Published in final edited form as:
J Autism Dev Disord. 2014 September ; 44(9): 2162–2174. doi:10.1007/s10803-014-2092-z.

The Role of Supported Joint Engagement and Parent Utterances in Language and Social Communication Development in Children with Autism Spectrum Disorder

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Abstract

This study examined associations between three parent–child engagement states and social communication, expressive language, and receptive language at 8 month follow-up, in 63 preschool-age children with autism spectrum disorder. We extend the literature on supported joint engagement by dividing this state into higher order (HSJE) and lower order types, with HSJE involving greater reciprocity in toy play. We also examined parents' follow-in utterances that co-occurred with each state. We found that only HSJE predicts later social communication and expressive language, while object engagement predicts receptive language. HSJE combined with follow-in utterances (HSJE+FI) predicts all three outcomes when controlling for HSJE+FI in other engagement states. When controlling for total HSJE, HSJE+FI is predictive of receptive language.

Keywords

Autism spectrum disorder; Parent–child interaction; Social communication; Language

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Introduction

Longitudinal research has shown that for young children with autism spectrum disorder (ASD) social communication and language abilities in early childhood have long-term impacts on adult outcomes, underscoring the importance of understanding these abilities early on (Gillespie-Lynch et al. 2012). Informal estimates suggest that approximately 28 % of children diagnosed with ASD fail to develop language (Sigman and Ruskin 1999; Tager-Flusberg et al. 2005), and these children are at heightened risk for poor adult outcomes (Billstedt et al. 2007). Social communication difficulties (i.e., difficulties in nonverbal and verbal communication for the purpose of sharing interest with others) are endemic to the disorder, and persist throughout adulthood regardless of if the child develops spoken language (Tager-Flusberg et al. 2001). Social communication and language are also developmentally intertwined, as social communication predicts concurrent and later language in young children with ASD (Toth et al. 2006). In this study, we investigate the developmental substrates and early social experiences that contribute to later spoken language and social communication development in pre-school age, minimally verbal children with ASD in order to improve our understanding of the disorder and inform future intervention research.

Joint Engagement and the Development of Language

Typical Development

The development of expressive and receptive language originates in affectively-laden, face-to-face interactions between infants and caregivers in the first months of life (Trevarthen 1979). Following these early dyadic exchanges, infants begin to engage with others in increasingly complex ways. From 6 months until the end of the first year, children develop joint attention abilities, where they learn to coordinate their attention between a partner and a referent (Bakeman and Adamson 1984; Trevarthen and Hubley 1978). By 13 months, children are able to enter into sustained episodes of coordinated joint engagement, wherein the child actively shifts gaze between the adult and the object of interest at key moments within an extended interaction (Bakeman and Adamson 1984). For example, the parent and child take turns dropping strings of beads into a container. After each turn, the child looks to the parent’s face, smiles, and then looks back to the container. In this example, the child’s coordinated looks between the adult and play materials work to maintain the interaction and share pleasure with the parent in regards to the play experience.

Prior to the development of coordinated joint engagement, children engage in *supported joint engagement* (SJE). In this state, the child and caregiver engage with the same object in such a way that the parent influences the child’s object play, but the child does not give explicit attention to the adult through visual referencing (Adamson et al. 2004).[1] Thus, the

[1]In Bakeman and Adamson’s original 1984 manuscript on this topic, supported joint engagement was referred to as ‘passive’ joint engagement. However, in subsequent work Adamson et al. (2004) clarify that “…it is important to emphasize that during periods of supported joint engagement, a child is neither passive (as we may have unfortunately implied in Bakeman and Adamson 1984, when we used the label *passive joint engagement*) nor unaware of the adult’s actions. Even though the child is not explicitly acknowledging the partner, the child is engaged in a shared activity that he or she is constructing with the partner” (p. 1183). It is this clarified definition of supported joint engagement that we use in the current study.

caregiver takes on the majority of the "work" required to maintain interactions around shared interests (Bakeman and Adamson 1984; Siller and Sigman 2008). Because the adult provides a significant amount of interactional scaffolding, they "may in effect free their infants of the need…to shift attention back and forth between the mother and the object of mutual concern" (Bakeman and Adamson 1984; p. 1279).

When caregivers infuse joint engagement episodes with language and other referential symbols (e.g., pretend play), they provide a context for the child to begin matching symbols with their external referent (Adamson et al. 2004). Evidence has shown that the duration of supported joint engagement infused with symbols predicts expressive and receptive language to a greater extent than the duration of symbol infused coordinated joint engagement (Adamson et al. 2004; Adamson et al. 2009). The conceptualization of supported joint engagement as a useful language learning context is rooted in developmental theory that emphasizes how linguistically competent adults usher children into the world of symbols through heavily scaffolded, culturally textured interactional routines (Bakeman and Adamson 1984; Bruner 1983; Trevarthen and Hubley 1978; Vygotsky 1978). Adamson et al. (2009) hypothesize that the decreased attentional and cognitive demands of supported joint engagement, in comparison to coordinated joint engagement, allow the child to focus on connecting verbal input to a referent without needing to simultaneously coordinate visual attention with the adult (Bloom and Tinker 2001). However, this is not a scenario in which the child is simply matching disembodied words with objects. Supported joint engagement still requires *engagement* between the adult and child. That is, even though the child is not managing the interaction with eye contact, the child still engages with the adult through their mutual actions on objects.

