

# Joint attention and symbolic play in young children with autism: a randomized controlled intervention study

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**Background:** Delays and deficits in joint attention and symbolic play constitute two important developmental problems in young children with autism. These areas of deficit have been well studied in autism but have rarely been the focus of treatment efforts (see Kasari, Freeman, & Paparella, 2001). In this study, we examine the efficacy of targeted interventions of joint attention and symbolic play. **Methods:** Participants were 58 children with autism aged 3 and 4 years (46 boys). Children were randomized to a joint attention intervention, a symbolic play intervention, or control group. Interventions were conducted 30 minutes daily for 5–6 weeks. Both structured assessments of joint attention and play skills and mother–child interactions were collected pre and post intervention by independent assessors. **Results:** Results indicate that both intervention groups improved significantly over the control group on certain behaviors. Children in the joint attention intervention initiated significantly more showing and responsiveness to joint attention on the structured joint attention assessment and more child-initiated joint attention in the mother–child interaction. The children in the play group showed more diverse types of symbolic play in interaction with their mothers and higher play levels on both the play assessment and in interaction with their mothers. **Conclusions:** This randomized controlled trial provides promising data on the specificity and generalizability of joint attention and play interventions for young children with autism. Future studies need to examine the long-term effects of these early interventions on children’s development. **Keywords:** Intervention, joint attention, symbolic play, autism.

Young children with autism are characterized by significant deficits in social communication skills. In the early years, these skills center on an inability to engage in joint attention and symbolic play – skills that develop within the first 2 years of life. Joint attention skills involve sharing attention with others through pointing, showing, and coordinated looks between objects and people. Symbolic play involves the representational use of objects – pretending one object represents another as when a sponge represents a cracker, or imagining that dolls have personal attributes and abilities, as when a doll drives a car.

Because these skills are highly representational and abstract they present particular challenges for intervention. How does one teach skills that involve cognitive representations of absent attributes, or require the use of a pointing gesture as a means to indicate something of interest to another? Indeed, these skills are rarely the direct focus of an intervention with children who have autism.

There are both theoretical and empirical reasons, however, for why these skills *should be* the focus of intervention with young children with autism. Theoretically, joint attention and play skills represent beginning understandings of the mental representations of others (Baron-Cohen, Tager-Flusberg, & Cohen, 1994; Hobson, 2002; Roeyers, Van Oost, & Bothuyne, 1998) and understanding others leads to better social, cognitive, and language abilities

(Baron-Cohen & Swettenham, 1997). Indeed, significant associations are found between joint attention skills and later language abilities (Charman et al., 2003; Loveland & Landry, 1986; Mundy, Sigman, & Kasari, 1990), as well as symbolic play skills and social relationships (Sigman & Ruskin, 1999). Moreover, the absence of both joint attention and symbolic play places a child at high risk for autism (Charman et al., 2003) and represents key deficits used in the diagnosis of the disorder in young children (Baron-Cohen, Allen, & Gillberg, 1992; Osterling & Dawson, 1994).

The existing evidence, then, suggests that joint attention and symbolic play skills are deficient in the majority of young children with autism and are important predictors of later language and social abilities. Despite their importance, there is little evidence of their focus in early intervention programs, and even whether joint attention and play can be taught to children with autism.

A few published studies exist. Rogers and Lewis (1989) report improvements in symbolic play skills as the result of a comprehensive early intervention program focused on play and social-communication skills. Similarly, Drew et al. (2002) report marginal improvements in language development as the result of a parent implemented intervention on joint attention skills. In both of these studies, however, a number of methodological difficulties were encountered, including the reliance on parent report (Drew

et al., 2002) and the lack of comparison samples and specificity of the intervention (Rogers & Lewis, 1989).

Other studies have intervened on few children using single subject designs. Stahmer (1995) taught symbolic play skills to 7 preschool children and obtained significant increases in the amount and complexity of their symbolic play. Joint attention skills were recently taught to 5 preschool children with autism (Whalen & Schreibman, 2003). All of the children improved in responding to joint attention gestures of the experimenter and 4 out of the 5 were able to improve in their initiation of joint attention gestures. Three months later, all of the children continued to respond to joint attention, but joint attention initiations were not maintained. Moreover, generalization of the taught skills to interactions with an untrained adult (the mother) yielded only partial success with 2 of the children showing improvement.

