

Brief Report: Longitudinal Improvements in the Quality of Joint Attention in Preschool Children with Autism

Kathy Lawton · Connie Kasari

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Abstract Children with autism exhibit deficits in their quantity and quality of joint attention. Early autism intervention studies rarely document improvement in joint attention quality. The purpose of this study was to determine whether there was a change in joint attention quality for preschoolers with autism who were randomized to a joint attention intervention, symbolic play intervention, or a control group. Quality was defined as shared positive affect during joint attention as well as shared positive affect and utterances during joint attention. Interactions of group and time were found for both types of joint attention quality. During the follow up visits, the joint attention and symbolic play intervention groups produced more of these two types of joint attention quality than the control group.

Keywords Autism · Intervention · Joint attention · Shared positive affect · Preschool

Introduction

Joint attention is an early-emerging social communication skill that involves sharing interest regarding an object, person, or event with a social partner (Mundy et al. 2003). Several aspects of typical development, such as language

acquisition, emotion regulation, and theory of mind, are consistently linked to the successful emergence of joint attention (Tomasello and Farrar 1986; Adamson and Russell 1999; Baron-Cohen 1993). Joint attention is a core autism deficit (Loveland and Landry 1986; Mundy et al. 1986) that has been linked to several social communication and social emotional impairments characteristic of children with autism (Mundy et al. 1992; Adamson and Russell 1999; Whalen et al. 2006).

According to Bruner, shared positive affect clearly differentiates joint attention gestures from requesting or protoimperative gestures (Bruner 1983). Using shared positive affect during joint attention can be an especially powerful way to inform a communicative partner about the emotional significance of a shared experience (Adamson and Russell 1999). For example, a child may smile at an adult while using a joint attention point to convey his excitement about a toy. The presence of the child's smile with a joint attention gesture can efficiently and effectively serve the function of joint attention: to share a positive experience with a communicative partner (Kasari et al. 1990).

Young children who are typically developing or developmentally delayed frequently combine shared positive affect and joint attention. In one study, two-year-old children who were typically developing used shared positive affect during 60 percent of the joint attention acts that they exhibited during a semi-structured social communication assessment (Kasari et al. 1990). Children who were developmentally delayed at a mean developmental age of 2 years incorporated shared positive affect during 58 percent of their joint attention acts.

It is important to note that children with autism do not seem to have a specific, universal, and primary deficit displaying positive affect (Dawson et al. 1990; Kasari et al. 1990). However, children with autism do seem to have a

K. Lawton (✉)
Center for Autism Research and Treatment, University of California, 68-268 Semel Institute, Los Angeles, CA 90024, USA
e-mail: lawton.kathy@gmail.com

C. Kasari
Psychological Studies in Education and Center for Autism Research and Treatment, University of California, 68-268 Semel Institute, Los Angeles, CA 90024, USA

unique impairment using sharing positive affect during joint attention (Kasari et al. 1990). In the previously described study, preschoolers with autism combined shared positive affect and joint attention gestures significantly less than children who were typically developing or developmentally delayed; they used shared affect during joint attention in only 24 percent of their gestures.

Previous research suggests that early childhood interventions can improve the frequency of joint attention acts produced by young children with autism (e.g., Whalen and Schriebman 2003; Kasari et al. 2006). Unfortunately, published joint attention interventions rarely report whether joint attention quality may also increase as a result of intervention. One exception to this trend is a joint attention intervention study by Whalen et al. that documented treatment effects in the frequency of shared positive affect (Whalen et al. 2006).

In this study, we were interested knowing whether an intervention that was previously documented to increase the quantity of joint attention in young children with autism (Kasari et al. 2006) could also increase the quality of joint attention in these children. Our study had two aims. First, we were interested in knowing whether the frequency of shared positive affect used during instances of joint attention increased more for children who had been randomized to a joint attention intervention or a symbolic play intervention than a control group. Second, we wanted to know whether the frequency of shared positive affect with utterances during joint attention increased more in these treatment groups than in the control group.

Method

Data from a previously published Randomized Control Trial were used (Kasari et al. 2006). Preschoolers with autism in this study were randomized to a joint attention intervention, a symbolic play intervention, or a control

group. Primary outcomes included joint attention quantity, play act quantity, duration of joint engagement, as well as expressive language (Kasari et al. 2008).

Participants

As Table 1 details, this sample included 52 preschoolers with autism. Children needed to meet the specific inclusion and exclusion criteria previously described by Kasari et al. (2006).

Materials

An extensive battery of developmental assessments was administered to all children in the study. Five of these measures were used in the current study. Evaluators independent of the intervention team and blind to treatment assignment completed all of these measures.

Before the study began, the ADOS (Lord et al. 2001) and ADI-R (Lord et al. 1993) were used to validate the child's clinical diagnosis of autism. Additionally, The Mullen Scales of Early Learning (Mullen 1989) was used to report the general cognitive ability of each child. All children were also administered the Reynell Developmental Language Scales (Reynell 1977) to assess receptive and expressive language abilities.

