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Collaborative Mother-Toddler Communication and Theory of Mind Development at Age 4

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Abstract

Focusing on social pragmatics, this longitudinal study investigated the contribution of mother-toddler collaborative communication to theory of mind (ToM) development at age 4. At age 2½, 78 toddlers' (42 boys) and their mothers were observed during pretend play. At age 4, children were tested using 4 false belief understanding tasks. Both mothers and toddlers engaged in more collaborative (*inform*, *guide/request*, and *support/confirm*) than non-collaborative communication acts. Other-focused collaborative acts of *support/confirm* by mothers and toddlers predicted children's false belief understanding, even after controlling for 5 covariates. In addition, as *active* agents in their own ToM development, the contribution of toddlers' collaborative acts to false belief understanding was independent of their mothers. Finally, the way toddlers and their mothers *co-constructing* their communication mattered. Only when toddlers engaged in high levels of collaborative acts, the mothers' high levels of collaborative acts demonstrated a positive effect on children's ToM development. The applied implications of these findings were discussed.

Keywords

theory of mind; social pragmatics; mother-child pretend play; collaborative communication acts

With age, children come to recognize that human actions are governed by mental states, and that their own and others' mental states, such as desires, intentions, emotions, and beliefs, may be different. A key indicator of such ability, known as "theory of mind" (ToM), is a child's understanding that beliefs of representations of reality can be false. In spite of

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individual differences, young children show normative development progressing from consistently failing to consistently passing explicit, verbal (i.e., elicited-response) false belief tasks between ages 3 to 5 (e.g., Astington & Jenkins, 1995; Bartsch & Wellman, 1995; Dunn, 2004; for recent reviews, see Apperly, 2012; San Juan & Astington, 2012). Using diverse implicit, nonverbal (i.e., spontaneous-response) tasks, impressive research in the past decade has further shown that children's ToM ability may begin to emerge in infancy as young as 7 months of age (Kovács, Téglás, & Endress, 2010; for reviews see Baillargeon, Scott, & He, 2010; Liszkowski, 2013; Sodian, 2011). However, because of variations in definitions and assessment paradigms, ToM researchers disagree not only on the specific age of its emergence, but also on the nature of its development. Whereas some believe ToM development involves a continuous process of change in the belief understanding system progressing from implicit to explicit (e.g., Baillargeon et al., 2010; Liszkowski, 2013), others believe implicit and explicit understanding involves two distinctive, either related or disassociated, systems that develop either in sequence (Sodian, 2011) or exist in parallel (Apperly & Butterfill, 2009).

Various cognitive accounts have been formulated to explain ToM development. Nativist modular perspectives theorize ToM as an innate cognitive ability to perceive and represent others' internal mental states (e.g., Baillargeon et al., 2010). Cognitive constructivist perspectives highlight structural changes in children's mental state representations, in which the child is seen as a lone-working scientist deriving correct theories on his or her own (e.g., Leslie, 1994; Wellman, 1992). These cognitive approaches rarely address questions about individual differences or their social-interactional origins (Apperly, 2012; Liszkowski, 2013; San Juan & Astington, 2012). By contrast, social constructive perspectives propose that children develop ToM through interpersonal processes. Emphasizing the functional use of ToM in predicting others' actions during social interaction, Liszkowski (2013) postulates that the emergence and development of ToM system are driven by children's interactive experience. Guided by a social constructive perspective, the goal of this study was to examine the role of mother-child communication in ToM development

Social constructive perspectives differ in how children develop ToM abilities within interpersonal contexts. For example, in Liszkowski's (2013) usage-based account, ToM development results from children's repeated interactive use of language during communication with others. Through cumulative interactive experience, infants initially develop simple expectations about others' actions extracted from contingency and regularities in interaction, with which they form the basis for further interaction. With repeated practice, complex abstractions, interpretation, and predictions about others' actions become possible, which are further used for regulating social interactions (Astington, 2003) and inferring cultural meanings (Feldman, 2000). Although language is often theorized as a mechanism for the developmental transition between early implicit and later explicit understanding of mind (e.g., San Juan & Astington, 2012), theorists also differ in their conceptualizations about the role of language. Nelson (2005) proposes that children enter adults' "communities of minds" by participating in a discourse about social interactions and accumulating meaningful shared experiences with others. Dunn (2004) emphasize that children learn about mind and emotion within close relationships (e.g., family and friends)

through talks about inner states, engagement in pretend play, argument about conflicts, exposure to deception, and construction of collaborative narratives.