Development in Children with ASD

Children with ASD spend less time in coordinated joint engagement with caregivers and more time in object engagement than do their typically developing peers (Adamson et al. 2009). Continuing with the bead play example, object engagement would occur when a child and parent play with separate strands of beads, the parent's actions on the beads do not influence the child's play, and the child does not seek to involve the parent. Deficits in joint attention behaviors, including responding to joint attention, initiating joint attention, and switching gaze within joint attentional states are well documented, and are thought to influence the pathway toward later language and social communication differences in this population (Charman 2003; Werner and Dawson 2005; Shumway and Wetherby 2009; Wetherby et al. 2007; Wetherby et al. 2004). In contrast, 30 month old children with ASD do not differ from language matched, 18 month old typically developing children in the amount of time spent in supported joint engagement (Adamson et al. 2009). On the one hand, this finding is consistent with current conceptualizations of ASD. The decreased demands of supported joint engagement on the child may make this state an interactional modality that is not exacerbated by the executive functioning, social attention, and social communication deficits found in ASD (Dawson et al. 2004; Hill 2004; Yoder and Stone 2006). On the other hand, the prevalence of delayed or absent speech in children with ASD begs the question of whether SJE, as traditionally defined, provides the same language learning context for children with ASD as it does for typically developing children (Sigman and Ruskin 1999; Tager-Flusberg et al. 2005).

It is possible that a refinement in the way SJE is defined and measured in children with ASD could provide a more robust predictor of later language. Typically developing children are presumed to be aware of and engaged with the adult whenever the adult is influencing the child's play with toys, even though the child does not explicitly look to the adult (Adamson et al. 2004). However, the same assumptions are not necessarily plausible for children with ASD, as there is evidence that they are more likely to reject or be unaware of parental bids for interaction during toy play (Adamson et al. 2001). For children with ASD, it may not be enough for the parent to be influencing the child's toy play in order for the child to be adequately engaged with the adult in a way that has a sufficient impact on development. That is to say, children with ASD may be unaware of the adult as a source of collaboration and potential communication partner, even when the adult is influencing how they play with toys. Incorporating more explicit behavioral evidence of engagement with the adult into the SJE construct may demarcate a state that better predicts later language than an SJE state that does not include explicit markers of adult engagement.

We hypothesized that for the purpose of predicting later language and social communication in children with ASD, it would be beneficial to divide the supported joint engagement state into two categories. In *higher order* supported joint engagement (HSJE), the child more clearly demonstrates engagement with the adult through their reciprocal play with objects. For example, the parent and child are playing with beads and a small container. After the child drops her beads into the container she waits expectantly for the parent to take a turn while maintaining focus on the container, continuing in this way for several turns. In contrast, *lower order* supported joint engagement (LSJE) occurs when the parent influences the child's play with toys, but the child shows little or no evidence that they are aware of the parent's involvement in the play scheme as a potential play partner. For example, the parent drops beads into a container while the child manipulates the beads within the container; the child does not anticipate or reciprocally respond to the parent's actions, but continues to play with the beads. We suspected that only HSJE would predict later language and social communication.

Synchronous Parent Verbalizations

A separate strand of research has shown that parent verbal input that is synchronous with the child's current focus of attention (a particular form of symbol infusion) is an important predictor of both later language development and the rate of language growth in both typically developing children and children with ASD (Carpenter et al. 1998; Harris et al. 1986; McDuffie and Yoder 2010; Siller and Sigman 2002, 2008; Tamis-LeMonda et al. 2001). Utterances formulated around the child's current interests do not require the child to shift attention to a new object and maximizes the possibility that the child will attend to the utterance. Thus, maintaining a topic of mutual interest by focusing on objects with which the child is already engaged helps to ensure that a 'communicative channel' between the parent and child is established and maintained (Adamson et al. 2001).

McDuffie and Yoder (2010) use the term ‘follow-in’ utterances to describe both comments and directives that are synchronous with the child’s current focus of attention. Follow-in comments are utterances that are related to the child’s focus of attention, but do not instruct the child to perform a new behavior. For example, a parent would give a follow-in comment as her child rolls a truck along the floor by saying “the truck is driving to the car”. Follow-in directives are utterances related to the child’s focus of attention that ask the child to perform a behavior other than their current actions. In the previous example, the parent would give a follow-in directive by saying “make the truck honk at the car.” Both types of follow-in utterances predict subsequent expressive and receptive language in children with ASD (McDuffie and Yoder 2010). However, we do not yet know the extent to which the parent–child engagement state during the parent’s provision of linguistic input affects the relationship between follow-in utterances and later language and social communication development. Nor do we know the extent to which the type of engagement state affects the strength of the association between follow-in utterances and later language and social communication development.

Social Communication Development

Research to date on the role of engagement states and parent verbal input has primarily focused on the development of receptive and expressive language (but see Siller and Sigman 2002). However, deficits in social communication, which we define as the propensity to communicate with others using verbal and nonverbal means for the purpose of sharing, remains the most difficult aspect of communication for children with ASD (Shumway and Wetherby 2009). Given our conceptualization of HSJE as the type of supported joint engagement in which the child is interacting reciprocally with the parent through object play, it is possible that this engagement state has implications for social communication. Children who are able to enter into HSJE are showing evidence that they are willing to incorporate a partner into their play experience, and can engage in rudimentary social exchanges through objects. Because of this increased willingness to play with others, they have increased access to play situations where social communication is relevant.

Follow-in utterances within HSJE may also support social communication development. In HSJE, the child is engaged in a social event scaffolded by the caregiver, where follow-in utterances are a critical component of that scaffolding. In this context, the child experiences caregiver utterances as social communication acts that work to co-construct play with the child. This type of experience may foster an understanding for communication as a means of sharing in experiences with others. In contrast, in LSJE there is no evidence that the child is engaged in play as a social event, or that they are involved in collaboration with the caregiver. The child is therefore not experiencing the caregiver’s linguistic input as a means for sharing and collaborating within play, regardless of how responsive the input is to the child’s current focus of attention. As a result, follow-in utterances would have no effect on later social communication when the dyad is in LSJE. Furthermore, when follow-in utterances are supplied during HSJE, the parent is foregrounding objects of mutual attention as potential communication topics (Adamson et al. 2001; Siller and Sigman 2002). Children with ASD may be more motivated to communicate for the purpose of sharing when their current interests are made salient. Follow-in utterances can therefore enhance the HSJE state by working as additional scaffolding to elicit social communication from the child.

