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## Procedural Variations of RIRD: A Systematic Review of the Literature

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Procedural Variations of RIRD: A Systematic Review of the Literature

by

Stephanie Almendarez

A literature review submitted in partial fulfillment  
of the requirements for the degree of  
Master of Science in Applied Behavior Analysis  
Department of Child and Family Studies  
College of Behavioral and Community Sciences  
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## **ABSTRACT**

The purpose of this paper was to summarize and synthesize the current literature on RIRD. Specifically, the aim of this review was to determine proportion of cases in which RIRD was effective in reducing stereotypy as well as to identify RIRD procedural variations that appear to be correlated with an increased probability of positive outcomes. Researchers synthesized the results of 21 articles according to the following categories: (a) participant characteristics (e.g., sex, age, diagnosis, communication repertoire, and topography of stereotypy), (b) RIRD procedural variations (e.g., form of RIRD, type of task, response requirement, number of tasks, and intervention), and (c) outcomes (e.g., duration of RIRD and treatment efficacy). The majority of the participants included in the studies were males, had an ASD diagnoses, and engaged in vocal stereotypy. Across all studies included in this review, in the majority of cases RIRD allowed prompted responses and required the completion of three consecutive vocal tasks in the absence of stereotypy. Research has found that RIRD is an effective intervention at reducing stereotypy when implemented alone and in combination with other interventions. Moreover, it appears RIRD is effective independent of the specific procedural variations employed. However, procedural variations may impact the efficiency of RIRD and response effort associated with implementing the procedure. Implications and future directions are discussed

## **CHAPTER ONE: INTRODUCTION**

A key diagnostic feature of Autism Spectrum Disorder (ASD) is engagement in restricted and repetitive behavior that can be vocal or motor (American Psychiatric Association, 2013). Some topographies of vocal stereotypy include echolalia (e.g., repetition of words and sounds of others; Shield et al., 2017), repetition of distinct phrases, or a combination of the two (Athens et al., 2008). Examples of motor stereotypy include flipping objects, lining up toys, hand flapping, twirling of hair, body rocking, and nail biting (American Psychiatric Association, 2013; Mackenzie, 2018). Currently, the prevalence of vocal stereotypy in individuals with ASD is unknown (Royal, 2018), but it is estimated that 88% of children with ASD engage in motor stereotypy (Mackenzie, 2018).

Although both typically developing children and children with ASD engage in stereotypy, as individuals age and acquire new skills, levels of stereotypy for typically developing children decrease while levels of stereotypy in individuals with ASD either remain stable or increase over time (MacDonald et al., 2007). These behaviors can interfere with skill acquisition and may also be socially stigmatizing (Cunningham & Schreibman, 2008). Additionally, stereotypic behaviors can impede social interactions (MacDonald et al., 2007) and may interfere with learning that usually occurs through observation of and engagement with peers. Therefore, it is important to identify effective and feasible interventions for stereotypy.

One of the most common interventions to decrease stereotypy is response interruption and redirection (RIRD; Ahearn et al., 2007; Martinez & Betz, 2013). In RIRD, contingent on stereotypy, the therapist gains the attention of the participant by making eye contact and calling his or her name. Then, either motor or vocal tasks are presented until the participant complies with a specific number of tasks consecutively without the occurrence of stereotypy. Thus, RIRD consists of both interruption of problem behavior and redirection to another activity or behavior. Many studies have shown that RIRD alone (e.g., Ahearn et al., 2007; Ahrens et al., 2011; Liu-Gitz & Banda, 2010) or in combination with other procedures (e.g., DRA; Cividini-Motta et al., 2019; RC; McNamara & Cividini-Motta, 2019) is effective in reducing vocal and/or motor stereotypy.

Since the initial RIRD evaluation completed by Ahearn and colleagues (2007), several iterations of RIRD have been evaluated. For instance, Saini et al. (2015) compared RIRD-1 (i.e., tasks are presented until the participant completes one task in the absence of stereotypy) and RIRD-3 (i.e., tasks are presented until the participant completes three tasks in the absence of stereotypy). Authors found that both variations were equally effective, and RIRD-1 was less intrusive than RIRD-3. Other studies have evaluated the type of tasks used during RIRD implementation, motor (i.e., presenting motor tasks contingent on stereotypy) and vocal (i.e., presenting vocal tasks contingent on stereotypy) RIRD. For example, several studies have compared motor and vocal RIRD tasks (Shawler & Miguel, 2015; Trasatti, 2017; Wunderlich & Vollmer, 2015) with participants who engaged in vocal stereotypy and showed that both types of RIRD tasks were effective in reducing stereotypy. Thus, the efficacy of RIRD was not dependent on the type of RIRD task implemented.

Besides variation in number of tasks (i.e., RIRD-1 vs. RIRD-3) and form of RIRD tasks (i.e., vocal vs. motor), another aspect of RIRD that has differed across previous studies is the task completion requirement to end RIRD implementation. More specifically, although all RIRD studies require completion of RIRD tasks in the absence of stereotypy, both prompted and/or independent completion of the tasks has been accepted towards the criteria to end RIRD. For instance, Shawler and Miguel (2015) implemented RIRD until the participant engaged in an independent response, whereas Carroll and Kodak (2014) seized RIRD intervals contingent on either prompted and/or independent responses. These variations in RIRD procedures may have collateral effects, such as decreasing the time spent in RIRD, acquisition of new skills, and feasibility of implementation for the person implementing RIRD.

....There are many variations to procedures implemented during RIRD. These include the number of tasks to end the RIRD interval (1 vs. 3), form of RIRD (motor vs. vocal), and response requirement (independent vs. prompted). Furthermore, RIRD can be used to treat both motor and vocal topographies of stereotypy. Therefore, the purpose of this paper was to summarize and synthesize the current literature on RIRD. Specifically, the aim of this review was to determine proportion of cases in which RIRD was effective in reducing stereotypy as well as to identify RIRD procedural variations that appear to be correlated with an increased probability of positive outcomes

## CHAPTER TWO:

### METHOD

#### Initial Search

We searched for articles that described and implemented RIRD to reduce stereotypy in the databases PubMed, ERIC (EBSCO), and Web of Science. Key terms were inserted into the search boxes to locate relevant articles. The searches included “Response Interruption and Redirection” AND “automatic reinforcement”, “Response Interruption and Redirection” AND “stereotypy”, “Response Interruption and Redirection” AND “autism spectrum disorder”, “Response Interruption and Redirection” AND “ASD”, “RIRD” AND “automatic reinforcement”, “RIRD” AND “stereotypy”, “RIRD” AND “autism spectrum disorder”, and “RIRD” AND “ASD”. Given that a review of the RIRD literature was recently conducted by Martinez and Betz (2013) and included articles published through 2012, the current review includes only articles published in 2013 and later. Thus, the inclusion criteria consisted of peer reviewed articles, written in English, and published between 2013-2020. A total of 38 articles were identified during the initial search. Following the initial search, a title-abstract analysis of the articles was conducted and articles were excluded if they consisted of a literature review ( $n = 5$ ), did not mention RIRD or stereotypy ( $n = 2$ ), was a guide for practitioners ( $n = 1$ ), or of a combination of these ( $n = 2$ ). The title-abstract review yielded 28 articles for further review.

