Behavior Modification
34(4) 267–289

DOI: 10.1177/0145445510370713
http://bmo.sagepub.com
SAGE

The Effects of an Abolishing Operation Intervention Component on Play Skills, Challenging Behavior, and Stereotypy

Russell Lang[1], Mark O'Reilly[2], Jeff Sigafoos[3], Wendy Machalicek[4], Mandy Rispoli[5], Giulio E. Lancioni[6], Jeannie Aguilar[2], and Christina Fragale[2]

Abstract

The purpose of this study was to reduce stereotypy and challenging behavior during play skills instruction by adding an abolishing operation component (AOC) to the intervention strategy. An alternating treatments design compared one condition in which participants were allowed to engage in stereotypy freely before beginning the play skills intervention (AOC condition) to a second condition without this free access period (No AOC condition). Across 4 participants with autism spectrum disorders (ASD), levels of stereotypy and challenging behavior were lower and functional play was higher during play intervention sessions that followed the AOC. These

[1]Texas State University, San Marcos
[2]University of Texas at Austin
[3]Victoria University of Wellington, New Zealand
[4]University of Wisconsin at Madison
[5]Texas A&M University
[6]University of Bari, Italy

Corresponding Author:
Russell Lang, Department of Curriculum and Instruction, Special Education 3045, Texas State University
E-mail: russlang@mail.utexas.edu

data provided support for the inclusion of an AOC in interventions aimed at increasing the play skills of children with ASD who present with stereotypy.

Keywords

stereotypy, play, autism, challenging behavior, motivating operation, abolishing operation

Children with autism spectrum disorders (ASD) often experience substantial delays in the development of play behavior (Baron-Cohen, 1987). In a longitudinal study, Sigafoos, Roberts-Pennell, and Graves (1999) reported that although other areas of adaptive behavior showed gains over a 3-year period, there was very little improvement in play among a sample of 13 preschool children with autism and related developmental disorders. Even when matched with children according to mental age, children with autism tend to engage in significantly more stereotypic and repetitive behaviors and fewer appropriate play behaviors (Wing, Gould, Yeates, & Brierley, 1977). Indeed, these deficits are central to the definition of autism *Diagnostic and Statistical Manual of Mental Disorders*, (4th ed.) (*DSM-IV*; American Psychiatric Association, 1994) and items related to play are integral components on autism diagnostic tools (e.g., Autism Diagnostic Observation Schedule, Autism Diagnostic Interview). Deficits in play behavior can further exacerbate the social and communication delays experienced by children with autism. Clearly, teaching play skills is an important goal of early intervention with this population (Koegel, Koegel, Frea, & Fredmen, 2001).

Given that deficits in play skills are prevalent, persistent, and a core feature of autism, it is not surprising that a considerable amount of intervention research has focused on developing successful procedures for teaching play skills to children with autism (for reviews, see Lang et al., 2009; Stahmer, Ingersoll, & Carter, 2003; Terpstra, Higgins, & Pierce, 2002). With intervention, improvements in the diversity, flexibility, and spontaneity of play have been reported. In addition, successful play interventions have also been associated with improvements in socialization, language, cognition, functional use of objects, motor skills, and exercise (Brown & Murray, 2001). However, many researchers and practitioners have reported that stereotypic behavior (e.g., body rocking, and spinning or mouthing toys) often interferes with attempts to teach play skills (e.g., Baker, 2000; Baker, Koegel, & Koegel, 1998; Honey, Leekam, Turner, & McConachie, 2007; Koegel, Firestone, Kramme, & Dunlap, 1974). Stereotypy may occur because the behavior itself produces visual, tactile, or vestibular consequences that are likely to serve as

reinforcement for the behavior (i.e., automatic reinforcement; Rapp, Vollmer, Peter, Dozier, & Cotnoir, 2004). One possible relationship between stereotypy, challenging behavior, and play is that when stereotypy is interrupted during a play intervention, for example, access to this source of automatic reinforcement is denied. In these instances, the individual may engage in other forms of challenging behavior (e.g., tantrum, aggression, and self-injury) in an attempt to remove the interruption so as to be able to continue to engage in stereotypy. In this scenario, these other forms of challenging behavior might be maintained by the resulting escape from interruption. In any event, the need to interrupt stereotypy, which might then evoke challenging behavior, would certainly seem to complicate implementation and hinder the effectiveness of a play intervention (Sigafoos, Arthur, & O'Reilly, 2003).

Research-based procedures for addressing stereotypy during interventions to teach play skills exist and additional approaches are warranted (Lang et al., 2009; Rapp et al., 2004). One potential novel approach involves attempting to reduce stereotypy by decreasing (or abolishing) the child's motivation to engage in stereotypy. If the motivation to engage in stereotypy is decreased before implementing a play intervention, then less stereotypy, and hence, less need, to interrupt stereotypy should occur. This in turn would be likely to prevent other forms of challenging behavior that arise when stereotypy is interrupted. Reducing the stereotypy and challenging behavior that interferes with play could lead to more efficient and effective play interventions. Motivating operations (MOs) have been demonstrated to have a powerful influence on reinforcer value (Vollmer & Iwata, 1991). MOs may provide a means to alter the value of the automatic reinforcement produced by stereotypy. MOs influence the value of reinforcers in different ways, depending on where the individual is on a continuum from deprivation to satiation with respect to a specific reinforcing stimulus (Vollmer & Iwata, 1991). For example, if an individual has not been permitted to engage in stereotypy for an extended period of time, then he or she might be in a relative state of deprivation with respect to the automatic reinforcement stereotypy provides, thereby increasing its reinforcing value. Conversely, if the same individual has engaged in stereotypy freely for an extended period of time, then he or she might be in a relative state of satiation, and consequently, engagement in stereotypy might be less reinforcing. The term used to describe an increase in reinforcer value (as in a state of deprivation) is the *reinforcer-establishing effect*. When reinforcing value is decreased (as in a state of satiation) it is referred to as the *reinforcer-abolishing effect* (Michael, 1982, 1993, 2000; O'Reilly et al., 2008). Several studies have demonstrated the potential of satiation-based interventions to influence reinforcer value in a manner consistent with intervention

goals (e.g., Berg et al., 2000; Guiterrez et al., 2007; Klatt, Sherman, & Sheldon, 2000; Langthorne, McGill, & O'Reilly, 2007; McAdam et al., 2005; McGill, 1999; O'Reilly et al., 2007, 2008; O'Reilly, Lacey, & Lancioni, 2000; Wilder & Carr, 1998).

