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Toddlers' Joint Engagement Experience Facilitates Preschoolers' Acquisition of Theory of Mind

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Abstract

Forty-two children participated in a longitudinal study that investigated the relationship between their joint engagement experience when toddlers and their development of theory of mind when preschoolers. Controlling for language comprehension at 30-months, higher preschool false belief scores were associated with more time in coordinated joint engagement earlier (18–21 mo, $\beta = .34$) and in symbol-infused joint engagement later (27–30 mo, $\beta = .35$) in toddlerhood. Findings suggest that the early foundation of theory of mind development is laid as toddlers attend to both social-emotional and symbolic aspects of shared events.

Acquiring a theory of mind is fundamental to a child's understanding the social world (Premack & Woodruff, 1978; Wellman, 1990) and to his or her ability to make sense of and predict others' actions (Tager-Flusberg, Baron-Cohen, & Cohen, 1993; Wellman & Lagattuta, 2000). Passing false belief tasks has been broadly accepted as an indicator that a child has acquired a theory of mind, but this performance is best conceived as a culmination of a long and nuanced development path that begins years earlier during toddlers' interactions with their caregivers (Bruner & Feldman, 1993).

Cross-sectional research has established many concurrent influences, such as presence of siblings, verbal IQ, and pretend play, on false belief task performance (Perner, Ruffman, & Leekam, 1994; Taylor & Carlson, 1997; Watson, Painter, & Bornstein, 2001). However, there have been remarkably few longitudinal investigations of early social experiences and later theory of mind acquisition. Nevertheless, there are provocative hints that what transpires during toddlers' interactions may influence subsequent theory of mind development. For example, Charman et al. (2000) observed that joint attention behavior such as the alternation of gaze between a partner and an object in order to share the experience at 20-months predicted theory of mind performance at 44-months, although its small sample ($n = 13$) invites replication.

The study reported here examined the relation of toddlers' joint engagement experiences with their mothers from 18 to 30 months and subsequent false belief understanding. Our interest in early joint engagement experiences was motivated by the notion that sharing objects and events with their caregivers affords toddlers the opportunity to learn about people's communicative actions and intentions (Adamson & Bakeman, 1991; Tomasello, 1995), which may provide a foundation for theory of mind development (Wellman, Phillips, Dunphy-Leli, & LaLonde, 2004). We hypothesized that early variations in the amount and form of toddlers' joint engagement experiences may explain subsequent variation in the timing of preschoolers' understanding of false beliefs; cumulatively, experiences across this year may capture more reliable and robust differences in the child's tendency to attend to people, objects, or symbols

than a single observation would have allowed. Second, we predicted that this influence may be nuanced by the developmental course of joint engagement across this year; that is, looking earlier and later in the year may capture important variation as skills such as coordination of attention and symbol use are emerging.

Our characterization of the child's joint engagement (i.e., active sharing of an object or event with a social partner) captured two distinctions that characterize important developmental variations in the way toddlers attend to people, objects, and symbols (Adamson, Bakeman, & Deckner, 2004; Adamson & Chance, 1998). First, to describe the child's attention to the caregiver during periods of joint engagement, we distinguished periods when the child is explicitly acknowledging the mother, often by gaze alternation between her and their shared focus (*coordinated joint engagement*), from periods when the child was focused primarily on the shared object without explicitly attending to the mother (*supported joint engagement*). Coordinated joint engagement with caregivers emerges between 9 and 15 months of age while supported joint engagement can be observed considerably earlier (Bakeman & Adamson, 1984). Second, to retain information about whether or not a child was engaged with aspects of objects and events that extend beyond the immediate and tangible, we distinguished *non-symbol infused* and *symbol-infused* joint engagement. As Piaget (1962) and Werner and Kaplan (1963) argued long ago, the formation and use of symbols, including words and symbolic gestures, can displace the child's attention from the immediate aspects of objects and events to represented aspects, including internal states (Adamson & Bakeman, 2006). By the middle of the second year, symbols begin to infuse joint engagement, although there is considerable variation in how often toddlers sustain symbol-infused joint engagement (Adamson et al., 2004).

