Play skills taught via behavioral intervention generalize, maintain, and persist in the absence of socially mediated reinforcement in children with autism

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ABSTRACT

We measured generalization, maintenance and parent reports of child happiness in the context of a behavioral intervention to teach toy-play skills to three young children with autism. Lag schedules of reinforcement were implemented for two participants whose play did not initially generalize. The play skills intervention was conducted within the participants' early childhood classroom and the utility of teaching play as a means to reduce stereotypy within this setting was also evaluated. A multiple baseline design across participants demonstrated that play taught via behavioral intervention may be maintained after programmed reinforcement is discontinued, generalize across settings and toys (i.e., response and stimulus generalization), and occasion a decrease in stereotypy. Further, the occurrence of play in the absence of socially mediated reinforcement suggested that play taught via behavioral interventions may come to be automatically reinforced. Finally, parent responses on rating scales suggested that two of the participants were happier, in a better mood, and were more interested in appropriate toy-play following behavioral intervention.

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1. Introduction

Play is widely acknowledged to be an important mechanism for children's intellectual, social, physical, and emotional development (e.g., Lifter, Foster-Sanda, Arzmarski, Briesch, & McClure, 2011; Piaget, 1962). Unfortunately, children with autism often do not develop play in the same way as typically developing children (Lifter, Ellis, Cannon, & Anderson, 2005). For example, in the early stages of play development, most children begin to manipulate various objects in multiple ways; however, children with autism often manipulate only a few objects in a limited number of ways (van Berckelaer-Onnes, 2003; Bruckner & Yoder, 2007; Tilto & Ottinger, 1964). Children with autism engage in significantly fewer appropriate play

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behaviors and more stereotypic behaviors than other children of equivalent chronological and/or mental age (American Psychiatric Association, 2013; Lang, Regester, Rispoli, Pimentel, & Camargo, 2010; Wing Gould, Yeates, & Brierley, 1977). In the absence of intervention, play deficits often persist and, it is not uncommon for adults with autism to lack the skills required to engage in recreational and leisure activities (Billstedt, Gillberg, & Gillberg, 2011; Palmen, Didden, & Korzilius, 2011). Meaningful leisure activities offer relief from boredom and provide a context for social engagement. More importantly, such activities may contribute to a person's ability to successfully cope with and recover from stressful life events (Kleiber, Hutchinson, & Williams, 2002).

Hine and Wolery (2006) offer several additional reasons why teaching play to young children with autism is a valuable treatment goal. First, children that do not learn to play may miss opportunities for social interactions and that loss may negatively influence the development of social skills (Barton & Wolery, 2008; Licciardello, Harchik, & Luiselli, 2008; Pierce-Jordan & Lifter, 2005). Second, increasing the quality and frequency of appropriate play has been shown to decrease stereotypy and other problem behaviors in some children with autism and may be an effective approach to the prevention or treatment of these behaviors (e.g., Koegel, Firestone, Kramme, & Dunlap, 1974; Lang, O'Reilly, et al., 2010). Third, teaching play reduces the observable differences between children with autism and typically developing children. A reduction in the apparent differences may increase the likelihood that the children with autism will be considered for inclusion in activities with typically developing children (Hine & Wolery, 2006). Finally, adults and other children may be more likely to comment on or join in the play of the child with autism if the child is engaged in behaviors that are recognized as play. For example, peers and teachers may be hesitant to comment or interact with a child that is mouthing a toy cow, but may interact if the child is moving the cow around a toy barn. This type of increased exposure to language has been shown to be associated with the acquisition of speech (e.g., McDuffie & Yoder, 2010; Venker, McDuffie, Ellis Weismer, & Abbeduto, 2012; Yoder, McCathren, Warren, & Watson, 2001). Ultimately, play provides a context for addressing many of the core deficits associated with autism and, play skills instruction can be implemented proactively during early childhood (Lifter, Foster-Sanda, et al., 2011; Lifter, Mason, & Barton, 2011; Ninci et al., 2013).

There are two distinct perspectives regarding the nature and development of play that can be generally characterized as the behavioral perspective and the constructivist perspective (Lifter, Foster-Sanda, et al., 2011a). Although these perspectives are not necessarily mutually exclusive, researchers operating from these different paradigms have traditionally focused their research agendas in different directions (Lifter, Foster-Sanda, et al., 2011). Specifically, the majority of research conducted from the constructivist perspective involves the cognitive and neurodevelopmental underpinnings of play (Lifter, Foster-Sanda, et al., 2011; Rutherford & Rogers, 2003). By contrast, behavioral play research is more likely to focus on interventions designed to make play skills appear more similar to that of typically developing children (Barton & Wolery, 2008; Lang, Machalicek, et al., 2009; Lang et al., 2011; Lifter, Foster-Sanda, et al., 2011).

Previous play research from the behavioral paradigm has demonstrated that improving the frequency, quality, and/or diversity of play may reduce stereotypic behavior (Koegel et al., 1974; Lang, O'Reilly, et al., 2009; Lang, O'Reilly, et al., 2010; Lang, Regester, et al., 2010), improve language (Kasari, Paparella, Freeman, & Jahromi, 2008), and facilitate the acquisition of social skills and competence (Manning & Wainwright, 2010) in children with autism. Despite the reported success of previous behavioral play intervention research, Applied Behavior Analysis-based (ABA) play interventions are often considered lacking for several reasons. Specifically, it has been hypothesized that behavioral interventions do not teach children to engage in genuine play, but instead to engage in behaviors that merely resemble play. Jobling (1988) examined the characteristics of play within the context of early intervention programs and argued that the inherent fun and enjoyment of authentic play is being overlooked within such programs. Similarly, Luckett, Bundy, and Roberts (2007) assert that play skills acquired via ABA interventions fail to meet commonly accepted definitions of genuine play. Specifically, play should be intrinsically motivated (i.e., automatically reinforced), flexible in form, generalize across contexts, and bring joy to the individual playing. However, behavioral interventions designed to improve play are often said to rely on extrinsic (i.e., socially mediated) reinforcers, lack generalization and maintenance measures, and depend on highly structured and contrived contexts and intervention components. Further, the happiness of the child engaging in play is not often measured and should not be assumed (Jobling, 1988; Luckett et al., 2007).