Given the success of previous research, it is reasonable to assume that manipulating MOs may increase the effectiveness of interventions. This study incorporates the MO concept (specifically the abolishing effect) into an existing research-based play intervention in an attempt to enhance its effectiveness. The play intervention used in this study had been shown to be effective in previous research and consisted of modeling appropriate play, prompting play behavior, reinforcing play behavior, and redirecting stereotypy and challenging behavior back to appropriate play (Lang et al, 2009; Kasari, Freeman, & Paparella, 2006).

The purpose of this study was to evaluate the effectiveness of a research-based play intervention for children with autism with and without an earlier abolishing operation for stereotypy. Effectiveness of interventions was measured by the extent to which stereotypy and challenging behavior were reduced and appropriate play skills were increased during intervention under two conditions (i.e., arranging prior opportunities to engage in stereotypy vs. providing no such opportunities). Our hypothesis was that allowing children to engage in stereotypy before beginning a play intervention session would act as an abolishing operation component (AOC) freely and thereby reduce the reinforcing value of stereotypy. This reduction in the motivation to engage in stereotypy would in turn lead to less stereotypy and less challenging behaviors during the intervention sessions. Ultimately, reducing these behaviors was anticipated as one way of enhancing the effectiveness of play interventions for children with autism who present with frequent stereotypy.

Method

Participants

Four children with ASD were selected to participate in this study. Children were selected according to the following four criteria: (1) formal diagnosis of autism, (2) low or nonexistent levels of functional play behaviors, (3) between 3 and 8 years of age, and (4) frequent stereotypic behaviors likely maintained by automatic reinforcement. When given access to toys as a reinforcer during individual instruction, each of the children would use the toy to engage in high levels of stereotypy. It was the desire of the teachers and parents that the children use the toys in functional play as opposed to engaging in stereotypy.

Table 1. Participant Characteristics

Participant	Sex	Age	Ethnicity	CARS	Vineland Adaptive Age Equivalent	Vineland Adaptive Behavior Composite Standard Score
Johnny	Male	4	White	52 (severe autism)	1 year 11 months	34
Rusty	Male	7	Asian	43 (severe autism)	1 year 9 months	40
Karen	Female	4	Indian	43 (severe autism	2 years 9 months	38
Dorothy	Female	5	Hispanic	42 (severe autism	1 year 8 months	40

Note: CARS = Childhood Autism Rating Scale.

Each child was assessed using the Vineland Adaptive Behavior Scale (Sparrow, Balla, & Cicchetti, 1984) and the Childhood Autism Rating Scale (CARS; Schloper, Reichler, Devellis, & Daly, 1980). Table 1 summarizes participant characteristics.

Setting

All participants attended a specialized school for children with developmental or speech delays. Each child's class consisted of four to eight other children with varying levels of disabilities. Within the group classroom individualized behavior plans for each child had been designed and were being implemented by classroom teachers prior to the study. Among other intervention components targeting various behaviors, these behavior plans called for interrupting and then redirecting stereotypic behaviors as they occurred. Prior to the study, at least three classroom observations of each participant were conducted to observe the fidelity of the teacher's implementation of the interrupting and redirecting portion of the behavior plan. For all 4 participants, the teachers successfully interrupted and blocked more than 80% of stereotypy as it occurred. In addition, toys that the children preferred to use when engaging in stereotypy were not made available. As a result, very little stereotypy occurred in the group classroom.

During each child's regular daily school schedule a 2-hr block was reserved for individual instruction. This instruction took place in a separate classroom and typically consisted of systematic and intensive behavioral therapy. The current study was conducted in this individual instruction room during the typical scheduled time for each participant. The play space was approximately

4 × 5 m. No other children or adults, other than those involved in the research, were present during sessions. The intervention sessions were implemented by the teacher who typically provided instruction during this time. Teachers were special educators with board certifications in behavior analysis.

Assessments

Each participant was given three assessments before the implementation of the intervention procedures. The first assessment identified toys to be used during a subsequent assessment and during play intervention. Age appropriateness and social validity of toys was determined using a four-step process. First, the play of same age typically developing children within the same community was observed, and only toys used by these children were considered for use in the study. Second, parents and teachers were asked to review each of the potential toys for each participant and remove toys that they considered inappropriate. A list of potential toys specific to each participant was then created on the basis of these first two steps. Third, to assess participants' preferences for toys on their list, each toy was given one at a time to the participant for 2 min. This was done to ensure that each child had enough prior experience with each toy to form a preference. Finally, a paired-choice preference assessment was conducted (Fisher et al., 1992). Toys that were associated with the highest levels of stereotypy were also the most frequently selected toys during preference assessment. Examples of the types of toys used included, wooden puzzles, paper and crayons, small plastic animals, puppets, and toy cars.

The second assessment process was intended to determine whether stereotypy was maintained by automatic reinforcement. A two-step process was used to make this determination. First, participants were observed for three 10-min sessions in which they had free access to preferred items, no demands or instructions were given, and a therapist provided attention noncontingently every 10 s. Similar to a functional analysis play condition, because socially mediated consequences (i.e., obtaining preferred items, escaping from task demands, and obtaining attention) were freely provided, any behaviors occurring during this time were not likely to be maintained by these potential reinforcers (Hanley, Iwata, & McCord, 2003; Iwata, Dorsey, Slifer, Bauman, & Richman, 1994/1982). Second, the Questions About Behavioral Functions Scale (QABF; Paclawskyj, Matson, Rush, Smalls, & Vollmer, 2001) was given to parents and teachers. All participants engaged in high levels of stereotypy during the play condition, and all parents' and teachers' QABF scores suggested a nonsocial function for stereotypy.

The third assessment identified a behavioral indicator of satiation. To achieve some level of satiation, the AOC (described in the section Play Intervention with AOC) requires that the participant be given sufficient time to engage in stereotypy before play intervention. In previous research this has been done by setting an arbitrary time limit for precession access, usually between 10 and 30 min. However, O'Reilly et al. (2009) noted that this method of examining satiation or deprivation may be problematic because insufficient precession access may serve as a form of reinforcer sampling or response primer (establishing operations), thereby increasing the reinforcing effectiveness of the stimulus (Ayllon & Azrin, 1968; Azrin & Powell, 1969; Catania, 1998; O'Brien, Azrin, & Henson, 1969; Roantree & Kennedy, 2006). As opposed to a preestablished amount of time for precession access, O'Reilly et al. proposed a methodology for identifying a behavior that indicates satiation.

O'Reilly et al.'s (2009) methodology involves a two-step process. First, each child's parents and teachers were asked, "What behavior does your child engage in when they do not want to do something anymore?" On the basis of this question, follow-up questions were asked until a specific operational definition of a behavior that was likely to identify a state of satiation was created. Second, this hypothesized behavioral indicator of satiation was then systematically evaluated in an alternating treatment design in which each child was exposed to two conditions (i.e., a high-preference condition and a low-preference condition). In the high-preference condition, each child was given the toy most commonly selected during preference assessment. In the low-preference condition, the child was given a toy not selected during preference assessment. Five 10-min sessions of each condition were conducted with each participant. The percentage of intervals containing the hypothesized behavioral indicator of satiation was measured and compared across conditions. If the behavior occurred more often in the low-preference condition than in the high-preference condition, then the behavior was considered a valid indicator of satiation. Specific behavioral indicators of satiation for each child are listed in Table 2.