The Current Study

In this section, we outline the general aims and specific research questions that guided our analysis. First, we were interested in whether making the distinction between high versus low level supported engagement would improve the scientific utility of measuring individual differences in engaging in supported joint engagement. That is, we distinguished between LSJE, where the parent is influencing the child's play with objects but there is little reciprocity or collaboration in their actions, and HSJE, where the parent and child collaborate in their play but the child does not overtly attend to the adult through gaze. Second, we were interested in whether noting the engagement state in which follow-in utterances occur increased the scientific utility of quantifying individual differences in parents' use of follow-in utterances. Put another way, we wanted to know if follow-in utterances that occurred in the hypothesized superior engagement state (HSJE) helped explain why HSJE was associated with later social communication and language.

To represent the full continuum of child engagement, we included object engagement as a category of interest. Because object engagement does not involve coordination with the adult, it is theoretically the least cognitively taxing of our three engagement states. Additionally, object engagement was the most prevalent state for our sample of very young children with ASD. Although coordinated joint engagement (CJE) is also of interest, we were not able to measure this in the current sample due to its low occurrence.

To address these interests, we posed three research questions. First, we asked whether the proportion of time in HSJE at Time 1 contributes unique variance to the prediction of expressive language, receptive language, and social communication at 8 month follow up when controlling for the proportion of time in LSJE or object engagement. Second, we asked whether follow-in utterances that occurred within HSJE (HSJE+FI) at Time 1 contributes unique variance to the prediction of expressive language, receptive language, and social communication at 8 month follow up when controlling for LSJE+FI and object +FI. Finally, since we hypothesized that the addition of follow-in utterances to HSJE was partly responsible for its superior association with later receptive language and social communication, we wanted to know whether HSJE+FI is a unique predictor of receptive language and social communication after accounting for total HSJE.

Methods

Design

We used a longitudinal correlational design to answer each of our three research questions. Our participants were drawn from a larger longitudinal study aiming to determine predictors of intentional speech. Predictor and outcome data were used from Time 2 and Time 4 from the larger project, which we refer to as Time 1 and Time 2 in the current project. Participant descriptors and mental age, a control variable in the current analysis, were collected at the larger study's Time 1. Eight months elapsed between the two assessment periods in the current study. All assessments were administered by a trained examiner.

Subjects

Participants included 63 initially minimally-verbal children with ASD. Inclusion criteria were that the child was diagnosed with classic autism or ASD per DSM-IV TR (American Psychiatric Association 2000) criteria, and had a chronological age between 24 and 47 months. Classic autism was confirmed for 97 % of participants, and ASD for the remaining 3 %. The average education of the primary caregiver was 1–2 years of college. Participant characteristics, including chronological age, ADOS scores, and predictors and outcome scores are given in Table 1. Not all subjects provided data for all assessments. Listwise deletion was used to deal with missing data for each analysis (see *n* values in Tables 5, 6, 7).

Procedures

Autism Diagnostic Observation Schedule (ADOS)—The ADOS Module 1 (Lord et al. 2000), was administered by a research-reliable examiner at intake (4 months prior to the current study's Time 1) to confirm that participants had either an autism or ASD diagnosis according to the instrument's diagnostic algorithm and DSM-IV criteria as judged by the diagnostician. The ADOS diagnostic algorithm is applied to the observation scores, which in turn determines if the child meets the criteria for autism or ASD.

Mullen Scales of Early Learning (MSEL)—The MSEL (Mullen 1995) is a standardized assessment developed for children ages birth to 68 months. The average age equivalency score from four cognitive sub-scales, including visual reception, fine motor, receptive language, and expressive language, was the measure of mental age. The MSEL was administered at the larger study intake (4 months prior to the current study's Time 1).

Parent–Child Free Play Procedure (PCFP)—The PCFP was administered at Time 1 as a context to measure engagement states and parent follow-in utterances (coding is described below). This procedure is a 15-min video recorded session in which the primary caregiver and the child are asked to play with a standard set of toys in a way that they normally would at home. No other instructions are given. Toys included manipulatives (e.g., beads, blocks, pop-up toys), books, and pretend play items (e.g., dolls, farm animals) arranged either on the floor along a circular rug or at a table with chairs.

Expressive Language Aggregate—To improve the validity of the analyzed measure of language, the average z score of several language measures was computed (Rushton et al. 1983). The language measures include both parent report and examiner-elicited measures of language, granting a more complete picture of the child's comprehension and use of language from multiple sources. The expressive language measures included the *MacArthur Communication Development Inventories* (MCDI; Fenson et al. 1993) words and gestures subscale, a 15-min examiner-child language sample, and the *Communication and Symbolic Behavior Scales Developmental Profile* (CSBS DP; Wetherby and Prizant 2002). The MCDI is a parent report used to assess vocabulary in young children. The words and gestures subscale consists of a vocabulary checklist of words that a child between 8 and 16 months would be expected to have exposure to. The 15-min language sample is taken from an examiner-child play session with a standard set of toys. The examiner follows the child's lead in playing with the toys and offering opportunities for the child to respond to adult talk, without explicitly prompting child language use. Within the language sample, the number of different word roots was transcribed and coded by trained research assistants. Only non-imitative, canonical or close approximations of canonical words that were used in a semantically and pragmatically conventional manner were coded (i.e., were not used idiosyncratically by the child). The CSBS DP is scored from a behavior sample involving a semi-structured play session with a standard set of toys intended to elicit spontaneous communication. The behavior sample is scored according to a standard manual (Wetherby and Prizant 2002). To derive the expressive language aggregate, we averaged z scores from the number of words said of the MCDI, the number of different word roots used referentially and communicatively in the language sample, and the raw sum of the Words portion (subscales 12–15) of the CSBS. The average Pearson's correlation between these three measures is 0.59 (range 0.49–0.76). Pearson correlations between individual expressive language measures and predictor variables are given in the top portion of Table 3. All correlations between language measures and our variables of interest are in the expected direction.

