

*PARAMETRIC ANALYSIS OF RESPONSE INTERRUPTION AND REDIRECTION AS TREATMENT FOR STEREOTYPY*VALDEEP SAINI, MEAGAN K. GREGORY, KIRSTIN J. URAN, AND
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Response interruption and redirection (RIRD), a procedure in which demands are delivered contingent on stereotypy, has been shown to reduce vocal and motor stereotypy maintained by automatic reinforcement. However, RIRD can be time consuming and can interrupt ongoing activities and access to reinforcement for appropriate behavior. We attempted to address these limitations by comparing the effectiveness of RIRD using the standard 3-demand procedure to RIRD using just 1 demand. Results showed that RIRD with 1 demand was effective in reducing stereotypy for all participants, required fewer demands overall, and resulted in shorter implementation time. In addition, 2 participants showed an increase in appropriate play during RIRD. These results suggest RIRD with 1 demand may be an effective and less intrusive procedure for reducing stereotypy.

Key words: autism, automatic reinforcement, response interruption and redirection, stereotypy

Ahearn, Clark, MacDonald, and Chung (2007) introduced a procedural variation of response blocking, termed *response interruption and redirection* (RIRD), that entailed presenting demands that require a vocal response contingent on vocal stereotypy. Demands were terminated after the individual completed three consecutive correct responses without stereotypy. If stereotypy occurred during RIRD, the therapist issued a new set of instructions. As a result, stereotypy decreased below baseline levels, and appropriate vocalizations increased for all four subjects. To equate the length of baseline and RIRD sessions, the session timer was stopped when RIRD was implemented to allow

5 min of session time in which vocal stereotypy could occur. Therefore, one of the limitations cited by Ahearn et al. was that RIRD sessions often exceeded 10 min. Similarly, Cassella, Sidener, Sidener, and Progar (2011) conducted a systematic replication of Ahearn et al. and found that many of their sessions lasted up to 30 min.

One reason for lengthy RIRD sessions may be related to the requirement for the participant to comply with three RIRD demands without additional prompting or stereotypy. For example, if the participant does not independently comply with the second demand in the sequence, the next demand is counted as the first demand (of three total demands). Previous researchers have successfully eliminated the compliance requirement while still maintaining low levels of stereotypy. Ahrens, Lerman, Kodak, Worsdell, and Keegan (2011) required only the absence of stereotypy, not independent compliance, for three consecutive trials. Nevertheless, RIRD remained labor intensive.

Similarly, Athens, Vollmer, Sloman, and St. Peter Pipkin (2008) evaluated a modified RIRD procedure in which independent compliance was

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not required, and only one demand was issued contingent on stereotypy. RIRD, in combination with noncontingent attention and response cost, effectively decreased vocal stereotypy. However, they did not directly compare the three-demand procedure to the one-demand procedure nor did they report any measures of time spent in RIRD.

Other researchers have examined RIRD in combination with noncontingent reinforcement. For example, Love, Miguel, Fernand, and LaBrie (2012) identified stimuli that provided similar sensory consequences as stereotypy, and they delivered these stimuli on a fixed-time schedule (i.e., noncontingent reinforcement [NCR]) in combination with RIRD. Subsequently, RIRD and NCR were evaluated in isolation. When these matched stimuli were available, RIRD was implemented on fewer occasions, and total session duration was shorter for one of two participants.

Although the primary purpose of RIRD is to reduce stereotypy, it has been shown to affect nontargeted behavior. For example, RIRD produced an increase in appropriate vocalizations for some participants who engaged in vocal stereotypy (Ahearn et al., 2007; Ahrens et al., 2011; Love et al., 2012). However, in some cases, individuals with skill deficits may need to be explicitly taught appropriate vocal verbal behavior outside the RIRD sessions (Colón, Ahearn, Clark, & Masalsky, 2012). With respect to nontargeted inappropriate behavior, no research has reported an increase in other topographies of problem behavior (e.g., aggression or disruption) during RIRD.