This study is designed to address the above criticisms of behavioral play intervention in several ways. First, generalization of play behaviors taught via behavioral intervention was assessed across toys and settings (i.e., response and stimulus generalization). Second, play behavior was assessed in the absence of discriminative stimuli associated with the delivery of socially mediated reinforcement. Third, happiness, mood, and interest in playing were assessed by the participating children's mothers before and after intervention. Finally, the maintenance of play behavior was assessed after the systematic play intervention had been withdrawn for up to four months. In addition to addressing concerns regarding behavioral play interventions, this study sought to replicate and extend previous research by demonstrating a reduction in stereotypy following the acquisition of play skills (e.g., Koegel et al., 1974; Lang, O'Reilly, et al., 2010) in an early childhood educational setting.

2. Method

2.1. Participants

Three children with autism attending a school for young children with developmental disabilities participated in this study. These participants were selected according to the following predetermined criteria: (a) a chronological age between 2

and 6 years of age (i.e., so as to focus on an age range where independent toy play is developmentally appropriate; see Frost, Wortham, & Reifel, 2011), (b) a formal diagnosis of autistic disorder based upon the *DSM-IV-TR* (American Psychiatric Association, 2000), and (c) having stereotypic behavior that involved toys (e.g., waving toys in front of face) and a dearth of recognizable appropriate play skills. The first three children referred to the study met all the above criteria and were included. All the participants who began the study completed the study.

Ashley was 3 years and 7 months and scored a 34 on the Childhood Autism Rating Scale (CARS) indicating mild–moderate symptoms of autism (Schopler, Reichler, DeVellis, & Daly, 1980). Ashley was able to communicate in one to two word utterances using an estimated 20 different words or approximations. Ashley's toy-based stereotypy included: (a) repeatedly opening and closing small hinges on toys (e.g., a dollhouse door), (b) holding toys within 5–10 cm from her face while staring at a small piece of the toy, and (c) slowly moving her finger along textured areas of toys (e.g., plastic shingles on a dollhouse). In addition to improving play skills, Ashley's individualized educational program (IEP) included goals related to improving her verbal communication, toilet training, simple social skills (e.g., greeting peers) and completing school routines (e.g., putting materials away).

Vince was 3 years and 10 months and scored a 36 on the CARS indicating mild–moderate symptoms of autism. Vince was able to communicate in two to three word utterances using approximately 15 different words. Vince's toy-based stereotypy included: (a) repeatedly picking up toys and dropping them to the ground, (b) lining toys up in a straight row, (c) repeatedly touching features of the toy with his index finger while counting aloud, and (d) rubbing toys and other items with his feet. In addition to improving play skills, Vince's IEP included goals related to receptive identification of items, verbally labeling the actions of others, answering "wh" questions, and toilet training.

Colt was 3 years and 6 months and scored a 36 on the CARS indicating mild–moderate symptoms of autism. Colt communicated in one to two word sentences but rarely spoke unprompted. Colt's stereotypy included: (a) repeated manipulation of only one small part of a toy (e.g., pressing the same button dozens of times consecutively while ignoring a toy's other features), (b) tapping the sides of toys to make a soft sound, and (c) waving toys in front of his face. Colt's IEP included goals related to toilet training, school routines, communication (e.g., requesting preferred items), simple social interactions (e.g., greeting peers), and play.

2.2. Setting and materials

All sessions were conducted in a school for young children with developmental disabilities located in the southwest United States. The participants' classroom included two teachers, two teaching assistants, and fluctuating enrollment of approximately eight students with mild to moderate developmental disabilities. One teacher was a certified speech language pathologist and the other was a board certified behavior analyst (BCBA). Teaching assistants were graduate students studying special education, behavior analysis, and/or speech language pathology. The teachers and assistants in this classroom must be considered to have a higher level of training than that of typical teachers in such settings and thus may have required less support in implementing this intervention than would normally be expected (e.g., Rispoli, Neely, Lang and Ganz, 2011). Teachers were trained to implement intervention procedures using verbal instructions and role play.

The study took place in the participants' classroom (8 m × 9 m) and in a second smaller individual therapy room (3 m × 3 m) at the school. Baseline and intervention sessions were held in different rooms in order to assess for generalization across settings. All baseline sessions (except for one session taking place in the main classroom) were conducted in the school's individual therapy room. Prior to the study, the participants had no (or very limited) previous experience in the therapy room. During baseline sessions, the therapy room only contained materials associated with the experimental sessions (e.g., toys and data collection equipment). The only people in the therapy room during baseline sessions were the data collector and participant. The data collectors had no previous history with the participants and refrained from interacting with the participants during the course of the study. Data collectors were graduate students in ABA specializing in autism and were trained to collect data in a formal graduate level course focused on single-subject research design.

All intervention sessions and one baseline session were conducted in the classroom. The classroom was arranged typical of an early childhood educational setting and contained shelves of toys, child-sized chairs, and developmentally appropriate instructional and play materials. Intervention sessions were embedded during the regularly scheduled center time (i.e., common early childhood classroom activity that involves rotating through stations containing a variety of different activities designed to target different skills). During intervention sessions as many as six additional children, two teachers, one or two teaching assistants, and one or two data collectors were present. All the children in the class rotated through centers individually. The toys used during intervention were placed in one of these centers and the teacher trained to deliver the intervention manned that center. Intervention was delivered when a participant rotated to that specific center. In this way intervention was embedded into the children's daily routine without changing their current schedule or the classroom's daily procedures.

During all phases of the study, data were collected using a small handheld video recorder (i.e., a Kodak Play Sport©). The device was 9.5 cm long and 4.5 cm wide and recorded in 1080p high definition (HD). The compact size and clarity allowed the data collector to adjust position easily and capture clear footage. After sessions, different data collectors watched the videos on a larger computer screen to enable easier coding. Videos were coded using a data collection sheet designed specifically for this study (available upon request).

2.3. Toy selection procedures

The following factors were considered when selecting toys for use in this study: (a) participants' age, (b) participants' exposure to specific toys prior to the study, (c) appropriateness of toys for the classroom, and (d) participants' preference for specific toys. First, teachers were asked to make a list of toys that the school currently did not own that would be appropriate in the classroom. New toys (i.e., toys not available to the participants prior to the study) were identified to reduce the potential confound of an uncontrolled history of reinforcement involving any specific toy previously available in the classroom. Second, age appropriateness of toys was determined by observing the toy play of same age typically developing children attending a different school. Only toys used by typically developing children of the same chronological age as the participants were considered. Third, each toy's store packaging had a suggested age range and only toys in which the age range overlapped with the participants' age were considered. The final list contained four sets of toys to be further considered for use in the study (i.e., house set, amusement park set, doctor office set and cooking set with food). These four toy sets were then purchased in order to assess each participant's preference for each set of toys.