Dependent Variables, Data Collection, and Interobserver Agreement

Three target behaviors were selected as dependent variables, (1) functional play, (2) stereotypy, and (3) challenging behavior. *Functional play* was defined as the use of play materials in a manner consistent with their intended function (Libby, Powel, Messer, & Jordan, 1998). Examples of functional play

Table 2. Operational Definitions of Stereotypy and Challenging Behavior

Participant	Stereotypy	Challenging Behavior	Behavioral Indicators of Satiation
Johnny	Holding toy near eyes and repeatedly swinging it back and forth	Throwing toys at least 3 feet and/or loud vocalizations substantially above the conversational level (i.e., screams)	Toy moved from near eyes to below chin and gaze shifted to other objects
Rusty	Placing one toy in front of another until a straight line of at least three toys is created then repeatedly and verbally counting the toys	Places hands on furniture or therapist and pushes and/or lets body fall limp to the ground	Walking at least 3 feet from play area leaving toys
Karen	Picking up two toys, holding them close to her ear (within 20 cm) and tapping them together making a soft banging sound	Loud vocalizations substantially above the conversational level (i.e., screams) and/or falling to the ground by buckling both knees	Transferring both toys to the same hand and using the free hand to manipulate other objects
Dorothy	Repeatedly picking up toys and verbally labeling them	Loud vocalizations substantially above the conversational level (i.e., screams)	Walking at least 3 feet from play area leaving toys

included (a) using crayons to color on paper, (b) putting a puzzle piece into a puzzle, and (c) looking through the pages of a picture book. The operational definitions of stereotypy and challenging behavior were individualized for each participant. Table 2 lists operational definitions.

A 10-s partial-interval data collection procedure was used to record the occurrence of each of the three dependent variables. Two independent observers recorded data during all sessions. Interobserver agreement (IOA) was calculated on an interval-by-interval basis by dividing the number of agreements (occurrence plus nonoccurrence) by the total number of intervals and then multiplying by 100%. IOA exceeded 87% in all conditions for all participants (range, 87%-97%).

Experimental Design

An alternating treatments design with a baseline was utilized. Baseline sessions lasted for 10 min. During baseline, participants had free access to all toys, no demands or instructions were given, and the therapist made positive verbal statements (e.g., "I'm having a good time playing with you") every 10 s. During the alternating treatments phase, two conditions were alternated: (1) 10-min play intervention sessions without the preceding AOC, and (2) 10-min play intervention sessions proceeded by the AOC. To reduce carry-over and order effects, the order of the AOC versus non-AOC conditions was randomly determined across days of play intervention. In addition, only one play intervention session was conducted per day.

Play Intervention Without AOC

The play intervention used in this study has been shown to be effective in previous research and consists of modeling appropriate play, prompting play behavior, reinforcing play behavior, and redirecting stereotypy and challenging behavior back to appropriate play (e.g., Kasari, et al., 2006; Lang et al, 2009). The therapist set up the room so that the toys were spread out near the child and easily accessible. Participants were free to approach any of the toys, and the therapist followed the child's lead. When a child indicated an interest in a toy by approaching and touching it, the therapist then modeled appropriate play with the toy. Multiple sets of identical toys were available so the therapist would not need to remove the toy from the participant to model play behavior. A most-to-least prompting hierarchy (physical, verbal, and then model prompts) was used to prompt play behavior. Praise was delivered by the therapist, contingent on the child's engagement in functional play. When stereotypy or challenging behavior occurred, it was interrupted and redirected back to play. Interruption and redirection consisted of physically stopping stereotypy and immediately prompting functional play.

Play Intervention With AOC

This condition differed from the previous in that we manipulated the presession situation by allowing free access to stereotypy, which was hypothesized to act as an AOC. During presession AOC, the therapist provided an environment containing all selected toys spread out and easily accessible. Participants were allowed to engage in any nondangerous behavior. All occurrences of

stereotypy and challenging behavior were ignored (i.e., not physically interrupted). The AOC continued until participants engaged in their behavioral indicator of satiation (see Table 2). The mean duration of the AOC presessions was approximately 34 min (range, 11-42 min). Following the AOC, play intervention was immediately initiated.

Treatment Fidelity

Treatment fidelity data were collected during 33% of sessions for Johnny, 100% of sessions for Rusty, and 50% of sessions for Karen and Dorothy. Treatment fidelity was collected on implementation of the AOC and on delivery of play skills intervention. The first author observed participants and therapists during play intervention and noted whether intervention was begun following the occurrence of the behavioral indicator of satiation. In all sessions this was done with 100% accuracy. In addition, treatment fidelity was measured during play intervention. A 10-s partial interval procedure was used to record errors in play intervention implementation. Because intervention consisted of three main components (i.e., prompting, reinforcement, and interrupting stereotypy) three possible types of errors were recorded. A "prompting error" was scored if the therapist failed to delivery a prompt or failed to use the correct prompting hierarchy. A "stereotypy error" was scored if the therapist failed to interrupt stereotypy. Finally, a "reinforcement error" was scored if the therapist failed to provide the programmed reinforcement (i.e., praise). The percentage of correct implementation (100% error minus the percent error in implementation) for all participants exceeded 88% (range, 88%-100%).

Results

Figure 1 displays results for Johnny. The top panel displays the percentage of intervals Johnny engaged in functional play behaviors. During baseline functional play did not occur. After seven intervention sessions (combined AOC and No AOC), play behaviors increased in the AOC condition (13%). Play behaviors did not increase in the No-AOC condition until the 13th session (13%). Overall, the AOC condition contained higher levels of functional play (M = 17%; range, 0%-48%) than did the No-AOC condition (M = 7%; range, 0%-23%). Functional play showed an increase in both conditions across successive sessions. The middle panel displays the percentage of intervals during which Johnny engaged in stereotypy. During baseline stereotypy occurred during an average of 77% of intervals (range, 75%-82%). Stereotypy remained