Martinez and Betz (2013) advocated for procedural variations of RIRD that may increase its efficiency and the applicability in less controlled environments. In particular, identification of variations that decrease the duration of intervention without reducing its effectiveness may be beneficial. As a result, we attempted to replicate and extend the RIRD procedure described by Athens et al. (2008) by (a) comparing the effects of the standard three-

demand RIRD procedure to a modified one-demand RIRD procedure on stereotypy, (b) comparing the total duration of time in RIRD across both procedures, and (c) evaluating whether appropriate behaviors increased as a result of implementing motor RIRD for vocal and motor stereotypy.

METHOD

Participants and Setting

Four children with autism participated. Caregivers had referred all participants because they engaged in stereotypy that interfered with learning or was socially inappropriate. Three of the participants engaged in motor stereotypy, and one participant engaged in vocal stereotypy. Participants were included in this study after demonstrating independent compliance to at least 10 motor instructions (e.g., clap hands). In addition, a functional analysis, using procedures similar to those described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994), was conducted for each participant to ensure that stereotypy was not maintained by social consequences.

Fabian was a 5-year-old boy who had been diagnosed with autism and who had very limited vocal language; his primary mode of communication was a picture exchange system. He relied on caregivers to complete most activities of daily living. He engaged in both vocal and motor stereotypy. Only motor stereotypy was targeted in the current study because it occurred at high rates and interfered with Fabian's participation in academic and leisure activities. By contrast, vocal stereotypy occurred at lower rates and did not interfere with daily functioning. Walter was an 8-year-old boy who had been diagnosed with autism and who communicated using two- to four-word vocal requests for preferred items. He completed most activities of daily living independently. He engaged in vocal stereotypy. Barry and Carlton were 5-year-old boys who had been diagnosed with autism; both communicated

using three- to five-word vocal phrases and completed most activities of daily living independently. Both boys engaged in motor stereotypy.

For all participants, experimental sessions were conducted in three different therapy rooms (one for each experimental condition) in the outpatient clinic of a university-based autism center. The rooms contained a table, two chairs, and two moderately preferred items that we selected based on an individualized paired-stimulus preference assessment (Fisher *et al.*, 1992) that was conducted before the functional analysis for each participant. We selected items for inclusion in the preference assessment based on caregiver report of preferences.

Response Definitions and Measurement

Motor stereotypy for Fabian, Barry, and Carlton was defined as noncontextual motor movements that lasted more than 1 s or that occurred more than once in a 10-s period (for knocking only). A 1-s onset/1-s offset criterion was applied for scoring instances of motor stereotypy because Carlton and Barry engaged in brief instances of stereotypy that lasted 2 to 3 s, which would not have been captured using a longer onset–offset interval. *Visual hand tracking* was defined as Carlton slowly moving his hand across his face and watching it with his eyes. *Hand flapping* (Fabian, Barry, and Carlton) was defined as rapid movement of the hand in a back-and-forth motion. *Finger stretching* (Fabian and Barry) was defined as any instance of fully extending and stiffening fingers in an outstretched manner. *Hand clapping* (Fabian and Barry) was defined as clapping hands in front of the face or body. *Hyperextension* was defined as Fabian extending his fingers back beyond the natural plane of the hand, and *knocking* was defined as Fabian making contact with an object or himself with an open or closed fist at least twice consecutively within 10 s. The first instance of knocking was not scored. If knocking occurred again within 10 s, it was scored until 10 s elapsed with no knocking.

Vocal stereotypy for Walter was defined as any noncontextual vocalization, including speech sounds or phrases that lasted more than 1 s. Similar to motor stereotypy, a 1-s onset/1-s offset criterion was applied to scoring instances of vocal stereotypy. Vocal stereotypy also included any contextual speech sound that occurred at least three consecutive times within 10 s (e.g., seeing a toy car and repeatedly saying “car”). The first and second instances of “car” were not scored, but each successive instance was scored as vocal stereotypy until there were at least 10 consecutive seconds with no instance of saying “car.”