Overall, joint engagement experience likely facilitates theory of mind development and so the more often toddlers engage in joint engagement of any form, the earlier they may acquire false belief understanding as preschoolers. However, a consideration of the form of joint engagement may help clarify what is crucial about shared experiences. First, we hypothesized that the more time toddlers spent in coordinated joint engagement—especially earlier in toddlerhood when they become more able to coordinate their attention between people and objects—the earlier they might succeed on false belief tasks as preschoolers. During periods of coordinated joint engagement, the child has the opportunity to integrate information about the social partner's nonverbal behavior and their shared focus at crucial moments during their interaction. For example, the child may look at the partner when something the child finds surprising, pleasing, intriguing, scary, or otherwise socially salient occurs (Tomasello, 1995); to share affect (Adamson & Bakeman, 1985); or to check whether the mother is also reacting to an exciting event (Charman et al., 2000). In many discussions of the emergence of intentional communication (Baldwin, 1995; Mundy & Willoughby, 1996; Tomasello, 1995), the child's active coordination of attention between objects and partners is viewed as a key indication that the child has a rudimentary understanding of others as intentional beings, a necessary precursor to theory of mind development.

Second, we hypothesized that the more time toddlers spent in symbol-infused joint engagement—especially later in toddlerhood when they can not only coordinate their attention to their social partner and a shared topic but also infuse the shared attention with symbols—the earlier they might succeed on false belief tasks as preschoolers. This hypothesis is consistent with previous findings that variation in toddler's language, which is related to the ability to sustain periods of symbol-infused joint engagement (Adamson et al., 2004), may account for variance in preschooler's theory of mind development (Watson et al., 2001). Moreover, it reflects the likelihood that periods of symbol-infused joint engagement may provide children with opportunities to interweave symbols into shared activities in ways that have been shown to facilitate the development of theory of mind. For example, during early episodes of symbol-

infused joint engagement, toddlers and their caregivers may converse about shared activities, including their beliefs and desires (Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991; Ruffman, Slade, & Crowe, 2002), participate in reciprocal conversational interactions (Peterson & Siegal, 1999), and orchestrate pretend play scenarios (Taylor & Carlson, 1997).

Method

Design

This report is based on a longitudinal study of the development of joint engagement from 18 to 66 months of age. The first phase of the study provided assessments of joint engagement during 5 visits (18–30 mos at 3-mo intervals; Adamson et al., 2004). Receptive language measures were obtained at the 30-month and false belief tasks were administered at the 42-, 54-, and 66-month visits.

Participants

This report is based on 42 participants with complete data. Initially 56 full-term, typically-developing toddlers were recruited (see Adamson et al., 2004); of those, 1 missed the 30-month visit, 2 did not complete the Peabody Picture Vocabulary Test-III (PPVT, Dunn & Dunn, 1997) at 30 months, 4 did not continue past the 30-month visit, 5 missed the 42-month visit, and 2 missed the 54-month visit. Half were first born, and 57 percent were girls; 81% were European American and 14% were African American.

Procedures

All sessions were held in a laboratory playroom designed for observational research. Two recordings were made using cameras hidden behind one-way mirrored windows and synchronized with a common vertical interval time code (VITC). Visits lasted approximately 2 hours. Mothers were told we were primarily interested in observing how her child was currently communicating. During the first 5 visits, observations were made using the *Communication Play Protocol* (Adamson et al., 2004), which was designed to facilitate a broad range of communication. Conditions were semi-structured with the child serving as the star of the show and the mother as the supporting actress in the Play. Mothers were given cue cards with a few suggestions and props to facilitate the interaction; however, a specific script did not structure their behaviors or conversations. Six 5-minute scenes were observed and structured to encourage interacting, requesting, and commenting. After the Play's completion, demographic interviews and standardized tests were given. At 42-, 54-, and 66-month visits, false belief tasks were administered.