Fonagy, Gergely and Target's (2007) "pedagogical stance" posits that caregivers act in the role of a teacher from whom children learn about the social world. Others have further theorized that secure attachment relationships and emotional connections with caregivers provide young children with stable and organized mental representations for understanding their own and exploring others' mental states (e.g., Ontai & Thompson, 2008; Repacholi & Trapolini, 2004). Caregivers' sensitive and appropriate responses enable children to be attuned to the psychological states of caregivers and to derive meaning from interactions with caregivers (Steele, Steele, & Johansson, 2002). Meins and colleagues (2002, 2003) further revealed that it is maternal mind-mindedness (mothers' appropriate comments on their infants' mental states), rather than maternal sensitivity or secure attachment, contributes to ToM understanding at preschool age. Taken together, it appears that early ToM development in part is grounded in children's linguistic skills and communication experiences within close relationships. Family demographic variables, such as maternal education level (e.g., Ensor & Hughes, 2008; Ruffman, Slade, & Crowe, 2002) and number of siblings (e.g., McAlister & Peterson, 2013), are also positively correlated with ToM.

Maternal Input and Theory of Mind Development

The emerging ability to use language as means for communication and representation is necessary for early social understanding and deemed to be a covariate for empirical investigation (for reviews, see Hughes, 2011; San Juan & Astington, 2012). In addition to a general link between children's linguistic skills and ToM, complex connections exist between language and ToM at the structural (i.e., semantics and syntax) and functional (e.g., pragmatics) levels.

At the structural level, researchers have placed an emphasis on the role of syntactic composition (e.g., complement syntax following mental verbs) (e.g., de Villiers & de Villiers, 2000; Tager-Flusberg, 2000) and semantic content (e.g., mental-state words, such as "*think*" and "*remember*") (Adrián, Clemente, & Villanueva, 2007; Meins et al., 2002; Symons, Fossum, & Collins, 2006). Extensive research has shown that as children begin to develop ToM, mothers increase their use of inner-state language (e.g., Taumoepeau & Ruffman, 2008), including words expressing desire, intention, cognitive activity, and affect (Bartsch & Wellman, 1995; Hughes, Fujisawa, Ensor, Lecce, & Marfleet, 2006), which is related to increased FBU in children (Jenkins, Turrell, Kogushi, Lollis, & Ross, 2003; Meins et al., 2002).

Although researchers agree that the functional or pragmatic aspect of language extracted from conversational exchanges is critical for ToM understanding (e.g., Milligan, Astington, & Dack, 2007; San Juan & Astington, 2012), empirical evidence linking communication pragmatics to ToM development, however, remains to be lacking (Fernández, 2011). A recent study found that the connectedness in mother-child talk (i.e., the degree to which maternal speech is semantically linked to the child's prior utterance) contributes to ToM skills, even after child current verbal ability and earlier social understanding were controlled

(Ensor & Hughes, 2008). Clinical research provides further evidence that deprivation of conversational experiences, particularly, deficits in pragmatics due to deafness, blindness, and autism, lead to delayed ToM development (Meristo, Falkman, Hjelmquist, Tedoldi, Surian, & Siegal, 2007; Siegal, Varley, & Want, 2006; Siegal & Peterson, 2008). Children appear to develop their ToM system not only through the content of conversations, but also through the pragmatic use of language (Deleau, 2012). By participation in conversational exchanges, children acquire an awareness of different viewpoints, the meaning of dialogues, and representations of mental states (Deleau, 2012; Fernyhough, 2008; Montgomery, 2005). Elaborated discourse and complex conversation moves within complex social situations may augment ToM development (Liszkowski, 2013). Thus, the present study was aimed to address the research gap by examining the contribution of mother-toddler communication pragmatics to ToM development.

Social Pragmatics Approach to Theory of Mind Development: Communication Acts Analysis

A social pragmatics perspective of communication centers on the meaning of inner-state words emerging from pragmatic functions, rather than on the word-referent relations (Fernández, 2011; Montgomery, 2005). One approach to the examination of social pragmatic functions of language is to identify speech or communication acts (Garvey, 1982; McTear & Conti-Ramsden, 1992; Ninio & Snow, 1996). Communication acts are messages conveyed by the speaker to the listener. Collaborative communication acts are those that are high in directness and involvement (Leaper, 1987, 2000), whereby a speaker continuously keeps track of the listener's interest, affective state, and comprehension of the message. During pretend play, young children often use communication acts to create and share mentally constructed worlds and integrate conflicting mental representations. As such, pretense has been theorized to reflect a context that permits the child to acquire ToM (e.g., Leslie, 1994; Lillard, 2001, 2007a; Schwebel, Rosen, & Singer, 1999). The first goal of this study, therefore, was to examine the contributions of mothers' and their toddlers' collaborative communication acts during pretend play to children's later ToM development at age 4. It was expected that both maternal and toddler collaborative communication acts would make a significant contribution to children's ToM development that was above and beyond that of non-collaborative acts, even after the covariates were controlled.

