 3-min video that showed a clip during baseline in which no contingencies were present and a clip during treatment with DR. We randomly selected the video clips using Microsoft Excel. After viewing the video, the assessor filled

out a survey that included questions with a 7-point scale about the acceptability of the treatment followed by an open-ended question.

### *Results and Discussion*

We observed undifferentiated responding for all participants when no differential consequences occurred (Figure 6), indicating no strong color biases. When differential consequences were provided (i.e., different treatments) for selections, Jon selected the activities-only treatment during 45% of opportunities and the treatment with DR on 47% of opportunities, showing that he preferred these treatments similarly over the blocking-only treatment. Patrick and Edward showed preference for the treatment with DR (selected 58% and 75%, respectively) over both the activities-only and the blocking-only treatments. Selections were undifferentiated during the reversal to no differential consequences, providing additional evidence that selections in the previous condition (i.e., differential consequences) were influenced by the treatments.

All participants responded away from the blocking-only treatment, and two of the three preferred the treatment with DR. They preferred a context with a requirement to behave in a certain manner to earn access to their stereotypy over a context in which stereotypy was freely available. Although it is not possible to specify the amount of reinforcement obtained by each participant, it seems reasonable to infer that more automatic reinforcers were available during the activities-only sessions because stereotypy was higher during the activities-only sessions compared to stereotypy during access periods of the treatment sessions. Therefore, amount of reinforcement earned probably did not drive the observed selections.

An alternative explanation for the observed preferences is that the intermittent response blocking during treatment created a state of deprivation for the automatic reinforcers associated with stereotypy. Therefore, the initial link associated with the treatment may have devel-

oped properties of a conditioned establishing operation (McGill, 1999). In this explanation, it could be assumed that the automatic reinforcement derived from engaging in stereotypy would be more reinforcing in the preferred treatment than when stereotypy was available for free. Another explanation relates to the difference between the two treatments with regard to the presence or absence of a programmed contingency. The present results may provide more evidence of preference for contingent over noncontingent reinforcement. Numerous studies have shown that individuals prefer contingent reinforcement over noncontingent reinforcement when the reinforcement is tangible or socially mediated (Hanley, 2010; Luczynski & Hanley, 2009; Singh & Query, 1971). The present results are unique in that the apparent preference for contingency involved both mediated and automatic reinforcement.

Another important finding was that no one preferred the blocking-only treatment. Blocking only was the least effective arrangement for reducing stereotypy, so perhaps the participants preferred the context in which treatment was most effective and avoided the least effective treatment. Regardless of the controlling variables, these results highlight the importance of including a reinforcement component (e.g., DR) when considering the use of a likely punishment component such as blocking.

Results of the social validity assessment with stakeholders showed that the stakeholders agreed that the treatment goals, procedures, and amount of behavior change were acceptable, appropriate, and important for both participants (see Table 1).

## GENERAL DISCUSSION

The current results demonstrated that the stereotypy of three participants could be used as a reinforcer for a more desirable alternative behavior. We replicated results of Hanley *et al.* (2000) in that a combination of activities, prompting engagement, restriction of the