Engagement State Coding

The coding scheme used (Adamson, et al., 2004) characterizes a child's involvement with people, objects, and symbols. The current study employed 4 of the original 11 codes; these 4 described forms of the child's joint engagement with his or her mother and a shared object or event.

Non-symbol infused supported joint engagement—The child and mother are actively involved with the same object or event, but the child does not explicitly acknowledge the mother.

Non-symbol-infused coordinated joint engagement—The mother and child are actively involved with the same object or event, and the child actively and repeatedly acknowledges the mother's involvement, usually by looking at her.

Symbol-infused supported joint engagement—The mother and child are involved with the same object or event, and the child is actively attending to symbols, but the child does not explicitly acknowledge the mother's participation. Verbalizations, response to verbal requests, the use of pretense, or the production of symbolic gestures indicated symbol use.

Symbol-infused coordinated joint engagement—The child coordinates attention to the mother and the shared object or event while also attending to symbols. The child's attention to the mother may be evident through language, as when the child explicitly addresses the mother, as well as gaze patterns.

Engagement states were coded by nine trained individuals who worked in teams of two to maintain vigilance and ensure uniformity. Teams were responsible for identifying seams or breaks between different engagement states and for recording onset times to the nearest second. By definition, a state lasted at least 3 seconds.

For reliability purposes, two teams independently coded 16% of the videotapes chosen randomly. Cohen's kappa (Cohen, 1960) for non-symbol-infused supported joint, symbol-infused supported joint, non-symbol-infused coordinated joint, and symbol-infused coordinated joint were .82, .78, .72, and .64, respectively. See Adamson et al. (2004) for further details concerning reliability procedures.

To compute the three joint engagement variables used in this study (total joint engagement, coordinated joint engagement, and symbol-infused joint engagement), proportions of time spent in each were computed from the four codes described earlier. Averages across the five visits (18–30 mo), as well as means based on the first two (18–21) and the last two (27–30) visits, were computed.

Language Measure

The Peabody Picture Vocabulary Test III (Dunn & Dunn, 1997), a receptive language measure, was administered to children at 30 months of age.

False Belief Tasks

False belief tasks were performed at the 42-, 54-, and 66-month visits. Two standardized tasks were used: changed location (Baron-Cohen, Leslie & Frith, 1985; Peterson & Siegel, 1999) and misleading container (Perner, Frith, Leslie & Leekam, 1989; Welch-Ross, 1997). Props used for the tasks were changed across visits for each child and then counterbalanced across children. For each task, false belief and control questions were asked; children passed if they answered all questions correctly. As in previous literature (Wellman, Cross, & Watson, 2001), essentially all of our children at 66-months succeeded on the false belief tasks, so 66-month scores were not included in analyses. Consequently, the theory of mind score summed results from the tasks administered at 42- and 54-month visits in order to increase confidence in the reliability of our measurement; scores could range from 0 to 4.

A third false belief task, changed appearance (Leekam & Perner, 1991; Peterson & Siegel, 1999), was also administered. A disproportionate number of children (81% at 42-months; 48% at 54-months) did not correctly answer the control questions, which suggested that many children did not understand this task. Consequently results from this task were not included in analyses.

Results

The average proportion of time children spent in total, coordinated, and symbol-infused joint engagement cumulatively across the year, along with their language and false belief scores,

are given in Table 1. Means are listed separately by gender because *t*-tests revealed that girls spent a statistically significantly greater proportion of time in symbol-infused joint engagement and passed a statistically significantly greater number of false belief tasks than boys. These two sex differences made us wonder whether gender might also moderate the hypothesized associations between joint engagement variables and false belief, thus before we examined these associations we first checked for moderation. When analyzing false belief scores, interactions between sex and total, coordinated, and symbol-infused joint engagement were small and statistically insignificant ($\alpha^2 = .04, .01$, and $.02, p = .216, .503$, and $.400$, respectively); accordingly, subsequent analyses pooled over males and females.