#### Full Inclusion Review/Extended search

The 28 articles identified during the title-abstract review were downloaded and evaluated based on the following inclusion criteria: a) implemented RIRD as an intervention, b) targeted

stereotypy, c) utilized a single-subject experimental design to evaluate treatment effects, and d) reported results in a visual graphic display. Following the full inclusion review, a total of 19 articles were identified for inclusion in this review. In order to ensure that all relevant articles published in 2013 or later were identified, we then conducted an extended search, which consisted of reviewing the references of all articles selected for inclusion thus far. References that met the following criteria were considered for further review: (a) published between 2013-2020, (b) not an article that was already included/excluded in the review, and (c) must include “RIRD” or “Response Interruption and Redirection” in the title. The extended search yielded two additional articles. These articles then went through the title-abstract and full inclusion review. Both articles met the inclusion criteria and are included in the review. Therefore, a total of 21 articles were identified and are discussed in the current review (see Figure 1 for a search graphic).

### **Descriptive Synthesis**

We reviewed all the articles selected for inclusion and extracted data according to the following categories: (a) participant characteristics (e.g., sex, age, diagnosis, communication repertoire, and topography of stereotypy), (b) RIRD procedural variations (e.g., form of RIRD, type of task, response requirement, number of tasks, and intervention), and (c) outcomes (e.g., duration of RIRD and treatment efficacy).

### **Participant Characteristics**

Participant information was gathered for sex, age, and diagnoses. Furthermore, we coded each participant’s communication repertoires as either non-verbal (i.e., no functional communication skills), simple verbal (i.e., single word responses), or complex verbal (i.e., communication responses consisting of two or more communication responses). Topography of

stereotypy refers to the stereotypy emitted by the participants and was coded as either vocal, motor, or both. Vocal stereotypy included non-contextual repetitive words, phrases, or other vocalizations (e.g., sounds), whereas motor stereotypy consisted of non-contextual repetitive motor movements (e.g., hand flapping, spinning).

## **RIRD Procedural Variations**

### ***Form of RIRD***

Form of RIRD refers to the topography of the task presented to the participant during the implementation of RIRD and was coded as vocal, motor, or both. Vocal RIRD tasks were defined as any task requiring a vocal response (e.g., vocally stating their name), whereas motor RIRD tasks included any task requiring a motor response (e.g., touching their hand to their head) by the participant.

### ***Type of Task***

The type of RIRD task refers to whether the tasks presented to the participant during RIRD implementation were in the participant's repertoire prior to the intervention. These were coded as mastered, non-mastered, unspecified, or mixed. Mastered tasks included tasks already in the individual's repertoire whereas, non-mastered is defined as responses that cannot be completed independently by the individual. To be coded as mastered, authors must have either a) conducted RIRD probes (Cividini-Motta et al. 2019) or utilized a similar methodology (e.g., demand assessment; Wunderlich & Vollmer, 2015) to identify tasks that the participants could complete independently on a certain number of opportunities, as specified in the article (e.g., 100% of opportunities; Cividini-Motta et al., 2019) or b) explicitly stated that the RIRD tasks were mastered tasks for each participant. Tasks were coded as unspecified when the authors did not specify whether the tasks were mastered or non-mastered, and as mixed when the authors

indicated that the tasks varied across participants (i.e., some participants were presented with mastered tasks whereas others were asked to complete non-mastered tasks)

### ***RIRD Response Requirement***

RIRD response requirement refers to the criterion to terminate each RIRD implementation. Specifically, whether participants were required to complete the RIRD tasks independently or whether prompted task completion was accepted. The RIRD response requirement was coded as independent, prompted, both, or unspecified. Independent was defined as the participant completing the RIRD tasks in the absence of a prompt, whereas prompted was defined as the participant completing the RIRD tasks only following a prompt by the therapist or experimenter.

### ***Number of Tasks***

The number of RIRD tasks refers to the number of tasks the participant was required to complete during each RIRD implementation and were coded according to the number reported in the article (e.g., 1, 3, or 5). For example, in RIRD-3, the participant was required to complete three consecutive tasks in the absence of stereotypy, whereas in RIRD-1, the participant was only required to complete one task in the absence of stereotypy.

### ***Intervention***

Given that RIRD is often evaluated in combination with other interventions (e.g., RIRD and Response Cost (RC); Topper-Korkmaz et al. 2018), we reviewed the description of the procedures and extracted information on the interventions evaluated in the study (e.g., RIRD alone, RIRD plus RC). If a study evaluated multiple treatment conditions (e.g., RIRD alone vs RIRD plus RC), we extracted the name of the interventions in effect during each treatment condition.

## **Outcomes**

### ***Duration of RIRD***

Duration of RIRD refers to whether the authors of the study reported the duration of time the participant spent in RIRD (i.e., the total duration of RIRD implementation). This category was coded as either yes or no, with yes indicating that the authors measured the duration of RIRD implementation and no indicating that they did not.