The foregoing studies suggest that both joint attention and play skills can be taught with success to some but not all children. Success is greater for responding behaviors than for initiating behaviors, and skills are often improved within the intervention context but not always maintained over time or generalized to new contexts and people (Hwang & Hughes, 2000; Kasari, 2002). In the current study, we employed a randomized control design in which two different intervention groups were contrasted with a control group. Several methodological issues were addressed, including the amount and intensity of treatment over the course of the study, independently conducted pre and post assessments, carefully assessed fidelity of treatment protocols, and tests of generalizability with non-treatment providers. We employed a combined developmental and behavioral intervention approach and hypothesized that joint attention and symbolic play skills would be improved in the experimental groups over the control group. Joint attention responding skills were expected to improve more than initiating skills. Moreover, we tested for the cross-over or collateral effects of behaviors in the two interventions, and expected that there may be some lower-level effects,

such as more coordinated joint looking and greater functional play as a result of both interventions.

## Method

### Participants

Sixty-five children with autism were randomized to treatment conditions of joint attention, symbolic play or control group. Pre- and post-intervention analyses were conducted on a final sample of 58 children. Seven children (2 in the joint attention group, 1 in the play group, and 4 in the control group) were excluded from analyses because they did not meet ADI-R and ADOS criteria for autism, refused final assessments, or left the program unexpectedly. Thus, the final sample consisted of 20 children in the joint attention group, 21 children in the play group and 17 children in the control group.

*Randomization/consent procedures.* All of the participants were recruited from an existing early intervention program. Staff ratios were nearly 1:1 in the program, and the school day was 6 hours in length. The program approach was based on applied behavior analysis principles and followed a typical preschool curriculum. The staff in the Early Intervention Program (EIP) were independent of the research staff, and blind to the hypotheses of the intervention study. Indeed, joint attention skills and symbolic play skills were not assessed or taught in EIP.

Children in the EIP were invited to participate in the study if the child was 3 or 4 years of age and had received a clinical diagnosis of autism. Children were not invited to participate if they had seizures, were 5 years of age or older, had additional medical diagnoses (e.g., genetic syndromes), were geographically inaccessible for follow-up visits (e.g., international families) or did not plan to stay in the EIP for at least 4 weeks. Characteristics of the children are presented in Table 1.

### Procedures

Prior to beginning intervention and after obtaining informed consent, independent clinical testers (not associated with research staff and blind to study purpose and hypotheses) assessed each child. Children were assessed with the ADOS (Lord et al., 2000) and parents

**Table 1** Developmental characteristics of randomized intervention groups prior to intervention

Child characteristic	Joint attention	Symbolic play	Control
Chronological age	43.20 (7.05)	42.67 (6.93)	41.94 (4.93)
Mental age	26.29 (8.71)	24.55 (8.09)	21.86 (9.26)
Developmental quotient	58.30 (17.18)	58.90 (18.21)	51.98 (21.84)
Exp. lang. age	20.60 (6.51)	21.43 (7.59)	19.41 (7.70)
Rec. lang. age	20.55 (7.27)	21.00 (9.75)	17.53 (8.70)
Gender (males/females)	15/5	16/5	15/2
Ethnicity (N)			
Caucasian/Minority	13/3	14/6	10/7
Mother's education (N)			
High school grad	0	3	2
Some college/technical	2	4	4
College/professional	18	14	11

were administered the ADI-R (Lord, Storoschuk, Rutter, & Pickles, 1993) in order to validate the clinical diagnosis of autism. A battery of child assessments was completed, including the Mullen Scales of Early Learning, the Reynell Developmental Language Scales, the Early Social-Communication Scales, and the Structured Play Assessment. In addition, the mother and child were observed playing with each other with a standard set of toys for 15 minutes. Parents also completed a demographic questionnaire regarding background characteristics of the child and family members, and asked specifically about the child's history of intervention, and any additional interventions received during the course of the study. These assessments were repeated at the end of intervention (except for the Mullen and diagnostic measures) which co-occurred with the child leaving the EIP – approximately 5–6 weeks later. Experimental measures and derived variables are described below:

*Early Social-Communication Scales.* The child and tester sit facing each other at a table with a set of toys in view but out of reach of the child (Mundy, Hogan, & Doelring, 1996). Toys include several small wind-up and hand-operated mechanical toys, a hat, comb, glasses, ball, car, balloon, and book. The child is presented with 3 trials of the mechanical toy, 3 trials of the hand-operated toys and 2 trials of a social interaction game (i.e., singing a song with a tickle). The procedure is videotaped and later scored. The major variables of interest for this study included frequency of both initiations (coordinated looking, pointing and showing) and responses (responding to experimenter points and gaze) of joint attention behaviors (see Appendix A). Cohen's Kappa was .79 based on 20% of the sample coded independently by two independent coders who were blind to child group status. The ESCS has shown good reliability and validity in a variety of studies (Mundy et al., 1986; Mundy, Sigman & Kasari, 1994).

