

John T. Rapp and Marc J. Lanovaz

Introduction

Individuals with intellectual disabilities often engage in one or more forms of repetitive behaviors such as body rocking, hand flapping, head rolling, object twirling, and echolalia (Bodfish, Crawford, Powell, & Parker, 1995). These repetitive behaviors are commonly referred to as stereotypy in the research literature on challenging behaviors (De Winter, Jansen, & Evenhuis, 2011; Lloyd & Kennedy, 2014). Given that stereotypy may take on many forms, Rapp and Vollmer (2005) proposed three defining characteristics to differentiate stereotypy from other forms of challenging behaviors. According to Rapp and Vollmer, stereotypy is characterized by (a) repetition, (b) movement invariance, and (c) persistence in the absence of social consequences. In other words, stereotypy is a category of repetitive invariant behaviors that have a nonsocial function; however, note that Rapp and Vollmer excluded repetitious, injurious behaviors from

the category of stereotypy. Lanovaz and Sladeczek (2012) extended this definition to include vocal forms of stereotypy, which they defined “as any repetitive sounds or words produced by an individual’s vocal apparatus that are maintained by nonsocial reinforcement” (p. 148).

These definitions of stereotypy include both structural and functional characteristics of the behavior. Thus, motor and vocal stereotypy may refer to behaviors with different forms but that share a common function. Assuming that two topographically similar repetitive behaviors have different functions, it is also possible for one to be considered as stereotypy and the other not. For example, the repetitive vocalizations of a child who repeats previously heard words to generate reinforcing auditory stimulation would be labeled as vocal stereotypy, whereas the repetitive vocalizations of another child who repeats words to access attention would not. It should be noted that other researchers have excluded the functional component from their definition of stereotypy (e.g., Cunningham & Schreibman, 2008; Kennedy, Meyer, Knowles, & Shukla, 2000). If we excluded the functional component, the repetitive vocalizations of both children in our previous examples would meet the definition of vocal stereotypy.

The main concern with excluding the functional component of the definition is that structurally similar behaviors with dissimilar functions may need considerably different treatments

J.T. Rapp (✉)

Department of Psychology, Auburn University,
226 Thach Hall, Auburn, AL 36849, USA
e-mail: jtr0014@auburn.edu

M.J. Lanovaz

École de psychoéducation, Université de Montréal,
C.P. 6128, succ. Centre-Ville, Montréal, QC H3C 3J7,
Canada

(Iwata, Pace, Cowdery, & Miltenberger, 1994; Kennedy et al., 2000; Wacker et al., 1990). In our previous examples, the child who sought auditory stimulation may benefit from listening to music on a regular basis, whereas the one who sought attention would rather benefit from learning how to request age-appropriate forms of attention. As such, the clinical utility of using the label “stereotypy” is limited unless the definition also includes a functional component. Moreover, researchers have clearly shown that motor forms of stereotypy are maintained by nonsocial reinforcement in at least 85 % of cases (Healy, Brett, & Leader, 2013; Matson, Bamburg, Cherry, & Paclawskyj, 1999; Querim et al., 2013). These results indicate that repetitive and invariant behaviors maintained by social consequences are uncommon. The current review will thus adopt a functional definition of stereotypy and make recommendations for behaviors maintained by nonsocial reinforcement. Practitioners and researchers who are faced with repetitive behaviors maintained by social reinforcement should use function-based interventions recommended for other topographies of challenging behavior (e.g., self-injurious behavior, aggression).

Innocuous behaviors such as singing in one’s car and playing simple video games sometimes share defining characteristics with stereotypy. Although repetitive, invariant, and maintained by nonsocial consequences, these behaviors are not typically considered as problematic. Practitioners and researchers should be cautious to treat only forms of stereotypy that (a) are a significant departure from social or cultural norms in which the person with an intellectual disability is integrated and (b) considerably interfere with the individual’s daily functioning, health, social inclusion, or learning given its frequency, duration, and/or intensity. As such, we do not recommend the treatment of generally accepted forms of stereotypy (e.g., masturbation, singing) unless the frequency, intensity, or context warrants intervention.

Unlike many types of challenging behaviors (e.g., aggression, destruction, self-injury), stereotypy does not necessarily produce direct harm to one’s self or others. However, stereotypy has

been associated with a number of behavioral deficits, which underline the importance of targeting it for reduction. First, to some extent, researchers have shown that engaging in stereotypy may interfere with learning new behavior (e.g., Chung & Cannella-Malone, 2010; Koegel & Covert, 1972; Lang et al., 2009; Lang, O’Reilly, et al., 2010). In a recent review, Lanovaz, Robertson, Soerono, and Watkins (2013) found that reducing engagement in stereotypy may increase engagement in socially appropriate behavior, suggesting that stereotypy may interfere with their occurrence. Second, higher levels of stereotypy have been associated with more significant impairments in adaptive behavior, social skills, and executive functioning as well as with the presence of self-injurious behaviors in individuals with intellectual and developmental disabilities (Bodfish et al., 1995; Evans, Kleinpeter, Slane, & Boomer, 2014; Gabriels, Cuccaro, Hill, Ivers, & Goldson, 2005; LeMonda, Holtzer, & Goldman, 2012; Matson, Cooper, Malone, & Moskow, 2008; Matson, Kiely, & Bamburg, 1997; Matson, Minshawi, Gonzalez, & Mayville, 2006; Richman et al., 2013). Reducing stereotypy may potentially improve the functioning of the individual and eventually facilitate social inclusion. Finally, Jones, Wint, and Ellis (1990) have shown that engaging in stereotypy may be a barrier to the inclusion of individuals with intellectual disabilities. Their results indicated that adolescents held more negative attitudes toward individuals who engaged in stereotypy than those who did not, which strongly supports the importance of reducing stereotypy in community settings.

Epidemiology of the Behavior

Several studies have examined the prevalence of stereotypy in children and adults with intellectual and developmental disabilities, but all have used structural definitions of stereotypy (e.g., Bodfish et al., 1995; Bodfish, Symons, Parker, & Lewis, 2000; Goldman et al., 2009; Lundqvist, 2011; Poppes, Van der Putten, & Vlaskamp, 2010; Rojahn, Matson, Lott, Esbensen, & Smalls, 2001). The issue of function notwithstanding the

impact of using a structural definition should be minimal given that these behaviors are maintained by nonsocial reinforcement for a high proportion of individuals (>85 %). In one of the only studies using direct observational measures, Goldman et al. (2009) reported that approximately 30 % of children with low IQ (i.e., <80) and 70 % of children with low IQ and autism spectrum disorders (ASD) engaged in one or more forms of motor stereotypy. Furthermore, children with ASD engaged in higher frequencies and in a larger variety of forms of stereotypy. Using parental ratings, Medeiros, Curby, Bernstein, Rojahn, and Schroeder (2013) found a higher prevalence in cohorts of younger children with Down syndrome (68 %), developmental delay (84 %), and at risk for autism (99 %). The difference may be due to the younger age, more severe cognitive deficits, and the use of parental ratings in the latter sample. Most other studies involving children with intellectual disabilities, ASD, or both have produced consistent results showing that the prevalence of stereotypy is higher in children with comorbid ASD and in those with lower IQs or lower levels of functioning (Campbell et al., 1990; Carcani-Rathwell, Rabe-Hasketh, & Santosh, 2006; Hattier, Matson, Macmillan, & Williams, 2012; Mayes & Calhoun, 2011; Medeiros, Kozlowski, Beighley, Rojahn, & Matson, 2012).

In a study with adults, Bodfish et al. (1995) found that approximately 60 % of adults with intellectual disabilities engaged in stereotypy. In a subsequent study involving individuals with severe to profound intellectual disability, Bodfish et al. (2000) noted that approximately 80 % and 90 % of individuals with and without comorbid autism, respectively, engaged in at least one form of stereotypy and that individuals with autism exhibited more forms. Other studies have found that the percentage of adults with intellectual disabilities that engaged in stereotypy varied between approximately 30 % and 80 % (e.g., Grey, Pollard, McClean, MacAuley, & Hastings, 2010; Lundqvist, 2011; Poppes et al., 2010; Rojahn et al., 2001). The large discrepancy is most likely due to the heterogeneous samples across studies; as with children, adults with ASD

with lower levels of functioning or lower IQ engaged in higher levels of stereotypy (Rojahn, Wilkins, Matson, & Boisjoli, 2010). The main limitation of the prevalence estimates is that most previous studies with both children and adults did not include a specific measure for vocal stereotypy, which most likely resulted in an underestimation of prevalence.

Typically developing children also engage in stereotypy as infants, but the behavior tends to fade as they grow older (Berkson & Tupa, 2000; MacLean, Ellis, Galbreath, Halpern, & Baumeister, 1991; Symons, Sperry, Dropik, & Bodfish, 2005; Thelen, 1979). The problem in children with intellectual disabilities is that stereotypy persists and may even increase when the behavior begins declining in children with typical development (Berkson, 2002; Berkson, Tupa, & Sherman, 2001; MacDonald et al., 2007; Richman & Lindauer, 2005). This persistence in stereotypy has also been observed in children raised in socially deprived environments (e.g., Beckett et al., 2002; MacLean, 2004). Several hypotheses have been proposed to explain the emergence and maintenance of stereotypy in individuals with intellectual disabilities (e.g., Guess & Carr, 1991; Hutt, Hutt, Lee, & Ounsted, 1964; Lewis, Gluck, Bodfish, Beauchamp, & Mailman, 1996; Lovaas, Newsom, & Hickman, 1987). However, the behavioral and the neurobiological interpretations are the only two hypotheses that have amassed substantial empirical support in the research literature (Lanovaz, 2011).

The behavioral interpretation hypothesizes that engaging in stereotypy generates a sensory reinforcing consequence, which maintains the behavior (e.g., Lovaas et al., 1987; Rapp, 2008). This process is referred to as automatic reinforcement in the behavior analytic research literature (Kennedy, 1994; Vollmer, 1994). Stereotypy is thus an operant behavior that is maintained by nonsocial reinforcement contingencies (i.e., independent of the social environment). For example, a child with intellectual disability may put nonedible objects in her mouth because the behavior generates a reinforcing gustatory or tactile form of stimulation. Similarly, an adult may

emit nonsensical sounds, which produce idiosyncratic reinforcing auditory stimulation. This hypothesis may explain why stereotypy is challenging to reduce: the practitioner has little direct control over the consequence maintaining the behavior. As noted by Rapp and Vollmer (2005), studies have strongly supported the behavioral interpretation by showing that (a) eliminating or attenuating the sensory consequence may extinguish stereotypy (e.g., Rapp, Miltenberger, Galensky, Ellingson, & Long, 1999; Rincover, Cook, Peoples, & Packard, 1979; Rincover & Devany, 1982), (b) stereotypy is influenced by processes known to alter the reinforcing value of consequences (e.g., Lang et al., 2009; Lang, Koegel, et al., 2010; Lang, O'Reilly, et al., 2010; Rapp, 2004, 2007), and (c) providing contingent access to stereotypy may function as a reinforcer for other behaviors (e.g., Charlop, Kurtz, & Casey, 1990; Hanley, Iwata, Thompson, & Lindberg, 2000).

In contrast, neurobiologists have attempted to explain the maintenance of stereotypy at a molecular and physiological level. The neurobiological interpretation postulates that stereotypy is the product of brain dysfunction. More specifically, researchers have implicated the basal ganglia pathways and the dopaminergic system in the maintenance and emergence of stereotypy (Garner, 2006; Langen, Durston, Kas, van Engeland, & Staal, 2011; Langen, Kas, Staal, van Engeland, & Durston, 2011; Lewis, Presti, Lewis, & Turner, 2006; Lewis, Tanimura, Lee, & Bodfish, 2007). That is, imbalances in dopamine and in other neurotransmitters may enhance or inhibit specific pathways in the basal ganglia, which may lead to the emission of stereotypy by individuals with intellectual disabilities. From a clinical standpoint, the utility of studies examining the neurobiological basis of stereotypy is still limited for now. To date, the only treatment that has been derived from the neurobiological interpretation is the use of selective serotonin reuptake inhibitors, which may reduce stereotypy by affecting the dopaminergic system (Hollander et al., 2005, 2012; McDougle et al., 1996). Nonetheless, research on neurobiology may yield insights that eventually lead to development of

new pharmacological treatments for stereotypy. The behavioral and neurobiological interpretations of stereotypy should not be perceived as incompatible; both provide descriptions of stereotypy at different levels. Neurobiology explains stereotypy at a molecular and physiological level, which may lead to the development of pharmacological interventions, whereas the behavioral interpretation examines processes that are amenable to behavior analytic interventions.

Criteria for Evidence-Based Treatments

The stereotypy literature contains numerous demonstrations of antecedent- and consequent-based interventions that decrease various forms of vocal and motor stereotypy (DiGennaro Reed, Hirst, & Hyman, 2012; Rapp & Vollmer, 2005). Although these interventions are described and critiqued within various review articles and book chapters, we reviewed the literature using the guidelines provided by Kratochwill et al. (2010) for visual analysis of treatment outcomes that are produced with single-case experimental designs (SCEDs). The Kratochwill et al. guidelines are twofold. First, design standards are imposed on each study to ensure that each demonstrates a high degree of internal validity with the stated SCEDs. Based on visual inspection of the SCEDs, each study is categorized as depicting strong evidence, moderate evidence, or no evidence. Second, evidence standards are imposed to determine the extent to which the combined outcomes across studies on each antecedent- or consequent-based intervention are empirically supported. As part of our analysis, we did not attempt to calculate effect size estimates as suggested by Kratochwill et al.

We used several criteria to categorize interventions as having strong, moderate, or no evidence. As a prerequisite for evaluating the empirical support for each antecedent and consequent intervention, we required that each study demonstrated the persistence of the target stereotypy (as defined above) in the absence of social consequences. These demonstrations could have

been provided via (a) a full functional analysis showing elevated levels of stereotypy in the alone or no-interaction condition or across numerous conditions (e.g., Iwata, Dorsey, Slifer, Bauman, & Richman, 1994) or (b) three or more consecutive alone or no-interaction conditions (e.g., Iwata & Dozier, 2008; Querim et al., 2013). In a recent review, DiGennaro Reed et al. (2012) found that relatively few studies conducted a functional analysis of behavior that was a priori deemed to be stereotypy. As an additional step in the evaluative process, we also considered that sensitivity of the method that was used to measure motor or vocal stereotypy. We viewed continuous measures such as continuous duration recording and continuous frequency recording as appropriate measurement systems. In addition, we included studies that employed small interval sizes of either partial interval recording or momentary time sampling (Meany-Daboul, Roscoe, Bourret, & Ahearn, 2007; Rapp et al., 2007; Rapp, Colby-Dirksen, Michalski, Carroll, & Lindenberg, 2008; Schmidt, Rapp, Novotny, & Lood, 2013; Wirth, Slaven, & Taylor, 2014). Studies that either employed only indirect measures of stereotypy or collapsed stereotypy with other target behavior (e.g., self-injurious behavior) were excluded from our analysis. In terms of identifying interventions with strong, moderate, or no evidence, we also considered the effects on nontargeted forms of stereotypy and appropriate behavior (e.g., Lanovaz et al., 2013). For example, an intervention may consistently decrease the targeted form of stereotypy for most participants but may intermittently increase nontargeted forms of stereotypy for some participants. In this way, the positive effects for the targeted form may be undermined by increases in nontargeted stereotypy.