Receptive Language Aggregate—To compute a receptive language score, we averaged z scores across the raw score from the MCDI Words Understood subscale (i.e., the sum of words said and understood plus words understood only), and the raw score of the Understanding portion (subscale 16) of the CSBS DP. The Pearson's correlation between these two measures is 0.59. Pearson correlations between individual receptive language measures and predictor variables are given in the bottom portion of Table 3. All correlations between language measures and our variables of interest are in the expected direction.

Social Communication—We derived the social communication variable by summing raw totals from the Social Interaction and Joint Attention portions (subscales 6 and 7) of the CSBS DP. These did not have to be z-score transformed before summing because the raw score is on the same scale for subscales 6 and 7. The social interaction subscale measures acts used to attract or maintain attention to oneself, such as acts within a social routine or greeting. The joint attention subscale measures acts used to direct another's attention to an object, event, or topic of a communicative act, such as while commenting on an object or requesting information about the referent. We chose these subscales to measure communication specifically for the purpose of sharing affect or interest with others, which excludes communication for requesting, an instrumental function.

Coding and Reliability

Videos of the PCFP procedure administered at Time 1 were coded using ProcoderDV software (Tapp 2003). Engagement states were conceptualized as event codes, in which the start and stop time for each state was recorded in order to calculate a total duration. We applied a mutually exclusive and exhaustive code list to each video, which is described in Table 2. However, only HSJE, LSJE, and object states were analyzed. All other codes were considered 'other'. To ensure that we coded *states* and not brief events, codes were only applied to interactions that were at least 3 s long or consisted of at least three turns. Brief sequences that did not meet this 'three second or three turn' criterion were absorbed into the previously occurring state, as these brief behaviors did not warrant a change of state. Engagement states were coded in two passes; the first pass involved coding supported joint engagement, object engagement, and 'other' states. In the second pass, coders divided supported joint engagement states into HSJE and LSJE. Because the codable length of each video was not uniform across participants (calculated as total session time minus uncodable segments), the variable was transformed into a proportion of the total codable time.

Follow-in utterances were coded in a third pass, using a partial interval behavior sampling system in which intervals were 5 s long. This form of coding involves dividing each session into 5 s intervals, and coding the presence or absence of a follow-in utterance if it occurs at any time during the interval. We expected follow-in utterances to be short in duration, occur at relatively low rates over a given session, and spread out over the session, indicating that a partial interval coding system is a cost effective and appropriate method of estimating the occurrence of this variable (Yoder and Symons 2010). The definition used to code this construct is also described in Table 2. For the larger study, coders identified intervals with follow-in utterances, and follow-in utterances plus physical play. We combined these two codes into a single variable of 'total follow-in utterances' for the current study. Physical play was not of interest for the current study, the variables were only combined to derive total follow-in utterances.

For research questions 2 and 3, we derived the HSJE+FI, LSJE+FI, object+FI variables using Procoder Merger (Tapp 2013). This program reports the number of intervals in which two codes occurred together. Because the total length of each session was not uniform across videos, the number of intervals containing each code was divided by the total number of 5 s codable intervals to create a proportion of total intervals.

For engagement state coding, intra-class correlation coefficients estimated using two-way random effects models were used to determine absolute agreement for the relative duration of each state for each session, reported by two independent coders. The two coders were given a randomly selected sample of 20 % of the videos. For duration coding, ICCs were 0.88, 0.77, 0.79, and 0.97 for SJE, HSJE, LSJE, and object engagement, respectively. As described above, the interval coding scheme for parent behavior included codes for follow-in utterances and follow-in utterances plus physical play. Both of these codes were summed to provide the number of follow-in utterances, which was used to derive engagement state + FI variables. The ICC for the number of follow-in utterances was 0.96.

Analysis Plan

We used a series of multiple linear regressions to answer each research question. For all three research questions, three separate regressions were conducted with each criterion variable. For all regressions, predictor variables were entered simultaneously. To test research question 1, the three engagement states were analyzed as predictors. To test research question 2, the proportion of intervals for each engagement state that co-occurred with parent follow-in utterances were analyzed as the predictors. For research question 3, HSJE+FI was analyzed as the predictor of interest while controlling for the total proportion of HSJE.

Mental age is a common correlate of later language. At issue in this study is whether the engagement states and follow-in utterances add to the value of statistical models predicting language and social communication after mental age is controlled. Engagement states and follow-in utterances are dyadic variables in the sense that they reflect both child and parental attributes and interactional tendencies. To rule out covariation with mental age as an alternative explanation to the associations of interest, mental age was statistically controlled in all tests of our research questions. The Results section highlights statistically significant findings after controlling for mental age in each model. Although initial levels of expressive language may also be a correlate of later language, we did not control for this variable in our main analysis as we determined that high inter-correlations between initial expressive language and our criterion variables (ranging from $r = 0.47$ to 0.76) left too little variance left over to explain. High inter-correlations among predictor variables would wipe out associations that could motivate future experimental studies to test the causal nature of such associations.[2]

Results

Preliminary Analyses

All analyses were conducted using Stata 13 software (StataCorp 2013). We suspected that some of our predictor variables might be highly intercorrelated, due to the closely related constructs that we sought to examine. To determine if this would be a factor in subsequent analyses, we calculated pairwise Pearson's correlations among predictors. These are shown in Table 4. For each of our regression analyses, there was evidence of unequal variance among residuals (i.e., violation of the homoscedasticity assumption). Therefore, we used the robust option in Stata. This option uses Huber-White sandwich estimators when computing the t statistic and protects against bias due to heteroscedasticity. For one of our models, there was evidence of kurtosis and skewness in the distribution of residuals (i.e., violation of the normality assumption). For this model, we used bootstrap regression with 10,000 repetitions of resampling with replacement. This procedure empirically estimates the sampling distribution, and bias corrects standard errors which may be too small using procedures that rely on a normal distribution.