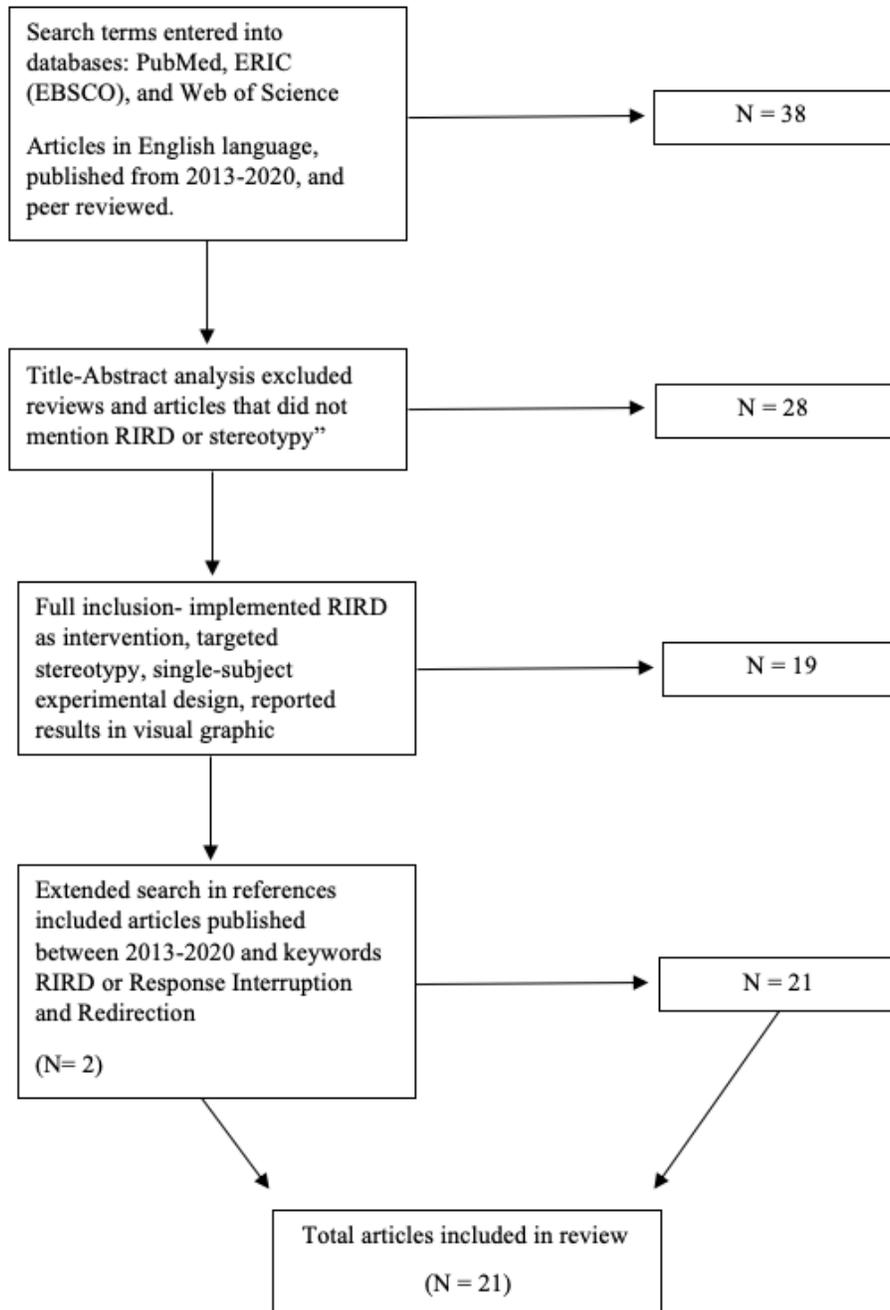
### ***Treatment Efficacy***

Lastly, treatment efficacy refers to whether the intervention reduced stereotypy and was coded as positive, negative, or mixed. Positive was defined as the intervention resulting in a decrease in stereotypy across all participants. Negative was defined as the intervention not leading to a decrease in stereotypy for any of the participants. Mixed was defined as the intervention leading to a decrease in stereotypy for some participants but not all of the participants.

### **Interrater Agreement (IRA)**

IRA was calculated in every step of the search and during the descriptive synthesis by comparing the data from the researcher to that of a second, independent rater. The second rater reviewed the 38 articles identified during the initial search until 100% agreement was obtained. During the initial title-abstract review and the full inclusion review the researcher and second rater coded each article as meeting (1) or not meeting (0) the inclusion criteria. Then the percentage of articles with agreement was calculated by dividing the total articles with agreement by the number of total articles and multiplying by 100. IRA was calculated for 33% of the articles (six of the 21 articles) included in the title-abstract review and the IRA was 92%. During the full inclusion review, both raters reviewed all 21 articles and IRA was 100%. The second

rater completed the extended search for 33% of the articles (six out of the 21 articles) and IRA was 100%. During the descriptive synthesis, the second rater independently coded 150 of the items coded by the researcher and the same code was provided on 146 (97%) of these items.



**Figure 1:** Search Steps and Number of Articles Remaining

## **CHAPTER THREE:**

### **RESULTS**

The descriptive synthesis results are presented in Table 1. The descriptive synthesis summarizes each study by the following categories: (a) participant characteristics (e.g., sex, age, diagnosis, communication repertoire, and topography of stereotypy), (b) RIRD procedural variations (e.g., form of RIRD, type of task, response requirement, number of tasks, and intervention), and (c) outcomes (e.g., duration of RIRD and treatment efficacy).

#### **Participant Characteristics**

##### ***Sex, Age, and Diagnoses***

The 21 articles included in this review yielded a total of 56 participants. All the studies reported the gender of the participants with 75% of the participants male ( $n = 42$ ) and 25% of the participants female ( $n = 14$ ). The average age of the participants was 9.5 years (range, 4 to 21 years). Most of the participants had an ASD diagnosis ( $n = 53$ ). Three participants were diagnosed with ASD and another disability. Other diagnoses included Global Developmental Delay ( $n = 1$ ; Gould et al., 2018), Down Syndrome ( $n = 1$ ; Pastrana et al., 2013), and Trisomy 9 and Intellectual Disability ( $n = 1$ ; Wunderlich & Vollmer, 2015). Taken together, the majority of participants were males ( $n = 39$ ) and the most common diagnosis was ASD ( $n = 53$ ). Overall, RIRD was effective in 91% of the cases. In addition, RIRD was effective for 92% of the male participants, 95% of the female participants, and 89% of the participants with an ASD.

### ***Communication Repertoires***

The participant's communication repertoires varied greatly across studies. Fewer than half of the participants were non-verbal ( $n = 13$ ) and most participants had a verbal repertoire, which was further categorized as simple verbal ( $n = 16$ ) or complex verbal ( $n = 27$ ). Only four articles included participants with all three differing communication repertoires ( $n = 18$  participants; Cividini-Motta et al., 2019; Colon & Ahearn, 2019; DeRosa et al., 2019; Wunderlich & Vollmer, 2015). For example, in DeRosa et al. (2019), one participant had no functional communication skills (e.g. non-verbal), one participant was only able to emit single word responses (e.g. simple verbal), and one participant was able to communicate with two or more communication responses (e.g., complex verbal). Taken together, the majority of participants had complex verbal communication repertoires ( $n = 26$ ). RIRD was effective for participants that did not have a verbal repertoire in 85% of the cases, in 94% of the cases where participants had a simple verbal repertoire, and in 93% of the cases where participants had a complex verbal repertoire.