Zero-order correlations are shown in Table 2. As is typically the case with zero-order correlations, specification error is probably present (Cohen & Cohen, 1983); in particular both redundancy and suppression seem likely here because more time in symbol-infused joint engagement, but less time in coordinated joint engagement, was associated with higher language comprehension scores (.46 and $-.28$, moderate and weak, respectively), whereas more time in both was associated with higher false belief scores (.42 and $.16$, moderate and weak, respectively; per Cohen, 1988, we characterize correlations of $.1$ as weak, $.3$ moderate, and $.5$ strong). Thus language comprehension is an excellent covariate candidate for two reasons: the pattern of zero-order correlations just described and the fact that, as expected, higher language scores were moderately associated with higher false belief scores (.35).

Accordingly, and mindful of our relatively small sample size, we regressed false belief on language comprehension and then on total, coordinated, and symbol-infused joint engagement separately. Coefficients from these regressions controlling for language comprehension are shown in Table 3 (all visits, 18–30 mo). Not surprisingly given the zero-order pattern, the coefficient for coordinated increased to $.28$ and for symbol-infused decreased to $.32$; these values are similar in magnitude and, given the sample size, both approach but do not quite reach a conventional level of statistical significance (for reasons given in Wilkinson and the Task Force on Statistical Inference, 1999, both effects sizes and statistical significance are emphasized here; see also Bakeman, 2006). Their magnitude suggests that, controlling for language comprehension, more time in both coordinated and symbol-infused joint engagement over the 18–30 month period was associated weakly to moderately with higher false belief scores.

Next, we conducted analyses to determine if joint engagement experience either earlier, or later, in this age range might have more predictive power than year-long averages. We computed engagement means based on earlier and later visits (i.e., the two at 18 and 21 months and the two at 27 and 30 months, respectively). Consistent with earlier results (Adamson et al., 2004), coordinated joint engagement remained relatively constant (.19 and $.21$, $SD = .09$ and $.12$) but symbol-infused joint engagement increased (.13 and $.47$, $SDs = .09$ and $.16$), for the earlier and later visits, respectively. Multiple regressions like those described for the 18–30 month means were performed, and the results suggest clearer prediction when engagement experience is based on a more targeted age range (see Table 3). Controlling for language comprehension at 30 months, more time in coordinated joint engagement earlier (18–21 mo, $\beta = .34$) but in symbol-infused joint engagement later (27–30 mo, $\beta = .35$)—and also more time in total joint engagement later (27–30 mo, $\beta = .31$)—was moderately associated with higher theory of mind scores.

Discussion

The findings of this longitudinal study provide one of the first empirical demonstrations of the often argued view that early shared experiences with a caregiver provide a foundation for the development of a theory of mind (Hobson, 1993; Tomasello, 1995). Variations in the amount

and form of toddlers' joint engagement with their mothers influenced the emergence of false belief understanding when they became preschoolers, and different aspects of these experiences seem particularly influential at different points along the developmental pathway.

Our methods provide a view of each toddler's propensity for joint engagement over time within the relatively stable frame of the Communication Play Protocol, which ensured that when each toddler was observed, he or she had the opportunity to engage with an attentive mother and a comparable collection of interesting objects within a constant set of communicative conditions. Thus the variations we observed in the joint engagement variables over time and between children can be ascribed primarily to variations in the children's propensity to focus attention on the partner, shared objects, and symbols rather than to variations in the opportunity for shared attention. This study suggests that distinguishing forms of joint engagement helps discern early social communicative precursors of theory of mind development (in addition to predicting language outcomes, Adamson et al., 2004).