For all participants, *appropriate play* was defined as any manipulation of the toy in a manner in which it was intended. *Appropriate vocalizations* were defined as any contextually appropriate vocalization that did not meet the definition for vocal stereotypy (e.g., “They’re spinning!” while playing with the gears on a toy car) excluding *negative vocalizations*, which were defined as any vocalizations made at a pitch and loudness above conversational volume (e.g., screaming and emotional responding such as crying) that was accompanied by observable negative affect (e.g., frowning). Because the definitions of appropriate vocalizations and vocal stereotypy were mutually exclusive, an individual vocalization could not be scored as both types of response.

We collected data on all dependent variables using a 10-s partial-interval recording system and summarized data for each topography as the percentage of intervals in which the behavior occurred. Observers collected data using ABC Data Pro software on iPads. To ensure that response rates were not artificially suppressed by the implementation of a procedure that is incompatible with motor stereotypy, the duration of the RIRD procedure was subtracted from the total session time. Sessions continued until 5 min had elapsed outside RIRD for all participants regardless of the topography of stereotypy. In addition, stereotypy that occurred during the implementation

of RIRD was not represented in the record of occurrences. Observers collected frequency data on the number of demands, the initiation of each implementation of RIRD, and any other severe problem behavior that occurred during treatment. In addition, we recorded the duration of RIRD.

Interobserver Agreement and Treatment Integrity

We collected interobserver agreement data for 53%, 75%, 62%, and 51% of sessions for Fabian, Walter, Barry, and Carlton, respectively. To calculate interobserver agreement, we divided sessions into 10-s intervals and compared data on an interval-by-interval basis. The number of intervals in which both observers agreed on the occurrence or nonoccurrence of all target behaviors was divided by the total number of intervals and the result was converted to a percentage. The mean interobserver agreement across all target behaviors (i.e., stereotypy, appropriate vocalizations, and appropriate play) for each participant was as follows: Fabian, 96% (range, 80% to 100%); Walter, 95% (range, 80% to 100%); Barry, 94% (range, 80% to 100%); and Carlton, 94% (range, 80% to 100%).

An independent observer collected treatment integrity data during a minimum of 34% of sessions for all participants on the following therapist behaviors: acquiring the participant's attention before beginning RIRD, prompts, and praise. We recorded each occurrence of the therapist's behavior as correctly or incorrectly implemented. If there was no opportunity for the therapist to engage in a given behavior, the observer recorded behavior as not applicable. Treatment integrity was summarized as the percentage of components implemented correctly and was calculated by dividing the total number of components implemented correctly by the total number of components applicable and converting the result to a percentage. Mean treatment integrity scores were 97% (range, 82% to 100%) for Fabian, 99% (range, 85% to

100%) for Walter, 98% (range, 91% to 100%) for Barry, and 100% for Carlton.

General Procedure

A combined multielement and reversal design was used to evaluate the effects of different numbers of RIRD demands on stereotypy in the following conditions: baseline, RIRD with one demand, and RIRD with three demands. All sessions lasted 5 min outside the implementation of RIRD. To aid discrimination, each condition was correlated with specific stimuli (Ahrens et al., 2011; Cassella et al., 2011; Love et al., 2012; Schumacher & Rapp, 2011). That is, the therapist conducted each condition in a different room in separate wings of the building, the therapist wore a specific colored t-shirt, and the therapist's shirt matched the color of the curtains in the room.

The participants had access to two moderately preferred items identified via a paired-stimulus preference assessment, and the therapist did not interact with the participant except to respond briefly to appropriate vocalizations and to provide a praise statement once per minute contingent on appropriate toy play (e.g., "Nice job playing with the toys."). Toys included an interactive game book and school bus for Fabian, a doodle board and bouncy ball for Walter, a doodle board and action figures for Barry, and a race car and rotating gears for Carlton. No programmed consequences were provided for problem behavior other than stereotypy.