### ***Topography of Stereotypy***

All the studies reported the topography of stereotypy emitted by each of the participants. Therefore, topography of stereotypy was coded on a case-by-case (e.g., participant) basis. Of 56 participants, 38 engaged in only vocal stereotypy, eight engaged in only motor stereotypy, and 10 engaged in both vocal and motor stereotypy. For example, in Frewing et al. (2015), the participant engaged in both vocal stereotypy (i.e., laughing, whispering, humming, moaning, and echolalia) and motor stereotypy (i.e., rocking, belly slapping, hand flapping, finger flipping, leg or belly rubbing, and covering and uncovering ears). RIRD was effective in 87% of the cases for participants who engaged in vocal stereotypy, in 88% of the cases for participants who engaged

in motor stereotypy, and in 100% of the cases for participants who engaged in both vocal and motor stereotypy.

## **RIRD Procedural Variations**

### ***Form of RIRD***

In regard to the form of RIRD (i.e., presentation of vocal or motor tasks), nine studies presented vocal tasks (Colon & Ahearn, 2019; Gibbs et al., 2018; Gibney et al., 2020; McNamara & Cividini-Motta, 2019; Shawler et al., 2020; Sivaraman & Rapp, 2019; Sloman et al., 2017; Topper-Korkmaz et al., 2018; Wells et al., 2016) and eight studies presented motor tasks (Carroll & Kodak, 2014; DeRosa et al., 2019; Falligant & Dommestrup, 2020; Giles et al., 2018; Gould et al., 2018; Martinez et al., 2016; Pastrana et al., 2013; Saini et al., 2015) during RIRD. In addition, in four studies both motor and vocal tasks were used (Cividini-Motta et al., 2019; Frewing et al., 2015; Shawler & Miguel, 2015; Wunderlich & Vollmer, 2015); however, in some studies vocal and motor tasks were presented to the same participant (e.g., Shawler & Miguel, 2015) whereas in others different forms of RIRD were used across participants (e.g., vocal for one, motor for another; Cividini-Motta et al., 2019). For 23 participants RIRD included vocal tasks, for 17 participants RIRD included motor tasks, and for 16 participants this included both vocal and motor tasks.

Moreover, in the nine studies that used vocal tasks, the topography of the task presented in RIRD matched the topography of stereotypy. That is, 23 participants (61%) who engaged in vocal stereotypy were required to engage in vocal RIRD tasks. Three participants who engaged in vocal stereotypy were required to complete motor RIRD tasks. The topography of stereotypy and of tasks presented during RIRD matched in all four studies that used motor tasks during RIRD (8 out of 8 participants, 100%). Additionally, in two other studies motor RIRD tasks were

presented but participants engaged in both vocal and motor stereotypy (Pastrana et al., 2013; Saini et al., 2015). RIRD was effective in 87% of the cases where RIRD consisted of vocal tasks, in 94% of the cases where RIRD comprised of motor tasks, and in 88% of the cases where RIRD consisted of both motor and vocal tasks.

### ***Type of Task***

Most of the studies reported the type of task (i.e., mastered, non-mastered) used during RIRD ( $n = 15$ ; Carroll & Kodak, 2014; Cividini-Motta et al., 2019; Frewing et al., 2015; Gibbs et al., 2018; Gibney et al., 2020; Giles et al., 2018; Gould et al., 2018; McNamara & Cividini-Motta, 2019; Pastrana et al., 2013; Shawler et al., 2020; Shawler & Miguel, 2015; Sloman et al., 2017; Toper-Korkmaz et al., 2018; Wells et al., 2016; Wunderlich & Vollmer, 2015). Of the studies included in this review, thirty participants (54%) were presented with mastered tasks, 10 participants (18%) were presented with both mastered and non-mastered tasks (i.e., mixed), one participant (2%) was presented with only non-mastered tasks, and for 16 participants (29%), the type of tasks were not specified. RIRD was effective in 83% of the cases where RIRD consisted of mastered tasks, in 100% of the cases that consisted of non-mastered tasks, in 90% of the cases that consisted of mixed tasks, and in 100% of the cases that did not specify the tasks.

### ***Response Requirement***

Of the 21 studies included in this review, only 13 specified whether participants were required to independently complete the tasks presented during RIRD (Carroll & Kodak, 2014; Cividini-Motta et al., 2019; DeRosa et al., 2019; Falligant & Dommestrup, 2020; Frewing et al., 2015; Giles et al., 2018; Martinez et al., 2016; McNamara & Cividini-Motta, 2019; Pastrana et al., 2013; Saini et al., 2015; Shawler & Miguel, 2015; Toper-Korkmaz et al., 2018; Wunderlich & Vollmer, 2015). These 13 studies included a total of 38 participants; 15 of these participants

(39%) were required to complete the RIRD tasks independently, for one participant prompted responses were accepted, and for 22 participants both independent and prompted responses were accepted. Eight out of 22 studies ( $n = 18$ ) did not specify the response requirement for RIRD (Colon & Ahearn, 2019; Gibbs et al., 2018; Gibney et al., 2020; Gould et al., 2018; Shawler et al., 2020; Sivaraman & Rapp, 2019; Sloman et al., 2017; Wells et al., 2016). Finally, if a study did not clearly indicate that prompted, independent, or both types of responses were acceptable (e.g., stated that a correct response was required but did not explicitly state that the response had to be independent), then the article was coded as unspecified ( $n = 8$ ).

RIRD was effective when an independent response was required in 87% of the cases and when a prompted response was accepted, RIRD was effective for 100% of the cases. Moreover, when RIRD comprised of both independent and prompted responses, RIRD was effective for 95% of the cases. RIRD was effective when RIRD was not specified in 83% of the cases.