*Structured Play Assessment.* The child is presented with sets of toys at a table (Ungerer & Sigman, 1981). Toys consist of 3 different-sized dolls, doll furniture, baby bottles, a tea set, a dump truck, a garage, blocks, a piece of paper, three pieces of sponge, a telephone, a brush, and a mirror. The entire play interaction lasts approximately 15–20 minutes. The child's play behaviors are videotaped and later coded. This measure has shown excellent reliability and validity in a variety of studies (Sigman & Ruskin, 1999; Sigman & Ungerer, 1984; Ungerer & Sigman, 1981).

Variables used in the analyses were *functional play types*, *symbolic play types*, and *play level*. *Functional play type* refers to the number of different novel, child-initiated functional play acts. An example would be a child who puts a spoon to his mouth several times as if to eat (type 1), and puts a comb to his hair several times (type 2). The number of times the child does each act is irrelevant, but the number of different types would be 2. *Symbolic play type* refers to the number of different novel, child-initiated symbolic play acts, from single scheme sequences to sociodramatic play. *Play level* represented the highest, most frequent, and flexible level at which the child played with mastery. Mastery

was defined as the highest spontaneous play level attained with at least 3 different types/exemplars of that level and 8 different frequencies. Play level ranged from 1 (physical and conventional combinations) to 14 (sociodramatic and thematic/fantasy play).

Reliability was calculated between 2 independent coders blind to group status for 12 subjects. Intraclass correlation coefficients ranged from .94 to 1.00, mean .97 for types and 1.00 for mastery.

*Caregiver-child interaction.* A 15-minute videotaped interaction was collected for each child. Caregivers were asked to play with their child as they normally would at home using a standard set of toys (including dolls, dishes, puzzles, truck, and blocks). The interaction was coded in two ways. First, we examined the child's play behaviors during the mother-child interaction, and coded again for *types* of functional and symbolic playacts. A weighted score was used to create the mastered *play level* score to control for differences in opportunities that may have occurred between dyads. Each play act was multiplied by the level of play it was coded and then divided by their total number of acts. Intraclass correlation coefficients established between 2 independent coders blind to group status was .84, range .60–1.00.

Second, the mother-child interaction was coded for joint attention skills. The coding identified: amount of time (seconds) in which parent and child were jointly engaged and interactive around objects (Bakeman & Adamson, 1984); who initiated joint engagement (parent or child); and the child's frequency of joint attention skills (e.g., coordinated looks, pointing, and showing). The overall intraclass coefficient between 2 independent coders blind to group status was .78, range .65–.95.

### Intervention procedures

*Defining the treatment goals (content).* A treatment manual was developed for the study, and can be obtained from the first author. A listing of treatment goals for both interventions is provided in Appendix A. Each child's first goal was determined from the assessment results of the ESCS, the Structured Play Assessment and the interaction with the mother. The initial objective represented a skill that was not yet mastered (demonstrated at least 3 times and showing 3 different types), but should have been emerging next in the child's development as determined from the literature on joint attention and play.

*Structure.* Trained experimenters (graduate students in educational psychology experienced with children with autism) worked with each child daily for approximately 30 minutes. Training consisted of 2–3 pilot subjects with constant supervision prior to beginning the study, weekly supervision by the PI, and 3 times a week supervision by the research coordinator throughout the study duration. Intervention lasted on average 5–6 weeks depending on the child's stay in the Early Intervention Program (EIP).

Each experimenter was randomized to treatment procedure and child. Using a checklist reflecting the

procedural protocol, the research coordinator checked fidelity of treatment implementation for random sessions.