For the purpose of this chapter, we categorized the totality of the results for each intervention as having (a) strong evidence in the literature, (b) moderate in the literature, and (c) limited or no support in the literature. Our *strong evidence* category was based on the three general criteria offered by Kratochwill et al. (2010, p. 21) for combining studies; the criteria are as follows. First, the literature must contain at least five

SCED studies that either meet evidence standards or meet evidence standards with reservations. Second, the five or more SCED studies must be published by at least three different research teams. Third, the five or more SCED studies must contain at least 20 data demonstrations across participants (note that Kratochwill et al. referred to SCED examples). Moreover, these participants had to have a reported diagnosis of intellectual disability (or mental retardation), ASD, developmental disability (or delay), or a combination. We also included a category of interventions with moderate evidence. Our *moderate evidence* category was also based on the three criteria described above; however, interventions in this category need only address two of the three criteria to fit this category (note that Kratochwill et al. did not suggest a category for moderate evidence). As the most common example, an intervention may fit into the *moderate evidence* category if five or more studies have been published by three or more research groups; however, the total combined number of SCED demonstrations across studies was less than 20. Interventions with limited or no evidence were those that did not adhere to at least two of the three criteria outline above. In some cases, the number of studies eligible in support of a given intervention was limited due to (a) failure to meet the SCED standards outlined by Kratochwill et al. (2010), (b) the evaluation of a nonspecific intervention that contained numerous antecedent- and consequent-based intervention components, or (c) both (a) and (b).

In addition to specific procedures described below, most antecedent- and consequent-based interventions require the conduct of one or more empirical preferences assessments to identify items that are either delivered contingently or noncontingently or removed contingently. Several preference assessment methods have been used repeatedly in the literature including the free-operant preference assessment method (FOPA: Roane, Vollmer, Ringdahl, & Marcus, 1998), the multiple stimulus without replacement method (MSWO: DeLeon & Iwata, 1996), the brief MSWO method (Carr, Nicolson, & Higbee, 2000), and the paired-choice method (Fisher et al., 1992). In addition, items identified with

any of the aforementioned methods can be further evaluated in a competing stimulus assessment (e.g., Piazza, Adelinis, Hanley, Goh, & Delia, 2000). A detailed description of each type of preference assessment method is beyond the scope of this chapter; however, a recent study by Weldy, Rapp, and Capocasa (2014) includes links to video tutorials of the FOPA and brief MSWO methods.

Antecedent Interventions

Based on the guidelines provided by Kratochwill et al. (2010), we identified two antecedent interventions with either strong or moderate evidence. In addition, there are a handful of antecedent interventions with little or no evidence. For each of the two antecedent interventions, we describe (a) a recent study that best illustrates the effects on stereotypy and (b) the potential strengths and limitations of the intervention from a practical perspective.

Strong evidence. This section will include descriptions of antecedent interventions with considerable empirical support. As indicated in prior literature reviews (e.g., DiGennaro Reed et al., 2012; Rapp & Vollmer, 2005), noncontingent reinforcement (NCR) with matched stimulation may be the most empirically supported intervention for treating vocal stereotypy (Lanovaz, Fletcher, and Rapp, 2009; Lanovaz, Rapp, and Ferguson, 2012; Lanovaz, Sladeczek, and Rapp, 2011, 2012; Love, Miguel, Fernand, and LaBrie, 2012; Rapp, 2007; Rapp et al., 2013; Saylor, Sidener, Reeve, Fetherston, and Progar, 2012; for a review of behavioral interventions for vocal stereotypy, see Lanovaz & Sladeczek, 2012) and motor stereotypy (Dozier, Iwata, Wilson, Thomason-Sassi, & Roscoe, 2013; Goh et al., 1995; Higbee, Chang, & Endicott, 2005; Lanovaz & Argumedes, 2010; Piazza et al., 2000; Rapp et al., 1999; Simmons, Smith, & Kliethermes, 2003; Tang, Patterson, & Kennedy, 2003; Wilder, Kellum, & Carr, 2000). Piazza et al. (1998, 2000) introduced the concept of matching the overt stimulation generated by engaging with alternative items to the putative

stimulation generated by engaging in automatically reinforced behavior (e.g., pica, motor stereotypy). The process for identifying matched stimuli is twofold. First, a practitioner employs a method of preference assessment to evaluate the extent to which the individual displays a relative preference for matched items. Second, a practitioner evaluates the extent to which engagement with preferred matched (or unmatched) items competes with engagement in stereotypy using a competing stimulus assessment or another brief assessment couched within an appropriate SCED.

Based on methodology articulated by Simmons et al. (2003), Lanovaz et al. (2009) and Rapp (2007) later distinguished between a structurally matched stimulus, as identified by procedures described by Piazza et al. (2000), and a functionally matched stimulus, which was not only structurally matched to the putative product of stereotypy but also was empirically demonstrated to decrease immediate engagement in the targeted stereotypy without increasing stereotypy (relative to a no-intervention baseline) after the preferred item was removed. We elaborate on procedures and methodology for identifying functionally matched stimuli in the “Translation of Research to Practice” section below. For purposes of this section, matched stimulation need only be shown to decrease immediate engagement in the targeted stereotypy.

A study by Lanovaz, Rapp, et al. (2012) illustrates the procedures for implementing NCR with continuous access to matched stimulation for decreasing vocal stereotypy for multiple participants. Although fixed and variable time schedules are variations of NCR, nearly all of the studies cited here involved NCR with continuous access to empirically identified items (the main exception being those that used edible stimuli to reduce mouthing). Based on the hypothesis that auditory stimulation from music would compete with auditory stimulation produced by engagement in vocal stereotypy, Fig. 28.1 shows that Lanovaz et al. identified each participant’s most and least preferred music genres using a variation of paired-choice preference assessment (Horrocks & Higbee, 2008). Thereafter, Lanovaz et al. demonstrated that vocal stereotypy persisted across consecutive no-interaction sessions for each of their

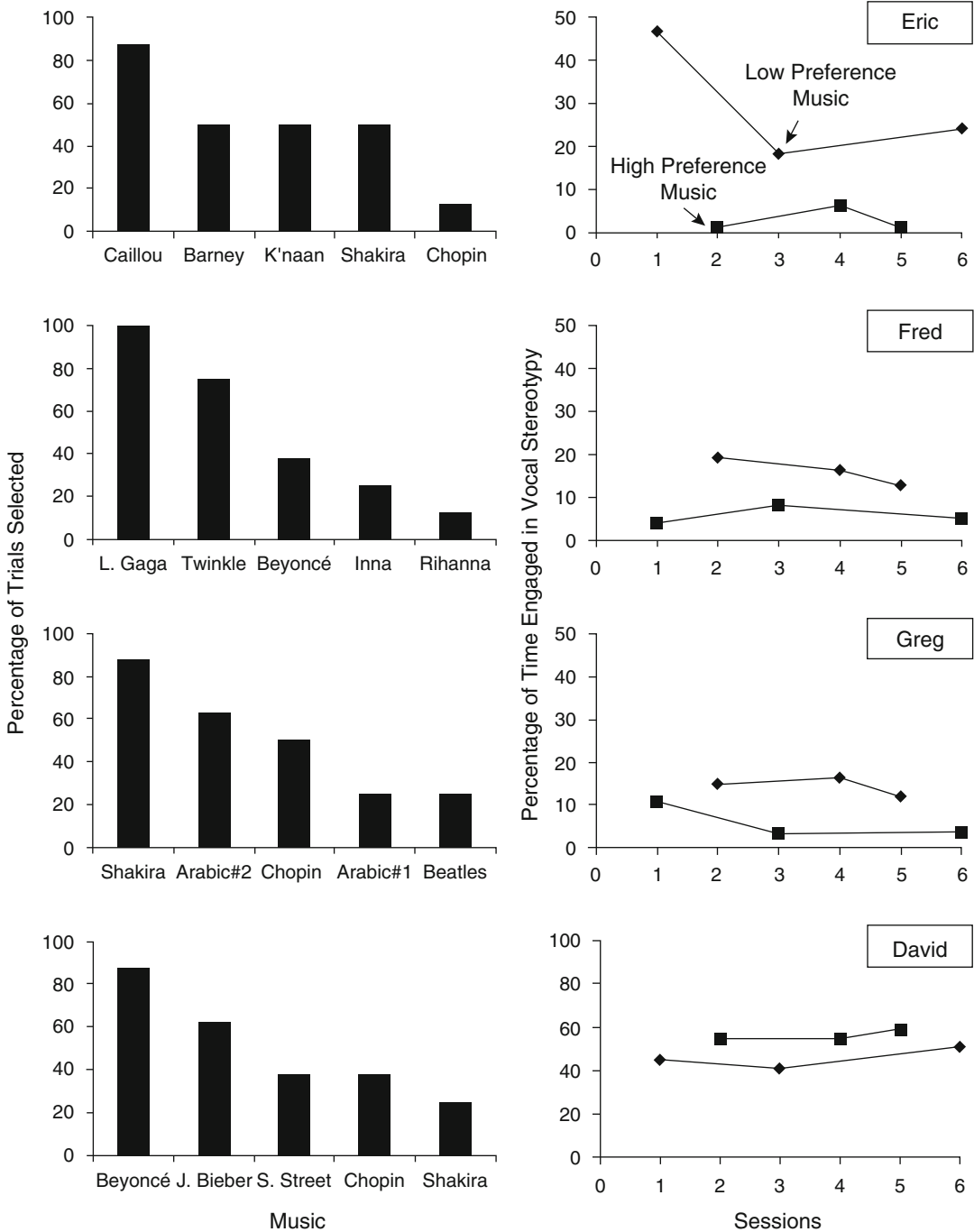


Fig. 28.1 Percentage of trials Eric, Fred, Greg, and David selected each song (*left*) and percentage of time each participant engaged in vocal stereotypy when high- and low-preference music played (*right*). Reprinted from Lanovaz, M. J.; Rapp, J. T.; and Ferguson, S. (2012). The

utility of assessing musical preference before implementation of noncontingent music to reduce vocal stereotypy. *Journal of Applied Behavior Analysis*, 45, 845–851. doi:10.1901/jaba.2012.45-845

four participants. Subsequently, Lanovaz, Rapp, et al. used multielement designs to show that high-preference music produced lower levels of vocal stereotypy than low-preference music for three of the four participants during relatively brief sessions. In addition, Lanovaz et al. (see Fig. 28.2) showed that vocal stereotypy was substantially lower for the same three participants when their high-preference music was provided versus when no alternative stimulation was available.

Indeed, NCR with matched stimulation may be the most empirically supported intervention for treating vocal stereotypy and, likewise, perhaps the primary advantage of this intervention is the relative ease of implementation compared to consequent interventions (see below). Nevertheless, NCR with matched stimulation is not without potential limitations. First, engagement with alternative stimulation that is provided during NCR interventions may compete with academic engagement in much the same way as engagement in stereotypy (Enloe and Rapp, 2014; Shillingsburg, Lomas, and Bradley, 2012; but see also Lanovaz, Sladeczek, et al., 2012). As such, this intervention may not lend itself well to application during instructional segments. Second, most studies involve session durations of 10 min or less. Thus, the duration of time for which a practitioner should expect matched, preferred items to compete with stereotypy is not clear. Relatedly, it is not clear how often preference assessments should be updated in order to identify items that will compete with engagement stereotypy over time. Third, at least one recent study has shown that preferred, matched stimulation may decrease vocal stereotypy while simultaneously increasing other, previously less probable, forms of motor stereotypy (Rapp et al., 2013). On a broader level, given the different sensory consequences that are produced by engagement in vocal stereotypy versus the various forms of motor stereotypy, more research is needed to determine if NCR with matched stimulation has robust effects for decreasing the various forms of motor stereotypy, such as body rocking, hand flapping, and object spinning, among others.

Moderate evidence. The only behavioral intervention in this category is antecedent exercise.

Not unlike NCR, interventions involving antecedent exercise potentially contain provisions of alternative forms of stimulation, which may compete with or substitute for stimulation generated by engaging in stereotypy (e.g., Morrison, Roscoe, and Atwell, 2011). However, interventions involving antecedent exercise differ from those involving NCR insofar as the former interventions typically involve active participation in gross motor movements that increase cardiovascular activity (e.g., jogging for 20 min), whereas the latter interventions may involve passive, sedentary consumption of ambient stimulation (e.g., listening to music or manipulating items that produce auditory stimulation).

Lang, Koegel, et al. (2010) recently reviewed group-design and SCED studies on the effects of physical exercise on problem behavior displayed by individuals with ASD. Lang, Koegel, et al. highlighted a number of interpretative problems with several studies in this area of the literature; however, they concluded that the overall results suggest individuals with ASD may benefit from regular physical activity. Several SCED (Bachman & Sluyter, 1988; Celiberti, Bobo, Kelly, Harris, & Handleman, 1997; Kern, Koegel, & Dunlap, 1984; Kern, Koegel, Dyer, Blew, & Fenton, 1982; Morrison et al., 2011; Watters & Watters, 1980) and group-design (e.g., Rosenthal-Malek & Mitchell, 1997) studies provide evidence of the effects of physical exercise for reducing one or more forms of vocal or motor stereotypy. Because the actual procedures vary from study to study (jogging is among the most common activities), the extent to which physical exercise should be referred to as a unitary independent variable is not clear. Nevertheless, physical exercise should be viewed as an intervention with moderate evidence for decreasing motor stereotypy.

A study by Morrison et al. (2011) illustrates the manner in which interventions involving antecedent exercise should be developed and implemented to decrease motor stereotypy or other problem behaviors for individuals with autism. Morrison et al. first conducted paired-choice stimulus preference assessments to identify leisure and exercise items for two individuals

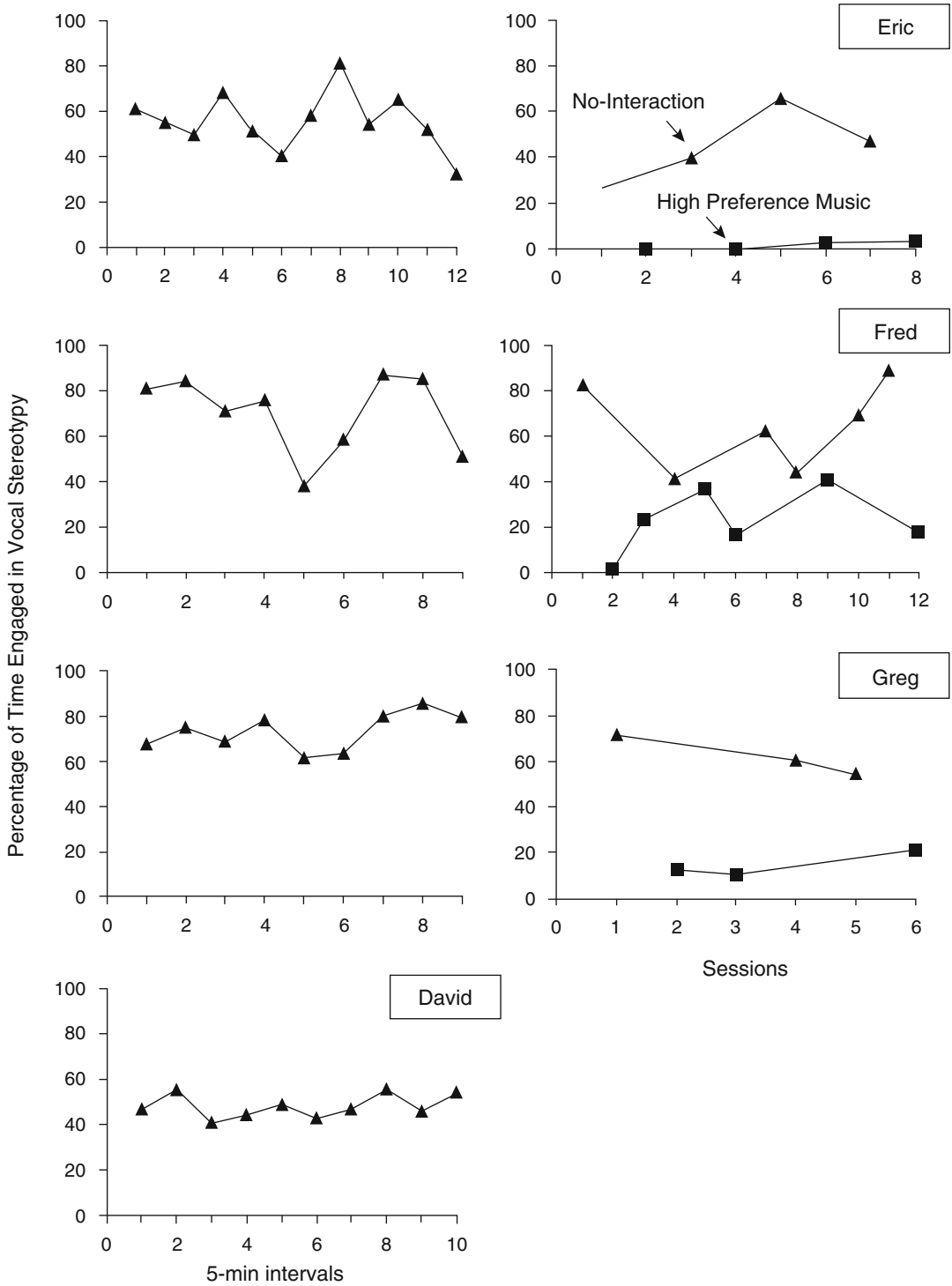


Fig. 28.2 Percentage of time Eric, Fred, Greg, and David engaged in vocal stereotypy during the free-operant observation periods (left) and during no-interaction and high-preference music sessions (right). Reprinted from Lanovaz, M. J.; Rapp, J. T.; and Ferguson, S. (2012). The

utility of assessing musical preference before implementation of noncontingent music to reduce vocal stereotypy. *Journal of Applied Behavior Analysis*, 45, 845–851. doi:10.1901/jaba.2012.45-845

with autism who displayed motor stereotypy. Thereafter, Morrison et al. evaluated the separate effects of an exercise item, a leisure item, and social interaction (as a control comparison) using a three-component multiple schedule, which is a variation of a multielement design. Specifically, each session was comprised of three, 10-min components (pre-intervention, intervention, and post-intervention). As an illustration of the effects, we focus on the results of the immediate and subsequent effects of each intervention on motor stereotypy displayed by a participant named Steve. Most notably, the results for the exercise-item assessment indicated that engagement with the exercise item (a) decreased Steve's immediate engagement in stereotypy during each session and (b) exerted a residual effect such that Steve's stereotypy remains low for a period of time after the intervention was removed. Results also showed that the leisure item decreased Steve's motor stereotypy; however, in most sessions Steve's engagement in motor stereotypy often increased above pre-intervention levels after the leisure item was removed. Finally, results for the social interaction (control) assessment indicated that social interaction, alone, did not decrease Steve's engagement in stereotypy. Together, the analyses for Steve show that a specific type of physical activity decreased his immediate and subsequent engagement in motor stereotypy.