Since the proportion of each session in which our predictor variable categories occurred was relatively low, we also calculated the number of participants who were coded as being engaged in each state and having intervals with each state + follow-in utterances. We found that the majority of participants engaged in each category (see Table 1 for these percentages).

[2]We conducted an additional series of analyses which controlled for initial levels of expressive language, and did indeed find that many of the associations we report in this manuscript were not significant. However, for research question 1, object engagement remains a significant predictor of receptive language. For research question 2, HSJE+FI remains a significant predictor of social communication and of receptive language. For research question 3, object engagement and HSJE+FI remain significant predictors of receptive language.

Primary Analyses

The first set of analyses tested the relative contributions of the engagement states to language and social communication. As predicted, HSJE accounted for unique variance in expressive language and social communication after mental age and other engagement states were controlled. Standardized regression coefficients indicate that for every increase of 0.38 standard deviations in HSJE, the expressive language z-score increased 1 unit. Likewise, for every increase of 0.26 standard deviations in the proportion of HSJE, the social communication score increased by 1 unit. Contrary to expectations, only object engagement accounted for unique variance in receptive language. For every increase of 0.23 standard deviations in the proportion of object engagement, receptive language z-score increased 1 unit. Full results are given in Table 5.

The second set of analyses tested the relative contribution of follow-in utterances within various engagement states on language and social communication. HSJE+FI accounted for unique variance in social communication and receptive language after controlling for follow-in utterances within the other two engagement states (standardized regression coefficients for HSJE+FI were 0.23, and 0.27 for social communication and receptive language, respectively). Full results are given in Table 6.

The third set of analyses tested the relative contribution of HSJE+FI in predicting social communication after controlling for HSJE and, in the case of receptive language, object engagement states. We included object engagement as a control variable in this analysis since it was a significant predictor of receptive language in our first set of analyses. Contrary to predictions, HSJE+FI was no longer a significant predictor of social communication after controlling for HSJE. As expected, HSJE+FI was a significant predictor of receptive language after controlling for HSJE and object engagement, while LSJE+FI was not (standardized regression coefficient was 0.43). Object engagement remained significant (standardized regression coefficient was 0.20). Full results are shown in Table 7.

Discussion

Our study was motivated by two primary issues. First, we wanted to know if the distinction between HSJE and LSJE would enhance our thinking about adaptive engagement states for young children with ASD in the early stages of language acquisition. Second, we wanted to know whether the distinction between HSJE and LSJE was important when determining the effects of follow-in utterances on language and social communication development. To address these issues we used a longitudinal correlational design in which a set of theoretically motivated predictors were entered into the same multiple regression model to control for the inevitable intercorrelation among multiple variables, all of which could predict later language and social communication. Mental age was statistically controlled in all analyses to rule out covariation with this important child characteristic as an alternative explanation for the associations of primary interest.

Refining the Supported Joint Engagement Construct

Our results show that it is indeed useful to make a distinction between HSJE and LSJE, which differ in the clarity of evidence that the child is engaging with the parent through object play. However, the importance of this distinction is conditional on the dependent variable. The proportion of HSJE was predictive of later expressive language and social communication after controlling for other engagement states and mental age, while the proportion of LSJE did not have predictive value for any of our research questions. Conversely, the proportion of HSJE did not predict unique variance in later receptive language.

For expressive language and social communication, the child's social orientation to the adult through mutual engagement with objects may be an important component of interaction that renders higher order supported joint engagement a developmentally important phenomenon. Children who are able to engage in higher rates of HSJE are providing evidence that they are more open to sharing their play experience with parents than children who engage in lower rates of HSJE. Therefore, these children have experiences where language production and social communication are heavily supported by the adult, as the adult works to maintain a shared focus of attention and collaborative engagement with toys. The adult scaffolds an interactive context in which expressive language and social communication become resources for the child to share control of the play experience. Thus, experiences within HSJE may provide the contextual support and social motivation necessary for expressive language and social communication to be a means by which the child interacts with others. Much has been written about the value of mutual engagement with speaker and referent in learning to talk (e.g., Adamson et al. 2004; Adamson et al. 2009; Bakeman and Adamson 1984). We add to this theoretical framework by providing evidence that reciprocal interaction without gaze coordination is an important component of this state.

In contrast, receptive language showed a different pattern of results that only partially confirmed our hypotheses. When we examined the contribution of engagement state without considering parental utterances, only object engagement predicted receptive language when controlling for mental age. There are two possible explanations for this unexpected finding. First, it is possible that the child's propensity to engage with objects facilitates receptive language learning about objects. Object exploration within this state may increase the child's object knowledge, which can support object-word associations (e.g., object names, verbs describing actions on objects). Since most HSJE does not include follow-in utterances—only 1/3 of the HSJE in our data set contained such utterances- it is possible that the lack of an association of HSJE with receptive language occurred because linguistic input is necessary for the child's receptive language to benefit from engagement in HSJE. Second, it is possible that negative associations with unengaged or onlooker states confound the relationship between object engagement and receptive language. Distinguishing unengaged and onlooker states was not necessary to address our research questions, so we did not train to reliability for identifying these states, only between the states and those named in our research questions. Therefore, we were unable to test this possibility. Future research is needed to determine if negative associations with unengaged or onlooker states better account for variability in receptive language.