A paired stimulus preference assessment was conducted using the four toy sets (Fisher et al., 1992). First, each participant was individually allowed 2-min of free access to each set of toys one at a time. This was done to give the participants experience with each set of toys and allow them the opportunity to form a preference. Then, to assess preference, toys were presented two at a time and the participant was asked to "pick a toy". Selection was defined as reaching for or pointing toward one of the two toys offered. After the child selected a toy they were given 20-s of access. The toy was then removed and another pair of toys was presented. In order to control for the potential of position bias (e.g., always selecting the toy on the left), the position of any given toy was systematically altered across presentations so that it was presented on both the left and right side of the pair. Every combination of two toys was presented and selections were recorded. For each participant, the two sets of toys selected the most frequently were considered to be the most preferred. All three participants selected the same two sets of toys (see description of toys below) more often than the competing toy sets. Therefore, these two sets of toys were used with all three participants.

The Fisher Price Little People Happy Sounds Home© (Mattell Inc., 2012) was used during baseline and intervention sessions for Ashley and to assess generalization of play skills for Colt and Vince. The house had a center hinge that opened to reveal interior rooms (i.e., bedroom, bathroom, nursery, laundry room, and living room). The set contained four small action figures representing a mother, father, baby, and older sibling and five pieces of movable furniture (i.e., two chairs, a highchair, a table and crib). In addition to the detached furniture, the house contained a refrigerator, couch, bed, sink, bathtub, washing machine and television that were affixed to the plastic base. The doors to the house and refrigerator opened on a hinge. Pressing specific areas on the toy activated noises related to that area. Specifically, the toilet made a flushing sound, the phone rang, and the laundry machine made a washing sound.

The Pop-On-Pals Amusement Park© (Mommy, 2010) was used during baseline and intervention sessions for Colt and Vince and to assess generalization of play skills for Ashley (baseline sessions only). The amusement park contained several stations attached to the plastic base, specifically: (a) rollercoaster, (b) swings, (c) Ferris wheel, (d) bowling alley, and (e) strongman hammer game. The rollercoaster had a detached car that could be rolled down tracks. The set contained action figures that could be inserted into each of the park's activities. When the action figures were correctly inserted, the bell rang on the strongman game and the bowling game made the sound of pins falling down. Carnival music played when the Ferris wheel was rotated or the swing swung.

2.4. Dependent variables

The dependent variables were: (a) appropriate play, (b) stereotypy, and (c) parent ratings of each participant's mood, happiness and interest in play. Appropriate play was defined as the unprompted use of toys in a manner consistent with their intended function (Lang, Machalicek, et al., 2009). Additionally, in order to be scored as appropriate play, the behavior had to involve at least two actions consistent with a recognizable play scheme. For example, placing an action figure in the rollercoaster and then sending the car down the tracks would be recorded as appropriate play on the amusement park set. However, because only rolling the car down the track without first placing the action figure in the car might happen by accident, it would not be scored as play. Stereotypy was defined as the manipulation of toy materials in a repetitive manner that was inconsistent with recognizable appropriate play (c.f., Lang, O'Reilly, et al., 2010; Rapp & Vollmer, 2005). The descriptions of each participant's idiosyncratic forms of stereotypy provided in the participant characteristics section where used as operational definitions. Appropriate play and stereotypy were coded from videos using a 10-s partial interval procedure (Cooper, Heron, & Heward, 2007) by trained data collectors who were blind to the purpose of the study. Mood, happiness, and interest were evaluated using the *Mood Scale and Related Interview Questions* (MSRIQ; Carr, McLaughlin, Giacobbe-Grieco, & Smith, 2003) and the *General Child Affect Rating Scales* (GCARS; Koegel, Vernon, & Koegel, 2009).

The MSRIQ (Carr et al., 2003) is a five-point Likert-type scale that evaluates caregiver perception of an individual's mood. The scale ranges from bad mood (score of 1) to good mood (score of 5). The MSRIQ contains three follow-up questions (i.e., "What is it that the person did that led you to give him/her a (bad, neutral, or good) rating?", "What, if anything, might have brought on this mood?", and "If you had to cheer this person up or put him/her in a better mood right now, what strategies might you use?"). The MSRIQ was initially developed by Carr et al. to identify a correlation between caregiver ratings of mood

and the occurrence of challenging behavior in individuals with developmental disabilities. In the current study, the MSRIQ was used to assess participants' parents' opinion of their child's mood before and after play skills intervention.

The GCARS (Koegel et al., 2009) evaluates parent perception of their child's happiness and interest while the child is engaged in a target activity. It consists of two Likert-type scales (one for happiness and one for interest) that range from disinterested and unhappy (score of 0 or 1) to interested and happy (scores of 4 or 5). The GCARS was originally developed by Koegel and colleagues to measure happiness and interest of children with autism after receiving a social skills intervention. In this study, the scales were used to measure happiness and interest before and after play skills intervention.

For each participant, two videos from sessions one through six (pre-intervention) and two videos from sessions 37 to 41 (post-intervention) were selected at random from the pool of videos in those phases. To reduce potential expectancy bias, mothers were blinded to whether videos were from pre- or post-intervention sessions. Each participant's mother first watched the four videos of their child in a random sequence without completing the MSRIQ or GCARS. Mothers where then shown each video a second time and asked to fill out the MSRIQ and GCARS immediately following each video. Therefore, the MSRIQ and GCARS were completed four times by each mother (i.e., one MSRIQ and one GCARS rating for each baseline video and one each per post-intervention video).

2.5. Research design

This study utilized a multiple baseline design across participants with an embedded ABA design for Ashley and an embedded ABACA design for Vince and Colt. During all "A" phases, the participant had access to one set of toys at a time in the therapy room. Data were collected on appropriate play and stereotypy but intervention was not delivered. During "B" phases, a play skills intervention was implemented in the classroom with only the intervention toy set. After appropriate play increased, the participant was returned to baseline conditions (second "A" phase) to assess generalization of play skills across toys and settings. If play skills did not generalize during the return to baseline, as was the case for Colt and Vince, lag schedules of reinforcement were added to the behavioral intervention in Phase "C". Following phase "C", generalization of play and stereotypy were assessed again in the last return to baseline phase. Maintenance was then assessed at four, six, and eight weeks for all three participants.