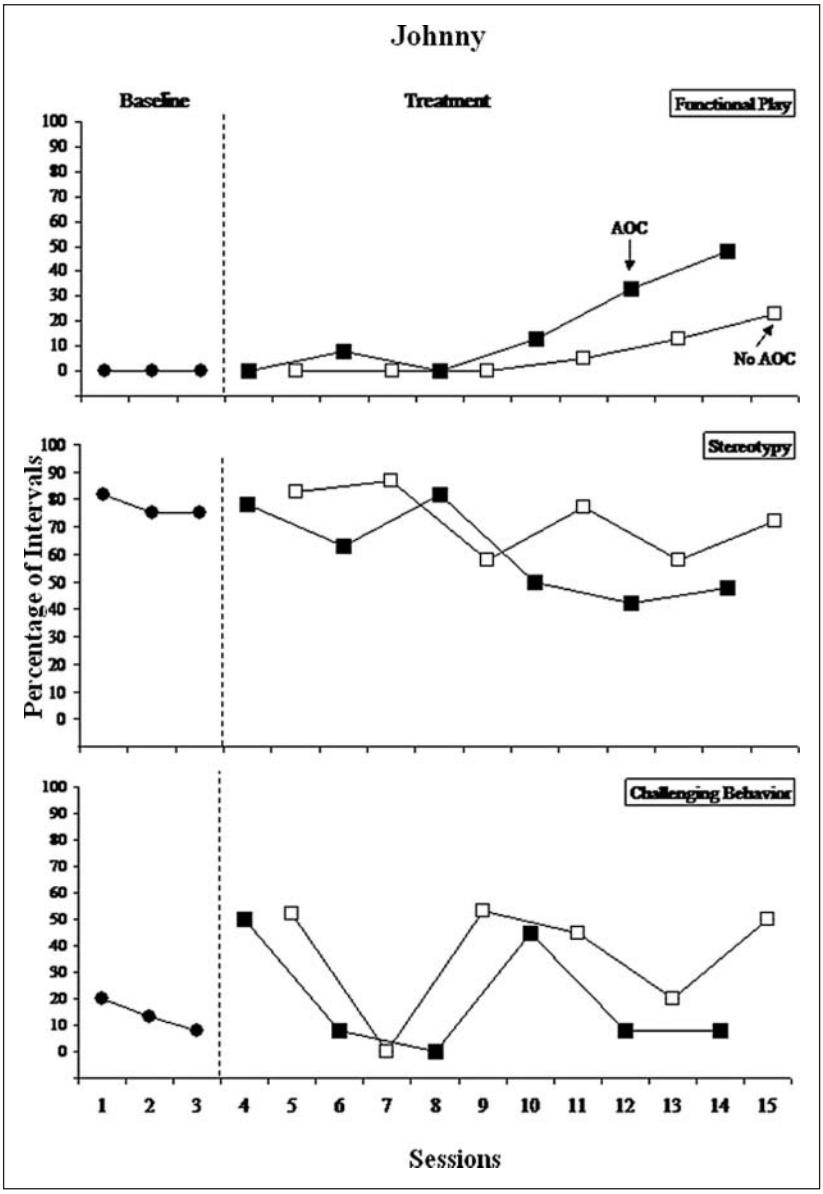

Figure 1. Johnny's data

at a relatively stable level until the last three AOC sessions when stereotypy decreased (M = 47%; range, 42%-50%). Overall, the AOC condition had lower levels of stereotypy (M = 61%; range, 42%-82%) than did the No-AOC condition (M = 73%; range, 58%-87%). The bottom panel displays the percentage of intervals during which Johnny engaged in challenging behavior. During baseline, challenging behavior occurred during an average of 14% of intervals (range, 8%-20%). With intervention, challenging behavior increased in both conditions. However, the AOC condition had lower overall levels of challenging behavior (M = 20%; range, 0%-50%) compared to the No-AOC condition (M = 37%; range, 0%-53%).

Figure 2 displays results for Rusty. During baseline, functional play was observed during an average of 29% of intervals (range, 17%-45%). Once Rusty began receiving intervention, play behaviors increased in both conditions (M = 51%; range, 33%-71%). The increased levels of functional play were similar across the AOC and No-AOC conditions and remained consistent, neither increasing nor decreasing over time. During baseline, stereotypy occurred during an average of 54% of intervals (range, 33%-77%). During intervention, the AOC condition had lower overall levels of stereotypy (M = 41%; range, 33%-50%) than did the No-AOC condition (M = 61%; range, 50%-68%). During baseline challenging behavior occurred during an average of 2% of intervals (M = range, 0%-8%). With intervention, challenging behavior remained at baseline levels in the AOC condition, but increased in the No-AOC condition (M = 13%; range, 5%-21%).

Figure 3 displays results for Karen. During baseline, functional play did not occur. Once Karen began receiving intervention, play behaviors increased in both conditions. However, the AOC condition contained slightly higher levels of functional play (M = 37%; range, 17%-50%) than the No-AOC condition (M = 31%; range, 17%-45%). In addition, both conditions showed an increase in overall levels of play over time. During baseline, stereotypy occurred during an average of 98% of intervals (range, 98%-100%). Once Karen began intervention, stereotypy decreased in both conditions. However, the AOC condition had lower overall levels (M = 40%; range, 21%-58%) than the No-AOC condition (M = 64%; range, 58%-71%). In addition, levels of stereotypy decreased over time in the AOC condition but remained consistently higher in the No-AOC condition. During baseline, challenging behavior occurred during an average of 1% of intervals (range, 0%-5%). Once Karen began intervention, challenging behavior increased slightly in the AOC condition (M = 12%; range, 5%-18%) and increased more substantially in the No-AOC condition (M = 32%; range, 21%-45%).