The Relevance of Engagement State for Follow-in Utterances

Only recently has theory regarding joint engagement made explicit the value of having both (a) sufficient, but not too cognitively demanding, engagement with both speaker and referent and (b) linguistic input that co-occurs in this type of engagement state (Adamson et al. 2009). In addition to clarifying that the targeted type of engagement state requires that children with ASD show explicit evidence of engagement with the adult (albeit without visually referencing the adult), we also show that the engagement state should be considered when investigating the predictive value of follow-in utterances. Likewise, a potentially critical component of the influence of HSJE on receptive language is the inclusion of follow-in utterances. The current study offers support for these claims in two ways.

First, follow-in utterances within HSJE were more predictive of social communication and receptive language than follow-in utterances within LSJE or object engagement. Follow-in utterances within HSJE may support social communication by making salient the act of pointing out the state of affairs during play at times that do not heavily tax the child's cognitive resources. Additionally, follow-in utterances create a supportive context for the child to provide his own communicative contribution to the mutual topic of engagement. Experiences within this format may expand the child's social communication repertoire, and help the child develop an understanding of communicating to share as a worthwhile endeavor when collaborating in play. However, expressive language was not predicted by any of the three engagement states + FI in our sample, indicating that follow-in utterances may not be a crucial component of the engagement state in facilitating expressive linguistic repertoires for young children with ASD.

Second, HSJE+FI predicted receptive language even after controlling for the total proportion of HSJE. Thus, the empirical support for the special importance that follow-in utterances add to the facilitative value of HSJE is strongest for receptive language. This latter finding is our most stringent test of the proposition that the engagement state in which follow-in utterances occur strengthens its predictive value because HSJE+FI and HSJE were very highly correlated. This high intercorrelation is understandable in light of the fact that HSJE +FI is a subcategory of HSJE and both are measured within the same assessment context at Time 1. The high interrelation between these two predictors is a probable explanation for why HSJE+FI did not uniquely predict social communication when HSJE was controlled. HSJE+FI may have uniquely predicted receptive language due to a stronger relation between parent follow-in utterances and receptive language than expressive language and social communication. The latter two variables have more obstacles for development in children with ASD than receptive language, such as deficits in oral motor skills and decreases in social orienting and social motivation (Dawson et al. 2004; Rogers et al. 2003; Rogers and Pennington 1991).

Limitations

There are four limitations to this study that warrant consideration. The first two arise from the lack of CJE in our sample (in contrast to Adamson et al. 2009). The low occurrence of CJE is likely related to the reduced vocabulary size of our participants relative to Adamson's study, as indicated by the parent-reported vocabulary checklist. Because too little CJE was present, we were unable to test the relationship between CJE and social communication, which has not been previously studied. For children with ASD who are developmentally older and able to engage in higher rates of CJE, it could be that CJE is more important than HSJE in predicting social communication. This is plausible given the conceptual links between CJE and social communication. Unlike language learning, which requires the availability of cognitive resources for linking words to referents, social communication development may be more reliant on a social orientation to others. This would indicate that visually referencing adults, as is characteristic of CJE, may be an important mode of interaction along the developmental pathway.

Second, the low CJE in our sample prevented us from entering CJE as a covariate in our regression models, which would have allowed us to test whether HSJE was superior to both LSJE (possibly characterized by too little reciprocity with the adult) and CJE (possibly characterized by too high cognitive demands) in predicting expressive language. Similarly, the inability to include CJE+FI in our analyses prevented an important aspect of the motivating theory behind the study. Thus, we were also unable to determine if distinguishing between HSJE and LSJE and specifying symbol-infusion to follow-in utterances would refine Adamson et al.’s (2009) finding that symbol-infused SJE is superior to symbol-infused CJE in predicting receptive language.

Third, our definitions of lower order and higher order supported joint engagement have not yet been determined reliable or tested by an external research group. Both independent coders were trained within a single research lab. Future research in other labs will be required to verify the reliability and validity of these new definitions. Lastly, we used a longitudinal correlational design, so it is not possible to confidently conclude that HSJE or HSHE+FI had causal influence on child social communication or language development. We suspect that higher-order supported joint engagement is a useful context for promoting expressive language and social communication, and for promoting receptive language when combined with follow-in utterances for minimally verbal children with ASD. However, a randomized control trial is needed to determine if this is in fact the case. Our results provide the needed empirical support to justify a more costly experimental study.

Implications for Future Research and Practice

If these findings are replicated in the context of an experimental design, they have important implications for future research and practice. We have given evidence that the interaction partner has an important role to play in promoting language and social communication in children with ASD. Each of our predictor variables was dyadic in nature, meaning that while they tapped capabilities of the child, they also recorded the efforts of the parent. Parents and interventionists alike could focus on scaffolding interactions so that they meet the conditions of higher-order supported joint engagement, and provide follow-in utterances during these episodes. Importantly, this state does not require the child to coordinate their gaze between the adult and play objects. Interventionists therefore may not need to reinforce gaze shifting in order to support social communication and language before the child is developmentally ready. Indeed, there is already a promising line of intervention research that promotes this type of engagement and has shown supported joint engagement can be increased through intervention (Kasari et al. 2006, 2008, 2010). However, this research has not differentiated between HSJE and LSJE or the use of follow-in utterances within these states. Future intervention work that recognizes these distinctions may further maximize intervention gains.