**Approach.** The approach involved applied behavior analysis and developmental procedures of responsive and facilitative interactive methods. Each child received approximately 5 to 8 minutes of discrete trial training to 'prime' the particular treatment goal. Thus, both a prompt hierarchy (verbal prompt, model, physical prompt) and positive reinforcement were used to achieve the child's appropriate response. Following the table training, the child worked on the same goal on the floor in a semi-structured session with the experimenter. During this session the targeted skill was still shaped using techniques of systematic prompting and reinforcement, but on the floor, the experimenter used naturally occurring opportunities, similar to milieu teaching (Warren & Kaiser, 1986; Koegel, Koegel, & Carter, 1999). Principles applied on the floor included following the child's lead and interest in activities, talking about what the child was doing, repeating back what the child said, expanding on what child said, giving corrective feedback, sitting close to the child and making eye-contact, and making environmental adjustments to engage the child. The floor session was child-driven rather than adult-directed, and environmental manipulations were strategically used to facilitate the child's social and communicative attempts. Based on other research findings (Lewy & Dawson, 1992; Ninio & Bruner, 1978; Tomasello & Farrar, 1986), two other strategies were also applied. One strategy was to imitate the child's actions on toys, and a second strategy was to use the child's activity interests to develop play routines.

The advantage of this combined (behavioral drill and milieu teaching) treatment approach is that the possibility of shaping the targeted behavior is maximized through repetition and drill. Generalization of the behaviorally trained skill is increased by moving the skills into a semi-structured social-play context.

**Mastery/moving to next goal.** Targeted goals were considered mastered if the child demonstrated the goal in 3 different ways (types) at least 3 times at both the table and the floor. The behaviors were counted only if initiated by the child and not prompted or suggested by the experimenter.

## Results

### Analytic approach

Mixed-effect regression models were used to evaluate the effect of the interventions on target variables from the ESCS, Structured Play, and mother-child interaction (both joint attention and play variables). We tested for overall intervention and time effects by examining *F*-statistics in the mixed-effect regressions (Weiss, 2005). All continuous response mixed-effect analyses were performed using SAS Proc mixed software, version 8.01 (SAS Institute, Cary, NC). All count outcome measures were modeled

using Poisson mixed-effect regressions and the GLIMMIX macro (Witte, Greenland, Kim, & Arab, 2000).

### Preliminary analyses

**Pretreatment comparability.** Children were randomized to group, and as expected, none of the characteristics were significantly different between groups (*p* values ranged from .31 to .84).

**Intervention sessions and fidelity checks.** A total of 1,301 intervention sessions were carried out. On average, the total number of sessions for each child in the joint attention group was 28.6 (SD = 15.6) and for the symbolic play group was 34.7 (SD = 16.40). The difference in number of sessions was not significant, nor was the number of sessions significantly associated with any of the outcome measures (*r* values range from -.29 to .14; *p* values .06 to .96).

A random set of sessions was assessed for the experimenter's adherence to the intervention protocol (*n* = 106 sessions). Across 5 interventionists, fidelity ranged from 79–100% for the floor with an average of 92%. Fidelity for the table was 87.5% to 100% with an average of 95%.

**Demographic variables.** We also examined demographic variables in relation to dependent variables, and found no effects of gender, ethnicity, or mother's education on pre- and post-intervention scores. Additional interventions as reported by the parents during the EIP were also examined. As the EIP is an intensive 6-hour per day program, according to parent report, no other behavioral interventions were undertaken during the EIP intervention for children in any of the 3 groups.

### Effects of the joint attention intervention

Means and standard deviations for individual joint attention variables from the ESCS and mother-child interaction are shown in Table 2.

**ESCS.** We first examined *joint attention initiation skills* (pointing, showing, giving, and coordinated joint looks). In terms of showing, a main effect of time ( $F(1, 55) = 4.13, p < .05$ ) and a significant interaction of group and time ( $F(2, 55) = 3.89, p < .05$ ) was found. Compared to the control group, both the joint attention group (EF 1.50) and the play group (EF 1.70) showed greater improvement in initiating shows. There was no significant difference between the play and joint attention group. A main effect for time was found for coordinated joint looks in that all groups improved in coordinated joint looks over time ( $F(1, 55) = 4.64, p < .05$ ). Finally, no significant difference was noted for initiating points or initiating gives. In terms of *responding skills*, a main effect of time ( $F(1, 55) = 7.02, p = .01$ ) was found as well as a

**Table 2** Means and standard deviations of measures of joint attention pre and post intervention for all 3 groups of children