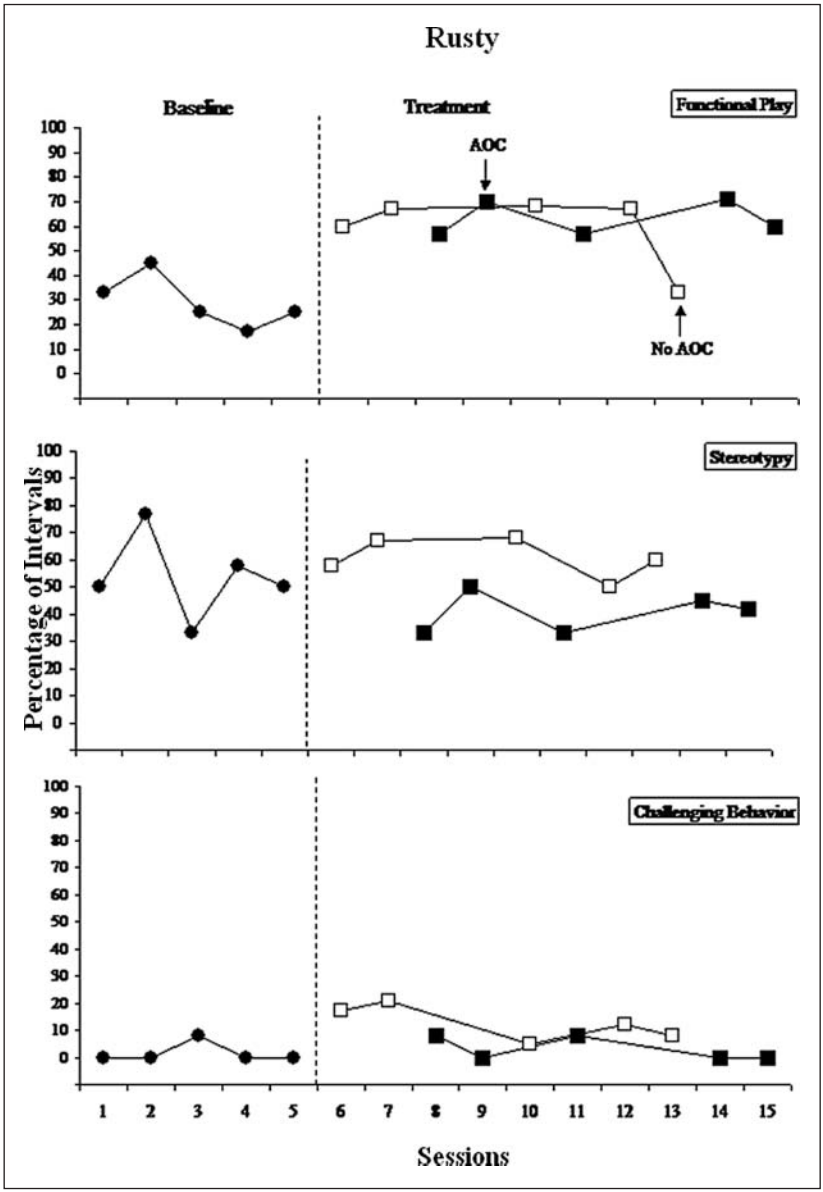

Figure 2. Rusty's data

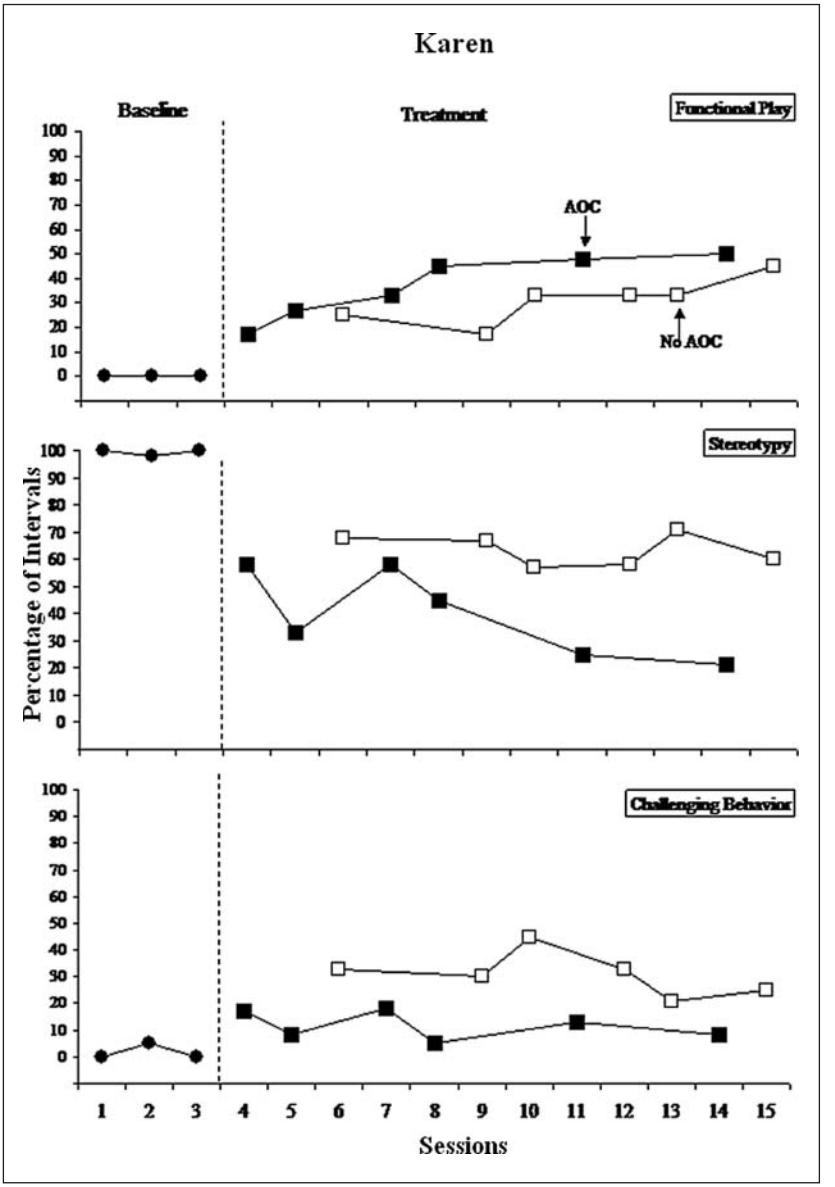

Figure 3. Karen's data

Figure 4 displays results for Dorothy. During baseline, functional play occurred during an average of 26% of intervals (range, 24%-30%). Once Dorothy began receiving intervention, play behaviors increased in both conditions. However, the AOC condition contained higher levels of functional play ($M = 68\%$; range, 45%-88%) than did the No-AOC condition ($M = 39\%$; range, 8%-55%). In addition, only in the AOC condition did Dorothy show an increase in her overall levels of play over time. During baseline, stereotypy occurred during 48% of intervals (range, 45%-50%). Once Dorothy began intervention, stereotypy decreased in the AOC condition ($M = 27\%$; range, 8%-50%) and remained consistently higher in the No-AOC condition ($M = 43\%$; range, 25%-55%). In addition, levels of stereotypy decreased in the AOC condition over time, with the exception of Session 10. During baseline, challenging behavior occurred during 3% of intervals (range, 0%-8%). Once Dorothy began intervention, challenging behavior remained consistently low in the AOC condition ($M = 5\%$; range, 0%-11%) and increased in the No-AOC condition ($M = 16\%$; range, 0%-30%).

Discussion

The purpose of this study was to determine whether effectiveness of a common research-based play intervention for children with autism could be enhanced by providing presession opportunities to freely engage in stereotypy (i.e., the AOC condition). We hypothesized that the AOC condition would, at least briefly, reduce the child's motivation to engage in stereotypy. This reduction in motivation would then reduce the actual occurrence of stereotypy and any challenging behavior that might be provoked when stereotypy was interrupted. Because these behaviors are known to interfere with play, their reduction could increase the effectiveness and efficiency of an intervention designed to teach play skills.