An inherent strength of interventions involving exercise is the likely health benefits that are produced by regular exercise. A potential limitation of such interventions is that procedures (e.g., prompting, reinforcement, prompt fading) are often needed to train individuals to engage in the exercise activities. In addition, some studies report that stereotypy returns to baseline levels within 45 min of the exercise intervention. As was noted for NCR, antecedent exercise is an unlikely treatment of choice during instructional segments.

Limited or no evidence. Under typical circumstances, it makes little sense to discuss interventions for stereotypy that are not supported by at least a moderate level of evidence. Nevertheless, numerous studies have employed sensory inte-

gration therapy (SIT) procedures such as body brushing, joint compression, deep pressure, hammock swinging, and weighted vests, among others, to reportedly decrease problem behavior such as vocal and motor stereotypy. Lang et al. (2012) review studies on the use of SIT for problem behavior in individuals with ASD. As a whole, Lang et al. concluded that most SIT studies did not yield positive effects on problem behavior (including motor and vocal stereotypy), and the few studies that did report positive outcomes contained one or more methodological problems. Our conclusions parallel those provided by Lang et al. (2012).

Consequence Interventions

Based on the guidelines provided by Kratochwill et al. (2010), there are four consequent interventions for motor and vocal stereotypy with strong or moderate evidence. To be defined as consequent-based intervention, the treatment in questions has to include delivery of a specified consequence for (a) engagement in motor or vocal stereotypy, (b) engagement in appropriate response (e.g., task engagement, communication), (c) not engaging in motor or vocal stereotypy, or (d) any combination of (a), (b), and (c). As with antecedent interventions, our description of each consequent intervention includes a recent study that best illustrates the effects on stereotypy, as well as the potential strengths and limitations of the consequent intervention.

Strong evidence. There is only one consequent-based intervention for stereotypy that fits into this category. Research on overcorrection procedures for stereotypy and other problem behavior spans over four decades. We should note that just because there is strong empirical support for the use of overcorrection procedures to decrease stereotypy does not mean that it should be viewed as a "first-line" intervention. Contrarily, reinforcement-based procedures with at least moderate empirical support should be implemented prior to interventions involving either positive or negative punishment (e.g., Miltenberger, 2012).

Although the literature contains various iterations of overcorrection procedures (e.g., Miltenberger, 2012), the variation that has garnered the most empirical support is positive practice overcorrection (PPOC), which involves the response contingent application of additional effort by an intervention agent in the form of repetitive engagement in an appropriate behavior (Anderson & Le, 2011; Foxx & Azrin, 1973; Coleman, Montgomery, Wilson, & Milan, 2000; Harris & Wolchik, 1979; Peters & Thompson, 2013; Roberts, Iwata, McSween, & Desmond, 1979; Rollings, Baumeister, & Baumeister, 1977; Wells, Forehand, & Hickey, 1977; Wells, Forehand, Hickey, & Green, 1977). When treating stereotypy, a typical form of PPOC involves a trainer manually guiding the individual who emitted stereotypy to manipulate a toy or leisure item for a prespecified period of time (e.g., 30 s).

A recent study by Peters and Thompson (2013) evaluated (a) the effects of PPOC on stereotypy displayed by children with ASD and (b) the extent to which the activity used in overcorrection is preferred or not preferred by the participant which alters the effects for reducing motor stereotypy. Prior to evaluating the effects of PPOC, Peters and Thompson conducted paired-stimulus preference assessments to identify high- and low-preference activities for each. Thereafter, Peters and Thompson used a multiple baseline across high and low activities with an embedded reversal for each participant; we focus on results for a participant named Max. During baseline, no social consequences were provided for Max's engagement with the activity or for his engagement in motor stereotypy. In the PPOC condition, Max's engagement in motor stereotypy was immediately followed by physical guidance from a trainer for Max to manipulate an item for 30 s. The results show that Max's motor stereotypy decreased rapidly following the implementation of PPOC. In addition, as an indirect effect of PPOC, results show that engagement with the activity that was used during the PPOC procedure increased. In this way, a positive punishment procedure may decrease problem behavior while simultaneously increasing appropriate behavior.

An obvious strength of this procedure is the concurrent acquisition of a social appropriate alternative response (e.g., playing with toys); however, such acquisition is only noted in approximately half of the studies. By contrast, a limitation, which appears to be common to most punishment procedures when intervening on nonsocially reinforced behavior, is the need to continue to implement PPOC across sessions (see below). Moreover, PPOC is a relatively invasive punishment procedure that is not viewed as a first-line intervention (e.g., Bailey & Burch, 2011).

Moderate evidence. Three consequent interventions fit this category. The first is differential reinforcement of other behaviors (DRO), which is among the oldest and most traveled behavioral interventions for problem behavior. The second intervention in this category is response interruption and redirection (RIRD), which is a relatively new intervention (at least in name). This intervention arguably contains a combination of overcorrection for engagement in stereotypy and social reinforcement for appropriate behavior (e.g., praise for appropriate speech). However, the provision of social reinforcement is typically a part of baseline sessions. As such, results across studies suggest that the consequences provided for stereotypy are the operative component of RIRD. The third class of intervention, which, like DRO, has been in application for quite some time, is response cost (RC) and time out (TO). To fit within this latter category, studies must have empirically demonstrated the participant's preference for the items that were removed or withheld contingent on stereotypy.

Differential reinforcement of other behaviors. This intervention involves delivery of one or more empirically identified preferred items contingent on the omission of the target stereotypy for a specified period of time. That is, the stimulus that is delivered following the omission of stereotypy may not be functionally related to the stimulation that is generated by engagement in stereotypy. As such, the individual must abstain from engaging in stereotypy for a specified period of time in order to access an alternative reinforcer. Numerous studies have shown that DRO

with preferred items produced clinically significant decreases in motor or vocal stereotypy (Fritz, Iwata, Rolider, Camp, and Neidert, 2012; Lanovaz and Argumedes, 2010; Lustig et al., 2013; Nuernberger, Vargo, and Ringdahl, 2013; Patel, Carr, Kim, Robles, and Eastridge, 2000; Repp, Dietz, and Speir, 1974; Ringdahl et al., 2002; Shabani, Wilder, and Flood, 2001; Rozenblat, Brown, Brown, Reeve, and Reeve, 2009; Taylor, Hoch, & Weissman, 2005, but see Lanovaz and Argumedes, 2009). As a collective whole, studies in this literature meet all three criteria for demonstrating *strong* evidence; however, we have placed DRO in the category of moderate evidence for two reasons. First, although each of the aforementioned studies decreased motor or vocal stereotypy using DRO, only half of the aforementioned studies demonstrated (or attempted to demonstrate) that the DRO schedule could be thinned to a practical variation (e.g., DRO 5 min). We suspect that practitioners will find DRO with small intervals (e.g., 30 s) to be of limited utility in applied settings. Second, in about a third of the studies that did thin the DRO schedule to at least 5-min intervals, researchers implemented self-monitoring procedures with participants prior to applying DRO procedures. As such, it is not clear whether DRO procedures will decrease stereotypy to the same extent for individuals who cannot monitor their own behavior.

A study by Taylor et al. (2005) exemplifies the steps that are needed to decrease stereotypy using DRO. First, Taylor et al. demonstrated that the vocalizations of a 6-year-old girl persisted across test and control condition of a functional analysis. Next, Taylor et al. used a multielement design to show that the participant's vocal stereotypy decreased with matched toys (i.e., those that produced auditory stimulation). Subsequently, Taylor et al. used a concurrent operant assessment (i.e., a variation of a preference assessment) to demonstrate that the participant preferred to manipulate operative auditory toys (matched toys) over nonoperative auditory toys (matched toys without batteries). Using an ABCBC reversal design, where B denotes fixed-time (FT) 1 min delivery of matched, operative toys and C

denotes DRO (resetting) 1 min delivery of matched, operative toys, Taylor et al. demonstrated that vocal stereotypy decreased with DRO 1 min, but not FT 1 min. Moreover, Taylor et al. showed that vocal stereotypy gradually decreased to near-zero levels as they (a) thinned the DRO schedule to 5 min and (b) implemented the intervention in novel settings. Furthermore, the authors provide long-term follow-up data indicating that the effects of the ongoing DRO intervention persisted over 9 months.

There are several important considerations when implementing DRO. First, DRO can be a complex and time-intensive intervention, particularly when the schedule involves relatively brief (e.g., 20 s), resetting intervals. Likewise, although there are some general guidelines for basing the initial DRO schedule on the mean interresponse time (IRT) from baseline observations (e.g., Cooper, Heron, & Heward, 2007), guidelines for thinning the DRO schedule across sessions are less formal (but see Cooper et al., 2007, p. 479). For example, Nuernberger et al. (2013) doubled the DRO interval after every two sessions without stereotypy. Alternatively, Rozenblat et al. (2009) have shown that percentile schedules based on the IRTs of stereotypy bouts may be useful for guiding decisions about both the initial DRO schedule and schedule thinning. Second, as previously noted, some of the aforementioned studies implemented DRO procedures in conjunction with self-monitoring procedures (e.g., Nuernberger et al., 2013; Ringdahl et al., 2002). Nevertheless, results from a study by Fritz et al. (2012) suggest that when DRO is used in conjunction with self-monitoring procedures, decreases in stereotypy are likely attributable to reinforcement contingencies (e.g., the omission of stereotypy or engagement in alternative behavior). Third, studies for which researchers were able to demonstrate consistent reductions in stereotypy with DRO schedules of 5 min or longer typically included participants with developed academic repertoires (e.g., individuals who could write, follow instructions, or both).

Response interruption and redirection. Since the introduction of RIRD as a formal procedure to treat vocal stereotypy (Ahearn, Clark,

MacDonald, & Chung, 2007), multiple studies have replicated the initial effects with vocal stereotypy (e.g., Ahrens, Lerman, Kodak, Worsdell, & Keegan, 2011; Cassella, Sidener, Sidener, & Progar, 2011; Colón, Ahearn, Clark, & Masalsky, 2012; Giles, St. Peter, Pence, & Gibson, 2012; Guzinski, Cihon, & Eshleman, 2012; Liu-Gitz & Banda, 2009; Love et al., 2012; Miguel, Clark, Tereshko, & Ahearn, 2009; Schumacher & Rapp, 2011) and a few studies have produced similar effects with motor stereotypy (Ahrens et al., 2011; Pastrana, Rapp, & Frewing, 2013). As described by Ahearn et al. (2007), RIRD involved two components. First, contingent on an individual's engagement in stereotypy, an intervention agent requires the participant to respond to three consecutive questions without engaging in stereotypy; this component is not unlike overcorrection. Second, the intervention agent delivers social reinforcement for appropriate vocal behavior. Based on the Kratochwill et al. (2010) criteria, there is relatively strong evidence for the use of RIRD to decrease vocal stereotypy; however, studies within the RIRD literature have employed multiple variations of RIRD procedures (Martinez & Betz, 2013). For example, some studies provided reinforcement for alternative behavior, whereas an equal number of studies did not. In addition, studies varied in the manner with which the contingent demands were provided and whether the time period wherein contingent demands were provided was removed from the total session time. As such, the extent to which RIRD should be considered a single intervention is not clear. Nevertheless, the fact that studies employing similar but not identical procedures yield comparable outcomes suggests that the procedure may be useful for some individuals in some contexts.

Results for a participant in the original study by Ahearn et al. (2007) illustrate how RIRD can be implemented to decrease vocal stereotypy. Specifically, Ahearn et al. evaluated the effects of RIRD on Mitch's vocal stereotypy using an ABAB reversal design. The authors opted to collect data on Mitch's vocal stereotypy using 10-s momentary time sampling, which is sufficiently sensitive for measuring changes in duration

events (Meany-Daboul et al., 2007; Rapp et al., 2007, 2008; Wirth et al., 2014). In addition, the authors collected data on Mitch's engagement in appropriate vocalizing. During baseline, Mitch was seated in a room that was relatively devoid of alternative forms of stimulation. A teacher provided social reinforcement for Mitch's appropriate vocal responses, but she ignored Mitch's engagement in vocal stereotypy. During the RIRD phase, the teacher continued to provide social reinforcement for Mitch's appropriate vocal behavior; however, she delivered a series of social questions to Mitch contingent on his engagement in vocal stereotypy. The teacher stopped providing the social questions after Mitch responded to three consecutive questions without engaging in vocal stereotypy. Results showed that RIRD decreased Mitch's vocal stereotypy and increased his appropriate vocalizing.

As noted above, the majority of studies have evaluated the effects of RIRD, which requires vocal responses, on vocal stereotypy. By contrast, only a few studies have evaluated the effects of RIRD (Ahrens et al., 2011; Pastrana et al., 2013), which requires motor responses contingent on motor or vocal stereotypy. Nevertheless, when studies on the effects of motor RIRD are considered in conjunction with studies on PPOC, there seems to be sufficient evidence for motor RIRD and related variations. Perhaps the most noteworthy limitation of RIRD is the potential need to interrupt stereotypy on a continuous basis. Specifically, the number of times an intervention agent implements RIRD may not decrease across sessions (e.g., Cassella et al., 2011; Pastrana et al., 2013). In a recent study that compared RIRD to NCR with matched stimulation for decreasing vocal stereotypy, Carroll and Kodak (2014) found that the effects of RIRD may be overestimated when the time spent implementing the interruption and compliance sequence was not factored into the total session time. By contrast, NCR with matched stimulation was found to be a more efficient intervention than RIRD. In addition, a recent review article by Lydon, Healy, O'Reilly, and McCoy (2013) provided a generally conservative conclusion about the effectiveness of response

interruption procedures for treating various types of problem behaviors displayed by individuals with intellectual disabilities.