Assessment Measure <sup>1</sup>	Joint attention group		Play group		Control group		Significance of findings $p < .05$
	Pre	Post	Pre	Post	Pre	Post	
<b>ESCS</b>							
Showing <sup>T</sup>	0.10 (0.31)	0.70 (1.19)	0.52 (1.78)	1.29 (2.65)	0.35 (0.61)	0.17 (0.53)	JA & P > C
C JA looks <sup>T</sup>	7.25 (6.05)	9.55 (7.88)	11.90 (9.07)	12.14 (9.30)	8.12 (6.75)	10.35 (9.74)	
Pointing	13.15 (14.95)	14.65 (15.60)	9.62 (12.81)	9.76 (10.21)	7.82 (11.96)	5.76 (7.57)	
Giving	3.65 (3.44)	5.10 (3.54)	2.52 (3.06)	3.05 (2.27)	3.59 (3.45)	3.59 (2.40)	
Responds JA <sup>TX</sup>	10.50 (5.42)	16.55 (6.64)	11.91 (9.07)	12.04 (5.91)	10.53 (6.49)	9.35 (6.00)	JA > P & C
<b>Mother-child interaction</b>							
C JA looks <sup>X</sup>	2.45 (3.35)	3.55 (5.38)	2.33 (2.67)	3.47 (3.76)	2.76 (4.19)	1.53 (1.77)	JA & P > C
Pointing <sup>T</sup>	2.35 (4.04)	2.45 (3.10)	2.62 (3.47)	3.71 (4.76)	2.18 (3.52)	4.53 (7.00)	
Giving <sup>X</sup>	1.65 (2.79)	3.25 (2.95)	2.09 (2.68)	1.28 (1.71)	1.47 (2.21)	2.06 (3.61)	JA > P
Showing <sup>X</sup>	1.00 (1.34)	2.65 (3.08)	2.90 (7.48)	2.90 (4.25)	0.53 (0.71)	1.23 (2.30)	JA > P
Child-initiated JA <sup>GX</sup>	140 (109)	299 (237)	128 (179)	212 (266)	229 (291)	128 (188)	JA > C
Mother-initiated JA	449 (191)	420 (194)	432 (233)	521 (236)	382 (226)	459 (207)	

<sup>1</sup>All variables are expressed in counts except for child- and mother-initiated JA which are in duration (seconds); <sup>G</sup>significant group difference; <sup>T</sup>significant time difference; <sup>X</sup>significant group by time interaction.

significant interaction of group and time ( $F(2, 55) = 6.78, p < .01$ ). Compared to the control group (EF 1.20) and to the play group (EF = 1.00), the JA group showed more improvement in responding to joint attention over time. There was no significant difference between the control group and the play group.

*Child's joint attention in mother-child interaction.* For joint attention initiation skills interaction effects were found for giving ( $F(2, 55) = 3.15, p < .05$ ), showing ( $F(2, 55) = 4.03, p < .05$ ) and coordinated joint looks ( $F(2, 55) = 5.37, p < .01$ ). The joint attention group made significantly more gains than the play group on gives (EF 1.41) and shows (EF .39). Both the joint attention group (EF 1.32) and the play group (EF 1.34) made significantly more gains in coordinated joint looks as compared to the control group, with no difference between the joint attention and play groups. In terms of pointing, a significant main effect of time was found with all groups improving ( $F(1, 55) = 4.71, p < .05$ ). For child-initiated joint engagement, there was a significant main effect of group ( $F(1, 55) = 3.66, p < .05$ ) and a significant interaction effect of group and time ( $F(2, 55) = 9.46, p < .001$ ). Children in the

joint attention group engaged in more child-initiated joint engagement than the control group (EF 1.38). No differences were found on mother-initiated joint engagement.

**Effects of the symbolic play intervention**

Means and standard deviations for the individual play variables from the structured play assessment and the mother-child interaction are shown in Table 3.

*Structured Play Assessment.* Significant main effects of time were found with all groups improving in functional ( $F(1,55) = 15.29, p < .001$ ) and symbolic types of play ( $F(1,55) = 11.96, p < .001$ ). For overall mastered level of play, a significant interaction effect of time and group was found ( $F(2, 55) = 3.18, p < .05$ ). The play group improved significantly more than the control group (EF .58).