Baseline. All instances of stereotypy were ignored, and there were no demands placed on the participant during this phase.

Response interruption and redirection (RIRD). We conducted three conditions in a series in a semirandom order using a multielement design: baseline, RIRD with one demand (RIRD 1), RIRD with three demands (RIRD 3). There was a minimum of 30 min between sessions, during which the toys used in sessions were unavailable and the participant engaged in other activities.

During these breaks, there were no programmed consequences for stereotypy.

Contingent on stereotypy in the RIRD conditions, the therapist said the participant's name, made eye contact, and delivered the appropriate number of one-step instructions. The therapist removed toys on each initiation of the RIRD sequence and returned them after completion of the RIRD sequence (Cassella et al., 2011; Miguel, Clark, Tereshko, & Ahearn, 2009). This is in contrast to the procedures of Athens et al. (2008), who removed toys on the third occurrence of stereotypy within 5 s.

We used motor demands during RIRD conditions because this allowed the therapist to use physical prompting in cases of participant noncompliance (Cassella et al., 2011). Thus, the demands were topographically similar in response form to motor stereotypy but topographically dissimilar to vocal stereotypy.

The therapist delivered one or three instructions contingent on stereotypy in the RIRD 1 and RIRD 3 conditions, respectively. All demands in each RIRD sequence differed from each other so that the participant was not required to complete the same demand twice in a row. The therapist used three-step guided compliance to prompt compliance with demands (Ahrens et al., 2011; Athens et al., 2008; Cassella et al., 2011). If the participant did not respond to the initial demand within 5 s, the therapist modeled the correct response. If the participant still did not respond within 5 s of the model, the therapist used hand-over-hand guidance to assist the participant in completing the response. After completion of each demand (including prompted responses), the therapist delivered brief praise.

On occasion, it was necessary for the therapist to interrupt instances of motor stereotypy when physically prompting compliance with demands (Cassella et al., 2011). If stereotypy occurred during the demand sequence, the therapist initiated a new set of instructions. For instance, if the participant engaged in stereotypy as the

therapist delivered the third demand in the RIRD 3 condition, the RIRD procedure restarted with the next demand serving as the first demand in a new sequence. This new sequence was counted as a new implementation of RIRD.

Our procedures differed from Ahearn et al. (2007) in at least three ways. First, similar to Ahrens et al. (2011), the present study did not require independent compliance with demands during RIRD conditions. Second, we removed all toys before starting the RIRD demand sequence and returned them after completion of the sequence (Cassella et al., 2011; Miguel et al., 2009). Third, we exclusively used motor demands during RIRD (Cassella et al., 2011).

When we determined that at least one RIRD intervention was effective in the initial treatment phase, the condition that required the fewest number of demands, required less time to implement, and remained effective at suppressing stereotypy to acceptable levels was conducted in isolation. Procedurally, this phase was identical to the RIRD 1 condition of the initial treatment phase for all participants.

RESULTS

Figure 1 shows the results of the treatment comparison for Fabian, Walter, Barry, and Carlton. During the initial baseline phase, Fabian and Walter engaged in high and increasing levels of stereotypy, and Barry engaged in moderate and stable levels of stereotypy. For these three participants, there was no immediate effect of RIRD on stereotypy; however, as RIRD continued, stereotypy gradually decreased in both RIRD conditions. In the return to baseline, stereotypy continued to occur at high levels for Fabian and Walter and moderate to high levels for Barry. In the final phase, we evaluated RIRD 1 independently because it was found to be as effective as RIRD 3. Previously observed effects were replicated for Barry, in that stereotypy remained at low levels in this phase compared to