2.5.1. Baseline

Baseline sessions were conducted in a different room than the intervention (except for one session in the main classroom) in order to assess generalization across settings later in the study. During all "A" phases, one participant at a time was led to the therapy room. The participant was told "You can play now, have fun!" or some equivalent phrase and the data collector began recording video. The teacher left the room and shut the door. Participants were prevented from seeing the teachers during all "A" phases in order to measure play in the absence of the person associated with the delivery of reinforcers (i.e., the discriminative stimulus for the availability of extrinsic or socially mediated reinforcement). All sessions were 5 min. Attempts by the participant to interact with the data collectors were ignored.

2.5.2. Play skills intervention

The play skills intervention was embedded within daily center time. During centers, the teachers set up specific activities and the children individually rotated through centers to work on goals embedded in each activity. Children spent 5 min in each center before rotating to the next. Therefore, all intervention sessions were also 5-min long. For each participant the same toy set was used during every intervention session so that play was only taught with one of the two toy sets. This allowed for generalization across toys to be assessed with the second toy set in the return to baseline. For Ashley, only the house set and for Vince and Colt only the amusement park set was used during intervention. Intervention was implemented individually with each participant daily. However, data were only collected two to three days per week during intervention.

The first play skills intervention (phase B) involved components commonly used to teach play skills to children with autism (e.g., Barton & Wolery, 2010; Lang, Machalicek, et al., 2009). The participants' teacher set out the appropriate toy set during centers and used a least-to-most prompting hierarchy that involved gesture, model, verbal, and physical prompts to directly teach play skills specific to the target toy set. Reinforcement in the form of social praise and small edibles (e.g., raisins) was delivered contingent upon occurrences of appropriate play behaviors. Initially, reinforcers were delivered on a fixed ratio of one play behavior to one reinforcer (FR1). When appropriate play increased above baseline levels in two consecutive sessions the teacher began to thin the reinforcement schedule until an average of three play behaviors were required for every reinforcer (i.e., a variable ratio reinforcement schedule [VR3]). No programmed contingencies were in place for stereotypy. However, if the child was engaged in stereotypy and did not respond to less intrusive prompts to play, a physical prompt (i.e., gently guiding the participant's hand) was delivered which, in effect, interrupted and redirected stereotypy to appropriate play. Intervention in this phase continued until participants engaged in appropriate play during 60% of 10-s intervals or more for three consecutive sessions in which data were collected.

2.5.3. Return to baseline

Participants were then returned to the baseline condition and play with both sets of toys was measured in the therapy room in the absence of the teacher. Play in the absence of teachers was considered important because it has been suggested in previous research that play should be intrinsically motivated (i.e., automatically reinforced) and the teacher was

associated with socially mediated (extrinsic) reinforcement after having delivered edibles and praise contingent upon play during the previous intervention phase. Ashley engaged in appropriate play with both sets of toys and remained in this condition until the maintenance phase. Vince and Colt's play skills did not generalize to the untaught toy set (i.e., house set). Therefore, an intervention that involved lag schedules of reinforcement was implemented as Phase "C" for those two participants.

2.5.4. Play skills intervention with lag schedules of reinforcement

During this phase, the intervention was again implemented during center time using the same toy set used in the previous intervention phase (i.e., amusement park). The teacher delivered reinforcement contingent upon the occurrence of an appropriate play behavior that differed from the previous appropriate play behavior (Lag 1). Reinforcement in this phase was the same as in the previous intervention phase. However, when the child stopped engaging in one play action and began engaging in another play action the teacher's praise highlighted the change (e.g., "You are trying something different! I like how the [action figure] can do lots of different things!"). For example, if Colt rolled the rollercoaster down the tracks and then put an action figure in the swing and activated the motion, the teacher provided the reinforcer. If the child repeated the same play behavior (e.g., repeatedly rolling the man in the rollercoaster down the track) no reinforcer was given and the teacher encouraged the child to engage in a different play behavior by verbally prompting "What else can the [action figure] do?", "Try something different", or "You did that already, do something different". Therefore, the intervention was configured to differentially reinforce variety of play over repetitious play. When the child began consistently contacting reinforcement under the Lag 1 schedule, a Lag 2 schedule was implemented. Under the Lag 2 schedule, reinforcement was contingent upon a play behavior being different than the previous two play behaviors. This phase ended after a minimum of five sessions under the Lag 2 reinforcement schedule. Participants were then returned to the baseline conditions described above to again assess for generalization of play across settings and toys.

2.5.5. Maintenance

Following the final return to baseline phase, data collection was stopped and the researchers did not return to the school for four weeks. Data on the maintenance of play skills and the reduction of stereotypy were collected at four, six, and eight weeks for each participant. Maintenance sessions were identical to baseline sessions. A systematic play skills intervention was not in place for the four weeks prior to the first maintenance session. The teachers were instructed to return to their typical center time activities. The purpose of this maintenance phase was to determine if appropriate play would persist following a period of time without ongoing play intervention.

2.6. Procedural integrity

Data collectors assessed procedural integrity (i.e., the extent to which teachers were able to accurately implement intervention) during 30% of the phase B intervention sessions for Ashley and 57% of Vince's and Colt's phase B and C intervention sessions. Based upon the procedures used to assess procedural fidelity described by Mavropoulou, Papadopoulou, and Kakana (2011), a checklist of five questions regarding the major aspects of the intervention with a Yes/No answer format was developed (i.e., "Was the intervention delivered for a minimum of 5 min?", "Was the correct set of toys used?", "Did the teacher use least-to-most prompting and make three or less prompting errors?", "Was the correct reinforcer used?" and, "Was the correct reinforcement schedule in place and were there three or less errors in delivering reinforcement?"). A prompting error was defined as the use of the wrong prompting hierarchy, giving the wrong prompt, or missing an opportunity to prompt. A reinforcement error was defined as missing an opportunity to reinforce or providing reinforcement when none should have been given. Procedural integrity was calculated by dividing the number of questions answered with "Yes" by the total number of questions and multiplying by 100 to estimate the percentage of steps implemented correctly.