### ***Number of Tasks***

All the studies reported the number of tasks used during RIRD ( $n = 21$ ). During RIRD implementation most of the articles required participants to complete three consecutive tasks in the absence of stereotypy ( $n = 15$ ; Carroll & Kodak, 2014; Cividini-Motta et al., 2019; Colon & Ahearn, 2019; DeRosa et al., 2019; Gibbs et al., 2018; Gibney et al., 2020; Giles et al., 2018; Gould et al., 2018; McNamara & Cividini-Motta, 2019; Pastrana et al., 2013; Shawler et al., 2020; Shawler & Miguel, 2015; Sivaraman & Rapp, 2019; Sloman et al., 2017; Wunderlich & Vollmer, 2015) and three studies required participants to comply with only one task in the absence of stereotypy (Falligant & Dommestrup, 2020; Frewing et al., 2015; Wells et al., 2016). Overall, 45 participants were required to engage in three tasks while three participants were only required to comply with one task. Additionally, three studies evaluated the effects of two

different RIRD task requirements on stereotypy; one participant experienced both RIRD-1 and RIRD-5 (Martinez et al., 2016) and seven participants were exposed to RIRD-1 and RIRD-3 ( $n = 2$ ; Saini et al., 2015; Toper-Korkmaz et al., 2018). RIRD-3 was effective in reducing stereotypy for 45 (87%) participants, while RIRD-1 was effective in reducing stereotypy for three (100%) participants. When two response requirements were compared, the smaller response requirement was as effective as the larger response requirement for 8 out of 8 participants (100%).

### ***Intervention***

The intervention implemented was described in all the studies included in this review ( $n = 21$ ). Of the 21 articles, only eight used RIRD as the sole intervention (Colon & Ahearn, 2019; Giles et al., 2018; Pastrana et al., 2013; Saini et al., 2015; Shawler & Miguel, 2015; Sivaraman & Rapp, 2019; Wells et al., 2016; Wunderlich & Vollmer, 2015) and nine articles utilized RIRD in combination with another intervention (Carroll & Kodak, 2014; Cividini-Motta et al., 2019; DeRosa et al., 2019; Falligant & Dommestrup, 2020; Gibbs et al., 2018; Gibney et al., 2020; McNamara & Cividini-Motta, 2019; Shawler et al., 2020; Toper-Korkmaz et al., 2018). For example, Cividini-Motta et al. (2019) evaluated RIRD alone, differential reinforcement of alternative behavior (DRA) alone, and RIRD plus DRA. Other studies included a response cost component (McNamara & Cividini-Motta, 2019; Toper-Korkmaz et al., 2018) or noncontingent reinforcement component (Carroll & Kodak, 2014; Gibney et al., 2020). Additionally, three articles included RIRD and a multiple schedule component (MS) in which the presence of a specific stimulus signals whether RIRD will be implemented (Frewing et al., 2015; Gould et al., 2018; Martinez et al., 2016; Sloman et al., 2017). Also, one article included RIRD, and RIRD plus matched stimulation (Gibbs et al., 2018). Lastly, one article included RIRD, MS, and differential reinforcement of an incompatible response (Falligant & Dommestrup, 2020). RIRD

alone was effective for 90% of the participants whereas RIRD in combination with another intervention was effective in 87% of the cases.

## **Outcomes**

### ***Duration of RIRD***

Duration of RIRD implementation was recorded in fewer than half of the articles ( $n = 8$ ; Carroll & Kodak, 2014; Colon & Ahearn, 2019; Gibbs et al., 2018; Martinez et al., 2016; Saini et al., 2015; Shawler & Miguel, 2015; Sloman et al., 2017; Topper-Korkmaz et al., 2018) and for fewer than half of the participants (23 out of 56 participants). For instance, Colon and Ahearn (2019) measured the duration of RIRD in both experiments whereas Giles et al. (2018) did not report the duration of RIRD.

### ***Treatment Efficacy***

In regard to treatment efficacy, in 17 studies RIRD had positive results, indicating that treatment led to a decrease in stereotypy for all participants (Carroll & Kodak, 2014; Cividini-Motta et al., 2019; Colon & Ahearn, 2019; DeRosa et al., 2019; Falligant & Dommestrup, 2020; Frewing et al., 2015; Gould et al., 2018; Martinez et al., 2016; McNamara & Cividini-Motta, 2019; Pastrana et al., 2013; Saini et al., 2015; Shawler et al., 2020; Sivaraman & Rapp, 2019; Sloman et al., 2017; Topper-Korkmaz et al., 2018; Wells et al., 2016; Wunderlich & Vollmer, 2015). RIRD led to mixed results (i.e., reduction in stereotypy for a portion of the participants) in three studies (Gibney et al., 2020; Giles et al., 2018; Shawler & Miguel, 2015), and RIRD had negative results (i.e., did not result in a reduction in stereotypy for any of the participants) in one study (Gibbs et al., 2018). Additionally, in the studies by Shawler and Miguel (2015) and Giles et al. (2018) the authors proposed that RIRD was not effective in reducing stereotypy because the

participant's stereotypy may have been maintained by access to attention. Across all of the studies included in this review, RIRD was effective in reducing stereotypy in 91% of the cases.

**Table 1**

## Descriptive Synthesis

Article	Participant Characteristics				RIRD Procedural Variables					Outcome Measures	
	Sex, Age	Diagnosis	Comm. repertoire (# participants)	Topography of Stereotypy	Form of RIRD	Type of Task	Response Requirement	# of Tasks	Intervention	Duration of RIRD	Treatment Efficacy
Carroll & Kodak (2014)	2 M (5-8 yo)	ASD	CV (2)	Vocal	Motor	Mastered	Both	3	RIRD/ NCR	Yes	Positive
Cividini-Motta et al. (2019)	2 F, 1 M (5-8 yo)	ASD	NV (1), SV (1), CV (1)	Both	Both	Mastered	Independent	3	RIRD/ DRA/ RIRD + DRA	No	Positive
Colon & Ahearn (2019)	1 F, 4 M (14-21 yo)	ASD	NV (1), SV (3), CV (1)	Vocal	Vocal	Non-Mastered	Unspecified	3	RIRD	Yes	Positive
DeRosa et al. (2019)	3 M (6-19 yo)	ASD	NV (1), SV (1), CV (1)	Motor	Motor	Unspecified	Both	3	RIRD/ RB	No	Positive
Falligant & Dommestrup (2020)	1 M (12 yo)	ASD	NV (1)	Motor	Motor	Unspecified	Prompted	1	RIRD + MS + DRI	No	Positive
Frewing et al. (2015)	1 M (19 yo)	ASD	CV (1)	Both	Both	Mastered	Independent	1	RIRD + MS	No	Positive
Gibbs et al. (2018)	1 F, 1 M (4-7 yo)	ASD	NV (2)	Vocal	Vocal	Mastered	Unspecified	3	RIRD/ RIRD + MST	Yes	Negative
Gibney et al. (2020)	1 F, 3 M (12-16 yo)	ASD	SV (2), CV (2)	Vocal	Vocal	Mastered	Unspecified	3	RIRD/ NCR- M	No	Mixed
Giles et al. (2018)	3 M (6-12 yo)	ASD	NV (2), CV (1)	Motor	Motor	Mixed	Both	3	RIRD	No	Mixed