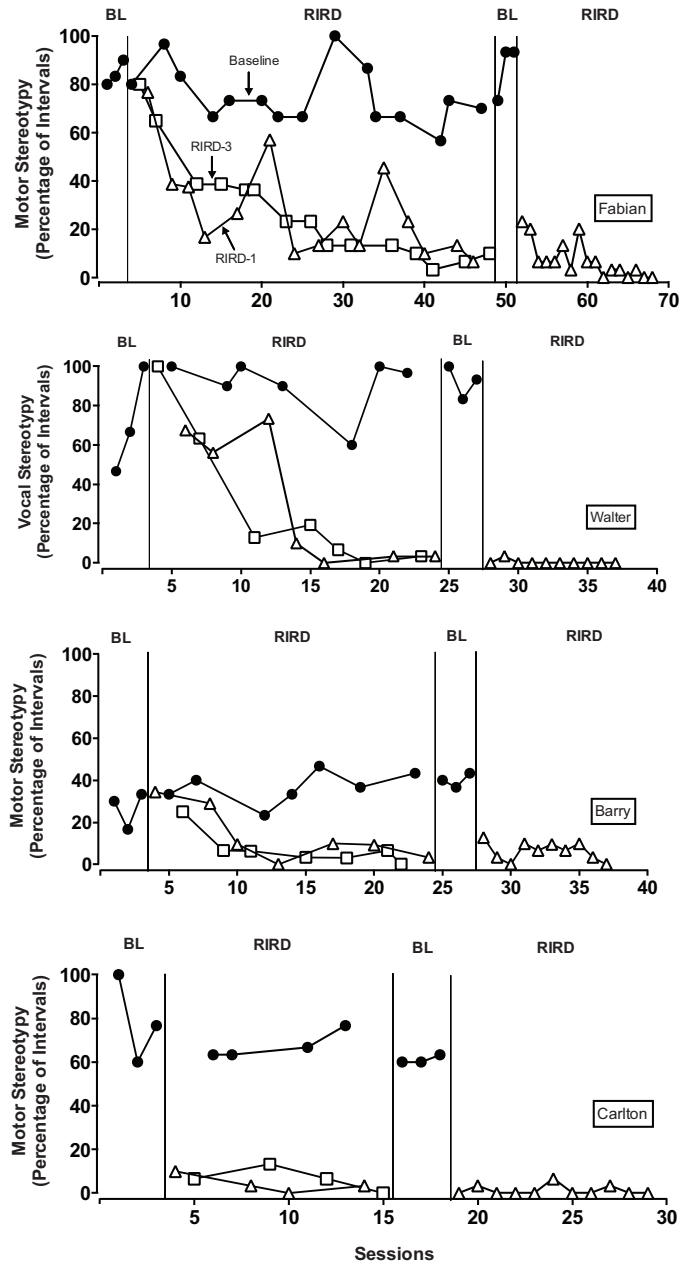


Figure 1. The percentage of intervals with stereotypy during baseline, RIRD 1, and RIRD 3 for Fabian, Walter, Barry, and Carlton.

baseline. For Fabian and Walter, the decrease in stereotypy during RIRD 1 was greater than that observed in the initial treatment phase.

Carlton's motor stereotypy occurred at a moderate to high level during the initial baseline

phase. However, there was a substantial and immediate decrease in stereotypy to zero or near-zero levels after introduction of the RIRD conditions. Stereotypy continued to occur at moderate to high levels in the baseline condition

during the multielement treatment comparison and the subsequent baseline phase. Because the two treatment conditions were equally effective, we implemented RIRD 1 alone in the final phase, which produced immediate decreases to zero or near-zero levels of stereotypy.

Results of one of the secondary dependent variables (appropriate play) are displayed in Figure 2. Appropriate play for Fabian and Walter did not appear to differ in either treatment condition compared to baseline. Fabian engaged in variable levels of appropriate play in the initial baseline and RIRD phase. However, appropriate play decreased over the course of treatment to near-zero levels. Walter engaged in low levels of appropriate play in the initial baseline phase and variable levels of appropriate play across all conditions in subsequent phases. Barry and Carlton exhibited higher levels of appropriate play in the two treatment conditions than in baseline. Barry engaged in low levels of appropriate play in both baseline phases and increasing levels of appropriate play in all conditions, including baseline, of the treatment phase. Carlton engaged in high levels of appropriate play in all treatment conditions and decreasing levels across all baseline sessions.