The play intervention, which was identical in both the AOC and No-AOC conditions, was generally associated with an increase in functional play for all participants. This finding supports previous research in which components of this intervention have been evaluated (Brown & Murray, 2001; Kasari et al., 2006; Stahmer et al., 2003). Overall, the AOC condition lead to either faster acquisition of functional play skills, more frequent functional play behaviors, or more consistent use of functional play skills than the No-AOC condition. When designing an intervention to teach functional play to a child with autism who engages in stereotypy, this data set suggests two points. First, the play intervention described here, which is common to both

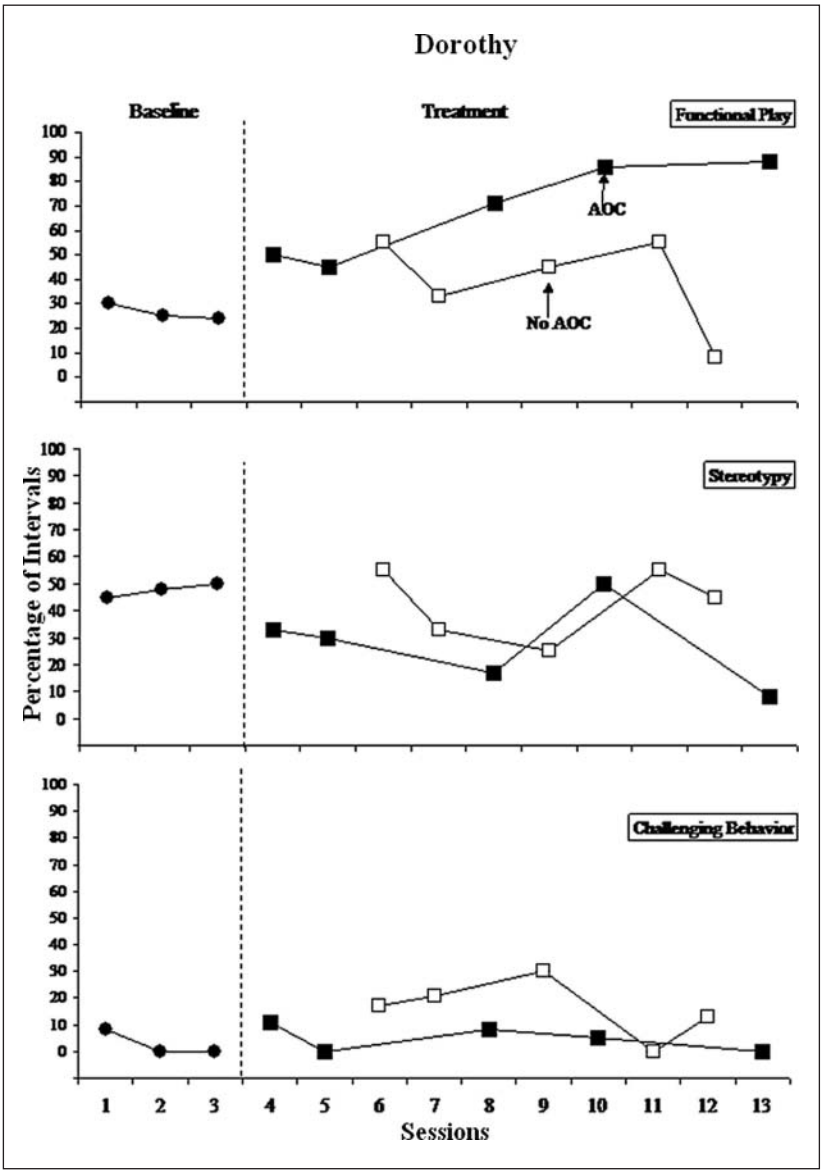

Figure 4. Dorothy's data

the AOC and No-AOC conditions, is potentially effective. Second, when a teacher (or parent) is planning on teaching play skills to a child who presents with stereotypy, it may be beneficial to allow the child to engage in stereotypy freely for a period of time before teaching as part of the overall teaching package.

With respect to the effects of intervention in stereotypy, we found that stereotypy decreased as functional play increased for 3 of 4 participants, (Rusty is the exception). This finding suggests that there may have been an inverse relationship between stereotypy and play skills. Specifically, as play skills increase, participants generally engaged in less stereotypy. This finding is consistent with some previous research demonstrating that interventions designed to decrease stereotypy or challenging behavior produce a collateral increase in functional play behaviors (e.g., Koegel et al., 1974). The possible existence of such a relationship suggests that one method for effectively treating stereotypy may be to teach children to play (e.g., Gillett & LeBlanc, 2007; Hume & Odom, 2007; Paterson & Arco, 2007).

In line with our hypothesis, we found that stereotypy was lower in the AOC versus the No-AOC conditions. This finding suggests that allowing a child to engage in stereotypy freely before providing instruction in play skills may decrease the motivation to engage in stereotypy during the subsequent session of play intervention, particularly if stereotypy is normally restricted, as was the case in the group classroom setting for each of these participants. Allowing a child to engage in stereotypy in this way may make it easier to engage the child in play and prompt functional play during intervention sessions.

The MO concept (which includes abolishing operations) offers a potential explanation for this finding (Laraway, Snycerski, Michael, & Poling, 2003). Specifically, it is possible that the reinforcing value of stereotypy was reduced following the AOC condition because the child has essentially become satiated with respect to stereotypy. In other words, the reinforcer-abolishing effect may have reduced the reinforcing value of stereotypy and created a window of opportunity for increasing the child's engagement in functional play skills. It is unlikely that the AOC condition produced a decrease in stereotypy due to fatigue as functional play showed an increase in the sessions that immediately followed the AOC condition.

An unanticipated finding was that challenging behavior frequently increased from baseline to intervention. As this increase was counterintuitive, it might be explained in terms of the increase in demands that were associated with onset of intervention when compared to baseline. Specifically, during intervention children were prompted to play and stereotypy was interrupted. This increase in prompting and interruption may have provoked

challenging behavior. If so, it would provide an additional rationale for the importance of reducing stereotypy before intervention. This finding might also suggest the value of using errorless procedures when teaching play skills. Unfortunately, we were not able to determine whether it was the increase in promoting, or interruption, or both, that provoked challenging behavior during intervention. It is also possible that other unknown variables may have been responsible for the instances of increased challenging behavior from baseline to intervention. However, in line with the possibility that interrupting stereotypy might occasion challenging behavior, those intervention sessions following the AOC condition contained fewer occurrences of challenging behavior than the No-AOC conditions. This difference across the AOC and No-AOC conditions lends some support to our hypothesis that challenging behavior might be provoked by interrupting stereotypy. In fact, there was less stereotypy to interrupt in intervention sessions following the AOC condition. This interpretation needs to be taken with caution, however, as we did not independently verify whether the interruption of stereotypy set the occasion for challenging behavior in these children.