**Table 1 (Continued)**

Gould et al. (2018)	1 M (10 yo)	ASD, GDD	NV (1)	Motor	Motor	Mastered	Unspecified	3	RIRD + MS	No	Positive
Martinez et al. (2016)	1 M (5 yo)	ASD	CV (1)	Vocal	Motor	Unspecified	Independent (except after session 46 in Exp. 2)	1, 5	RIRD + MS	Yes	Positive
McNamar a & Cividini-Motta (2019)	3 M (8-11 yo)	ASD	SV (1), CV (2)	Vocal	Vocal	Mastered	Both	3	RIRD/ RC/ RIRD + RC	Yes	Positive
Pastrana et al. (2013)	2 M (6-9 yo)	ASD, DS	NV (1), SV (1)	Both	Motor	Mastered	Independent	3	RIRD	No	Positive
Saini et al. (2015)	4 M (5-8 yo)	ASD	NV (1), CV (3)	Both	Motor	Unspecified	Both	1, 3	RIRD	Yes	Positive
Shawler et al. (2020)	1 F, 1 M (5-7 yo)	ASD	CV (2)	Vocal	Vocal	Mastered	Unspecified	3	RIRD/ CI	No	Positive
Shawler & Miguel (2015)	1 F, 4 M (5-12 yo)	ASD	SV (1), CV (4)	Vocal	Both	Mastered	Independent	3	RIRD	Yes	Mixed
Sivarama n & Rapp (2019)	2 M (5-7 yo)	ASD	SV (1), CV (1)	Vocal	Vocal	Unspecified	Unspecified	3	RIRD	No	Positive
Sloman et al. (2017)	1 M (13 yo)	ASD	CV (1)	Vocal	Vocal	Mastered	Unspecified	3	RIRD+ MS	Yes	Positive
Toper-Korkmaz et al. (2018)	2 F, 1 M (4-6 yo)	ASD	SV (1), CV (2)	Vocal	Vocal	Mastered	Independent	1, 3	RIRD/ RIRD +RC	Yes	Positive

**Table 1 (Continued)**

Wells et al. (2016)	1 M (13 yo)	ASD	CV (1)	Vocal	Vocal	Mastered	Unspecified	1	RIRD	No	Positive
Wunderlic h & Vollmer (2015)	5 F, 2 M (4-20 yo)	ASD, T9, ID	NV (2), SV (4), CV (1)	Vocal	Both	Mixed	Both	3	RIRD	No	Positive

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*Note.* CI= Competing items; CV= complex verbal; DRA= Differential reinforcement of alternative behavior; DRI= Differential reinforcement of incompatible behavior; DS= Down Syndrome; GDD= Global Developmental Delay; ID= Intellectual Disability; MS= multiple schedule; MST= Matched stimulation; NCR= Noncontingent reinforcement; NCR-M= Noncontingent matched stimulation; NV= non-verbal; RB=Response blocking; RC= Response cost; SV= simple verbal; T9= Trisomy

## **CHAPTER 4:**

### **DISCUSSION**

This review synthesized the current literature on the implementation of RIRD to reduce stereotypy. A total of 21 articles were included in the current review and were summarized in regard to participants' characteristics, procedural variations, and outcomes. Overall, RIRD was found to be effective at reducing both motor and vocal stereotypy for participants across a variety of ages, independent of their communication repertoire. However, given that the participant sample is highly homogeneous (e.g., most participants were diagnosed with ASD), the generality of these findings to individuals with other disabilities is unclear.

RIRD is a multi-step procedure that includes, but is not limited to, interruption of stereotypy and presentation of tasks. As previously described, within the articles included in this review, there were a lot of variations in the form of RIRD task (i.e., vocal vs motor), type of tasks (i.e., mastered vs non-mastered), response requirement (i.e., prompted, independent, or both), and number of tasks (i.e., RIRD-1, RIRD-3, RIRD-5). In general, it appears that RIRD is effective independent of the form of the RIRD task, type of task, response requirement, and number of tasks, but positive results were more likely to be attained when studies implemented motor tasks in RIRD in comparison to vocal tasks and both motor and vocal tasks. Also, positive results were more likely to be attained when studies implemented non-mastered tasks compared to mastered tasks, and prompted responses during RIRD were more likely to produce positive outcomes in comparison to when RIRD required independent responses. Lastly, positive outcomes were more likely when studies implemented RIRD-1 in comparison to RIRD-3 and

RIRD-5. However, it is important to note that there were many procedural variations across studies and that some iterations of RIRD were evaluated with a small number of participants (e.g., mastered tasks with 13 participants whereas non-mastered tasks with only one participant). Thus, it is likely that a combination of variables (e.g., participants' characteristics, RIRD procedural modifications) may be responsible for the differing outcomes across studies and participants. Although in the majority of the studies RIRD was implemented in combination with other procedures, RIRD alone was also effective in reducing stereotypy in the majority of the cases.

The current literature review identified multiple areas for future research and findings of this review have immediate implications to clinical practice. For instance, the efficacy of RIRD does not appear to be dependent on the type of task used (e.g., mastered or non-mastered). Thus, procedures previously employed to identify mastered tasks (e.g., RIRD probes) likely can be omitted from future research and clinical practice. Conversely, it is possible that when non-mastered tasks are used, the repeated presentation of these tasks may lead to skill acquisition. Thus, it may be advisable to include non-mastered tasks in RIRD because this would allow RIRD to be used to reduce stereotypy, but also to teach new skills. Future research should investigate whether participants indeed acquire new skills when non-mastered tasks are presented during RIRD and whether further modifications to the RIRD procedure (e.g., inclusion of prompts, reinforcement) will make acquisition of these skills likely.

In addition, given that RIRD is effective independent of the form of RIRD (i.e., motor or vocal) and the topography of stereotypy (i.e., motor or vocal) clinicians may want to consider using tasks that are easier to prompt or tasks that are less likely to occasion other disruptive behavior (e.g., non-compliance, aggression). Furthermore, for individuals with limited skills

clinicians may want to consider selecting various tasks from the category (i.e., motor or vocal) of responses that the client has the most deficits to provide the client with additional opportunities to practice these skills.

Furthermore, although the RIRD procedure employed in most of the articles included in this review required the participant to comply with three tasks in the absence of stereotypy ( $n = 15$ ), RIRD was also effective when participants were only required to comply with one task in the absence of stereotypy (e.g., Falligant & Dommestrup, 2020; Frewing et al., 2015; Wells et al., 2016). Thus, to decrease the response effort associated with the implementation of RIRD, clinicians may want to consider prescribing the RIRD with a smaller response requirement (i.e., RIRD-1). However, additional research should evaluate the efficacy of RIRD-1 to determine the generality of the treatment effects observed in previous studies across other participants.