Mean procedural integrity during the play intervention without lag schedules (phase B) was 87% (range 80–100%) for Ashley, 96% (range 80–100%) for Vince, and 95% (range 80–100%) for Colt. Across participants, the most common error during this phase was providing the wrong type of prompt or missing an opportunity to prompt. Mean procedural integrity during the play intervention with lag reinforcement schedules (phase C) was 90% (range 80–100%) for Vince and 80% (60–100%) for Colt. Across participants, the most common error during this phase was missing an opportunity to reinforce.

2.7. Inter-observer reliability

Inter-observer reliability was measured for appropriate play and stereotypy. For each participant, 33% of sessions were selected randomly from across phases for reliability coding. Two independent observers that were blinded to the purpose of the study and who had prior experience using a 10-s partial interval procedure watched the videos separately. The data collection sheets for both data collectors where then compared and agreements and disagreements where noted during each session. An agreement was defined as both data collectors recording the occurrence or nonoccurrence of appropriate play and stereotypy during the same 10-s interval. Inter-observer reliability was then calculated by dividing the number of agreements by the number of agreements plus disagreements (i.e., total number of intervals) and multiplying by 100 (Kazdin, 1982). Across participants the mean inter-observer agreement for stereotypy was 91% (range 82–100%). The mean inter-observer agreement for appropriate play was 88% (range 76–100%).
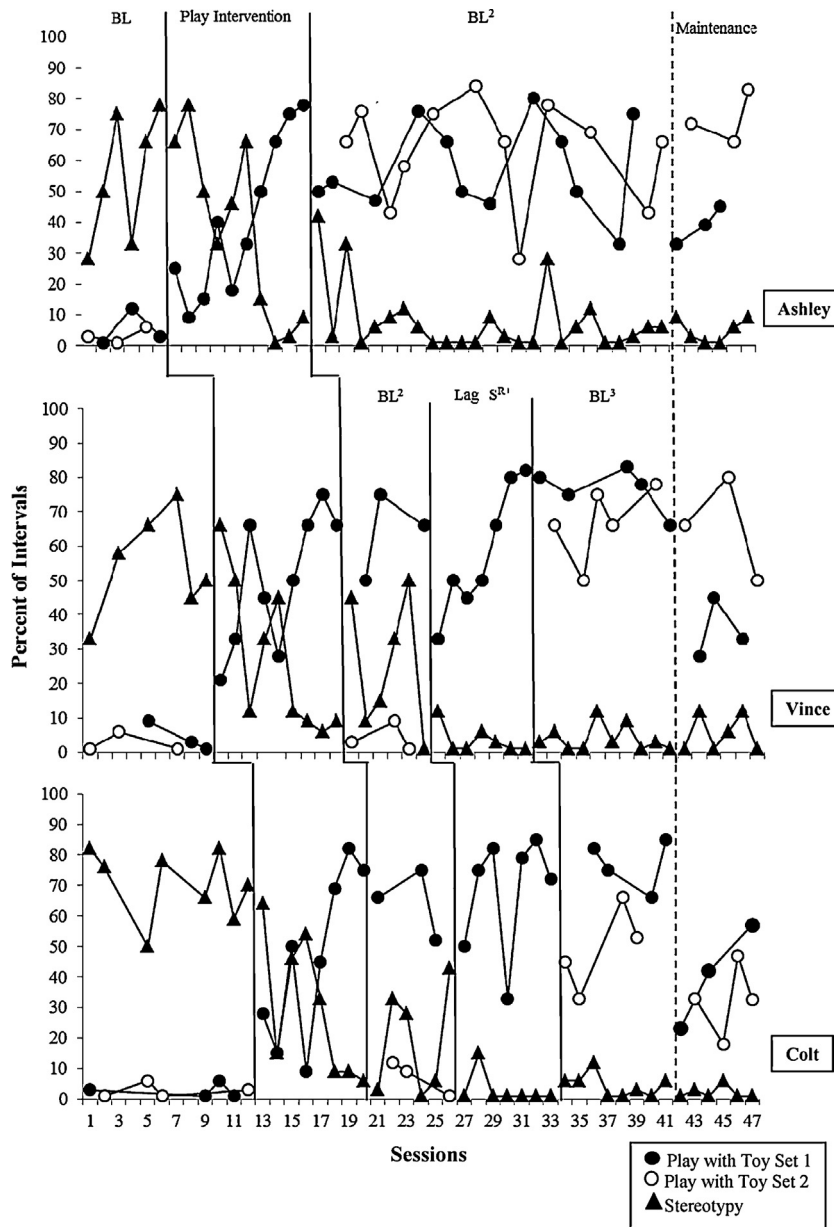
Fig. 1. Multiple baseline across participants displaying the percent of 10-s intervals containing stereotypy (black triangles) and appropriate play with the toy set used during intervention (black circles) and the toy set used to assess generalization (white circles) for Ashley (top panel), Vince (middle panel), and Colt (bottom panel). Initial baseline (BL), the first return to baseline (BL²) and second return to baseline (BL³) are labeled.

3. Results

Fig. 1 displays the percentage of 10-s intervals containing stereotypy and appropriate play across all phases of the study for Ashley (top panel), Vince (middle panel) and Colt (bottom panel). Overall, the three participants engaged in more appropriate play and less stereotypy following behavioral play intervention than in the initial baseline. Additionally, play skills occurred in the absence of the teacher and eventually generalized across settings (i.e., from main classroom to therapy room) and across sets of toys. These behavior changes were maintained at four, six, and eight weeks post intervention.

3.1. Results for Ashley

During Ashley's initial baseline, stereotypy occurred during 55% of intervals (range 27–80%) on average. The baseline mean for appropriate play with the house toy set was 5.3% of intervals (range 0–13%) and with the amusement park was 3.3%

of intervals (range 0–6%). During the first play intervention, a steady increase in Ashley's appropriate play with the house toy set was observed (M = 40%, range 9–80%). Initially, her stereotypy was variable, ranging from 33% to 80% of intervals during the first six sessions of this phase. Stereotypy then decreased and remained below baseline levels for the last four sessions in the phase (M = 36%, range 0–80%). When Ashley returned to baseline her stereotypy initially jumped to 43% of intervals but, overall, remained low (M = 8%, range 0–43%). Ashley's appropriate play with the house set used during intervention remained high (M = 58%, range 33–76%). Appropriate play generalized to the amusement park (M = 62%, range 43–80%). Because play generalized across toys and settings, Ashley remained in this condition until the maintenance phase and did not receive the lag schedule. During maintenance, Ashley's appropriate play remained above initial baseline levels at four, six, and eight weeks with the house set (M = 39%, range 33–46%) and the amusement park (M = 73%, range 66–83%). Stereotypy also remained below initial baseline levels (M = 5%, range 0–9%).