*Child's play in mother-child interaction.* Significant main effects for time ( $F(1, 55) = 6.46, p < .05$ ), group ( $F(2, 55) = 4.79, p < .05$ ), and interactions of group and time ( $F(2, 55) = 10.28,$

**Table 3** Means and standard deviations of measures of play pre and post intervention for all 3 groups of children

Assessment Measure <sup>1</sup>	Play group		Joint attention group		Control group		Significance of findings $p < .05$
	Pre	Post	Pre	Post	Pre	Post	
<b>Structured play</b>							
Functional (types) <sup>T</sup>	18.95 (8.17)	22.67 (6.51)	17.85 (8.57)	24.00 (8.56)	20.76 (4.75)	21.71 (6.82)	
Symbolic (types) <sup>T</sup>	2.43 (3.09)	4.52 (4.64)	4.00 (5.16)	6.30 (6.65)	2.71 (3.39)	3.12 (3.31)	
Level of play <sup>X</sup>	5.86 (2.73)	7.62 (2.75)	6.75 (2.27)	6.95 (2.30)	6.65 (2.45)	6.41 (2.60)	P > C
<b>Mother-child interactions</b>							
Functional types	5.33 (4.15)	7.43 (3.56)	6.45 (4.84)	5.95 (4.20)	5.71 (3.87)	5.23 (3.31)	
Symbolic types <sup>GTX</sup>	1.76 (2.77)	5.48 (7.19)	3.65 (4.73)	3.70 (4.28)	3.12 (4.70)	2.58 (3.62)	P > JA & C
Level of play <sup>GTX</sup>	4.89 (2.62)	7.61 (2.75)	6.14 (2.61)	7.47 (2.71)	5.70 (2.83)	5.69 (2.42)	P > JA & C

<sup>1</sup>All variables are expressed in counts except level of play which ranges from 1 to 14; <sup>G</sup>significant group difference; <sup>T</sup>significant time difference; <sup>X</sup>significant group by time interaction.

$p < .001$ ) were found, with the play group showing significantly more types of symbolic play over time compared to the joint attention group (EF .86) and the control group (EF 1.18). No differences existed between the joint attention and the control group. The same pattern existed for overall play level; main effect of time ( $F(1, 54) = 20.23, p < .001$ ), main effect of group ( $F(2, 54) = 4.42, p < .05$ ), and an interaction effect ( $F(2, 54) = 7.83, p < .001$ ). Compared to both the joint attention group (EF .51) and the control group (EF 1.13), the play group improved their levels of play significantly more over the course of intervention.

## Discussion

The current study suggests three main findings. First, at the outset of the study, a central question was whether joint attention and play skills could be taught to children with autism given the abstract and sometimes infrequent nature of these skills even among typically developing children. Indeed, changes in some behaviors were noted and more importantly, compared to the control group, the improvements were noted on structured assessments conducted by independent testers. Children in the joint attention group initiated more shows and greater improvement in responding to joint attention, and children in the play group showed greater diversity of play (types) and more sophistication of play (play levels). Moreover, effect sizes were large, confirming the efficacy of the treatments.

A second finding was that children were able to generalize their newly learned skills from the highly individualized treatment sessions with the experimenter to playing with their caregivers. Previous studies have noted problems in generalization from treatment sessions to different people and contexts (Hwang & Hughes, 2000; Whalen & Schreibman, 2003). In this study, children generalized acquired skills to play sessions with their mothers who were not the treatment providers. When playing with their mothers, children in the joint attention intervention showed more child-initiated joint attention and children in the play intervention showed more novel types of symbolic play and increased play levels. Both treatment groups were significantly different from the control group of children, and again effect sizes were large.

A third finding concerns the specificity of the interventions. Most studies in autism research have not compared one treatment to another or one approach to another as recommended by an APA task force on psychosocial interventions (Lonigan, Elbert, & Johnson, 1998). Studies to date have been more concerned with dose. That is, when more of an intervention is delivered – a high dose compared to a low dose – outcomes are better (Lovaas, 1987; Sheinkopf & Siegel, 1998). In this study, we

compared two interventions to a control condition. Dose was controlled in that all children received a 6-hour per day preschool program and parents reported no additional interventions.