In addition to the need for an experimental study in which HSJE +FI is manipulated while controlling for follow-in utterances in other engagement states, future research should include comparisons to typically developing children and/or developmentally delayed children without ASD. It is possible that for typically developing children, there is no meaningful separation between LSJE and HSJE, as they may 'default' to covertly orienting to the adult whenever the adult attempts to join the child in play. A developmentally delayed group would help determine if the developmental pathway discussed here is a result of the social deficits specific to ASD, or is due to developmental delays more generally. Studies that include these additional developmental groups can determine if the differential association of HSJE with language and social communication is moderated by group membership. Lastly, longer-term longitudinal work can determine developmental trajectories that arise out of HSJE in children with ASD, beyond the 8-month period explored in this study.

Contribution to the Literature

Our findings extend the literature on the relationship between parent and child engagement states, follow-in utterances, and later language and social communication in several important ways. First, we refine existing conceptualizations of supported joint engagement by showing that for children with ASD, the developmentally important state requires evidence of engagement with the adult (i.e., HSJE) beyond the parent influencing the child's play with toys (i.e., LSJE). Second, in our analysis we controlled for mental age, which rules out variation in mental age as an alternative explanation for our findings. Third, we included object engagement as a predictor, while Adamson et al. (2009) included only symbol-infused supported joint engagement and symbol-infused coordinated joint engagement. Fourth, we tested the importance of engagement frameworks both with and without the presence of parent follow-in utterances, and conducted a final analysis that controlled for total proportion of HSJE. Adamson et al. (2009) exclusively tested a larger category of symbol infusion, while we have considered parent follow-in utterances to be a subset of symbols that are known to be related to language development. Adamson did not control for the total proportion of supported joint engagement while examining the relation of symbol infusion on later outcomes. Lastly, we added social communication as a criterion variable, as we theorized that the social relatedness evidenced in these early interactions set an important foundation for later verbal and non-verbal social communication.

Conclusion

This study offers a refined definition of the type of supported joint engagement associated with later language and social communication development in young children with ASD. Additionally, we show that the engagement state has important implications for the relationship between follow-in utterances and later language. Our results should be considered by researchers interested in parent–child engagement as a context for optimizing the developmental potential of young children with ASD.

Acknowledgments

This research was funded by the National Institute of Deafness and Communication Disorders grant R01DC006893-01A2, Vanderbilt Kennedy Center grant P30HD15052, and Institute of Educational Sciences grant R324B080005. We would like to thank the children and families that participated in this research, and the research staff that worked diligently on this project: Ariel Schwartz, Nicole Thompson, Elizabeth Gardner, and Kristen Fite, Maura Tourian, Lucy Stefani, Amanda Haskins, Danielle Kopkin, Ann Firestine, Olivia Fairchild, Kathleen Berry. Finally, we would like to thank the anonymous reviewers for their helpful feedback on this manuscript.

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Table 1

Participant characteristics (n = 63)

Measure	M	SD	Range	% of Participants[a]
Time 1 CA in months	38.57	7.13	27–51	
ADOS at intake[b]	22.66	3.95	6–28	
Mullen AE in months at intake[b]	12.22	4.85	3.75–26.5	
Time 1 object engagement[c]	0.56	0.19	0.05–0.97	100
Time 1 LSJE engagement[c]	0.10	0.08	0–0.30	98
Time 1 HSJE engagement[c]	0.06	0.06	0–0.28	91
Time 1 object + FI[d]	0.16	0.10	0.01–0.38	100
Time 1 LSJE + FI[d]	0.04	0.04	0–0.14	87
Time 1 HSJE + FI[d]	0.02	0.04	0–0.24	71
Time 2 social communication[e]	4.70	3.13	0–12	
Time 2 CSBS social interaction	2.92	1.84	0–6	
Time 2 CSBS joint attention	1.78	1.96	0–6	
Time 2 MCDI expressive	59.26	86.98	0–396	
Time 2 Language sample	6.32	8.93	0–37	
Time 2 CSBS words	6.05	7.47	0–31	
Time 2 MCDI receptive	152.94	117.07	0–396	
Time 2 CSBS understanding	5.58	7.40	0–24	

ADOS autism diagnostic observation schedule module 1, *AE* age equivalency, *CA* chronological age, *CSBS* communication and symbolic behavior scales, *FI* follow-in utterances, *HSJE* higher-order supported joint engagement, *LSJE* lower-order supported joint engagement, *MCDI* macarthur communication development inventories

[a] % of Participants who were coded with the engagement state for any duration

[b] Intake occurred 4 months prior to Time 1

[c] Measured as proportion of total assessment

[d] Measured as proportion of intervals

[e] Raw sum of social interaction and joint attention items in CSBS

Table 2

Code definitions for engagement states and parent utterances

	Definition
Supported joint engagement (SJE)	The parent and child are engaged with the same materials. The parent's actions influence the child's play, but the child does not visually reference the adult's face
Higher order supported joint engagement (HSJE)	Within an SJE framework, the child reciprocates the adult's actions or collaborates with the adult. This includes turn taking sequences, imitation sequences, the child following through on the verbal commands of the parent, and heightened affective displays if the parent performs an action explicitly meant to elicit affect from the child
Lower order supported joint engagement (LSJE)	Within an SJE framework, there are no reciprocal or collaborative exchanges between the dyad
Object	The child manipulates toys independently. Parent may be an onlooker or provide narration to the child's play, but any parent actions do not affect the child's play with toys
Coordinated joint engagement	The parent and child are engaged with the same materials, and the child visually references the adult throughout the exchange
Onlooker	The child is watching the adult perform an action
Unengaged	The child is uninvolved with toys or the parent
Uncodable	Segment is not codable because the child is off screen, the child's back is to the camera, or the child's actions on toys are not discernible
Parent follow-in utterances	The parent provides verbal language that follows into the child's current focus of attention and either (1) describes what the child is looking at or playing with, or (2) requests that the child change some aspect of their play with the toys