Response cost and time out. Miltenberger (2012) defined TO as “the loss of access to positive reinforcers for a brief period of time contingent on...behavior” (p. 344), whereas Miltenberger defined RC as “the removal of a specified amount of a reinforcer contingent on...behavior” (p. 352). Regardless of the very minor procedural variations, both RC and TO are classified as negative punishment procedures. For the purpose of this section, we combined studies that evaluated the effects of either RC or TO on stereotypical behavior. In most studies, if noncontingent, continuous access to empirically identified preferred items did not decrease motor or vocal stereotypy to clinically acceptable levels, then access to the items was briefly removed contingent on engagement in motor or vocal stereotypy (Falcomata, Roane, Hovanetz, Kettering, & Keeney, 2004; Rapp, Patel, Ghezzi, O’Flaherty, & Titterington, 2009; Shillingsburg et al., 2012; Vollmer, Marcus, & LeBlanc, 1994; Watkins & Rapp, 2014).

Falcomata et al. (2004) used an ABCACBC reversal design to evaluate the effects of NCR (matched) and NCR (matched) plus RC on vocal stereotypy emitted by a young adult with autism (Derek). During the NCR phase, Derek was provided continuous access to a radio, which was identified as highly preferred via a stimulus preference assessment. During the NCR plus RC condition, Derek had continuous access to the radio unless he engaged in vocal stereotypy. Following each instance of vocal stereotypy, an intervention agent removed the radio for 5 s. Results indicated that NCR decreased Derek’s engagement in vocal stereotypy, but not to clinically acceptable levels. Subsequently, the addition of RC to NCR decreased Derek’s vocal stereotypy to zero or near-zero levels. Conceptually, it is likely that the RC is effective because the stimulation generated by engagement with preferred items is momentarily more valuable than the stimulation generated by engagement in stereotypy (Falcomata et al., 2004). As such, the individual learns to abstain

from engaging in stereotypy to avoid losing a more preferred consequence.

A potential strength of either RC or TO is that either can be readily implemented when NCR does not produce clinically significant reductions in stereotypy, as demonstrated in the Falcomata et al. (2004) study. Likewise, the procedures may be particularly useful during academic segments, as demonstrated in a study by Shillingsburg et al. (2012). As with other punishment procedures, however, a potential limitation of these negative punishment procedures is that decreases in the targeted stereotypy may be correlated with increases in other forms of stereotypy (Rapp, 2005).

Combining Antecedent and Consequent Interventions

The implementation of interventions involving stimulus control procedures (most often the signaled delivery of a positive punisher) is predicated on the assumption that engagement in stereotypy can be permitted in some situations (e.g., during leisure time), but not others (e.g., during instructional periods). Across studies, researchers have used various punishment procedures (e.g., verbal reprimands, response blocking, RC, RIRD, TO) for engagement in vocal or motor stereotypy and various antecedent stimuli (e.g., poster boards, wrist bands) to signal punishment delivery, and some have include reinforcement for appropriate behavior (Anderson, Doughty, Doughty, Williams, & Saunders, 2010; Brusa & Richman, 2008; Conroy, Asmus, Sellers, & Ladwig, 2005; Cook, Rapp, Gomes, Frazer, & Lindblad, 2014; Doughty, Anderson, Doughty, Williams, & Saunders, 2007; Haley, Heick, & Luiselli, 2010; Langone, Luiselli, & Hamill, 2013; McKenzie, Smith, Simmons, & Soderlund, 2008; O’Connor, Prieto, Hoffman, DeQuinzio, & Taylor, 2011; Rapp et al., 2009). Furthermore, studies vary considerably in the duration of the free access (when stereotypy is permitted) versus restricted access (when mild punishment is provided contingent on stereotypy) conditions. These variations notwithstanding, there is

burgeoning empirical support for the use of stimulus control procedures to treatment motor and vocal stereotypy; however, as with RIRD, the extent to which studies in the category evaluated a common intervention is debatable. Nevertheless, because stimulus control procedures have the potential to be useful in a variety of settings, we have opted to highlight the application of such procedures in this section.

A recent study by Cook et al. (2014) evaluated (a) the extent to which verbal reprimands decreased five individuals' engagement in targeted and untargeted stereotypy and (b) whether inhibitory stimulus control of the targeted stereotypy could be acquired during a signaled punishment condition. The effects of the procedures are illustrated here for a participant named Hannah. Prior to conducting the treatment evaluation, Cook et al. (2014) showed that Hannah's body rocking and arm flapping occurred almost exclusively when music was present (see Fig. 28.3). During the NC condition, the participant had free access to engage in the targeted or untargeted stereotypy without social consequence. During the

RC condition, a trainer delivered a mild verbal reprimand following each instance of the targeted stereotypy but did not specifically provide consequences for the participant's engagement in the untargeted stereotypy. Figure 28.4 shows that Hannah's body rocking (upper panel) decreased in the RC condition and remained at high levels in the NC condition. In addition, results suggest that Hannah's arm flapping decreased in the RC condition. Cook et al. also found that relatively few reprimands (upper panel, secondary y-axis) were required per session to maintain near-zero levels of stereotypy, and the RC sessions could be increased to 10 min, while the NC sessions were decreased to 1 min.

There are several issues stemming from the use of signaled punishment procedures. First, across studies it is not clear if the antecedent stimulus exerts effects when inhibitory control is not achieved. When inhibitory control is achieved, it is likely to be temporary. Second, as with RIRD, it may be necessary to deliver the punisher on an ongoing basis across sessions, which can diminish the clinical utility of the

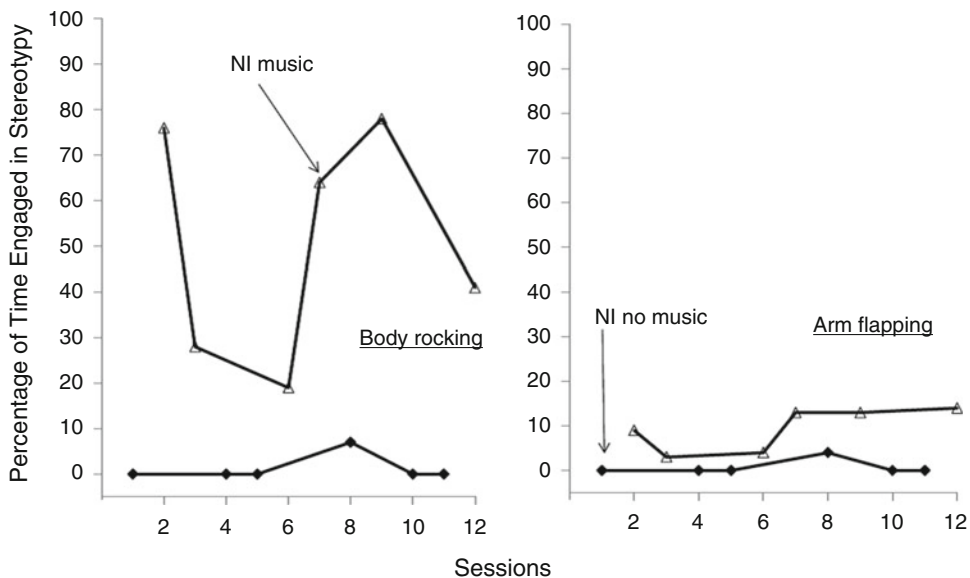


Fig. 28.3 Percentage of time Hannah engaged in body rocking (*left panel*) and arm flapping (*right panel*) during no-interaction (NI) music versus NI no music conditions. Reprinted from Cook, J. L.; Rapp, J. T.; Gomes, L. A.;

Frazer, T. J.; and Lindblad, T. L. (2014). Effects of verbal reprimands on targeted and untargeted stereotypy. *Behavioral Interventions*, 29, 106–124. doi:10.1002/bin.1378

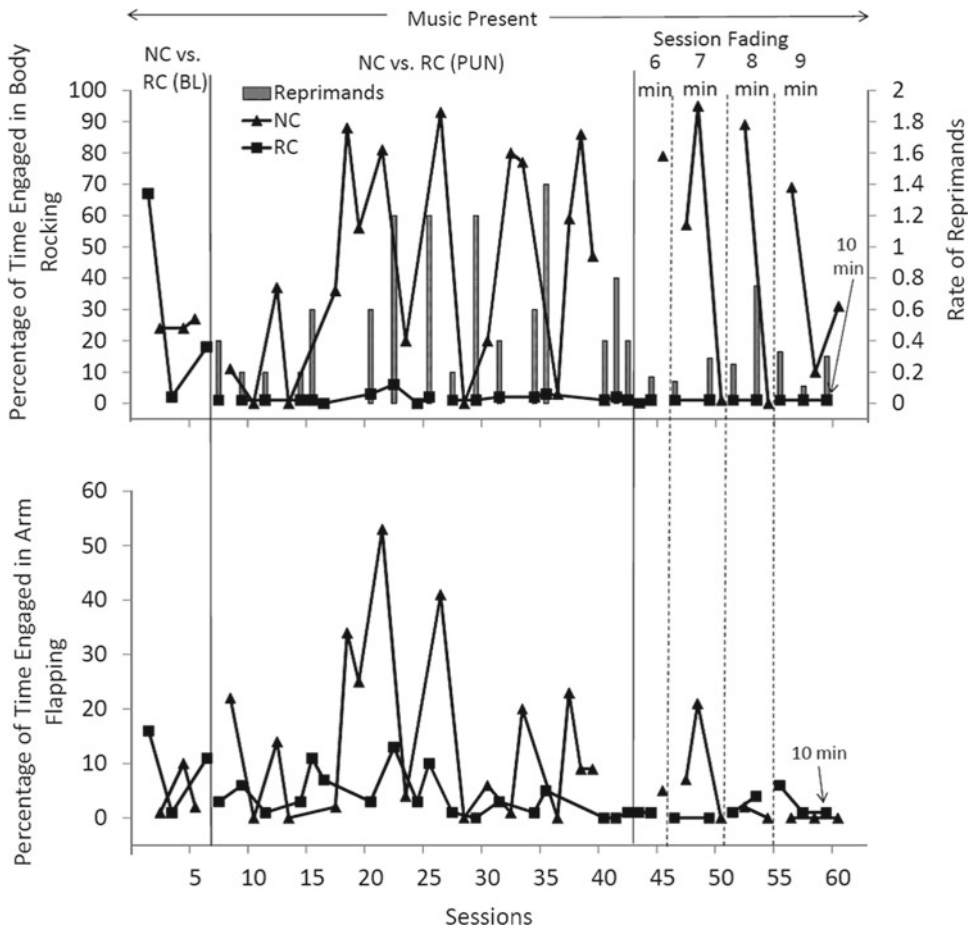


Fig. 28.4 Percentage of time Hannah engaged in body rocking (targeted; primary y-axis) and rate of reprimands (secondary y-axis) given by the experimenter (*upper panel*) and percentage of time Hannah engaged in arm flapping (untargeted, *lower panel*) during the no card (NC) versus red card (RC, baseline [BL]), the NC versus

RC (punishment [PUN]), and the session-fading phases. Reprinted from Cook, J. L.; Rapp, J. T.; Gomes, L. A.; Frazer, T. J.; and Lindblad, T. L. (2014). Effects of verbal reprimands on targeted and untargeted stereotypy. *Behavioral Interventions*, 29, 106–124. doi:10.1002/bin.1378

intervention. Finally, as shown with other participants in the Cook et al. (2014) study, punishment procedures may either increase or decrease untargeted forms of stereotypy (Lanovaz et al., 2013). Practitioners may also find that it is necessary to implement one intervention in one context and a different class of intervention in another context for the same individual. For example, a trainer could use signaled RIRD, with the intention of producing inhibitory stimulus control of stereotypy during instructional segments and NCR with matched stimulation during leisure periods.

Translation of Research to Practice

Treatment selection. One common problem faced by practitioners attempting to reduce engagement in stereotypy is determining which treatment should be selected for any given individual with intellectual disability. Albeit many interventions having strong or moderate empirical support to reduce stereotypy, treatment selection remains challenging as few studies have compared one or more interventions together. Nonetheless, Lanovaz et al. (2014) recently proposed an inter-

vention selection model for reducing engagement in vocal stereotypy. Figure 28.5 illustrates an adapted version of the model in which we incorporated the treatment of motor stereotypy. When developing the model, we considered research evidence, ease of use, context of implementation, restrictiveness, and topography of stereotypy.

For vocal stereotypy, the model recommends NCR with prompting first. The intervention involves continuous access to preferred music and prompting when the person is not appropriately engaged (e.g., playing, completing a task). Noncontingent reinforcement is recommended before other interventions for several reasons. First, NCR is easier to implement than differential reinforcement and less restrictive than RIRD or RC/TO. Second, NCR has strong empirical support in the research literature. Third, some studies suggest that music (i.e., matched stimulus typically used to reduce vocal stereotypy) does not generally interfere with ongoing behaviors, which makes it possible to implement in most contexts when headphones are used (Burlison, Center, & Reeves, 1989; Lanovaz, Rapp, et al., 2012; Lanovaz, Sladeczek, et al., 2012). Finally, the prompting component is essential as reducing stereotypy does not necessarily lead to increases in appropriate collateral behavior (Lanovaz et al., 2013). The introduction of prompting reduces engagement in motor stereotypy while strengthening engagement in appropriate behavior (Britton, Carr, Landaburu, & Romick, 2002; Lanovaz et al., 2014; Symons & Davis, 1994). By contrast, attempting to reduce vocal stereotypy with NCR alone may increase motor forms of stereotypy (Rapp et al., 2013).

If the intervention fails to reduce engagement in vocal stereotypy, the model recommends the implementation of differential reinforcement and prompting. To increase the probability of success, the reinforcer should be delivered when the individual with intellectual disability is both not engaging in vocal stereotypy (i.e., DRO) and simultaneously engaging in an alternative behavior (e.g., playing, completing a task). The intervention is recommended second as it remains less restrictive than either RIRD or RC/TO but is more complicated to implement than NCR. The

prompting component remains important to ensure that vocal stereotypy is replaced by socially appropriate behavior. If this intervention also fails, the final recommendation of the model is to combine NCR with prompting and RC/TO or RIRD. In addition to implementing NCR with prompting, the practitioner may either remove the preferred stimulus (music) for brief periods of time or make a series of demands or provide verbal reprimands contingent on the occurrence of vocal stereotypy (e.g., Ahearn et al., 2007; Falcomata et al., 2004; Watkins & Rapp, 2014). This intervention is recommended last as the implementation of punishment-based procedures may (a) have ethical implications (e.g., Bailey & Burch, 2011) and (b) produce several side effects such as aggressive behavior (Hagopian & Toole, 2009; Lerman & Vorndran, 2002).

The model for motor forms of stereotypy varies as NCR may involve the delivery of items that may compete with the occurrence of appropriate behavior. As such, the same sequence as vocal stereotypy is recommended only when the practitioner is aiming to reduce motor stereotypy in free or playtime periods. During this time, the practitioner can provide access to items that provide similar types of sensory stimulation (if possible) and prompt appropriate behavior when the individual is not engaged in appropriate activities (Britton et al., 2002). In work, task, or learning settings, the noncontingent delivery of tangible items may interfere with other activities in which the individual must be engaged. In these contexts, we propose that the practitioner begins by implementing differential reinforcement with prompting first. If this intervention fails to produce the desired outcome, the practitioner may add a RIRD or overcorrection. That is, engagement in motor stereotypy can be interrupted by contingent demands or be followed by an overcorrection procedure implemented by the practitioner. Although potentially effective, this approach is recommended last as it may evoke engagement in other inappropriate behavior.

It should be noted that the intervention model has yet to be empirically validated as whole, but the selection of the interventions is based on evidence available in the research literature.