3.2. Results for Vince

During Vince's initial baseline, stereotypy occurred during 55% of intervals (range 33–76%) on average. The baseline mean for appropriate play with the amusement park was 4% (range 0–9%) and with the house was 2% (range 0–6%). During the first play intervention an increase in Vince's appropriate play with the amusement park was observed (M = 50%, range 27–76%). Initially, his stereotypy was variable, ranging from 12% to 66% of intervals during the first five sessions of this phase. Stereotypy then decreased and remained below baseline levels for the last four sessions in the phase (M = 27%, range 6–66%). During Vince's return to baseline, stereotypy remained low during sessions in which the toy used during intervention (amusement park) was available (M = 8%). However, when given the toy set with which play had not been directly taught (i.e., house) his mean stereotypy remained within the initial baseline range (M = 63%). Vince's appropriate play with the amusement park was within the range achieved during the previous phase (M = 63%, range 50–76%), but play did not generalize to the house set with which play had not been directly taught (M = 4%, range 0–9%). Consequently, he was exposed to new intervention ("C" phase) with lag schedule of reinforcement. During play intervention with lag schedules, Vince's stereotypy remained low (M = 3%, range 0–12%) and appropriate play with the amusement park remained consistent (M = 58%, range 33–83%). In the final return to baseline, Vince's stereotypy remained low with both sets of toys (M = 4%, range 0–12%). Appropriate play with the amusement park remained high (M = 76%, range 66–83%) and appropriate play generalized to the house set (M = 66%, range 50–76%). During maintenance, Vince's appropriate play remained above initial baseline levels at four, six, and eight weeks. The mean percentage of intervals with appropriate play with the house set was 65% (range 50–80%) and with the amusement park was 36% (range 27–46%). Stereotypy also remained below initial baseline levels (M = 5%, range 0–12%).

3.3. Results for Colt

During Colt's initial baseline, stereotypy occurred during 70% of intervals (range 50–83%) on average. Appropriate play was rare with both the amusement park and the house set (M = 2%, range 0–6%). During the first play intervention, an increase in Colt's appropriate play with the amusement park was observed (M = 46%, range 9–83%). Initially, his stereotypy was variable ranging from 16% to 63% of intervals during the first five sessions of this phase. Stereotypy then decreased and remained below baseline levels for the last four sessions in the phase (M = 30%, range 6–63%). During Colt's return to baseline, his stereotypy remained low during sessions in which the toy used during intervention (amusement park) was available (M = 3%). However, when given the toy set with which play had not been directly taught (i.e., house) his mean stereotypy was higher (M = 33%). Colt's appropriate play with the amusement park remained within the range achieved during the previous phase (M = 63%, range 50–76%), but play did not generalize to the house set (M = 3%, range 0–12%). Because Colt's play did not generalize across toys the play intervention with lag schedules of reinforcement was implemented in Phase "C". During the subsequent play intervention with lag schedules, Colt's stereotypy remained low (M = 2%, range 0–15%) and appropriate play with the amusement park increased steadily across the phase (M = 68%, range 33–86%). In the final return to baseline, Colt's stereotypy remained low (M = 4%, range 0–12%). Appropriate play with the amusement park remained high (M = 77%, range 66–86%) and appropriate play generalized to the house set (M = 50%, range 33–66%). During maintenance, Colt's appropriate play remained above initial baseline levels at four, six, and eight weeks. The mean percentage intervals with appropriate play with the house set remained higher than baseline (M = 33%, range 20–46%) and play with the amusement park increased (M = 40%, range 23–56%). Stereotypy also remained below initial baseline levels (M = 1%, range 0–6%).