The data presented in this study, though promising, have several limitations. First, this current study did not collect maintenance or generalization data regarding acquired play skills. Therefore, this study did not demonstrate sustained improvements in play skills in the absence of the intervention. However, the purpose of this study was not to assess the effects of the play intervention common to both conditions. In fact, this specific play intervention was chosen because it already had some research base demonstrating its effectiveness (Lang et al., 2009). The purpose of this study was to offer a potential improvement to this intervention, specifically, a method for addressing stereotypy during intervention.

Caution should also be used when considering possible explanations for observed differences among conditions for two reasons. First, an empirical demonstration of the functional properties of challenging behavior and stereotypy was not included in this study due to concerns by teachers that the functional analysis procedures may inadvertently teach children to use their stereotyped behaviors for socially mediated consequences. However, the baseline phase, during which challenging behavior was low and stereotypy was high, suggested that the former behavior was not likely to be related to automatic reinforcement, whereas the latter behavior was most likely to be maintained by automatically reinforcing sensory consequences (Kahng & Iwata, 1998).

Another possible limitation is that when differences between the AOC and No-AOC conditions were found, no measure of the magnitude of this

difference in terms of clinical significance is available. Because both conditions produced the desired increase in functional play and decrease in stereotypy over varying amounts of time, it is possible that the additional intervention component is not cost-efficient; that is, its benefits may not be considered large enough to compensate for its time costs. Still, these data showed a larger increase in functional play and a more pronounced decrease in stereotypy during intervention sessions that followed the AOC condition, suggesting that the AOC condition did in fact function to produce satiation with respect to stereotypy. It is unclear, however, how long any such satiation effect might last and the need for a presession experience of 11 to 42 min duration may be a hindrance to the application of this approach. Future research could explore the possibility of increasing the efficiency of this intervention component by embedding instructional activities into the AOC time.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interests with respect to the authorship and/or publication of this article.

Financial Disclosure/Funding

The author(s) received no financial support for the research and/or authorship of this article.

References

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

Ayllon, T., & Azrin, N. H. (1968). Reinforcer sampling: A technique for increasing the behavior of mental patients. *Journal of Applied Behavior Analysis, 1*, 13-20.

Azrin, N. H., & Powell, J. (1969). Behavioral engineering: The use of response priming to improve prescribed self-medication. *Journal of Applied Behavior Analysis, 2*, 39-42.

Baker, M. J. (2000). Incorporating the thematic ritualistic behaviors of children with autism into games: Increasing social play interactions with siblings. *Journal of Positive Behavioral Interventions, 2*, 66-84.

Baker, M., Koegel, R., & Koegel, L. (1998). Increasing the social behavior of young children with autism using their obsessive behaviors. *Journal of the Association of Persons with Severe Handicaps, 23*, 300-308.

Baron-Cohen, S. (1987). Autism and symbolic play. *British Journal of Developmental Disability, 5*, 13-148.

Berg, W., Peck, S., Wacker, D., Harding, J., McComas, J., Richman, D., & Brown, K. (2000). The effects of presession exposure to attention on the results of assessment as a reinforcer. *Journal of Applied Behavior Analysis, 30*, 463-477.

Brown, J., & Murray, D. (2001). Strategies for enhancing play skills for children with autism spectrum disorders. *Education and Training in Mental Retardation and Developmental Disabilities, 36*, 312-317.

Catania, A. C. (1998). *Learning* (4th ed.). Upper Saddle River, NJ: Prentice Hall.

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.

Gillett, J. N., & LeBlanc, L. A. (2007). Parent-implemented natural language paradigm to increase language and play in children with autism. *Research in Autism Spectrum Disorders, 1*, 247-255.

Guiterrez, A., Vollmer, T., Dozier, D., Borrero, J., Rapp, J., Bourret, J., & Gadaire, D. (2007). Manipulating establishing operations to verify and establish stimulus control during Mand training. *Journal of Applied Behavior Analysis, 40*, 645-658.

Hanley, G. P., Iwata, B. A., & McCord, B. E. (2003). Functional analysis of problem behavior: A review. *Journal of Applied Behavior Analysis, 36*, 147-185.

Honey, E., Leekam, S., Turner, M., & McConachie, H. (2007). Repetitive behavior and play in typically developing children and children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 37*, 1107-1115.

Hume, K., & Odom, S. (2007). Effects of an individual work system on the independent functioning of students with autism. *Journal of Autism and Developmental Disorders, 37*, 1166-1180.

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. (Reprinted from *Analysis and Intervention in Developmental Disabilities, 2,* 3-20, 1982)

Kahng, S. W., & Iwata, B. A. (1998). Play versus alone conditions as controls during functional analyses of self injurious escape behavior. *Journal of Applied Behavior Analysis, 31*, 669-672.

Kasari, C., Freeman, S., & Paparella, T. (2006). Joint attention and symbolic play in young children with autism: A randomized controlled intervention study. *Journal of Child Psychology and Psychiatry, 47*, 611-620.

Klatt, K., Sherman, J., & Sheldon, J. (2000). Effects of deprivation on engagement in preferred activities by persons with developmental disabilities. *Journal of Applied Behavior Analysis, 33*, 495-506.

Koegel, L. K., Koegel, R. L., Frea, W. D., & Fredmen, R. M. (2001). Identifying early intervention targets for children with autism in inclusive school settings. *Behavior Modification, 25*, 745-761.

Koegel, R. L., Firestone, P. B., Kramme, K. W., & Dunlap, G. (1974). Increasing spontaneous play by suppressing self-stimulation in autistic children. *Journal of Applied Behavior Analysis, 7*, 521-528.

Lang, R., Machalicek, W., O'Reilly, M. F., Sigafoos, J., Rispoli, M. J., Shogren, K., & Regester, A. (2009). Review of interventions to increase functional and symbolic play in children with autism. *Education and Training in Developmental Disabilities, 44*, 481-492.

Langthorne, P., McGill, P., & O'Reilly, M. (2007). Incorporating "motivation" into the functional analysis of challenging behavior: On the interactive and integrative potential of the motivating operation. *Behavior Modification, 31*, 466-487.

Laraway, S., Snycerski, S., Michael, J., & Poling, A. (2003). Motivating operations and terms to describe them: Some further refinements. *Journal of Applied behavior Analysis, 36*, 407-414.

Libby, S., Powel, S., Messer, D., & Jordan, R. (1998). Spontaneous play in children with autism: A reappraisal. *Journal of Autism and Developmental Disabilities, 28*, 487-497.

McAdam, D., Klatt, K., Koffarnus, M., Dicesare, A., Solberg, K., Welch, C., & Murphy, S. (2005). The effects of establishing operations on preferences for tangible items. *Journal of Applied Behavior Analysis, 36*, 297-307.