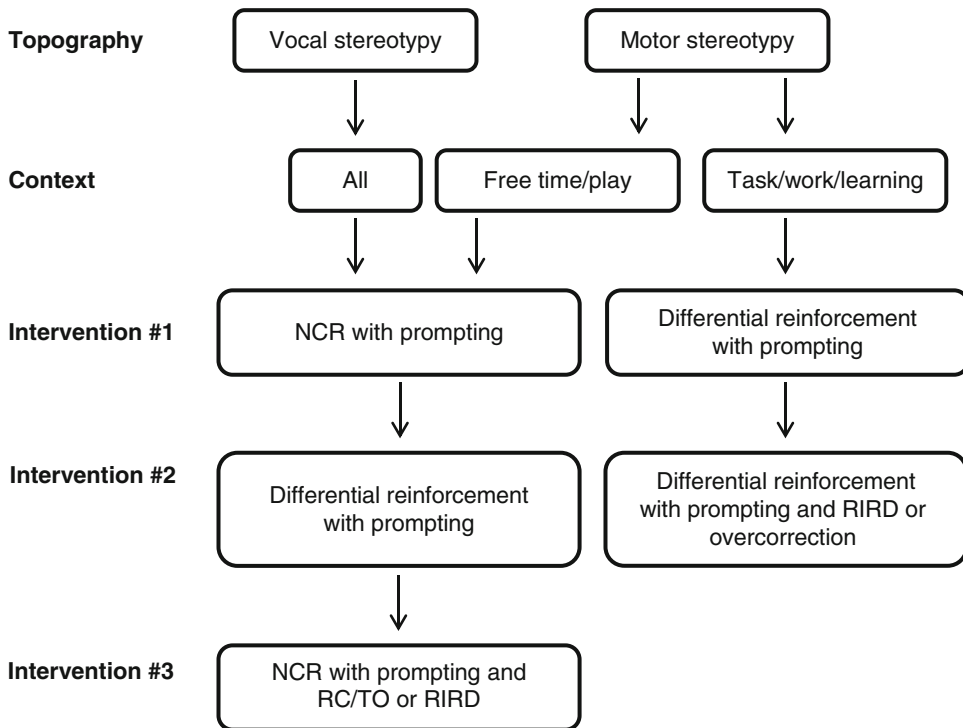


Fig. 28.5 Flowchart of proposed intervention selection model

Moreover, the model considers the advantages and disadvantages of implementing each intervention in applied settings. That said, practitioners should also consider the individual's personal characteristics and patterns of responding when setting the parameters of each intervention (e.g., reinforcement schedule, type of preferred stimuli, specific prompting protocol).

Treatment assessment. Once an intervention has been selected, its effects should be rigorously assessed and monitored. During the assessment, the practitioner should plan to (a) confirm that the repetitive behavior targeted for stereotypy are maintained by nonsocial reinforcement, (b) experimentally identify preferred stimuli to use as part of the interventions, (c) conduct a brief assessment of intervention effectiveness using a SCED, and (d) implement the intervention on a regular basis (if shown to be effective). Figure 28.6 presents a sequential assessment model adapted from Lanovaz, Rapp, and Fletcher (2010). This model outlines the steps that a prac-

itioner should adopt when assessing the effects of an intervention to reduce engagement in stereotypy.

The first step involves conducting a functional analysis to examine whether the repetitive behaviors are maintained by nonsocial reinforcement. The most straightforward method is to conduct a series of consecutive no-interaction sessions during which the individual does not have access to social consequences (Querim et al., 2013; Vollmer, Marcus, Ringdahl, & Roane, 1995). If the repetitive behaviors persist in the absence of social consequences, the practitioner may move to the next step and conduct a preference assessment. If the repetitive behaviors extinguish, then the practitioner should conduct a new functional analysis to identify its social function and then implement a function-based treatment.

As a second step, the practitioner should conduct a preference assessment to identify the stimuli that will be provided as part of the intervention. Whenever possible, age-appropriate stimuli that

matched the putative sensory product generated by the form of stereotypy should be selected. With the exception of music and edibles, we suggest that the practitioner conducts a FOPA (Roane et al., 1998) when the intervention is NCR. In this way, the assessment conditions will more closely resemble the intervention setting. For differential reinforcement, we recommend a selection-based preference assessment as the short duration of access during the assessment is similar to the type of access provided during the intervention (e.g., Carr et al., 2000; DeLeon & Iwata, 1996; Fisher et al., 1992). For edibles, the selection-based preference assessment is used regardless of the intervention as the free-choice method may lead to overeating. For music, a modified paired-choice method (Horrocks & Higbee, 2008) is typically used as providing free access to multiple musical stimuli simultaneously presents too many technical challenges and difficulties.

For the third step, the practitioner tests the effects of the selected intervention within a SCED. Intervention and no-intervention sessions are alternated semi-randomly on a daily basis to examine whether the treatment produces socially significant reductions in stereotypy. In addition to stereotypy, the practitioner should consider also measuring engagement in appropriate behavior to ensure that the intervention is not producing undesirable effects. If the intervention is planned to be implemented for short periods of time interspersed by other activities, we recommend that the practitioner also considers measuring pre- and post-intervention levels of stereotypy using the three-component multiple schedule. From a clinical standpoint, examining the post-intervention effects may be important as the practitioner will want to avoid interventions that worsen stereotypy when it is withdrawn.

As a form of treatment evaluation, the three-component multiple schedule is composed of three equal duration components: pre-intervention (first component), intervention or no-intervention (second component), and post-intervention (third component). The intervention is never implemented during the first or third components. The second component either involves the implementation of the intervention or the absence of the

intervention. The practitioner conducts no more than one session per day and alternates between intervention and no-intervention conditions (in the second component only) as in an alternating treatment design. Then, the data are analyzed using procedures adapted from Lanovaz et al. (2010). First, the immediate effects (i.e., second component) of the intervention are examined by comparing levels of stereotypy when the intervention is being implemented and when it is not being implemented on graphs. If the intervention is ineffective, the analysis stops at this level and the practitioner should modify the parameters of the intervention or move on to the next intervention in the model (see Fig. 28.6).

If the intervention reduces immediate engagement in stereotypy (i.e., in the second component), the practitioner analyzes the graphs of the third component to determine its post-intervention effects. If the intervention increases subsequent (post-intervention) engagement in stereotypy, the analysis stops here and the practitioner assesses the effects of a new intervention. If the intervention reduces subsequent engagement in stereotypy, we recommend that the intervention be implemented on a regular basis in the individual's environment (see step 4). If patterns remain undifferentiated, a within-sequence analysis should be conducted. To conduct a within-sequence analysis, changes in stereotypy from pre- to post-intervention are compared across conditions. If stereotypy is lower in the third component (post-intervention) than in the first component (pre-intervention) more often in the intervention sequence than in the no-intervention sequence (or if patterns are the same), the practitioner may conclude that the intervention does not increase subsequent engagement in stereotypy and propose its implementation on a regular basis. If stereotypy is lower in the third component than in the first component more often in the no-intervention sequence than the intervention sequence, the practitioner may conclude that the intervention potentially increases subsequent engagement in stereotypy and assess the effects of a new intervention.

A study by Pastrana et al. (2013) illustrates the application of both the between-sequence and

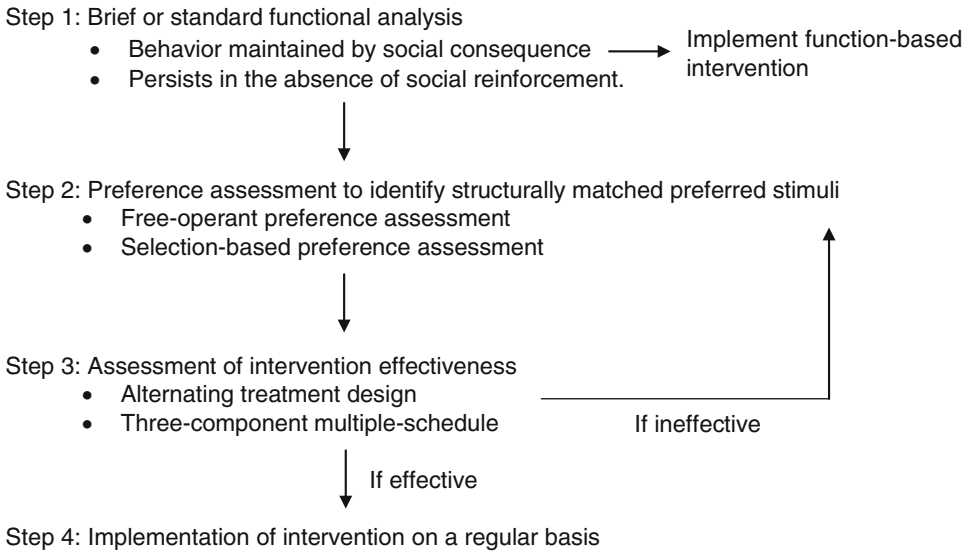


Fig. 28.6 Sequential treatment assessment model for stereotypy. Based on Fig. 28.1 from Lanovaz, M. J.; Rapp, J. T.; and Fletcher, S. M. (2010). Expanding functional

analysis of automatically reinforced behavior using a three-component multiple schedule. *European Journal of Behavior Analysis, 11*, 17–27

within-sequence analyses. Specifically, Pastrana et al. evaluated the effects of motor RIRD on targeted motor stereotypy and nontargeted vocal stereotypy for Emmett. In addition, the authors tracked the frequency with which RIRD was implemented across sessions. Results of the between-sequence analysis for Emmett (see Fig. 28.7) show that RIRD (a) decreased his immediate engagement in targeted motor stereotypy, (b) did not consistently alter his immediate engagement in vocal stereotypy, and (c) did not increase his subsequent engagement in motor or vocal stereotypy. In addition, Fig. 28.7 (lower panel) shows that the need to implement RIRD did not decrease across sessions. In order to assess small changes in motivation, Pastrana et al. also conducted a within-sequence analysis of the subsequent effects of RIRD on Emmett’s targeted and nontargeted behavior. Results from Fig. 28.8 suggest that RIRD did not increase Emmett’s subsequent engagement in motor stereotypy (upper panel) because his engagement was higher in the third component than in the first component for one of six sessions in both sequences (RIRD and NI). In addition, “Results show that Emmett’s vocal stereotypy (lower panel) was highest in the

second component for one of six sessions in the NI sequence and four of six sessions in the RIRD sequence...vocal stereotypy was lowest in the second component for three of six NI sessions and for zero of six RIRD sessions” (Pastrana et al., 2013, p. 602). Taken together, results of the within-sequence analysis suggest that RIRD temporarily increased Emmett’s immediate engagement in nontargeted vocal stereotypy but did not increase his subsequent engagement in either the targeted or nontargeted stereotypy. Based on the results from the between- and within-sequence analysis, RIRD may be an appropriate intervention for Emmett’s stereotypy.

A variation of this approach is using a two-component multiple schedule in which stereotypy is measured only during and after the intervention (e.g., Watkins & Rapp, 2014). In these situations, the analysis remains similar with the exception that it is not possible to conduct a within-sequence analysis because the pre-intervention component is omitted. If the data paths for the first and second components are either (a) undifferentiated or (b) differentiated such that the intervention data path is lower than the baseline data path, the practitioner can move

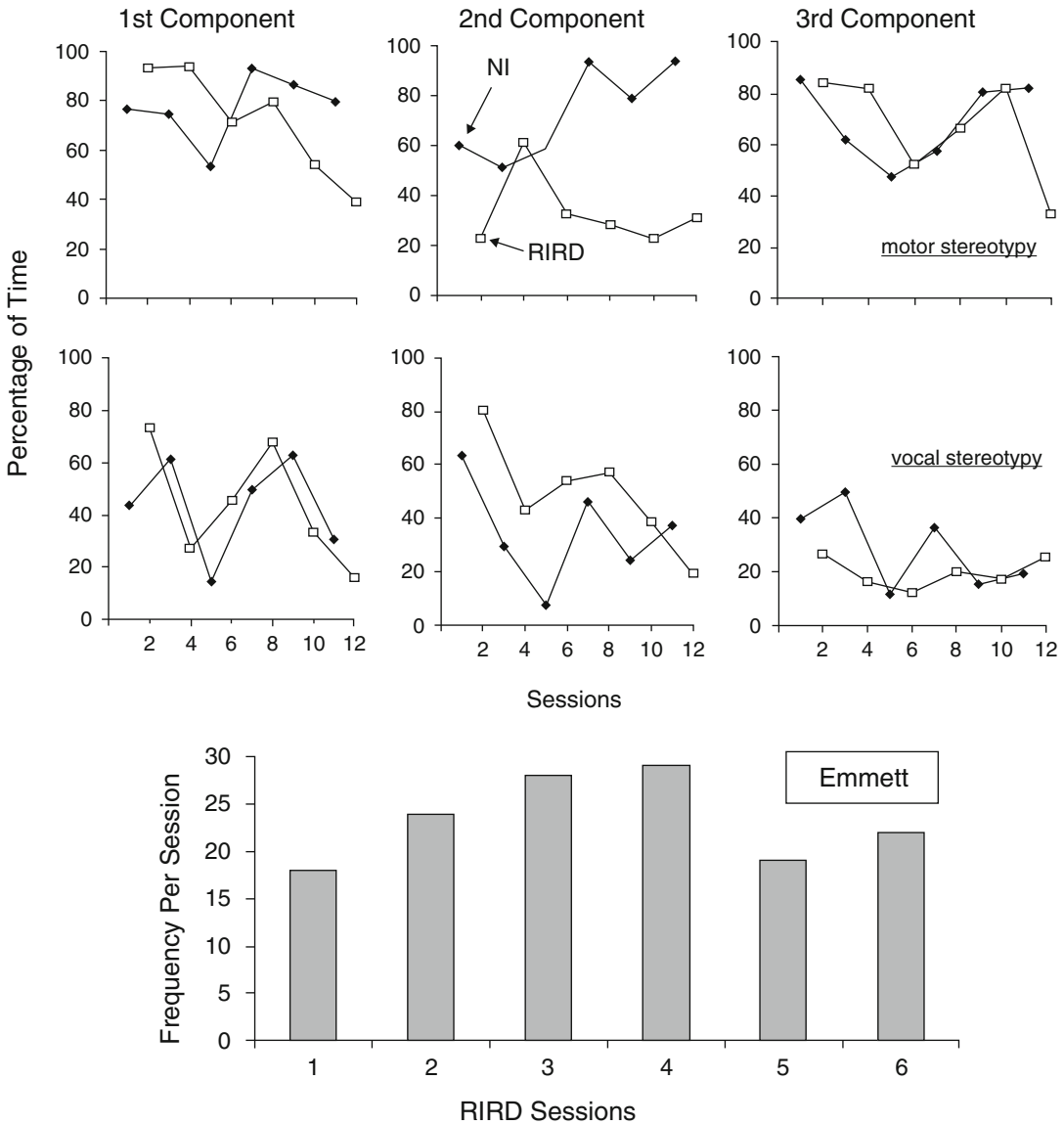


Fig. 28.7 Percentage of time Emmett engaged in motor stereotypy (*upper three panels*) and vocal stereotypy (*center three panels*) during the first, second, and third components of the no-interaction (NI) and response interruption and redirection (RIRD) sequences. Number of times we implemented RIRD across sessions during the second

component of the RIRD sequence (*lower panel*). Reprinted from Pastrana, S.; J, Rapp, J. T.; and 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. doi:[10.1177/0145445513485751](https://doi.org/10.1177/0145445513485751)

on to the implementation of the intervention on a regular basis. The final step involves the implementation of the intervention on a regular basis by staff or caregivers in the person’s environment. Stereotypy should continue to be measured and monitored on a regular, but less frequent

(e.g., weekly, biweekly), basis. If differential reinforcement is being implemented, the schedule should be gradually faded until it becomes realistic to implement without disruption to the routine of the individual and others in his or her daily setting.