The results of the other secondary dependent variable (appropriate vocalizations, not displayed) were consistent across participants. Fabian, Walter, and Barry engaged in low or near-zero levels of appropriate vocalizations across all conditions. Carlton engaged in low and variable levels of appropriate vocalizations across all conditions.

Three measures of intervention intrusiveness are displayed in Table 1: session duration, number of implementations of RIRD, and number of instructions. The mean session duration was shorter in RIRD 1 than in RIRD 3 for Fabian and Walter, and there were minimal differences between the mean session durations for Barry and Carlton. Prior RIRD studies included a session cap (i.e., a maximum session duration). For example, Cassella *et al.* (2011)

and Ahrens *et al.* (2011) capped sessions at 30 min. However, we did not include a session cap, and sessions ended after 5 min elapsed outside RIRD. For Walter, Barry, and Carlton, RIRD was implemented more frequently in the RIRD 1 condition. Fabian's results showed no difference in the number of implementations of RIRD in both treatment conditions. For all participants, there were fewer demands delivered in RIRD 1 than in RIRD 3.

As previously mentioned, independent compliance was not required. However, compliance occurred at high levels for all four participants. Compliance was 100% across both treatment conditions for Barry and Carlton and was 100% in RIRD 1 and 95.6% in RIRD 3 for Walter. Compliance for Fabian was only slightly lower at 81.4% in RIRD 3 and 71.4% in RIRD 1. Therefore, it is unlikely that the omission of an independent compliance requirement had a substantial influence on the duration of RIRD for Walter, Barry, and Carlton.

DISCUSSION

The present study examined the effects of RIRD using the traditional three-demand sequence (RIRD 3) with a variation on the procedure that only required one demand (RIRD 1) on stereotypy. Stereotypy was reduced to clinically significant levels for all four participants in both the RIRD 3 and RIRD 1 conditions. Furthermore, when implemented in isolation, RIRD 1 was effective at maintaining low levels of stereotypy.

For all participants, RIRD 1 could be described as a less intrusive procedure in that it usually required the participant to complete fewer demands during a session than RIRD 3. Although the absolute difference between the number of RIRD implementations across conditions was not always noteworthy (e.g., for Carlton the mean rate of RIRD implementations per session was 1.25 in RIRD 3 and 2 in RIRD 1), the sessions lasted only 5 min. If we