Moreover, future research should evaluate whether the type of tasks presented (i.e., mastered vs non-mastered) impacts the efficacy of RIRD when the participant is required to complete only a single task. It is also plausible that RIRD-1 may not lead to acquisition of tasks or that acquisition will be delayed because the participant will have fewer exposure to the tasks in comparison to RIRD-3 and RIRD-5. Thus, future research may want to evaluate the impact of RIRD-1, RIRD-3, and/or RIRD-5 on the acquisition of the non-mastered tasks presented during RIRD.

Another important variable to consider in relation to RIRD and skill acquisition is the response requirement (i.e., prompted versus unprompted). Only one article included in this review explicitly stated that the criteria to end RIRD implementation included prompted responses (Falligant & Dommestrup, 2020) and in this study, RIRD was effective in reducing stereotypy. Given that the use of prompts within RIRD does not appear to hinder its efficacy, this

provides additional support for the inclusion of non-mastered tasks, which in turn could lead to acquisition. Furthermore, the delivery of prompts may also decrease the overall time required to implement RIRD. More specifically, it is likely faster to implement RIRD when prompts are immediately delivered following a presentation of a demand then to continue to present tasks until the individual complies with a specific number of tasks independently. However, as with any other intervention or instructional procedure that includes the use of prompts, it is imperative that the participant's or client's preference for certain prompts be considered. For instance, if physical prompts are reinforcing, these should be avoided so that RIRD does not inadvertently reinforce stereotypy.

Lastly, despite research showing that RIRD is effective in reducing stereotypy, results of studies that measured duration of RIRD and the occurrence of stereotypy during RIRD intervals (e.g., Martinez et al., 2016; Shawler & Miguel, 2015) suggest that the efficacy of RIRD may be overestimated when duration of RIRD and stereotypy are not included. Specifically, Martinez et al. (2016) compared RIRD-1 and RIRD-5 and in this study participants spent more time in RIRD when they were required to complete five tasks (i.e., RIRD-5; 7% of the session) in comparison to one task (i.e., RIRD-1; 4% of the session). These data suggest that larger response requirements may result in clinicians spending more time implementing RIRD and clients missing out on more instructional time. Similarly, Shawler and Miguel (2015) compared vocal and motor RIRD with participants who engaged in vocal stereotypy and in this study three out of five participants spent more time in motor RIRD (avg. = 13 min) while two out of five participants spent more time in vocal RIRD (avg. = 9.5 min). These data suggest that more time may be spent in motor RIRD than in vocal RIRD. Therefore, data on duration of RIRD and

occurrence of stereotypy during RIRD are important indexes of the efficacy and efficiency of the various interactions of RIRD.

## **Limitations**

Although the current literature review encompassed various articles and data were extracted for a variety of variables, there are limitations to the current literature review. First, we excluded articles published prior to 2013 thus it is possible that overall conclusions would have differed if additional articles were synthesized. Second, the current literature review did not consider every possible procedural variation within RIRD. For instance, we did not code articles for the following variables: the use of prompts, type of prompts, or the inter-trial interval. Also, we did not quantify the efficacy of RIRD (e.g., calculated effect sizes). That is, we coded RIRD as effective as long as it led to any decrease in stereotypy in comparison to baseline, however, the specific degree of level change, was not coded. Therefore, it is possible that some iterations of RIRD may lead to a greater or faster reduction in stereotypy. Although we reported whether articles measured the duration of time spent in RIRD, we did not analyze the data on duration of RIRD implementation to determine whether a specific iteration of RIRD is associated with briefer treatment duration, and thus, less response effort on the part of the clinician or researcher. We also did not extract data on the occurrence of stereotypy during RIRD. Finally, systematic reviews conducted on a large body of literature require a lot of time and resources (e.g., multiple people to extract and synthesize the data). As such, new articles are often published while the manuscript is in preparation or under review. Thus, it is entirely possible that additional articles have been published since we conducted our literature search.

## **Conclusions**

Taken together, results of the studies included in this literature review indicate that RIRD is effective in reducing motor and vocal stereotypy in individuals with ASD across various ages and communication repertoires. Furthermore, various iterations of RIRD have been investigated and shown to be effective yet some articles lacked procedural details to allow readers to determine exactly how the procedures were implemented. Thus, future research should ensure that RIRD procedures are described in detail to aid in replication and should evaluate how variations to each component of RIRD impact its efficacy and efficiency in regard to both decreasing stereotypy and fostering skill acquisition. Furthermore, to ensure contextual fit and likely increase procedural integrity, clinicians should employ the RIRD procedure that requires less effort, is less likely to occasion problem behavior, and more likely to foster acquisition of novel skills. That is, RIRD should be individualized.

## REFERENCES

- Ahearn, W. H., Clark, K. M., Chung, B. I., & MacDonald, P. F. (2007). Assessing and treating vocal stereotypy in children with autism. *Journal of Applied Behavior Analysis, 40*, 263-275. 10.1901/jaba.2007.30-06.
- Ahrens, E. N., Lerman, D. C., Kodak, T., Worsdell, A. S., & Keegan C. (2011). Further evaluation of response interruption and redirection as treatment for stereotypy. *Journal of Applied Behavioral Analysis, 45*, 95-108. 10.1901/jaba.2011.44-95.
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed. American Psychiatric Association; 2013.
- Athens, E. S., Vollmer, T. R., Sloman, K. N., & Pipkin, C. (2008). An analysis of vocal stereotypy and therapist fading. *Journal of Applied Behavior Analysis, 41*, 291-297. 10.1901/jaba.2008.41-291.
- Carroll, R. A., & Kodak, T. (2014). An evaluation of interrupted and uninterrupted measurement of vocal stereotypy on perceived treatment outcomes. *Journal of Applied Behavior Analysis, 47*, 264-276. 10.1002/jaba.118.
- Cividini-Motta, C., Garcia, A. R., Livingston, C., & MacNaul, H. L. (2019). The effect of response interruption and redirection with and without a differential reinforcement of alternative behavior component on stereotypy and appropriate responses. *Behavioral Interventions, 34*, 1-16. 10.1002/bin.1654.