The Early Social Communication Scale (ESCS) (Mundy et al. 1996) was also administered. The ESCS is a 20 min structured observational measure that assesses the emergence of nonverbal communication skills in young children. This assessment has been used extensively with populations that are developmentally delayed. During the ESCS, an experimenter presented a child with approximately 20 situations designed to occasion nonverbal behavior for the purpose of joint attention, social interaction, or behavior regulation.

The ESCS was video recorded and later scored. A joint attention act was operationalized as one in which the child

Table 1 Sample characteristics at the beginning of the intervention

	Joint attention intervention (<i>n</i> = 20)	Symbolic play intervention (<i>n</i> = 16)	Control group (<i>n</i> = 16)
Chronological age	43.05 (6.863)	41.41 (6.491)	41.31 (4.542)
Mental age	26.29 (8.713)	26.59 (7.550)	22.05 (9.532)
Expressive language age	20.6 (6.508)	23.18 (7.418)	19.75 (7.819)
Receptive language age	20.55 (7.272)	23.35 (9.380)	17.94 (8.813)
Gender (males/females)	15/5	11/5	14/2
Ethnicity (Caucasian/minority)	16/4	12/4	9/7
Maternal education			
High school	0	0	1
Some college/technical	2	3	4
College/professional	18	13	11

Six children who completed the intervention were not included because portions of their ESCS data were missing

communicated about an object, event, or person for the purpose of sharing interest. Joint attention could be exhibited through a nonverbal gesture of pointing, coordinating looking, giving, or showing. Shared positive affect during joint attention was defined as any instance of joint attention in which the child directed a smile towards an adult. Shared positive affect with utterances during joint attention was defined as any joint attention act that included a smile directed towards an adult and a verbal utterance. Twenty percent of the ESCS tapes were coded for reliability. Kappa was .79.

Procedure

After completing the informed consent process and the assessments, the children were randomized to one of the three experimental conditions. Joint attention and symbolic play treatment sessions were held every day for 5–6 weeks. The goal of the joint attention intervention was to increase the child’s joint attention initiations during novel play routines developed specifically through the intervention approach. The purpose of the symbolic play intervention was to increase the child’s level and frequency of play acts according to a play scale adapted from Lifter et al. (1993). The purpose of the control group was to represent the standard method of treatment (applied behavior analysis) for children with autism. More detail about the interventions is provided in previous publications (Kasari et al. 2006, 2008).

Results

Analytic Plan

Mixed effects regression models were used to assess changes in the following types of joint attention quality at

four study time points: shared positive affect during joint attention as well as shared positive affect with utterance during joint attention. We tested for the effect of intervention group and study time point by comparing the Walden Chi-Square statistic produced using the regression generated by Stata 10.1. All count outcome measures were modeled using negative mixed-effect regressions. A negative mixed-effect regression model was more appropriate than a poisson mixed-effect regression model because of overdispersion in the data (Hilbe 2008).

Comparability of Groups at Entry

The three treatment groups were equal at entry according to a series of demographic variables as well as the variables under investigation. One way analyses of variances reported that there were no intervention group differences at entry on the following demographic variables: chronological age, mental age, expressive language age, receptive language age, ratio of males to females, maternal education, and ethnicity ($p > .05$). Walden Chi square analyses of the groups at entry reported no group differences for both types of joint attention quality ($p > .05$).

Treatment Effects

Table 2 illustrates the means and standard deviations of the intervention groups at all four study time points.

Shared Positive Affect During Joint Attention

We examined shared positive affect during joint attention. There was an interaction for the joint attention group and time as well as the symbolic playgroup and time (Wald $\chi^2(5) = 30.5, p < .01$). Follow-up Z tests revealed that the

Table 2 Joint attention quality at the four study time points

	Entry		Exit		6 month follow-up		12 month follow-up	
	Joint attention & shared positive affect	Joint attention & shared positive affect & Utterance (s)	Joint attention & shared positive affect	Joint attention & shared positive affect & Utterance (s)	Joint attention & shared positive affect	Joint attention & shared positive affect & Utterance (s)	Joint attention & shared positive affect	Joint attention & shared positive affect & Utterance (s)
Joint attention group	3.25 (5.37)	1.05 (2.44)	3.65 (5.03)	1.80 (2.57)	6.15* (5.72)	4.10* (4.64)	7.65* (6.80)	5.30* (5.68)
Symbolic play group	3.25 (4.38)	1.56 (4.00)	4.25 (4.64)	1.93 (3.15)	7.91* (3.06)	3.19* (3.58)	9.44* (3.88)	5.75* (7.02)
Control group	4.50 (6.57)	2.50 (4.56)	4.88 (7.65)	1.68 (3.09)	3.06 (4.39)	1.75 (3.38)	3.88 (5.32)	1.56 (3.10)

* $p < .05$

joint attention and symbolic play groups were not significantly different at exit ($z = .38$, $p = .705$), the 6 month follow-up ($z = .63$, $p = .529$), or the 12 month follow-up ($z = .81$, $p = .419$).