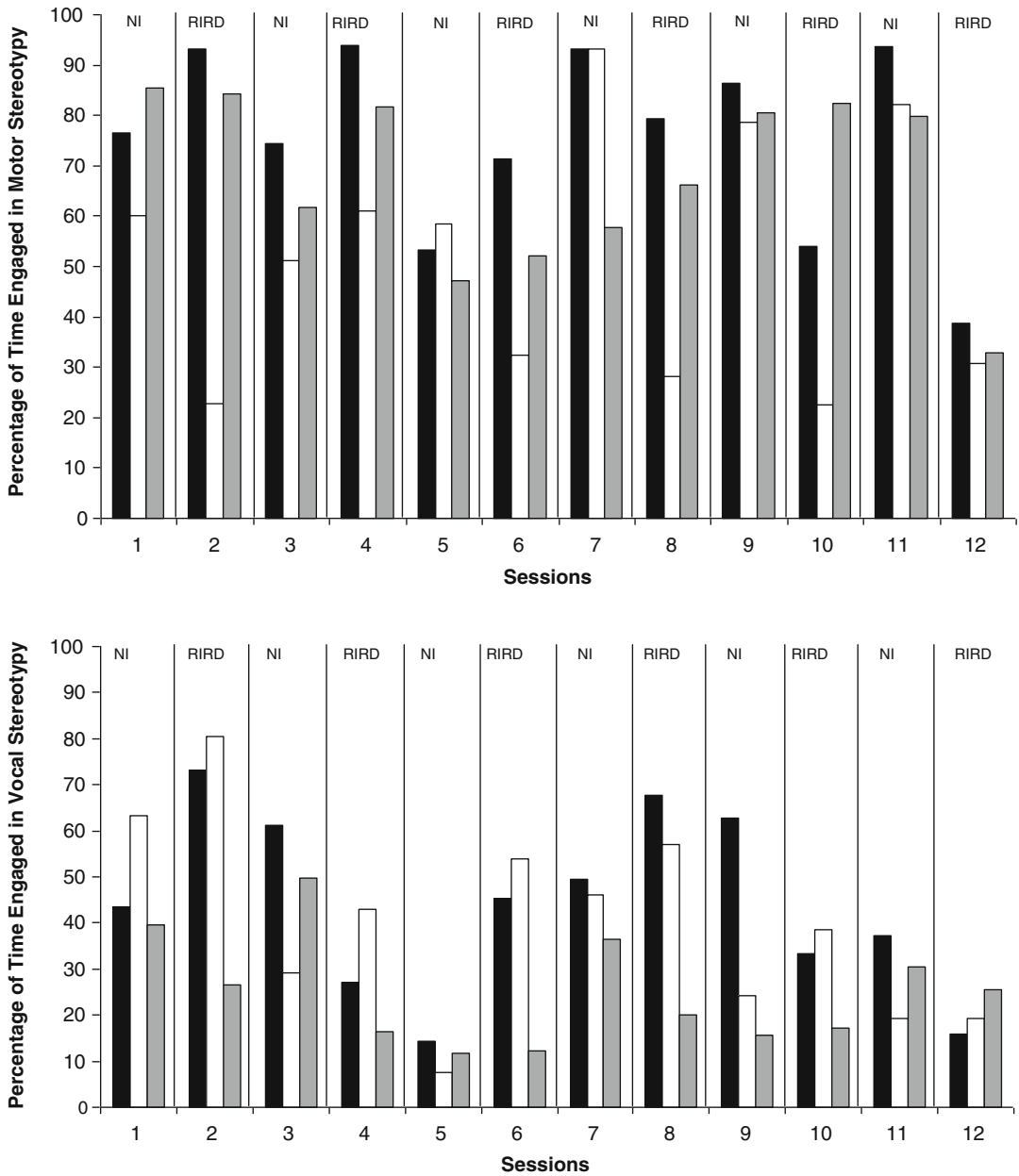


Fig. 28.8 Within-sequence analysis showing the percentage of time Emmett engaged in motor stereotypy (*upper panel*) and vocal stereotypy (*lower panel*) across the first, second, and third components of no-interaction (NI) and response interruption and redirection (RIRD) sequences.

Reprinted from Pastrana, S., J.; Rapp, J. T.; and 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. doi:[10.1177/0145445513485751](https://doi.org/10.1177/0145445513485751)

Conclusions

Although this chapter outlines several empirically supported behavioral interventions, as well as a recent methodology for evaluating the

immediate and subsequent effects of those interventions, treatment for motor and vocal stereotypy displayed by individuals with intellectual disabilities should continue to evolve. For example, future studies should evaluate the effects of

specific combinations of antecedent and consequence interventions on immediate and subsequent engagement in targeted and nontargeted forms of stereotypy.

References

- Ahearn, W. H., Clark, K. M., MacDonald, P. F., & Chung, B. I. (2007). Assessing and treating vocal stereotypy in children with autism. *Journal of Applied Behavior Analysis, 40*, 263–275. doi: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 Behavior Analysis, 44*, 95–108. doi:10.1901/jaba.2011.44-95.
- Anderson, C. M., Doughty, S. S., Doughty, A. H., Williams, D. C., & Saunders, K. J. (2010). Evaluation of stimulus control over a communication response as an intervention for stereotypical responding. *Journal of Applied Behavior Analysis, 43*, 333–339. doi:10.1901/jaba.2010.43-333.
- Anderson, J., & Le, D. D. (2011). Abatement of intractable vocal stereotypy using an overcorrection procedure. *Behavioral Interventions, 26*, 134–146. doi:10.1002/bin.326.
- Bachman, J. E., & Sluyter, D. (1988). Reducing inappropriate behaviors of developmentally disabled adults using antecedent aerobic dance exercises. *Research in Developmental Disabilities, 9*, 73–83. doi:10.1016/0891-4222(88)90021-2.
- Bailey, J., & Burch, M. (2011). *Ethics for behavior analysts* (2nd ed.). New York, NY: Routledge.
- Beckett, C., Bredenkamp, D., Castle, J., Groothues, C., O'Connor, T. G., & Rutter, M. (2002). Behavior patterns associated with institutional deprivation: A study of children adopted from Romania. *Journal of Developmental and Behavioral Pediatrics, 23*, 297–303.
- Berkson, G. (2002). Early development of stereotyped and self-injurious behaviors: II. Age trends. *American Journal on Mental Retardation, 107*, 468–477.
- Berkson, G., & Tupa, M. (2000). Early development of stereotyped and self-injurious behaviors. *Journal of Early Intervention, 23*, 1–19. doi:10.1177/1053815100230010401.
- Berkson, G., Tupa, M., & Sherman, L. (2001). Early development of stereotyped and self-injurious behaviors: I. Incidence. *American Journal on Mental Retardation, 106*, 539–547.
- Bodfish, J. W., Crawford, T. W., Powell, S. B., & Parker, D. E. (1995). Compulsions in adults with mental retardation: Prevalence, phenomenology, and comorbidity with stereotypy and self-injury. *American Journal on Mental Retardation, 100*, 183–192.
- Bodfish, J. W., Symons, F. J., Parker, D. E., & Lewis, M. H. (2000). Varieties of repetitive behavior in autism: Comparisons to mental retardation. *Journal of Autism and Developmental Disorders, 30*, 237–243. doi:10.1023/A:1005596502855.
- Britton, L. N., Carr, J. E., Landaburu, H. J., & Romick, K. S. (2002). The efficacy of noncontingent reinforcement as treatment for automatically reinforced stereotypy. *Behavioral Interventions, 17*, 93–103. doi:10.1002/bin.110.
- Brusa, E., & Richman, D. (2008). Developing stimulus control for occurrences of stereotypy exhibited by a child with autism. *International Journal of Behavioral Consultation and Therapy, 4*, 264–269.
- Burleson, S. J., Center, D. B., & Reeves, H. (1989). The effect of background music on task performance in psychotic children. *Journal of Music Therapy, 26*, 198–205. doi:10.1093/jmt/26.4.198.
- Campbell, M., Locascio, J. J., Choroco, M. C., Spencer, E. K., Malone, R. P., Kafantaris, V., & Overall, J. E. (1990). Stereotypies and tardive dyskinesia: Abnormal movements in autistic children. *Psychopharmacology Bulletin, 26*, 260–266.
- Carcani-Rathwell, I., Rabe-Hasketh, S., & Santosh, P. J. (2006). Repetitive and stereotyped behaviours in pervasive developmental disorders. *Journal of Child Psychology and Psychiatry, 47*, 573–581. doi:10.1111/j.1469-7610.2005.01565.x.
- Carr, J. E., Nicolson, A. C., & Higbee, T. S. (2000). Evaluation of a brief multiple-stimulus preference assessment in a naturalistic context. *Journal of Applied Behavior Analysis, 33*, 353–357. doi:10.1901/jaba.2000.33-353.
- 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, 46*, 264–276. doi:10.1002/jaba.118.
- Cassella, M. D., Sidener, T. M., Sidener, D. W., & Progar, P. R. (2011). Response interruption and redirection for vocal stereotypy in children with autism: A systematic replication. *Journal of Applied Behavior Analysis, 44*, 169–173. doi:10.1901/jaba.2011.44-169.
- Celiberti, D. A., Bobo, H. E., Kelly, K. S., Harris, S. L., & Handleman, J. S. (1997). The differential and temporal effects of antecedent exercise on the self-stimulatory behavior of a child with autism. *Research in Developmental Disabilities, 18*, 139–150.
- Charlop, M. H., Kurtz, P. F., & Casey, F. G. (1990). Using aberrant behaviors as reinforcers for autistic children. *Journal of Applied Behavior Analysis, 23*, 163–181. doi:10.1901/jaba.1990.23-163.
- Chung, Y.-C., & Cannella-Malone, H. I. (2010). The effects of pre-session manipulations on automatically maintained challenging behavior and task responding. *Behavior Modification, 34*, 479–502. doi:10.1177/0145445510378380.
- Coleman, G. A., Montgomery, R. W., Wilson, K. M., & Milan, M. A. (2000). Parametric analysis of overcorrection duration effects: Is longer really better than shorter? *Behavior Modification, 24*, 359–378. doi:10.1177/0145445500243004.

- Colón, C. L., Ahearn, W. H., Clark, K. M., & Masalsky, J. (2012). The effects of verbal operant training and response interruption and redirection on appropriate and inappropriate vocalizations. *Journal of Applied Behavior Analysis, 45*, 107–120. doi:10.1901/jaba.2012.45-107.
- Conroy, M. A., Asmus, J. M., Sellers, J. A., & Ladwig, C. N. (2005). The use of an antecedent-based intervention to decrease stereotypic behavior in a general education classroom: A case study. *Focus on Autism and Other Developmental Disabilities, 20*, 223–230. doi:10.1177/10883576050200040401.
- Cook, J. L., Rapp, J. T., Gomes, L. A., Frazer, T. J., & Lindblad, T. L. (2014). Effects of verbal reprimands on targeted and untargeted stereotypy. *Behavioral Interventions, 29*, 106–124. doi:10.1002/bin.1378.
- Cooper, J., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Pearson Education, Inc.
- Cunningham, A. B., & Schreibman, L. (2008). Stereotypy in autism: The importance of function. *Research in Autism Spectrum Disorders, 2*, 469–479. doi:10.1016/j.rasd.2007.09.006.
- De Winter, C. F., Jansen, A. A. C., & Evenhuis, H. M. (2011). Physical conditions and challenging behaviour in people with intellectual disability: A systematic review. *Journal of Intellectual Disability Research, 55*, 675–698. doi:10.1111/j.1365-2788.2011.01390.x.
- DeLeon, I. G., & Iwata, B. A. (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. *Journal of Applied Behavior Analysis, 29*, 519–533. doi:10.1901/jaba.1996.29-519.
- DiGennaro Reed, F. D., Hirst, J. M., & Hyman, S. R. (2012). Assessment and treatment of stereotypic behavior in children with autism and other developmental disabilities: A thirty year review. *Research in Autism Spectrum Disorders, 6*, 422–430. doi:10.1016/j.rasd.2011.07.003.
- Doughty, S. S., Anderson, C. M., Doughty, A. H., Williams, D. C., & Saunders, K. J. (2007). Discriminative control of punished stereotyped behavior in humans. *Journal of the Experimental Analysis of Behavior, 87*, 325–336. doi:10.1901/jeab.2007.39-05.
- Dozier, C. L., Iwata, B. A., Wilson, D. M., Thomason-Sassi, J. L., & Roscoe, E. M. (2013). Does supplementary reinforcement of stereotypy facilitate extinction? *Journal of Applied Behavior Analysis, 46*, 242–255. doi:10.1002/jaba.15.
- Enloe, K., & Rapp, J. T. (2014). Effects of noncontingent social interaction on immediate and subsequent engagement in vocal and motor stereotypy in children with autism. *Behavior Modification, 38*, 374–391. doi:10.1177/0145445513514081.
- Evans, D. W., Kleinpeter, F. L., Slane, M. M., & Boomer, K. B. (2014). Adaptive and maladaptive correlates of repetitive behavior and restricted interests in persons with Down syndrome and developmentally-matched typical children: A two-year longitudinal sequential design. *PLoS One, 9*, e93951. doi:10.1371/journal.pone.0093951.
- Falcomata, T. S., Roane, H. S., Hovanetz, A. N., Kettering, T. L., & Keeney, K. M. (2004). An evaluation of response cost in the treatment of inappropriate vocalizations maintained by automatic reinforcement. *Journal of Applied Behavior Analysis, 37*, 83–87. doi:10.1901/jaba.2004.37-83.
- Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis, 25*, 491–498. doi:10.1901/jaba.1992.25-491.
- Foxx, R. M., & Azrin, N. H. (1973). The elimination of autistic self-stimulatory behavior by overcorrection. *Journal of Applied Behavior Analysis, 6*, 1–14. doi:10.1901/jaba.1973.6-1.
- Fritz, J. N., Iwata, B. A., Rolider, N. U., Camp, E. M., & Neidert, P. L. (2012). Analysis of self-recording in self-management interventions for stereotypy. *Journal of Applied Behavior Analysis, 45*, 55–68. doi:10.1901/jaba.2012.45-55.
- Gabriels, R. L., Cuccaro, M. L., Hill, D. E., Ivers, B. J., & Goldson, E. (2005). Repetitive behaviors in autism: Relationships with associated clinical features. *Research in Developmental Disabilities, 26*, 169–181. doi:10.1016/j.ridd.2004.05.003.
- Garner, J. P. (2006). Perseveration and stereotypy: Systems-level insights from clinical psychology. In G. Mason & J. Rushen (Eds.), *Stereotypic animal behaviour: Fundamentals and applications to welfare* (2nd ed., pp. 121–152). Wallingford, UK: CAB International.
- Giles, A. F., St. Peter, C. C., Pence, S. T., & Gibson, A. B. (2012). Preference for blocking or response redirection during stereotypy. *Research in Developmental Disabilities, 33*, 1691–1700. doi:10.1016/j.ridd.2012.05.008.
- Goh, H., Iwata, B. A., Shore, B. A., DeLeon, I. G., Lerman, D. C., Ulrich, S. M., & Smith, R. G. (1995). An analysis of the reinforcing properties of hand mouthing. *Journal of Applied Behavior Analysis, 28*, 269–283. doi:10.1901/jaba.1995.28-269.
- Goldman, S., Wang, C., Salgado, M. W., Greene, P. E., Kim, M., & Rapin, I. (2009). Motor stereotypies in children with autism and other developmental disorders. *Developmental Medicine & Child Neurology, 51*, 30–38. doi:10.1111/j.1469-8749.2008.03178.x.
- Grey, I., Pollard, J., McClean, B., MacAuley, N., & Hastings, R. (2010). Prevalence of psychiatric diagnoses and challenging behaviors in a community-based population of adults with intellectual disability. *Journal of Mental Health Research in Intellectual Disabilities, 3*, 210–222. doi:10.1080/19315864.2010.527035.
- Guess, D., & Carr, E. G. (1991). Emergence and maintenance of stereotypy and self-injury. *American Journal on Mental Retardation, 96*, 299–319.
- Guzinski, E. M., Cihon, T. M., & Eshleman, J. (2012). The effects of tact training on stereotypic vocalizations in children with autism. *The Analysis of Verbal Behavior, 28*, 101–110.