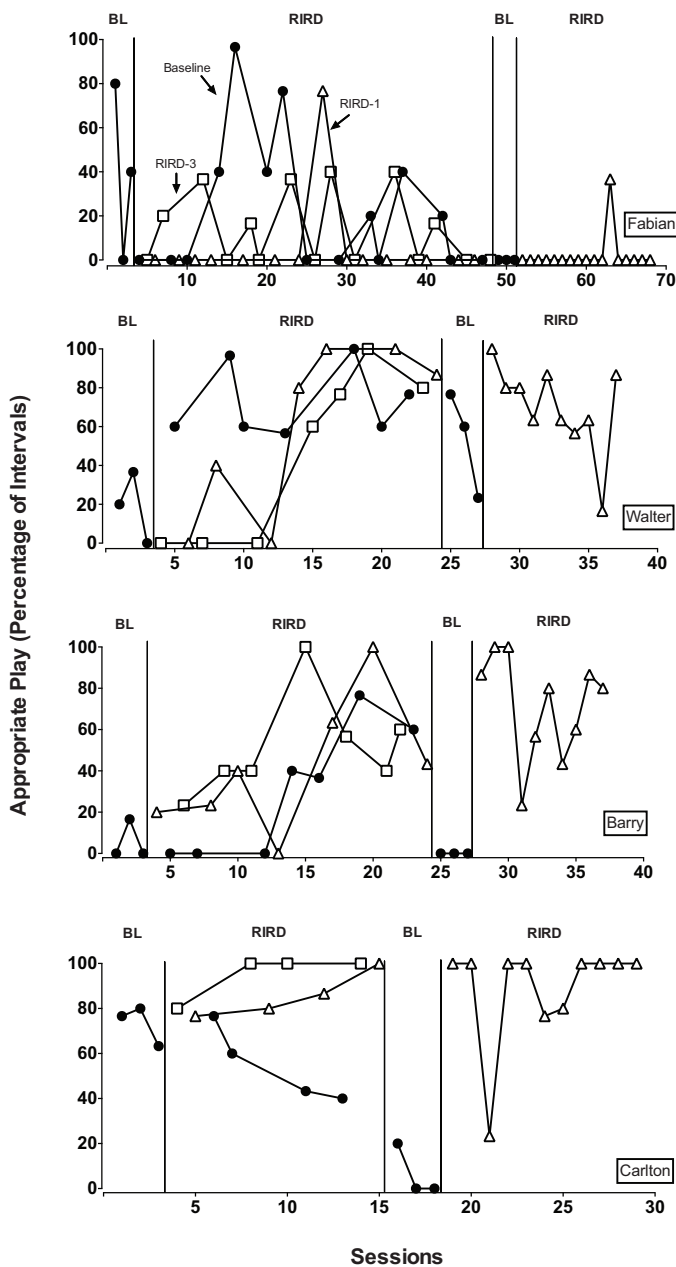


Figure 2. The percentage of intervals with appropriate play during baseline, RIRD 1, and RIRD 3 for Fabian, Walter, Barry, and Carlton.

extended the session duration or implemented the procedure during the individual's typical routine (e.g., a 6- to 8-hr school day), the differences in intrusiveness between RIRD 1 and

RIRD 3 may be more robust. Thus, there may remain important practical implications of choosing the procedure implemented on fewer occasions and for shorter durations. However,

Table 1
Measures of Intrusiveness for Each Participant in Both Treatment Conditions

Participant	Condition	Mean duration of session	Mean implementations of RIRD per session	Mean number of demands per session
Fabian	RIRD 3	8 min 25 s (5 min 21 s to 12 min 48 s)	11.3	34.0
	RIRD 1	6 min 50 s (5 min to 11 min 7 s)	11.4	11.5
Walter	RIRD 3	7 min 5 s (5 min to 10 min 16 s)	13.8	48.1
	RIRD 1	6 min 15 s (5 min to 9 min 20 s)	18.8	19.2
Barry	RIRD 3	5 min 45 s (5 min to 6 min 30 s)	2.2	7.8
	RIRD 1	5 min 25 s (5 min to 5 min 52 s)	4.2	4.2
Carlton	RIRD 3	5 min 21 s (5 min to 5 min 29 s)	1.25	3.75
	RIRD 1	5 min 12 s (5 min to 5 min 22 s)	2.0	2.0

Note. Mean duration reported is the total session time, with duration ranges in parentheses.

research has not yet examined the effects of RIRD 1 over longer durations. Therefore, it is unknown whether RIRD 1 would remain effective over more extended implementations. Because RIRD 1 is a potentially less aversive alternative to RIRD 3, it is also possible that it may be more susceptible to habituation. That is, an increase in the rate of stereotypy may occur after repeated or long-term exposure to RIRD 1 but may not occur after repeated exposure to RIRD 3.

Although the goal of treatment for stereotypy may be to use intermittent punishment schedules to decrease RIRD implementations, previous research on intermittent punishment has produced mixed results (Lerman & Vorndran, 2002). An alternative may be to conduct treatment sessions only periodically after a consistent implementation. For stereotypy in particular, there may be some conditions under which it is acceptable to engage in the behavior (e.g., when alone in your bedroom) and other conditions under which it is inappropriate (e.g., during academic demand periods). Schedule-correlated stimuli, such as those used in multiple schedules (e.g., Hanley, Iwata, & Thompson, 2001), might be used to identify periods when RIRD will or will not be implemented for stereotypy. Future researchers might investigate the use of multiple schedules as a method for fading RIRD.