3.4. Child happiness, interest and mood

Fig. 2 displays all the participants' mothers' ratings of their child's mood (black bars), happiness (white bars), and interest (striped bars) using the MSRIQ and GCARS. The first six bars (2 sets of 3 bars) represent the scores from the videos taken during the initial baseline (pre-intervention) and the last six bars represent the two videos taken during the final "A" Phase (post-intervention). Ashley's mother (top panel) and Vince's mother (middle panel) rated their children as happier, more interested, and in a better mood following the play intervention using the MSRIQ and GCARS. Colt's mother's ratings (bottom panel) did not change from pre- to post-intervention.
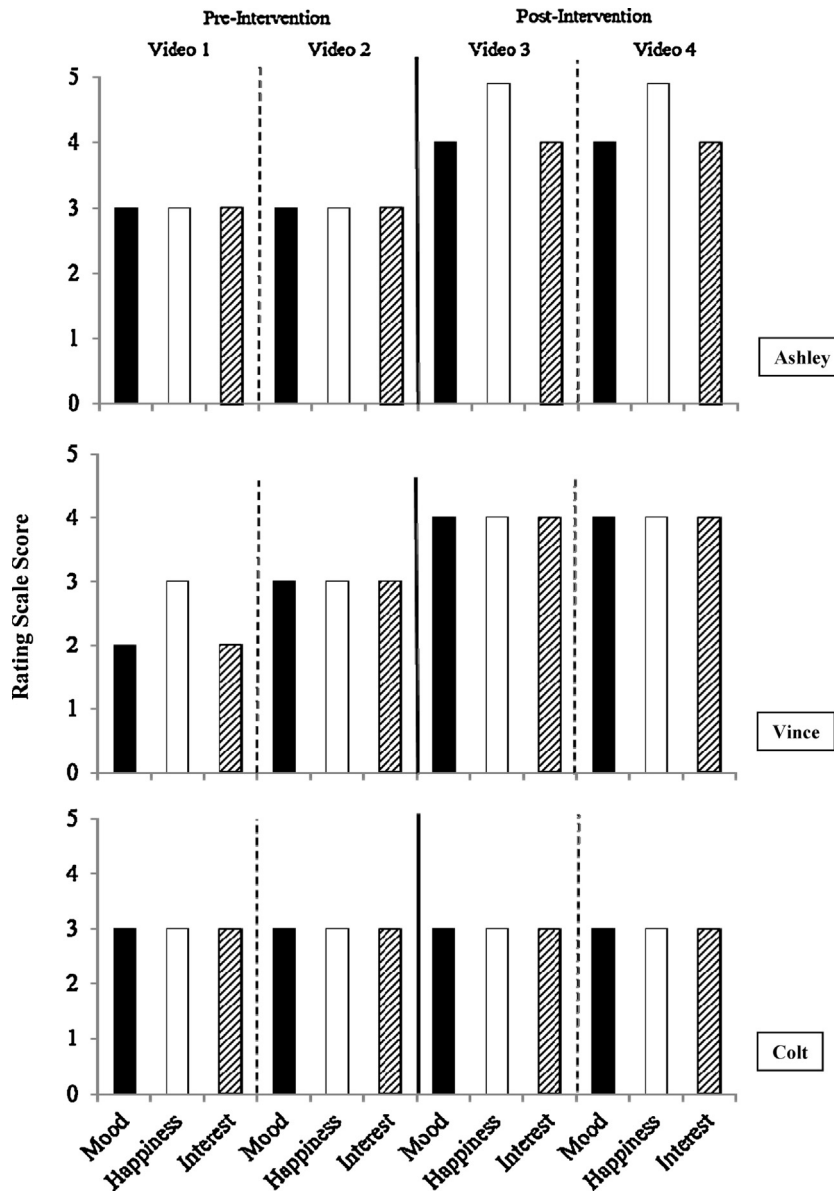
Fig. 2. Parent ratings using the Mood Scale and Related Interview Questions (MSRIQ) and the General Child Affect Rating Scales (GCARS) are depicted for the two videos from baseline and the two videos from maintenance for Ashley (top panel), Vince (middle panel), and Colt (bottom panel). Black bars represent ratings of mood, white bars represent happiness, and striped bars represent interest.

4. Discussion

In this study the utility of play skills instruction as means to reduce stereotypy within an early childhood educational setting was evaluated. Second, for two participants whose play did not generalize across toys following a traditional behavioral intervention, a modified behavioral intervention involving lag schedules of reinforcement was evaluated as a means to promote generalization. Finally, we sought to assess the validity of longstanding criticisms aimed at behavioral play interventions (e.g., Jobling, 1988; Luckett et al., 2007).

4.1. Evaluating concerns regarding behavioral play intervention

This study replicates and extends previous research by identifying improvements in play behavior following the application of a behavioral intervention package (e.g., Lang, Machalicek, et al., 2009). To address concerns regarding behavioral play interventions, we evaluated generalization, maintenance and indicators of child happiness in the absence of the discriminative stimuli associated with the delivery of reinforcement. In regards to generalization, one of the three

participants (Ashley) demonstrated both response and stimulus generalization during the first return to baseline phase. Specifically, Ashley's play was elevated above baseline levels with the toy set used during intervention despite the fact that the setting changed (stimulus generalization). Additionally, because toy-play also increased with the toy set with which play had not been directly taught and because play with that toy set involved different topographies of play behaviors (e.g., placing action figure in the swing and swinging) than those directly taught during intervention (e.g., placing action figure near washing machine and pushing button on washing machine), response generalization was also demonstrated. Having demonstrated response and stimulus generalization, Ashley remained in this condition until the maintenance phase. Vince and Colt also continued to engage in high levels of play with the toy set used during intervention in the first return to baseline phase, but did not engage in play with the toy set that was not used during intervention, thus demonstrating stimulus generalization but not response generalization. A lag schedule of reinforcement intervention was therefore initiated with these two participants. Following the play intervention with lag schedules, Vince and Colt were returned to baseline conditions and generalization of play skills across settings and toys was observed.

Several factors may have contributed to the generalization of play skills across settings and toys. First, toy-play was a developmentally appropriate skill for the participants and previous research has demonstrated that developmentally appropriate play skills are not only easier for a child to acquire but are also more likely to generalize (Lifter, Sulzer-Azaroff, Anderson, & Crowdery, 1993). Second, both sets of toys used in this study were similar in a number of ways. For example, both toy sets were structures mounted on a plastic base and included similar action figures designed to fit within those structures. Therefore, even though the sets involved different activities, themes, and features requiring different motor behaviors to activate, the similarities inherent across toys may have functioned as a type of mediation known to facilitate generalization (Stokes & Baer, 1977). Finally, although the baseline and intervention settings were different in a number of ways, the fact that both settings were in school may have facilitated generalization. Given the importance of setting and other environmental variables on the occurrence of play (e.g., Ullenhag et al., 2012), future research involving a larger variety of toys, settings (home and school), and interventionists (teachers, parents, peers) as well as research aimed at elucidating impediments to play generalization remains warranted.

These data also support the notion that play skills acquired via behavioral intervention can be maintained in the absence of ongoing intervention for at least two months. Further, because intervention with Ashley was ceased after generalization was demonstrated in the first return to baseline, she actually remained in baseline conditions identical to the maintenance phase for approximately eight weeks longer than Vince and Colt, and this additional time may also be viewed as evidence of maintenance for a total duration of 4 months for her. Maintenance data also provide support for the notion that play skills taught using socially mediated reinforcers may eventually come to be maintained by automatic reinforcement contingencies. Given that behaviors maintained exclusively by socially mediated reinforcement contingencies will decrease and/or adhere to patterns of responding characteristic of extinction (Skinner, 1953) when reinforcement is no longer provided, the continued engagement in play by all three participants suggests that play was, at least in part, maintained by automatic (or intrinsic) positive reinforcement. It is important to note that no observations occurred between the final baseline phase and the beginning of the maintenance phase or between maintenance probes. Although teachers were asked to discontinue the intervention, it is possible that they may have inadvertently continued to implement some aspects of the intervention during this time. Although such a practice could be seen as evidence that the intervention was socially valid, in terms of being appropriate for the classroom (Kennedy, 2002), future research involving additional controls to buttress internal validity during maintenance evaluations may be beneficial.