- Hagopian, L. P., & Toole, L. M. (2009). Effects of response blocking and competing stimuli on stereotypic behavior. *Behavioral Interventions, 24*, 117–125. doi:10.1002/bin.278.
- Haley, J. L., Heick, P. F., & Luiselli, J. K. (2010). Case Study: Use of an antecedent intervention to decrease vocal stereotypy of a student with autism in the general education classroom. *Child & Family Behavior Therapy, 32*, 311–321. doi:10.1080/07317107.2010.515527.
- Hanley, G. P., Iwata, B. A., Thompson, R. H., & Lindberg, J. S. (2000). A component analysis of “stereotypy as reinforcement” for alternative behavior. *Journal of Applied Behavior Analysis, 33*, 285–297. doi:10.1901/jaba.2000.33-285.
- Harris, S. L., & Wolchik, S. A. (1979). Suppression of self-stimulation: Three alternative strategies. *Journal of Applied Behavior Analysis, 12*, 185–198. doi:10.1901/jaba.1979.12-185.
- Hattier, M. A., Matson, J. L., Macmillan, K., & Williams, L. (2012). Stereotyped behaviours in children with autism spectrum disorders and atypical development as measured by the BPI-01. *Developmental Neurorehabilitation, 16*, 291–300. doi:10.3109/17518423.2012.727107.
- Healy, O., Brett, D., & Leader, G. (2013). A comparison of experimental functional analysis and the Questions About Behavioral Function (QABF) in the assessment of challenging behavior of individuals with autism. *Research in Autism Spectrum Disorders, 7*, 66–81. doi:10.1016/j.rasd.2012.05.006.
- Higbee, T. S., Chang, S., & Endicott, K. (2005). Noncontingent access to preferred Sensory stimuli as a treatment for automatically reinforced behavior. *Behavioral Interventions, 20*, 177–184. doi:10.1002/bin.190.
- Hollander, E., Phillips, A., Chaplin, W., Zagursky, K., Novotny, S., Wasserman, S., & Iyengar, R. (2005). A placebo controlled crossover trial of liquid fluoxetine on repetitive behaviors in childhood and adolescent autism. *Neuropsychopharmacology, 30*, 582–589. doi:10.1038/sj.npp.1300627.
- Hollander, E., Soorya, L., Chaplin, W., Anagnostou, E., Taylor, B. P., Ferretti, C. J., ... Settiani, C. (2012). A double-blind placebo-controlled trial of fluoxetine for repetitive behaviors and global severity in adult autism spectrum disorders. *American Journal of Psychiatry, 169*, 292–299. doi:10.1176/appi.ajp.2011.10050764.
- Horrocks, E., & Higbee, T. S. (2008). An evaluation of a stimulus preference assessment of auditory stimuli for adolescents with developmental disabilities. *Research in Developmental Disabilities, 29*, 11–20. doi:10.1016/j.ridd.2006.09.003.
- Hutt, C., Hutt, S. J., Lee, D., & Ounsted, C. (1964). Arousal and childhood autism. *Nature, 204*, 908–909. doi:10.1038/204908a0.
- Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis, 27*, 197–209. doi:10.1901/jaba.1994.27-197
- (Reprinted from *Analysis and Intervention in Developmental Disabilities, 2*, 3–20, 1982).
- Iwata, B. A., & Dozier, C. L. (2008). Clinical application of functional analysis methodology. *Behavior Analysis in Practice, 1*, 3–9.
- Iwata, B. A., Pace, G. M., Cowdery, G. E., & Miltenberger, R. G. (1994). What makes extinction work: An analysis of procedural form and function. *Journal of Applied Behavior Analysis, 27*, 131–144. doi:10.1901/jaba.1994.27-131.
- Jones, R. S. P., Wint, D., & Ellis, N. C. (1990). The social effects of stereotyped behaviour. *Journal of Intellectual Disability Research, 34*, 261–268. doi:10.1111/j.1365-2788.1990.tb01537.x.
- Kennedy, C. H. (1994). Automatic reinforcement: Oxymoron or hypothetical construct? *Journal of Behavioral Education, 4*, 387–395. doi:10.1007/BF01539540.
- Kennedy, C. H., Meyer, K. A., Knowles, T., & Shukla, S. (2000). Analyzing the multiple functions of stereotypic behavior for students with autism: Implications for assessment and treatment. *Journal of Applied Behavior Analysis, 33*, 559–571. doi:10.1901/jaba.2000.33-559.
- Kern, L., Koegel, R. L., Dyer, K., Blew, P. A., & Fenton, L. R. (1982). The effects of physical exercise on self-stimulation and appropriate responding in autistic children. *Journal of Autism and Developmental Disabilities, 12*, 399–419. doi:10.1007/BF01538327.
- Kern, L., Koegel, R. L., & Dunlap, G. (1984). The influence of vigorous versus mild exercise on autistic stereotyped behaviors. *Journal of Autism and Developmental Disabilities, 14*, 57–67. doi:10.1007/BF02408555.
- Koegel, R. L., & Covert, A. (1972). The relationship of self-stimulation to learning in autistic children. *Journal of Applied Behavior Analysis, 5*, 381–387. doi:10.1901/jaba.1972.5-381.
- Kratochwill, T. R., Hitchcock, J., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., & Shadish, W. R. (2010). *Single-case designs technical documentation*. Retrieved from What Works Clearinghouse website: http://ies.ed.gov/ncee/wwc/pdf/wwc_scd.pdf.
- Lang, R., Koegel, L., Ashbaugh, K., Regester, A., Ence, W., & Smith, W. (2010). Physical exercise and individuals with autism spectrum disorders: A systematic review. *Research in Autism Spectrum Disorders, 4*, 565–576. doi:10.1016/j.rasd.2010.01.006.
- Lang, R., O'Reilly, M., Healy, O., Rispoli, M., Lydon, H., Streusand, W., ... Giesbers, S. (2012). Sensory integration therapy for autism spectrum disorders: A systematic review. *Research in Autism Spectrum Disorders, 6*, 1004–1018. doi:10.1016/j.rasd.2012.01.006.
- Lang, R., O'Reilly, M., Sigafos, J., Lancioni, G. E., Machalicek, W., Rispoli, M., & White, P. (2009). Enhancing the effectiveness of a play intervention by abolishing the reinforcing value of stereotypy: A pilot study. *Journal of Applied Behavior Analysis, 42*, 889–894. doi:10.1901/jaba.2009.42-889.

- Lang, R., O'Reilly, M., Sigafoos, J., Machalicek, W., Rispoli, M., Lancioni, G. E., ... Fragale, C. (2010). The effects of an abolishing operation intervention component on play skills, challenging behavior, and stereotypy. *Behavior Modification, 34*, 267–289. doi:10.1177/0145445510370713.
- Langen, M., Durston, S., Kas, M. J., van Engeland, H., & Staal, W. G. (2011). The neurobiology of repetitive behavior: ... and men. *Neuroscience & Biobehavioral Reviews, 35*, 356–365. doi:10.1016/j.neubiorev.2010.02.005.
- Langen, M., Kas, M. J., Staal, W. G., van Engeland, H., & Durston, S. (2011). The neurobiology of repetitive behavior: of mice *Neuroscience & Biobehavioral Reviews, 35*, 345–355. doi:10.1016/j.neubiorev.2010.02.004.
- Langone, S. R., Luiselli, J. K., & Hamill, J. (2013). Effects of response blocking and programmed stimulus control of motor stereotypy: A pilot study. *Child & Family Behavior Therapy, 35*, 249–255. doi:10.1080/0731107.2013.818906.
- Lanovaz, M. J. (2011). Towards a comprehensive model of stereotypy: Integrating operant and neurobiological interpretations. *Research in Developmental Disabilities, 32*, 447–455. doi:10.1016/j.ridd.2010.12.026.
- Lanovaz, M. J., & Argumedes, M. (2009). Using the three-component multiple-schedule to examine the effects of treatments on stereotypy. *Journal on Developmental Disabilities, 15*, 64–68.
- Lanovaz, M. J., & Argumedes, M. (2010). Immediate and subsequent effects of differential reinforcement of other behavior and noncontingent matched stimulation on stereotypy. *Behavioral Interventions, 25*, 229–238. doi:10.1002/bin.308.
- Lanovaz, M. J., Fletcher, S. E., & Rapp, J. T. (2009). Identifying stimuli that alter immediate and subsequent levels of stereotypy: A further analysis of functionally matched stimulation. *Behavior Modification, 33*, 682–704. doi:10.1177/0145445509344972.
- Lanovaz, M. J., Rapp, J. T., Maciwi, I., Pregent-Pelletier, E., Dorion, C., Ferguson, S., & Saade, S. (2014). Effects of multiple interventions for reducing vocal stereotypy: Developing a sequential intervention model. *Research in Autism Spectrum Disorders, 8*, 529–545. doi:10.1016/j.rasd.2014.01.009.
- Lanovaz, M. J., Rapp, J. T., & Ferguson, S. (2012). The utility of assessing musical preference before implementation of noncontingent music to reduce vocal stereotypy. *Journal of Applied Behavior Analysis, 45*, 845–851. doi:10.1901/jaba.2012.45-845.
- Lanovaz, M. J., Rapp, J. T., & Fletcher, S. M. (2010). Expanding functional analysis of automatically reinforced behavior using a three-component multiple schedule. *European Journal of Behavior Analysis, 11*, 17–27.
- Lanovaz, M. J., Robertson, K. M., Soerono, K., & Watkins, N. (2013). Effects of reducing stereotypy on other behaviors: A systematic review. *Research in Autism Spectrum Disorders, 7*, 1234–1243. doi:10.1016/j.rasd.2013.07.009.
- Lanovaz, M. J., & Sladeczek, I. E. (2012). Vocal stereotypy in individuals with autism spectrum disorders: A review of behavioral interventions. *Behavior Modification, 36*, 146–164. doi:10.1177/0145445511427192.
- Lanovaz, M. J., Sladeczek, I. E., & Rapp, J. T. (2011). Effects of music on vocal stereotypy in children with autism. *Journal of Applied Behavior Analysis, 44*, 647–651. doi:10.1901/jaba.2011.44-647.
- Lanovaz, M. J., Sladeczek, I. E., & Rapp, J. T. (2012). Effects of noncontingent music on vocal stereotypy and toy manipulation in children with autism spectrum disorders. *Behavioral Interventions, 27*, 207–223. doi:10.1002/bin.1345.
- LeMonda, B. C., Holtzer, R., & Goldman, S. (2012). Relationship between executive functions and motor stereotypies in children with autistic disorder. *Research in Autism Spectrum Disorders, 6*, 1099–1106. doi:10.1016/j.rasd.2012.03.001.
- Lerman, D. C., & Vorndran, C. M. (2002). On the status of knowledge for using punishment: Implications for treating behavior disorders. *Journal of Applied Behavior Analysis, 35*, 431–464. doi:10.1901/jaba.2002.35-431.
- Lewis, M. H., Gluck, J. P., Bodfish, J. W., Beauchamp, A. J., & Mailman, R. B. (1996). Neurological basis of stereotyped movement disorder. In R. L. Sprague & K. M. Newell (Eds.), *Stereotyped movements: Brain and behavior relationships* (pp. 37–68). Washington, DC: American Psychological Association Press.
- Lewis, M. H., Presti, M. F., Lewis, J. B., & Turner, C. A. (2006). The neurobiology of stereotypy I: Environmental complexity. In G. Mason & J. Rushen (Eds.), *Stereotypic animal behaviour: Fundamentals and applications to welfare* (2nd ed., pp. 190–226). Wallingford, UK: CAB International.
- Lewis, M. H., Tanimura, Y., Lee, L. W., & Bodfish, J. W. (2007). Animal models of restricted repetitive behavior in autism. *Behavioural Brain Research, 176*, 66–74. doi:10.1016/j.bbr.2006.08.023.
- Liu-Gitz, L., & Banda, D. R. (2009). A replication of the RIRD strategy to decrease vocal stereotypy in a student with autism. *Behavioral Interventions, 25*, 77–87. doi:10.1002/bin.297.
- Lloyd, B. P., & Kennedy, C. H. (2014). Assessment and treatment of challenging behaviour for individuals with intellectual disability: A research review. *Journal of Applied Research in Intellectual Disabilities, 27*, 187–199. doi:10.1111/jar.12089.
- Lovaas, I., Newsom, C., & Hickman, C. (1987). Self-stimulatory behavior and perceptual reinforcement. *Journal of Applied Behavior Analysis, 20*, 45–68. doi:10.1901/jaba.1987.20-45.
- Love, J. J., Miguel, C. F., Fernand, J. K., & LaBrie, J. K. (2012). The effects of matched stimulation and response interruption and redirection on vocal stereotypy. *Journal of Applied Behavior Analysis, 45*, 549–564. doi:10.1901/jaba.2012.45-549.
- Lundqvist, L. O. (2011). Psychometric properties and factor structure of the Behavior Problems Inventory (BPI-01) in a Swedish community population of adults with intellec-

- tual disability. *Research in Developmental Disabilities*, 32, 2295–2303. doi:10.1016/j.ridd.2011.07.037.
- Lustig, N. H., Ringdahl, J. E., Breznican, G., Romani, P., Scheib, M., & Vinquist, K. (2013). Evaluation and treatment of socially inappropriate stereotypy. *Journal of Developmental and Physical Disabilities*, 25, 105–117. doi:10.1007/s10882-013-9357-x.
- Lydon, S., Healy, O., O'Reilly, M., & McCoy, A. (2013). A systematic review and evaluation of response redirection as a treatment for challenging behavior in individuals with developmental disabilities. *Research in Developmental Disabilities*, 34, 3148–3158. doi:10.1016/j.ridd.2013.06.010.
- MacDonald, R., Green, G., Mansfield, R., Geckeler, A., Gardinier, N., Anderson, J., ... Sanchez, J. (2007). Stereotypy in young children with autism and typically developing children. *Research in Developmental Disabilities*, 28, 266–277. doi:10.1016/j.ridd.2006.01.004.
- MacLean, K. (2004). The impact of institutionalization on child development. *Development and Psychopathology*, 15, 853–884. doi:10.1017/S0954579403000415.
- MacLean, W. E., Ellis, D. N., Galbreath, H. N., Halpern, L. F., & Baumeister, A. A. (1991). Rhythmic motor behavior of preambulatory motor impaired, Down syndrome, and non-disabled children: A comparative analysis. *Journal of Abnormal Child Psychology*, 19, 319–329. doi:10.1007/BF00911234.
- 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. doi:10.1002/jaba.38.
- Matson, J. L., Bamburg, J. W., Cherry, K. E., & Paclawskyj, T. R. (1999). A validity study on the Questions About Behavioral Function (QABF) Scale: predicting treatment success for self-injury, aggression, and stereotypies. *Research in Developmental Disabilities*, 20, 163–175. doi:10.1016/S0891-4222(98)00039-0.
- Matson, J. L., Cooper, C., Malone, C. J., & Moskow, S. L. (2008). The relationship of self-injurious behavior and other maladaptive behaviors among individuals with severe and profound intellectual disability. *Research in Developmental Disabilities*, 29, 141–148. doi:10.1016/j.ridd.2007.02.001.
- Matson, J. L., Kiely, S. L., & Bamburg, J. W. (1997). The effect of stereotypies on adaptive skills as assessed with the DASH-II and Vineland Adaptive Behavior Scales. *Research in Developmental Disabilities*, 18, 471–476. doi:10.1016/S0891-4222(97)00023-1.
- Matson, J. L., Minshawi, N. F., Gonzalez, M. L., & Mayville, S. B. (2006). The relationship of comorbid problem behaviors to social skills in persons with profound mental retardation. *Behavior Modification*, 30, 496–506. doi:10.1177/0145445505283415.
- Mayes, S. D., & Calhoun, S. L. (2011). Impact of IQ, age, SES, gender, and race on autistic symptoms. *Research in Autism Spectrum Disorders*, 5, 749–757. doi:10.1016/j.rasd.2010.09.002.
- McDoogle, C. J., Naylor, S. T., Cohen, D. J., Volkmar, F. R., Henger, G. R., & Price, L. H. (1996). A double-blind, placebo-controlled study of fluvoxamine in adults with autistic disorder. *Archives of General Psychiatry*, 53, 1001–1008. doi:10.1001/archpsyc.1996.01830110037005.
- McKenzie, S. D., Smith, R. G., Simmons, J. N., & Soderlund, M. J. (2008). Using a stimulus correlated with reprimands to suppress automatically reinforced eye poking. *Journal of Applied Behavior Analysis*, 41, 255–259. doi:10.1901/jaba.2008.41-255.
- Meany-Daboul, M. G., Roscoe, E. M., Bourret, J. C., & Ahearn, W. H. (2007). A comparison of momentary time sampling and partial-interval recording for evaluating functional relations. *Journal of Applied Behavior Analysis*, 40, 501–514. doi:10.1901/jaba.2007.40-501.
- Medeiros, K., Curby, T. W., Bernstein, A., Rojahn, J., & Schroeder, S. R. (2013). The progression of severe behavior disorder in young children with intellectual and developmental disabilities. *Research in Developmental Disabilities*, 34, 3639–3647. doi:10.1016/j.ridd.2013.08.002.
- Medeiros, K., Kozlowski, A. M., Beighley, J. S., Rojahn, J., & Matson, J. L. (2012). The effects of developmental quotient and diagnostic criteria on challenging behaviors in toddlers with developmental disabilities. *Research in Developmental Disabilities*, 33, 1110–1116. doi:10.1016/j.ridd.2012.02.005.
- Miguel, C. F., Clark, K., Tereshko, L., & Ahearn, W. H. (2009). The effects of response interruption and redirection and sertraline on vocal stereotypy. *Journal of Applied Behavior Analysis*, 42, 883–888. doi:10.1901/jaba.2009.42-883.
- Miltenberger, R. G. (2012). *Behavior modification: Principle and procedures* (5th ed.). Belmont, CA: Wadsworth.
- Morrison, H., Roscoe, E. M., & Atwell, A. (2011). An evaluation of antecedent exercise on behavior maintained by automatic reinforcement using a three-component multiple schedule. *Journal of Applied Behavior Analysis*, 44, 523–541. doi:10.1901/jaba.2011.44-523.
- Nuernberger, J. E., Vargo, K. K., & Ringdahl, J. E. (2013). An application of differential reinforcement of other behavior and self-monitoring to address repetitive behavior. *Journal of Developmental and Physical Disabilities*, 25, 105–117. doi:10.1007/s10882-012-9309-x.
- O'Connor, A. S., Prieto, J., Hoffman, B., DeQuinzio, J. A., & Taylor, B. A. (2011). A stimulus control procedure to decrease motor and vocal stereotypy. *Behavioral Interventions*, 26, 231–242. doi:10.1002/bin.335.
- 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. doi:10.1177/0145445513485751.
- Patel, M. R., Carr, J. E., Kim, C., Robles, A., & Eastridge, D. (2000). Functional analysis of aberrant behavior maintained by automatic reinforcement: Assessment of specific sensory reinforcers. *Research in Developmental Disabilities*, 21, 393–407. doi:10.1016/S0891-4222(00)00051-2.