Looking at early and late periods across this year was especially enlightening. Both our findings and those of Charman et al. (2000) suggest that during the middle of the second year variations in the amount of coordinated joint engagement predicted subsequent performance on false belief tasks. At this time, typically-developing infants have acquired skills that allow them to initiate and respond to joint attention bids (Mundy & Gomez, 1998) and are able to sustain periods of coordinated joint engagement with their caregivers (Adamson, et al., 2004; Bakeman & Adamson, 1984). During periods of coordinated joint engagement children explicitly attended to a social partner as well as the event they were sharing. This triadic pattern of attention may heighten the salience of the social partner's contribution to the social interaction, including their affective displays about and instrumental actions on objects, in ways that might enhance the child's appreciation of the partner's perspective on their shared experience and foster nascent theory of mind understanding. In particular, during periods of coordinated joint engagement, infants are well positioned to compare their own feelings about an event with their partners' emotional reaction to it (Hobson, 1993; Wellman, 1991) and to experience their social partners as intentional beings (Wellman, 1990) who not only react to the infant's actions on objects but also initiate actions.

By the middle of the third year, attention to symbolic communication rather than explicit attention to the partner seemed particularly beneficial to theory of mind development. Since the relationship between the amount of symbol-infused joint engagement and false belief understanding was moderately strong and statistically significant, after differences in receptive language were controlled, it is unlikely that this association merely reflects the effect of language skill on theory of mind tasks. Instead, it draws attention to how conversations between toddlers and caregivers about shared objects may lead to an understanding not only about events but also about another person's experience of them (Bartsch & Wellman, 1995).

An important implication of this study's findings is that the early foundation of theory of mind development may best be conceived of as multi-faceted. Both observing a partner's actions on and reactions to shared objects during periods of coordinated joint engagement and discussing shared objects during symbol-infused joint engagement may provide vital information about other people's mental states. The profound joint attention deficits that characterize autism and the prolonged delay of symbol acquisition experienced by late-signing deaf children have been implicated as contributing to their failure to pass standard false belief tasks as young children (Peterson, Wellman, & Lui, 2005). The present study demonstrates that, at least for typically developing children, all of whom passed false belief tasks by age 5, variation in joint engagement experiences when toddlers influenced the timing of their subsequent development of a theory of mind.

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Table 1

Percentage of Time Spent in Total, Coordinated, and Symbol-Infused Joint Engagement Averaged Over All Visits (18–30 months) and 30-Month Language Comprehension and False Belief Scores, Separately by Gender

Variable	Means		η^2	<i>p</i>
	Males	Females		
Total joint engagement	71	74	.04	.211
Coordinated joint engagement	19	19	.00	.805
Symbol-infused joint engagement	26	36	.14 *	.016
Language comprehension	98.	102.	.02	.317
False belief	1.7	2.4	.13 *	.020

Note. Scores are means, $N = 42$. Eta squared is the effect size for the sex difference.

* $p < .05$.

Table 2

Zero-Order Correlations

Variable	1	2	3	4
1. Total joint engagement	—			
2. Coordinated joint engagement	.49**	—		
3. Symbol-infused joint engagement	.63**	.36*	—	
4. Language comprehension	.06	-.28	.46**	—
5. False belief	.22	.16	.42**	.35*

Note. $N = 42$.

*
 $p < .05$

**
 $p < .01$

Table 3
Effects on False Belief of Joint Engagement Experience Averaged Over All, the First Two, and the Last Two Visits

Predictor Variable	All visits(18–30 mo)		Earlier visits(18–21 mo)		Later visits(27–30 mo)	
	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>
Total joint engagement	.20	.182	.11	.462	.31	.034
Coordinated joint engagement	.28	.066	.34	.020	.27	.093
Symbol-infused joint engagement	.32	.051	.22	.184	.35	.030

Note. *N* = 42. The betas derive from nine multiple regressions, three for each predictor variable averaging over all five, two earlier, and two later visits, respectively; all regressions controlled for language comprehension scores.