Shared Positive Affect with Utterances During Joint Attention

We also investigated whether the frequency of shared positive affect with utterances during joint attention increased as a result of treatment group. An interaction existed between the joint attention group and time as well as the symbolic playgroup and time (Wald $\chi^2(5) = 47.44$, $p < .01$). Follow-up Z tests revealed that the joint attention and symbolic play groups were not significantly different at exit ($z = .74$, $p = .456$), the 6 month follow-up ($z = .76$, $p = .449$), or the 12 month follow-up ($z = .62$, $p = .532$).

Discussion

This study investigated whether children with autism who were randomized to a joint attention, symbolic play, or control group would show qualitative improvements in joint attention across the four study time points. We were interested in determining whether there were increases in the frequency of shared positive affect during joint attention as well as shared positive affect with utterances during joint attention. The joint attention and symbolic playgroups increased both types of joint attention quality at the 6 and 12 month follow-up.

The quantity of joint attention was already documented to have improved in children with autism during the ESCS as a result of the investigated joint attention and symbolic play intervention (Kasari et al. 2006). This study suggests that either intervention can improve both the quantity and the quality of joint attention. Both the quantity and quality of joint attention are impaired in young children with autism (Kasari et al. 1990). Therefore, it is noteworthy that the experimental interventions can simultaneously target both aspects of a core deficit of autism.

Additionally, this study suggests that the children in the joint attention and symbolic play groups not only learned how to produce specific discrete joint attention behaviors, but also that both groups most likely understood the true communicative purpose of their joint attention behaviors. The function of joint attention is to share a positive experience with a communicative partner (Kasari et al. 1990). By exhibiting shared positive affect during joint attention, the joint attention and symbolic playgroups communicated their interest about an object in a way typical of young children (Kasari et al. 1990).

The treatment groups may have used shared positive affect more during joint attention because interventionists from both groups used shared positive affect to achieve the specific intervention outcomes. Interventionists used shared positive affect when engaging with the child around an object. Shared positive affect seems to support the emergence of communication regarding objects (Adamson and Bakeman 1985). Shared positive affect may increase the “emotional charge of a situation,” therefore increasing the probability that a child may direct a communicative gesture towards a communicative partner (Adamson and Russell 1999, p. 285).

Some of our hypotheses were supported and some were not. As we expected, some aspects of joint attention quality improved in children with autism who were randomized to a joint attention intervention. We did not hypothesize that the children who were randomized to the symbolic play intervention would show gains in joint attention quality. However, our results are consistent with other publications that have reported unanticipated benefits for children in the symbolic play intervention (Kasari et al. 2006, 2008). We continue to believe that children in both the joint attention and symbolic play intervention groups showed improvements because both interventions required mutual engagement around an object when teaching specific play or joint attention objectives (Kasari et al. 2008).

We were also somewhat surprised to see that there was not a significant improvement in the quality of joint attention until the follow-up visits. This may have been for two reasons. First, in young children with autism, it could be more difficult to improve joint attention quality than joint attention quantity. In children with autism, positive affect is paired with joint attention after the emergence of joint attention gestures (Paparella 2000). Children with autism may first need to be fluent at producing joint attention before being able to display more complex joint attention types. The joint attention frequency of children in both treatment groups was much higher at the follow-up visits than at exit (Kasari et al. 2008), suggesting that the children had become better versed at displaying joint attention by the follow-up visits.

Second, it is possible that positive affect is displayed more during certain joint attention skills. Positive affect seems to be more common in coordinated joint looks and points versus gives and shows (Paparella 2000). It is possible that joint attention quality increased at the follow-up visits because children displayed significantly more gestures that are more likely to incorporate positive affect. Future investigations can determine whether either of these explanations may explain on why joint attention quality did not improve until the follow-up visits.

Additionally, researchers should more closely examine the mediators and moderators of joint attention quality

treatment efficacy. There is great variability regarding the intervention methodology of published joint attention treatments (Lawton and Kasari 2010). It is quite possible that joint attention quality may increase more in some joint attention interventions than others. For example, shared positive affect might be paired more often with joint attention in treatments that are focused around the child's interests and motivation because these interventions might be more intrinsically enjoyable to children. It may also be that the amount of change in joint attention quality is influenced by characteristics of the child, such as chronological age.

Future joint attention interventions should measure both joint attention quantity and quality. Both aspects of joint attention are uniquely impaired in children with autism and have profound implications for the social, emotional, and communicative development of young children. Unfortunately, at this time, it is unknown how joint attention quality may change as a result of the published joint attention interventions because joint attention quality is very rarely measured.

Future investigators should also address the limitations of this study. First, it will be important to assess joint attention quality in more contexts with a greater variety of people. It may be beneficial to broaden the definition of joint attention quality to include dimensions such as eye contact. It might also be helpful to measure treatment effects across a longer period of time and assess the extent to which these treatment effects influence other aspects of development.

In conclusion, this investigation suggests that a developmentally informed treatment can simultaneously improve the quality and quantity of joint attention. In particular, it seems that children with autism can learn the true communicative function of joint attention through motivating episodes of supported engagement with another person and an object.

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