Regardless of theoretical orientation, there is no doubt that children should enjoy playing (Lifter, Foster-Sanda, et al., 2011). However, because happiness and enjoyment are difficult constructs to directly measure, behavioral researchers rarely address that aspect of play. This study extended previous research by demonstrating that two out of three participants' (Ashley and Vince) mothers believed their children were happier, in a better mood, and more interested in play following intervention. When asked why they provided these ratings, the mothers pointed out that they observed their children smiling and giggling more during play post intervention. Further, both Vince and Colt's mothers indicated that the reduction in stereotypy suggested that their children were "calmer" and "less frantic". Colt's mother's ratings did not change from pre- to post-intervention. In response to questions about those ratings, Colt's mother stated that the reduction in stereotypy was a notable improvement but that she still felt that his play skills needed further improvement. These data should be considered with appropriate caution given that the ratings scales utilized (i.e., MSRIQ and GCARS) lack psychometric evaluation and because any such rating scale can only provide indirect evidence, particularly when used to describe the feelings of another person. Despite these concerns, we believe that mothers may be the best available judges of the feelings of their children or, at least, that the mothers' perception of their child's happiness is a socially valid outcome measure. Regardless, future research could seek to identify alternative methods for more directly measuring changes in child happiness following the acquisition of play skills.

Finally, we sought to determine whether or not play acquired via behavioral intervention would occur in the absence of programmed reinforcement contingencies (extrinsic reinforcement). Our findings suggest that play skills acquired via socially mediated reinforcement may have come to be automatically reinforced (intrinsically motivated). Specifically, toy-play was reinforced with social praise and the delivery of preferred edibles during intervention phases. However, baseline phases were conducted in a therapy room where external reinforcement for play had never been delivered and where the person associated with reinforcer delivery (i.e., teacher) was absent. Therefore, the baseline sessions were absent the discriminative stimuli that signaled the availability of socially mediated reinforcement. With discriminative stimuli absent,

the occurrence of appropriate play in the therapy room could more likely be attributed to automatic reinforcement. This logic is similar to that used to identify automatic reinforcement contingencies for behaviors in a functional analysis 'alone condition' (Lydon, Healy, O'Reilly, & Lang, 2012). Further, if play was only reinforced by socially mediated contingencies (i.e., praise and/or edibles) then we would anticipate a decrease in play skills and potential resurgence of stereotypy with the removal of the intervention for eight weeks during the maintenance phase (Skinner, 1953; Volkert, Lerman, Call, & Trosclair-Lasserre, 2009).

We operated under the assumption that genuine play is indeed maintained by automatic reinforcement. However, future research in which this assumption is challenged may be edifying. For example, functional analysis methodology could be adapted (Lydon et al., 2012) and utilized to elucidate the contingencies maintaining the play of typically developing children. It is feasible that the play of typically developing children is initially acquired through naturally occurring social contingencies. That is, children may acquire novel play behaviors following the routine delivery of parent or peer social praise. It is reasonable to imagine that precursor motor behaviors (e.g., actively manipulating toys in a variety of ways, rotating a toy to find the functional side as with a mirror, or purposefully picking up and releasing objects) that emerge early in a child's life are acquired through contact with stimuli the infant finds pleasant (automatically reinforced behavior). Whereas, functional play (e.g., child rocks baby doll, child puts play food on plate) and play that is often undertaken in small cooperative groups of children may be more likely to be socially mediated. Therefore, even though this current study supports the notion that early toy-play skills taught via behavioral intervention can come to be maintained by automatic reinforcement, we suggest that other more sophisticated forms of play may in fact be maintained by social contingencies and behavioral interventions may not need to fade reinforcement schedules involving social stimuli entirely, if the goal is to teach play that is indistinguishable from that of typically developing children both in terms of topography and underlying operant mechanism.

Ultimately, these data suggest that play taught via behavioral intervention meets the definition of genuine play as described by Luckett and colleagues (2007). However, it is important to note that we taught toy-play and these findings should not be extrapolated to more sophisticated forms of play. Nevertheless, 'simple' functional toy-play is a relevant intervention target (Hine & Wolery, 2006).

4.2. Lag schedules of reinforcement

Lag schedules of reinforcement were used with Vince and Colt and appeared to have promoted generalization across toy sets. However, because lag schedules were used with only two of the three participants, the multiple baseline's capacity to demonstrate experimental control is hindered and should be considered with appropriate caution. Further, it is possible that the play intervention with lag schedules of reinforcement would not have been as effective if the play intervention without lag schedules of reinforcement had not preceded it. Alternatively, the play intervention with lag schedules of reinforcement alone might have been sufficient to promote response and stimulus generalization without the need of the preceding intervention phase. Regardless, this study replicates previous research demonstrating the potential applied utility of lag schedules (Camilleri & Hanley, 2005; Lee & Sturmey, 2006; Lee, Sturmey, & Fields, 2007; Napolitano, Smith, Zarcone, Goodkin, & McAdam, 2010) and highlights the need for future research to examine the possibility of sequence effects contributing to the success of such interventions.

4.3. Teaching play as a treatment for stereotypy

Although stereotypy was not directly targeted during intervention, it decreased for each participant as the frequency of appropriate play increased. This pattern of responding (decreased stereotypy with improved play skills) has been reported in previous research (e.g., Koegel et al., 1974; Lang, O'Reilly, et al., 2010). We posit that behavioral interventions targeting play provide children with novel functional behaviors that encounter new communities of reinforcement, thus potentially displacing stereotypy. In this study, response interruption and redirection may have contributed to the decrease in stereotypy (Martinez & Betz, 2013) when physical guidance happened to interrupt stereotypy. However, that concern does not diminish the fact that these data suggest it is possible that acquiring appropriate play skills early in life may preclude later development of stereotypy in individuals with autism and future research aimed at investigating this hypothesis is warranted.

5. Conclusion

Play skills taught via behavioral interventions may be maintained in situations without programmed reinforcement for at least 2 months and may generalize across settings and toys (response and stimulus generalization). Play in the absence of the discriminative stimuli associated with the delivery of reinforcement suggests that play taught via behavioral interventions may come to be automatically reinforced and participants' parents believe their children are happier, thus meeting definitions of "genuine" play. For children who do not readily generalize acquired play skills to different settings and toys, lag schedules of reinforcement may be an effective means to promote generalization, but future research involving lag schedules is required to establish this assertion.

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