When tested against each other, rival interventions provide important information about the specificity of an intervention (Chambless & Hollon, 1998). If the outcomes are similar for two competing interventions, the interventions yield general effects of treatment. However, where outcomes are different, specificity of treatment is more likely. In this study, play and joint attention groups showed some specificity of treatment, but they also yielded some similarities in outcomes. Most notably, both groups improved in some aspects of joint engagement and joint attention (i.e., coordinated joint looks) and functional play skills. One interpretation of these spillover effects suggests that the child-centered nature of the treatment approach yielded some positive effects of joint engagement with others. Compared to the control group, both experimental groups engaged in higher-level engagement states with their mothers. Another interpretation concerns the nature of the skills being taught. Joint attention may be more fundamental and sensitive to a child-centered approach in which a positive relationship between adult and child is forged. Symbolic play skills may be less intuitive in a child-centered approach necessitating direct teaching, and thus the finding that types and levels of symbolic play improved significantly only for the play group. Notably, however, the control group did not make improvements despite 6 hours of 1:1 intervention per day. The lack of improvement in the control group may have been due to the adult-centered, response-oriented approach to teaching in the EIP and the focus on skills other than joint attention and play. Further, despite some similarities in outcomes for each intervention group, specificity of skill was also noted, suggesting that to robustly affect changes in children, both joint attention and symbolic play skills should be a direct focus of intervention. Given these findings, early intervention programs may want to pay particular attention to the complex nature of both what is being taught and how skills are being taught.

These data are the first to our knowledge of a randomized design in which young children with autism both acquired and generalized skills in areas considered to be core deficits of the disorder. The significance of these changes in specific skills is reinforced by a number of factors we controlled for in the study. Indeed, previous studies have been plagued by a number of implementation problems that complicate interpretability of findings. One issue is that participants may engage in other interventions during the course of the study (Drew et al., 2002). Differences in the services subjects receive may make it difficult to determine if changes in outcome are due to the experimental intervention

or some additional service. The additional interventions may also alter the amount of intervention received for each group.

In the present study, we tightly controlled intensity of intervention so that the comparison between groups was not about amount of treatment but about the content of the treatment. Although there was some variability in the number of treatment sessions each child received, these differences were small and non-significant between groups. In our study we also controlled for how much and what type of general intervention children received. Everyone received 6 hours of intervention per day in the same early intervention program, and the same amount of 1:1 or small group contact. As reported by parents, no additional therapies were initiated during the time children were in the EIP. Thus, our data show effects of a targeted, content-based treatment on top of what would be the recommended numbers of hours of treatment per week (NRC, 2001). Future studies may want to examine the effects of a targeted intervention with less than optimal early intervention services.

Some other criticisms of previous studies have included the biased selection of subjects and therapists assigned to particular subjects, the lack of procedural fidelity measures, and outcome measures that may not reflect the focus of the treatment (Gresham & MacMillan, 1998; Kasari, 2002; Wolery & Garfinkle, 2002). We addressed all of these issues in the present study, increasing our confidence in the integrity of the results.

In summary, this randomized controlled trial provides promising data regarding interventions on core deficits of young children with autism. Children learned joint attention and play skills in a short period of time, and generalized these skills to new contexts and people. The children in the treatment groups improved in some of the particular skills that were targeted for intervention and these changes were greater than those of a control group of children who made less improvement in these skills despite optimal number of intervention hours. Future studies will need to determine the long-term effect of these early and intensive targeted interventions on children's social and communication abilities.

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## Intervention protocol

The children's daily experimental joint attention and play sessions (5x/wk) were administered in the following format. Intervention sessions were carried out in the same playroom with the same sets of toys.

## Determining the treatment goals

Each child's baseline ability was determined from a pre-test semi-structured joint attention (ESCS) or play (Structured Play) assessment, and a caregiver-child interaction session. The initial objective represented a skill that the child did not demonstrate independently, but did demonstrate with adult facilitation (emerging ability). A skill was considered independent if the child demonstrated it at least 3 times and each example represented a different type of act. Developmentally appropriate treatment

objectives were obtained from the literature on joint attention and play (see Appendix A & B).

**Intervention approach**

Each daily intervention session consisted of direct instruction at a table, and more naturalistic milieu-based instruction on the floor.

*Table activity (approximately 5 minutes).* The experimenter sat across from child and shaped the targeted joint attention (or play) skill while engaging the child in social interaction. The instruction was primarily adult-directed. Principles of applied behavior analysis were followed, including the use of hierarchical prompts (verbal prompt, model, physical prompt) and positive reinforcement to prime the specific treatment objective.

*Milieu teaching (approximately 20 minutes).* The direct instruction was immediately followed by naturalistic milieu instruction on the floor to enhance generalization and flexible learning. The same skill (play or joint attention) was targeted with an expanded set of toys. Principles of milieu teaching were used. Thus the session was child-driven, and the experimenter used techniques such as following the child’s lead and interest in activities, talking about what the child was doing, using environmental

manipulations to strategically facilitate the child’s social and communicative attempts (Warren & Kaiser, 1986; Koegel & Koegel, 1995).