McGill, P. (1999). Establishing operations: Implications for the assessment and treatment of problem behavior. *Journal of Applied Behavior Analysis, 32*, 393-418.

Michael, J. (1982). Distinguishing between discriminative and motivational functions of stimuli. *Journal of Experimental Analysis of Behavior, 37*, 149-155.

Michael, J. (1993). Establishing operations. *Behavior Analyst, 16*, 191-206.

Michael, J. (2000). Implications and refinements of the establishing operation concept. *Journal of Applied Behavior Analysis, 33*, 401-410.

O'Brien, F., Azrin, N. H., & Henson, K. (1969). Increasing communications of chronic mental patients by reinforcement and by response priming. *Journal of Applied Behavior Analysis, 2*, 23-29.

O'Reilly, M., Edrishina, C., Sigafoos, J., Lancioni, G., Cannella, H., Machalicek, W., & Langthorne, P. (2007). Manipulating the evocative and abative effects of an establishing operation: Influences on challenging behavior during classroom instruction. *Behavioral Interventions, 22*, 137-145.

O'Reilly, M. F., Lacey, C., & Lancioni, G. (2000). Assessment of the influence of background noise on escape-maintained problem behavior and pain behavior in a child with Williams syndrome. *Journal of Applied Behavior Analysis, 30*, 511-514.

O'Reilly, M. F., Lang, R., Davis, T., Rispoli, M., Machalicek, W., Sigafoos, J., . . . Didden, R. (2009). A systematic examination of different parameters of precession exposure to tangible stimuli that maintain challenging behavior. *Journal of Applied Behavior Analysis, 42*, 773-783.

O'Reilly, M., Sigafoos, J., Lancioni, G., Rispoli, M., Lang, R., Chan, J., . . . Langthorne, P. (2008). Manipulating the behavior-altering effect of the motivating operation: Examination of the influence on challenging behavior during leisure activities. *Research in Developmental Disabilities, 29*, 333-340.

Paclawskyj, T. R., Matson, J. L., Rush, K. S., Smalls, Y., & Vollmer, T. R. (2001). Assessment of the convergent validity of the Questions About Behavioral Function Scale with analogue functional analysis and Motivation Assessment Scale. *Journal of Intellectual Disability Research, 45*, 484-494.

Paterson, C. R., & Arco, L. (2007). Using video modeling for generalizing toy play in children with autism. *Behavior Modification, 31*, 660-681.

Rapp, J. T., Vollmer, T. R., Peter, C., Dozier, C. L., & Cotnoir, N. M. (2004). Analysis of response allocation in individuals with multiple forms of stereotyped behavior. *Journal of Applied Behavior Analysis, 37*, 481-501.

Roantree, C. F., & Kennedy, C. H. (2006). The paradoxical effect of precession attention on stereotypy: Antecedent attention as an establishing, not an abolishing operation. *Journal of Applied Behavior Analysis, 39*, 381-384.

Schloper, E., Reichler, R. J., Devellis, R. F., & Daly, K. (1980). Toward an objective classification of childhood autism: Childhood Autism Rating Scale (CARS). *Journal of Autism and Developmental Disabilities, 10*, 91-103.

Sigafoos, J., Arthur, M., & O'Reilly, M. (2003). *Challenging behavior and developmental disability*. London: Whurr Publishers.

Sigafoos, J., Roberts-Pennell, D., & Graves, D. (1999). Longitudinal assessment of play and adaptive behavior in young children with developmental disabilities. *Research in Developmental Disabilities, 20*, 147-161.

Sparrow, S. S., Balla, D. A., & Cicchetti, D. V. (1984). *Vineland Adaptive Behavior Scales*. Circle Pines, MN: American Guidance Service.

Stahmer, A. C., Ingersoll, B., & Carter, C. (2003). Behavioral approaches to promoting play. *Autism, 7*, 401-413.

Terpstra, J. E., Higgins, K., & Pierce, T. (2002). Can I play? Classroom based interventions for teaching play skills to children with autism. *Focus on Autism and Other Developmental Disorders, 17*, 119-126.

Vollmer, T. H., & Iwata, B. A. (1991). Establishing operations and reinforcement effects. *Journal of Applied Behavior Analysis, 24*, 279-291.

Wilder, D., & Carr, J. (1998). Recent advances in the modification of establishing operations to reduce aberrant behavior. *Behavioral Interventions, 13*, 43-59.

Wing, L., Gould, J., Yeates, S. R., & Brierley, L. M. (1977). Symbolic play in severely mental retarded and autistic children. *Journal of Child Psychology and Psychiatry, 18*, 167-178.

Bios

Russell Lang is currently an assistant professor at Texas State University. He received his Ph.D. from the University of Texas at Austin, and is a Board Certified Behavior Analyst-Doctoral. His research interests include the assessment and treatment of challenging

behavior, communication skills instruction, and improving the play skills of children with developmental and/or physical disabilities.

Mark O'Reilly is a professor of special education at The University of Texas at Austin. He received his PhD in Special Education from the University of Illinois at Urbana-Champaign in 1992. His research and teaching interests include curriculum and pedagogy for students with autism and developmental disability, assessment and treatment of challenging behavior, and development and evaluation of assistive technology.

Jeff Sigafoos is a professor at the University of Wellington in New Zealand. He received his Ph.D., from The University of Minnesota in 1990. He teaches in the area of developmental disability and conducts research on communication intervention, use of assistive technology, and assessment and treatment of challenging behavior in persons with developmental and physical disabilities.

Wendy Machalicek is an assistant professor at the University of Wisconsin in Madison. She received her Ph.D. from The University of Texas at Austin and is a Board Certified Behavior Analyst-Doctoral. Her research interests include the assessment and treatment of challenging behavior, communication skills instruction, and parent training to deliver interventions to children with developmental and/or physical disabilities.

Mandy Rispoli is an assistant professor at the Texas A&M University in College Station. She received her Ph.D. from The University of Texas at Austin and is a Board Certified Behavior Analyst-Doctoral. Her research interests include the assessment and treatment of challenging behavior, communication skills instruction, and the evaluation of motivating operation-based intervention components.

Giulio Lancioni is a professor at the Department of Psychology, University of Bari in Italy. His research interests include the development and evaluation of assistive technology, social skills training, and strategies for examining and teaching choice and preference with individuals with severe/profound and multiple disabilities.

Jeannie Aguilar is a doctoral student at the University of Texas at Austin and a Board Certified Behavior Analyst. Her research interest involves the assessment and treatment of challenging behavior in individuals with autism and developmental disabilities.

Christina Fragale is a doctoral student at the University of Texas at Austin and a Board Certified Behavior Analyst. Her research interest involves the assessment and treatment of challenging behavior in individuals with autism and developmental disabilities.