- Peters, L. C., & Thompson, R. H. (2013). Some indirect effects of positive practice overcorrection. *Journal of Applied Behavior Analysis, 46*, 613–625. doi:10.1002/jaba.63.
- Piazza, C. C., Adelinis, J. D., Hanley, G. P., Goh, H., & Delia, M. D. (2000). An evaluation of the effects of matched stimuli on behaviors maintained by automatic reinforcement. *Journal of Applied Behavior Analysis, 33*, 13–27. doi:10.1901/jaba.2000.33-13.
- Piazza, C. C., Fisher, W. W., Hanley, G. P., LeBlanc, L. A., Worsdell, A. S., Lindauer, S. E., & Keeney, K. M. (1998). Treatment of pica through multiple analyses of its reinforcing functions. *Journal of Applied Behavior Analysis, 31*, 165–189. doi:10.1901/jaba.1998.31-165.
- Poppes, P., Van der Putten, A. J. J., & Vlaskamp, C. (2010). Frequency and severity of challenging behaviour in people with profound intellectual and multiple disabilities. *Research in Developmental Disabilities, 31*, 1269–1275. doi:10.1016/j.ridd.2010.07.017.
- Querim, A. C., Iwata, B. A., Roscoe, E. M., Schlichenmeyer, K. J., Ortega, J. V., & Hurl, K. E. (2013). Functional analysis screening for problem behavior maintained by automatic reinforcement. *Journal of Applied Behavior Analysis, 46*, 47–60. doi:10.1002/jaba.26.
- Rapp, J. T. (2004). Effects of prior access and environmental enrichment on stereotypy. *Behavioral Interventions, 19*, 287–295. doi:10.1002/bin.166.
- Rapp, J. T. (2005). Some effects of audio and visual stimulation on multiple forms of stereotypy. *Behavioral Interventions, 20*, 255–272. doi:10.1002/bin.196.
- Rapp, J. T. (2007). Further evaluation of methods to identify matched stimulation. *Journal of Applied Behavior Analysis, 40*, 73–88. doi:10.1901/jaba.2007.142-05.
- Rapp, J. T. (2008). Conjugate reinforcement: A brief review and suggestions for applications to the assessment of automatically reinforced behavior. *Behavioral Interventions, 23*, 113–136. doi:10.1002/bin.259.
- Rapp, J. T., Colby, A. M., Vollmer, T. R., Roane, H. S., Lomaas, J., & Britton, L. M. (2007). Interval recording for duration events: A re-evaluation. *Behavioral Interventions, 22*, 319–345. doi:10.1002/bin.239.
- Rapp, J. T., Colby-Dirksen, A. M., Michalski, D. N., Carroll, R. A., & Lindenberg, A. M. (2008). Detecting changes in simulated events using partial-interval recording and momentary time sampling. *Behavioral Interventions, 23*, 237–269. doi:10.1002/bin.269.
- Rapp, J. T., Miltenberger, R. G., Galensky, T. L., Ellingson, S. A., & Long, E. S. (1999). A functional analysis of hair pulling. *Journal of Applied Behavior Analysis, 32*, 329–337. doi:10.1901/jaba.1999.32-329.
- Rapp, J. T., Patel, M. R., Ghezzi, P. M., O'Flaherty, C. H., & Titterton, C. J. (2009). Establishing stimulus control of vocal stereotypy displayed by young children with autism. *Behavioral Interventions, 24*, 85–105. doi:10.1002/bin.276.
- Rapp, J. T., Swanson, G. S., Sheridan, S., Enloe, K., Maltese, D., Sennott, L., ... Lanovaz, M. J. (2013). Immediate and subsequent effects of matched and unmatched stimuli on targeted vocal stereotypy and untargeted motor stereotypy. *Behavior Modification, 37*, 543–567. doi:10.1177/0145445512461650.
- Rapp, J. T., & Vollmer, T. R. (2005). Stereotypy I: A review of behavioral assessment and treatment. *Research in Developmental Disabilities, 26*, 527–547. doi:10.1016/j.ridd.2004.11.005.
- Repp, A. C., Dietz, S. M., & Speir, N. C. (1974). Reducing stereotypic responding of retarded persons by the differential reinforcement of other behavior. *American Journal of Mental Deficiency, 79*, 279–284.
- Richman, D. M., Barnard-Brak, L., Bosch, A., Thompson, S., Grubb, L., & Abby, L. (2013). Predictors of self-injurious behaviour exhibited by individuals with autism spectrum disorder. *Journal of Intellectual Disability Research, 57*, 429–439. doi:10.1111/j.1365-2788.2012.01628.x.
- Richman, D. M., & Lindauer, S. E. (2005). Longitudinal assessment of stereotypic, proto-injurious, and self-injurious behavior exhibited by young children with developmental delays. *American Journal on Mental Retardation, 110*, 439–450.
- Rincover, A., Cook, R., Peoples, A., & Packard, C. (1979). Sensory extinction and sensory reinforcement principles for programming multiple adaptive behavior change. *Journal of Applied Behavior Analysis, 12*, 221–233. doi:10.1901/jaba.1979.12-221.
- Rincover, A., & Devany, J. (1982). The application of sensory extinction procedures to self-injury. *Analysis and Intervention in Developmental Disabilities, 2*, 67–81. doi:10.1016/0270-4684(82)90006-4.
- Ringdahl, J. E., Andelman, M. S., Kitsukawa, K., Winborn, L. C., Barreto, A., & Wacker, D. P. (2002). Evaluation and treatment of covert stereotypy. *Behavioral Interventions, 17*, 43–49. doi:10.1002/bin.105.
- Roane, H. S., Vollmer, T. R., Ringdahl, J. E., & Marcus, B. A. (1998). Evaluation of a brief stimulus preference assessment. *Journal of Applied Behavior Analysis, 31*, 605–620. doi:10.1901/jaba.1998.31-605.
- Roberts, P., Iwata, B. A., McSween, T. E., & Desmond, E. F. (1979). An analysis of overcorrection movements. *American Journal of Mental Deficiency, 83*, 588–594.
- Rojahn, J., Matson, J. L., Lott, D., Esbensen, A. J., & Smalls, Y. (2001). The Behavior Problems Inventory: An instrument for the assessment of self-injury, stereotyped behavior, and aggression/destruction in individuals with developmental disabilities. *Journal of Autism and Developmental Disorders, 31*, 577–588. doi:10.1023/A:1013299028321.
- Rojahn, J., Wilkins, J., Matson, J. L., & Boisjoli, J. (2010). A comparison of adults with intellectual disabilities with and without ASD on parallel measures of challenging behaviour: The Behavior Problems Inventory-01 (BPI-01) and Autism Spectrum Disorders-Behavior Problems for Intellectually Disabled Adults (ASD-BPA). *Journal of Applied Research in Intellectual Disabilities, 23*, 179–185. doi:10.1111/j.1468-3148.2009.00519.x.

- Rollings, J., Baumeister, A., & Baumeister, A. (1977). The use of overcorrection procedures to eliminate the stereotyped behaviors of retarded individuals. *Behavior Modification, 1*, 29–46. doi:10.1177/014544557711003.
- Rosenthal-Malek, A., & Mitchell, S. (1997). Brief report: The effects of exercise on the self-stimulatory behaviors and positive responding of adolescents with autism. *Journal of Autism and Developmental Disorders, 27*, 193–202. doi:10.1023/A:1025848009248.
- Rozenblat, E., Brown, J. L., Brown, A. K., Reeve, S. A., & Reeve, K. F. (2009). Effects of adjusting DRO schedules on the reduction of stereotypic vocalizations in children with autism. *Behavioral Interventions, 24*, 1–15. doi:10.1002/bin.
- Saylor, S., Sidener, T. M., Reeve, S. A., Fetherston, A., & Progar, P. R. (2012). Effects of three types of stimulation on contingent auditory stimulation on vocal stereotypy in children with autism. *Journal of Applied Behavior Analysis, 45*, 185–190. doi:10.1901/jaba.2012.45-185.
- Schmidt, M. G., Rapp, J. T., Novotny, M. A., & Lood, E. A. (2013). Detecting changes in non-simulated events using partial interval recording and momentary time sampling: Evaluating false positives, false negatives, and trending. *Behavioral Interventions, 28*, 58–81. doi:10.1002/bin.1354.
- Schumacher, B. L., & Rapp, J. T. (2011). Evaluation of the immediate and subsequent effects of response interruption and redirection on vocal stereotypy. *Journal of Applied Behavior Analysis, 44*, 681–685. doi:10.1901/jaba.2011.44-681.
- Shabani, D. B., Wilder, D. A., & Flood, W. A. (2001). Reducing stereotypic behavior through discrimination training, differential reinforcement of other behavior, and self monitoring. *Behavioral Interventions, 16*, 279–286. doi:10.1002/bin.96.
- Shillingsburg, M. A., Lomas, J. E., & Bradley, D. (2012). Treatment of vocal stereotypy in an analogue and classroom setting. *Behavioral Interventions, 27*, 151–163. doi:10.1002/bin.1340.
- Simmons, J. N., Smith, R. G., & Kliethermes, L. (2003). A multiple-schedule evaluation of immediate and subsequent effects of fixed-time food presentation on automatically maintained mouthing. *Journal of Applied Behavior Analysis, 36*, 541–544. doi:10.1901/jaba.2003.36-541.
- Symons, F., & Davis, M. (1994). Instructional conditions and stereotyped behavior: The function of prompts. *Journal of Behavior Therapy and Experimental Psychiatry, 25*, 317–324. doi:10.1016/0005-7916(94)90040-X.
- Symons, F. J., Sperry, L. A., Dropik, P. L., & Bodfish, J. W. (2005). The early development of stereotypy and self-injury: A review of research methods. *Journal of Intellectual Disability Research, 49*, 144–158. doi:10.1111/j.1365-2788.2004.00632.x.
- Tang, J. C., Patterson, T. G., & Kennedy, C. H. (2003). Identifying specific sensory modalities maintaining the stereotypy of students with profound disabilities. *Research in Developmental Disabilities, 24*, 433–451. doi:10.1016/j.ridd.2003.02.001.
- Taylor, B. A., Hoch, H., & Weissman, M. (2005). The analysis and treatment of vocal stereotypy in a child with autism. *Behavioral Interventions, 20*, 239–253. doi:10.1002/bin.200.
- Thelen, E. (1979). Rhythmical stereotypies in normal human infants. *Animal Behavior, 27*, 699–715. doi:10.1016/0003-3472(79)90006-X.
- Vollmer, T. R. (1994). The concept of automatic reinforcement: Implications for behavioral research in developmental disabilities. *Research in Developmental Disabilities, 15*, 187–207. doi:10.1016/0891-4222(94)90011-6.
- Vollmer, T. R., Marcus, B. A., Ringdahl, J. E., & Roane, H. S. (1995). Progressing from brief assessments to extended experimental analyses in the evaluation of aberrant behavior. *Journal of Applied Behavior Analysis, 28*, 561–576. doi:10.1901/jaba.1995.28-561.
- Vollmer, T. R., Marcus, B. A., & LeBlanc, L. (1994). Treatment of self-injury and hand mouthing following inconclusive functional analysis. *Journal of Applied Behavior Analysis, 27*, 331–344. doi:10.1901/jaba.1994.27-331.
- Wacker, D. P., Steege, M. W., Northup, J., Sasso, G., Berg, W., Reimers, T., ... Donn, L. (1990). A component analysis of functional communication training across three topographies of severe behavior problems. *Journal of Applied Behavior Analysis, 23*, 417–429. doi:10.1901/jaba.1990.23-417.
- Watkins, N., & Rapp, J. T. (2014). Environmental enrichment and response cost: Immediate and subsequent effects on stereotypy. *Journal of Applied Behavior Analysis, 47*, 186–191. doi:10.1002/jaba.97.
- Watters, R. G., & Watters, W. E. (1980). Decreasing self-stimulatory behavior with physical exercise in a group of autistic boys. *Journal of Autism and Developmental Disabilities, 10*, 379–387. doi:10.1007/BF02414814.
- Weldy, C. R., Rapp, J. T., & Capocasa, K. C. (2014). Training staff to implement brief stimulus preference assessments. *Journal of Applied Behavior Analysis, 47*, 214–218. doi:10.1002/jaba.98.
- Wells, K. C., Forehand, R., & Hickey, K. (1977). Effects of a verbal warning and overcorrection on stereotyped and appropriate behaviors. *Journal of Abnormal Child Psychology, 5*, 387–403. doi:10.1007/BF00915087.
- Wells, K. C., Forehand, R., Hickey, K., & Green, K. D. (1977). Effects of a procedure derived from the overcorrection principle on manipulated and nonmanipulated behaviors. *Journal of Applied Behavior Analysis, 10*, 679–687. doi:10.1901/jaba.1977.10-679.
- Wilder, D. A., Kellum, K. K., & Carr, J. E. (2000). Evaluation of satiation-resistant head rocking. *Behavioral Interventions, 15*, 71–78. doi:10.1002/(SICI)1099-078X.
- Wirth, O., Slaven, J., & Taylor, M. A. (2014). Interval sampling methods and measurement error: A computer simulation. *Journal of Applied Behavior Analysis, 47*, 1–18. doi:10.1002/jaba.93.