**Differences between joint attention and play interventions**

The main difference between the two experimental interventions was the content of the experimental sessions. The joint attention intervention focused on teaching joint attention skills whereas the play intervention focused on improving symbolic play skills. Moreover, the joint attention intervention specifically incorporated imitation of the child and engineered play routines whereas the play intervention focused on object combinations that were increasingly more symbolic but were not contingent upon shared attention between adult and child.

**Criteria for mastery**

A skill was considered mastered when a child independently demonstrated it on the table and on the floor 1) at least 3 times, 2) generated 3 different types of exemplars, and 3) demonstrated ability in generalized contexts. When a skill met mastery criteria, the next (slightly more advanced) developmentally appropriate skill was targeted.

**Appendix A.** Definitions of joint attention skills

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Initiates joint attention:	
Coordinated Joint Look	Child looks between adult and a toy to share attention. No more than 3 seconds must separate the look between the toy and the adult.
Showing	Child has object in hand and holds it towards adult to share attention. Child does not give toy to adult.
Give to share	Child gives toy to adult. The child must make a clear attempt to give the toy to the adult. Just a general thrust or throw in the direction of the adult is not acceptable. Child does not want adult help. Child gives purely to share, e.g. for adult to look at a toy or for adult to take a turn with a toy.
Proximal Point	Child points to an object within 4 inches of object purely to share interest with the adult. Child’s finger does not need to be touching object.
Distal Point	Child points to an object which is more than 4 inches away from pointing finger purely to share interest with the adult. Child does not want adult to act on the toy.
Responsive Joint Attention:	
Following proximal point	After adult points (to object within 4 inches of pointing finger), child responds with an attentional focus. The child’s eye-gaze shifts to focus on the object that the adult is pointing to.
Following distal point	Child follows adult distal point (at least 4 inches away from object). The child’s eye-gaze shifts to focus on the object that the adult is pointing to.

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**Appendix B.** Definitions of play levels

Level	Categories	Definitions
1	Indiscriminate actions	All objects are treated alike (e.g., all objects are mouthed)
2	Discriminative actions	Differentiates among conventional objects, preserving their physical characteristics, or single objects (e.g., rolls round beads, squeezes stuffed animal)
3	Takes apart combinations	Separates configurations of objects (e.g., takes all pieces out of puzzle)
4	Presentation combinations	Re-creates combinations of objects according to their presentation configuration (e.g., puts puzzle pieces into puzzle; nests the nesting cups)
5	General combinations	Creates combinations of objects that result in simple, non-specific configurations such as container/contained relations (e.g., puts beads & puzzle pieces in the cup)
6	Pretend self	Relates objects to self, indicating a pretend quality to the action (e.g., brings empty cup to mouth to drink)
7	Specific combinations Physical attributes	Preserves unique physical characteristics of objects in the (physical attributes) configuration (e.g., stacks nesting cups, strings beads)
8	Child as agent	Extends familiar actions to doll figures, with child as agent of the activity (e.g. extends cup to doll's mouth)
9	Specific combinations Conventional attributes	Preserves unique conventional characteristics of object in the (conventional attributes) configuration (e.g., places cup on saucer; places string of beads on self)
10	Single scheme sequences	Extends same familiar action to two or more figures (e.g., extends cup to baby doll, to stuffed lamb, to interactant)
11	Substitutions	Uses one object to stand in place for another (e.g., puts bowl on head for a hat)
12	Substitutions without object	Pretends to use something that is not there (e.g., shakes an imaginary salt shaker)
13	Doll as agent	Moves doll figures as if they are capable of action (e.g., moves figure to load blocks in a truck; puts mirror into doll's hand as if to see itself)
14	Multischeme sequences	Extends different actions to same figure (e.g., feeds doll with spoon, wipes it with cloth, then puts to bed)
15	Sociodramatic play	Adopts various familiar roles in play theme (e.g., plays house, assigning the various roles)
16	Thematic fantasy play	Adopts roles of fantasy characters (e.g., plays "Superman" or "Wonderwoman", assigning the various roles)

Due to low frequency, levels 7 and 9, and levels 15 and 16 were combined. Levels 1–9 represent functional play categories, and Levels 10–16 represent symbolic play categories.