Because stereotypy is often maintained by automatic reinforcement, it is likely that when

a punishment contingency such as RIRD is removed, levels of stereotypy may return to baseline in the absence of intervention. Future researchers might consider evaluating the effects of RIRD after it is no longer in place. Although Schumacher and Rapp (2011) evaluated the rate of vocal stereotypy in the 10 min following RIRD, longer term outcomes have not yet been examined. Teaching other socially appropriate behaviors while RIRD is in effect, such as appropriate verbalizations (e.g., Colón et al., 2012), may aid in producing reductions in stereotypy after RIRD has been discontinued.

In some cases, increases in appropriate behaviors may co-occur with decreases in stereotypy. For Carlton and Barry, who both engaged in motor stereotypy, an increase in appropriate play occurred during RIRD. Given these results, it is possible that toy play, a behavior already in the repertoire of Carlton and Barry, produced a source of automatic reinforcement but may not have occurred at a high rate in the absence of RIRD due to the competing reinforcement obtained from stereotypy. When reinforcement was no longer available for stereotypy, toy play increased. These results are consistent with other studies that showed an increase in a lower probability behavior (e.g., toy play) when punishment was applied to a higher probability response (e.g., stereotypy; Koegel, Firestone, Kramme, & Dunlap, 1974).

Although Ahearn et al. (2007) and Dickman, Bright, Montgomery, and Miguel (2012) found that implementation of RIRD for vocal stereotypy produced increases in appropriate vocalizations, this effect was not seen with Walter, the only subject in the current study who engaged in vocal stereotypy. One major difference is that Ahearn et al. used vocal interruption, whereas we used motor interruption; therefore, Walter was not prompted to engage in an incompatible response that required the use of appropriate vocalizations during RIRD.

Thus far, most research on RIRD has taken place in highly controlled settings or has been implemented by highly trained staff (Casella et al., 2011; Love et al., 2012). However, Liu-Gitz and Banda (2009) examined RIRD in a school environment where teachers implemented RIRD with 100% treatment integrity and produced positive outcomes. Even so, it is likely that RIRD would be implemented at less than perfect treatment integrity by caregivers in more typical settings. Ahrens et al. (2011) evaluated the effectiveness of RIRD under varying levels of treatment integrity. In three different conditions, they implemented RIRD either after the second, fourth, or 10th occurrence of vocal stereotypy. Stereotypy decreased when RIRD was implemented following every second or fourth response but continued to occur at baseline levels when every 10th response resulted in RIRD. This suggests that RIRD may still be effective when implemented at less than perfect integrity. Future researchers could examine the integrity with which caregivers implement RIRD over longer durations to determine whether the effectiveness of the intervention is likely to be sustained.

The results obtained from this study may have important implications for clinical practice. Because RIRD 1 was shown to be just as effective as RIRD 3 for all participants and less intrusive for Fabian and Walter, RIRD 1 may be an appropriate first step when punishment is warranted as part of a treatment for stereotypy

maintained by automatic reinforcement. In addition, the procedure used in this study did not require participants to comply with demands independently. Although a direct comparison was not conducted in the current study, it seems likely that by not requiring independent compliance, the duration of each implementation of RIRD would be shorter. This may be especially important when treatment is being conducted in an environment that is not amenable to the more intrusive three-demand procedure (e.g., an instructional environment where therapists are responsible for implementation of both skill-acquisition and behavior-reduction procedures).

Lerman and Vorndran (2002) advocated for methods to identify the effectiveness of differing magnitudes of punishment before treatment interventions are implemented in the natural environment. The present study supports the utility of parametric analyses for punishment-based procedures in attempting to address this issue. Due to the nature of automatic reinforcement, finding effective interventions based solely on reinforcement, or even extinction, may prove to be challenging. As a result, punishment may be a necessary treatment component for these behaviors, and a parametric analysis allows practitioners to select the least intrusive, most effective level of treatment.

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