- Colon, C. L., & Ahearn, W. H. (2019). An analysis of treatment integrity of response interruption and redirection. *Journal of Applied Behavior Analysis, 52*, 337-354. 10.1002/jaba.537.
- Cunningham, A. B., & Schreibman, L. (2008). Stereotypy in autism: The importance of function. *Research in Autism Spectrum Disorders, 2*, 469-479. 10.1016/j.rasd.2007.09.006.
- DeRosa, N. M., Novak, M. D., Morley, A. J., & Roane, H. S. (2019). Comparing response blocking and response interruption/redirection on levels of motor stereotypy: Effects of data analysis procedures. *Journal of Applied Behavior Analysis, 52*, 1021-1033. 10.1002/jaba.644.
- Falligant, J. M., & Dommestrup, A. K. (2020). Decreasing motor stereotypy in leisure contexts: Analysis of stimulus control with response interruption and redirection. *Behavioral Interventions, 35*, 306-314. 10.1002/bin.1703.
- Frewing, T. M., Tanner, A., Bonner, A. C., Baxter, S., & Pastrana, S. J. (2015). The immediate and subsequent effects of response interruption and redirection on vocal stereotypy, motor stereotypy, and heart rate. *European Journal of Behavior Analysis, 16*, 351- 361. 10.1080/15021149.2015.1110407.
- Gibbs, A. R., Tullis, C. A., Thomas, R., & Elkins, B. (2018). The effects of noncontingent music and response interruption and redirection on vocal stereotypy. *Journal of Applied Behavior Analysis, 51*, 899-914. 10.1002/jaba.485.
- Gibney, C., Phillips, K. J., Arnold-Saritepe, A., & Taylor, S. A. (2019). An evaluation of the effects of response interruption redirection and matched stimulation on vocal stereotypy. *Behavioral Interventions, 35*, 114-130. 10.1002/bin.1700.

- Giles, A., Swain, S., Quinn, L., & Weifenbach, B. (2018). Teacher-implemented response interruption and redirection: Training, evaluation, and descriptive analysis of treatment integrity. *Behavior Modification, 42*, 148-169. 10.1177/0145445517731061.
- Gould, K. M., Harper, J. M., Gillich, E., & Luiselli, J. K. (2018). Intervention, stimulus control, and generalization effects of response interruption and redirection on motor stereotypy. *Behavioral Interventions, 34*, 118-126. 10.1002/bin.1652.
- Liu-Gitz, L. L., & Banda, D. R. (2010). A replication of the RIRD strategy to decrease vocal stereotypy in a student with autism. *Behavioral Interventions, 25*, 77-87. 10.1002/bin.297.
- MacDonald, R., Green, G., Mansfield, R., Geckeler, A., Gardenier, N., Anderson, J., ... Sanchez, J. (2007). Stereotypy in young children with autism and typically developing children. *Research in Developmental Disabilities, 28*, 266-277. 10.1016/j.ridd.2006.01.004.
- Mackenzie, K. (2018). Stereotypic movement disorders. *Seminars in Pediatric Neurology, 25*, 19-24. 10.1016/j.spen.2017.12.004.
- Martinez, C. K., & Betz, A. M. (2013). Response interruption and redirection: Current research trends and clinical application. *Journal of Applied Behavior Analysis, 46*, 549-554. 10.1002/jaba.38.
- Martinez, C. K., Betz, A. M., Liddon, C. J., & Werle, R. L. (2016). A progression to transfer RIRD to the natural environment. *Behavioral Interventions, 31*, 144-162. 10.1002/bin.1444.
- McNamara, K., & Cividini-Motta, C. (2019). Further evaluation of treatments for vocal stereotypy: Response interruption and redirection and response cost. *Behavioral Interventions, 34*, 1-17. 10.1002/bin.1657.

- Pastrana, S. J., Rapp, J. T., & Frewing, T. M. (2013). Immediate and subsequent effects of response interruption and redirection on targeted and untargeted forms of stereotypy. *Behavior Modification, 37*, 591-610. 10.1177/0145445513485751.
- Royal, H. R. (2018). *The effects of specific behavioral interventions on vocal stereotypy: A systematic review* (Doctoral Dissertation, Nova Southeastern University). Retrieved from [https://nsuworks.nova.edu/fse\\_etd/162](https://nsuworks.nova.edu/fse_etd/162).
- Saini, V., Gregory, M. K., Uran, K. J., & Fantetti, M. A. (2015). Parametric analysis of response interruption and redirection as treatment for stereotypy. *Journal of Applied Behavior Analysis, 48*, 96-106. 10.1002/jaba.186.
- Shawler, L. A., Dianda, M., & Miguel, C. F. (2020). A comparison of response interruption and redirection and competing items on vocal stereotypy and appropriate vocalizations. *Journal of Applied Behavior Analysis, 53*, 355-365. 10.1002/jaba.596.
- Shawler, L. A., & Miguel, C. F. (2015). The effects of motor and vocal response interruption and redirection on vocal stereotypy and appropriate vocalizations. *Behavioral Interventions, 30*, 112-134. 10.1002/bin.1407.
- Shield, A., Cooley, F., & Meier, R. (2017). Sign language echolalia in deaf children with autism spectrum disorder. *Journal of Speech, Language, and Hearing Research, 60*, 1622-1634. 10.1044/2016\_JSLHR-L-16-0292.
- Sivaraman, M., & Rapp, J. T. (2019). Further analysis of the immediate and subsequent effect of RIRD on vocal stereotypy. *Behavior Modification, 0*, 1-24. 10.1177/0145445519838826.
- Sloman, K. N., Schulman, R. K., Torres-Viso, M., & Edelstein, M. L. (2017). Evaluation of response interruption and redirection during school and community activities. *Behavior Analysis: Research and Practice, 17*, 266– 273. 10.1037/bar0000061.

- Toper-Korkmaz, O., Lerman, D. C., & Tsami, L. (2018). Effects of toy removal and number of demands on vocal stereotypy during response interruption and redirection. *Journal of Applied Behavior Analysis, 51*, 757-768. 10.1002/jaba.497.
- Trasatti, C. K. (2017). *The effects of verbal operant training and response interruption and redirection on vocal stereotypy* (Doctoral Dissertation, Southern Illinois University Carbondale).
- Wells, J., Collier, L., & Sheehey, P. H. (2016). Decreasing vocal stereotypy of a youth with autism in a classroom setting. *Child and Family Behavior Therapy, 38*, 164-174. 10.1080/07317107.2016.1172887.
- Wunderlich, K. L., & Vollmer, T. R. (2015). Data analysis of response interruption and redirection as a treatment for vocal stereotypy. *Journal of Applied Behavior Analysis, 48*, 749-764. 10.1002/jaba