Table 3

Correlations of predictors and individual language measures

	Object	LSJE	HSJE	Object+FI	LSJE+FI	HSJE+FI
Expressive language measures						
MCDI words said	−0.010	−0.206	0.362**	−0.007	−0.105	0.212
Word roots in LS	0.113	−0.094	0.329**	−0.078	−0.053	0.140
CSBS words	0.167	−0.199	0.309**	0.095	−0.060	0.173
Receptive language measures						
CSBS understanding	0.010	−0.182	0.256*	0.147	−0.007	0.386***
MCDI words understood	0.004	−0.139	0.334**	0.052	−0.096	0.432***

CSBS communication and symbolic behavior scales, *FI* follow-in utterances, *HSJE* higher order supported joint engagement, *LS* language sample, *LSJE* lower order supported joint engagement, *MCDI* MacArthur communicative development inventories

* $p < 0.05$;

** $p < 0.01$;

*** $p < 0.001$

Table 4

Inter-correlations among predictors

	HSJE	LSJE	Obj.	HSJE+FI	LSJE+FI	Obj.+FI
LSJE	−0.153					
Object	−0.115	−0.479***				
HSJE + FI	0.680***	−0.142	−0.046			
LSJE + FI	−0.164	0.702***	−0.299*	0.0307		
Object + FI	−0.061	−0.091	0.378***	0.274*	0.275*	
MA	0.338**	−0.441***	0.245*	0.368**	−0.273*	0.180

FI follow-in utterances, *HSJE* higher order supported joint engagement, *LSJE* lower order supported joint engagement, *MA* mental age, *Obj*. object engagement

* $p < 0.05$;

** $p < 0.01$;

*** $p < 0.001$

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Table 5

Predicting social communication and language from engagement state experience

	Coef.	Robust S.E.	β	t	Semi-partial Corr.
Social communication (n = 63)					
MA	0.128	0.086	0.199	1.49	0.168
HSJE	13.738	5.098	0.257	2.69**	0.237
LSJE	−3.13	5.473	−0.078	−0.57	−0.063
Object	−2.879	2.330	−0.173	−1.24	−0.148
Cons	4.167	1.846		2.26	
Receptive language (n = 60)					
MA	0.093	0.021	0.493	4.34**	0.415
HSJE	2.553	1.200	0.166	1.28	0.150
LSJE	0.701	1.155	0.059	0.61	0.048
Object	1.113	0.382	0.232	2.91**	0.195
Constant	−1.867	0.381		−5.21***	
Expressive language (n = 60)					
MA	0.044	0.027	0.254	1.64	0.214
HSJE	5.377	1.807	0.381	2.98**	0.345
LSJE	−1.135	0.949	−0.104	−1.20	−0.084
Object	0.324	0.392	0.074	0.83	0.062
Constant	−0.990	0.371		−2.67**	

HSJE higher order supported joint engagement, *LSJE* lower order supported joint engagement, *MA* mental age

* $p < 0.05$;

** $p < 0.01$;

*** $p < 0.001$

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Table 6

Predicting social communication and language from combined engagement state and follow-in utterance variables

	Coef.	Robust S.E.	β	t	Semi-partial Corr.
Social communication (n = 62)					
MA	0.170	0.083	0.263	2.05*	0.227
HSJE + FI	20.371	7.577	0.233	2.69**	0.204
LSJE + FI	6.936	9.236	0.084	0.75	0.076
Object + FI	−5.255	4.253	−0.169	−1.24	−0.149
Constant	2.567	1.079		2.38*	
Receptive language (n = 59)					
MA	0.087	0.023	0.465	3.86***	0.400
HSJE + FI	6.929	2.753	0.274	2.52*	0.239
LSJE + FI	−0.270	2.594	−0.011	−0.10	−0.010
Object + FI	1.042	1.079	0.113	0.97	0.101
Constant	−1.420	0.286		−4.97***	
		Bootstrap S.E.		z	
Expressive language (n = 59)[a]					
MA	0.058	0.028	0.336	2.08*	0.288
HSJE + FI	7.366	4.701	0.323	1.57	0.282
LSJE + FI	−1.988	2.212	−0.091	−0.90	−0.084
Object + FI	0.424	1.175	0.051	0.36	0.046
Constant	−0.967	0.317		−3.05	

FI follow-in utterances, *HSJE* higher order supported joint engagement, *LSJE* lower order supported joint engagement, *MA* mental age

* $p < 0.05$;

** $p < 0.01$;

*** $p < 0.001$

[a] Results from bootstrap regression

Table 7

Predicting social communication and language from HSJE and HSJE + FI

	Coef.	Robust S.E.	β	t	Semi-partial Corr.
Social communication (n = 62)					
MA	0.127	0.074	0.196	1.71	0.180
HSJE + FI	0.614	9.151	0.007	0.07	0.005
HSJE	14. 568	6.952	0.274	2.10*	0.190
Constant	2.151	0.892		2.41	
Receptive language (n = 59)					
MA	0.081	0.021	0.426	3.86***	0.364
HSJE + FI	10.848	3.351	0.429	3.24**	0.188
HSJE	−2.090	2.081	−0.135	−1.00	−0.093
Object	0.960	0.352	0.201	2.73**	0.293
Constant	−1.679	0.234		−7.17	

FI follow-in utterances, *HSJE* higher order supported joint engagement, *MA* mental age

* $p < 0.05$;

** $p < 0.01$;

*** $p < 0.001$