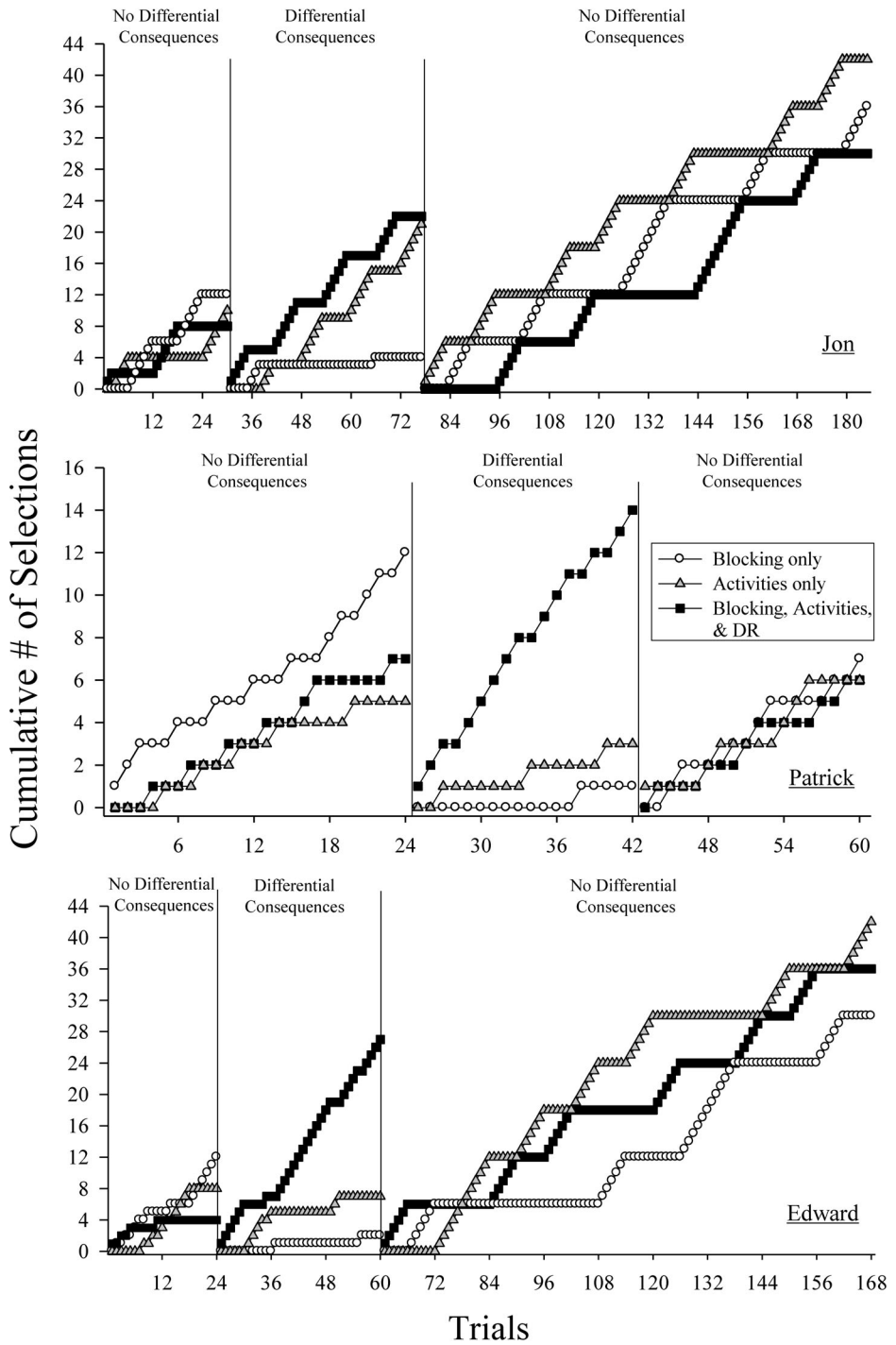


Figure 6. Cumulative number of selections for treatment conditions when differential consequences and no differential consequences were provided for selections for Jon, Patrick, and Edward.

Table 1  
 Questions and Results of the Social Validity Questionnaire

Questions	Responses	
	<i>M</i> (range)	
	Jon	Edward
1. Do you think that the treatment that involved prompting engagement or play behavior, blocking stereotypy, and differentially reinforcing engagement with 30-s access to the participant's own stereotypy was acceptable?	7	6.6 (6–7)
2. Do you think that the amount of behavior change (i.e., the effects of treatment) was acceptable or sufficient?	6.6 (6–7)	6.8 (6–7)
3. Do you feel that the overall goals of this treatment were acceptable, appropriate, and important for the individual?	6.6 (5–7)	7
4. Would you recommend this treatment package to other therapists or providers who are attempting to decrease motor stereotypy and increase age-appropriate play skills?	6.8 (6–7)	6.8 (6–7)

automatic reinforcer during teaching periods, and contingent access to that reinforcer was an effective treatment for automatically reinforced stereotypy. In addition, we extended the results with two participants by demonstrating that the amount and complexity of an alternative behavior could be shaped in the context of this treatment. Two participants also preferred the treatment package over commonly used components of the treatment, and stakeholders found the goals, procedures, and results highly acceptable despite the procedural complexity. In essence, we demonstrated the effectiveness of and preference for a function- and reinforcement-based treatment in decreasing stereotypy and increasing the independent leisure skills of three adolescents with an ASD.

Three important logistical considerations for this treatment include the necessity of careful planning before implementation, the laborious nature of the procedures, and the extensive time period necessary to observe changes in behavior. Hundreds of treatment sessions were required to develop the level of complexity of leisure skills observed at the end of the evaluation, and these skills were still not at a level or with items that are ultimately suitable for adolescents. These considerations highlight that an extensive amount of work and time is required to change a repertoire of automatically reinforced stereotypy. They also highlight the importance of targeting the

development of automatically and socially reinforced leisure skills early, when an individual is young, so that age- and developmentally appropriate play are less disparate at the start of treatment and intractable levels of stereotypy can be prevented.

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