Preschoolers use communicative acts of *confirm* to indicate agreement and *request* to ask for additional information when collaborating with their parents or peers during play and conversation (Leaper & Gleason, 1996). To establish mutual coordination with their preschool-aged children, parents also often employ collaborative acts, such as *inform* (e.g., give related information), *guide* (e.g., make suggestions) and *support* (e.g., show understanding) (Dunn & Brophy, 2005; Nelson, Skwerer, Goldman, Henseler, Presler, & Walkenfeld, 2003). Collaborative acts, with or without mental-state words, may not only deliver a clear message about the speaker's state of mind, but also invite the listener to reflect on his/her own mental state. For example, when a mother directly *informs* (e.g., "*I think the baby's diaper is dirty.*") or *guides* (e.g., "*You should change the diaper.*") her child, she makes her mental state openly accessible and directly aligns the child's mental

state with hers. Maternal *support* statements (e.g., “*I know you can do it.*” or “*I can help with the diaper.*”) and *request* questions (e.g., “*Do you know where the diaper is?*”) not only communicate the mother’s mental state to the child through complex messages (e.g., “*I know you don’t know how, but I will help you.*” or “*I don’t remember, but I thought you might remember.*”), but also require the child to reflect on the mother’s mental states in relation to his/her own state of mind. Some collaborative communication acts also require the listener to take a third person’s perspective into consideration. A *confirm* statement by the mother, for example, “*Baby likes clean diapers.*” goes beyond the mother’s and the child’s viewpoints. The second goal of this study, thus, was to reveal the specificity of different maternal and toddler collaborative acts in their associations with children’s ToM development. Given the lack of previous research, no specific hypothesis was made.

The Role of the Child in Theory of Mind Development

By age 2, children are able to use different terms to refer to others’ inner states that are distinctively different from their external behaviors (Wellman, 2002). Focusing on maternal input, past research has primarily examined the effect of maternal talk about emotion and mind to social understanding (e.g., Brophy & Dunn, 2002; Ensor & Hughes, 2008; Hughes & Dunn, 1998). Although children who engage in frequent and longer semantically connected conversations with their mothers and friends are more advanced in social understanding (Brophy & Dunn, 2002; Ensor & Hughes, 2008; Hughes & Dunn, 1998; Slomkowski & Dunn, 1996), the role of the child’s communication skills in their ToM development has been largely ignored. To address this gap, the third goal of this study was to examine the unique contribution of toddlers’ collaborative acts to their later ToM development. It was expected that toddlers’ collaborative acts would make a significant contribution to ToM development at age 4 that was independent of their mothers. The fourth and final goal of this study was to further test a joint effect between maternal and toddler collaborative acts. Based on the co-constructive communication model (Carpendale & Lewis, 2004), it was hypothesized that only when toddlers engaged in frequent collaborative communication acts, mothers’ frequent collaborative acts would have a positive effect on children’s later ToM development.

In sum, children’s language abilities, which include semantics, syntax, and pragmatics, are believed to be the underlying mechanism of ToM development (e.g., San Juan & Astington, 2012). While the links of semantics and syntax to ToM development have been extensively examined and validated, the role of conversational pragmatics is less clear (e.g., Milligan et al., 2007). Thus, this study focused on the pragmatic measures that assess children’s ability to use language in naturalistic conversation and their links to ToM understanding. Specifically, this was the first study applying a social pragmatic function approach to investigate the effect of mother-child talk on ToM development. We examined the individual and joint contributions of maternal and toddler collaborative communication acts at age 2½ to children’s ToM abilities at age 4, with all known covariates taken into consideration¹, including child age, number of siblings, maternal education, complexity of maternal and toddler language, and sophistication of maternal and toddler pretense speech.

Methods

Participants

Seventy-eight children (42 boys) and their mothers participated in a larger longitudinal study spanning from infancy to preschool age conducted in a university town in a Southeastern state. The data collection for the present study took place when the children were age 2½ (30 months $\pm$ 2 weeks) and again at age 4 (48 to 57 months). Approximately 87.3% of the mothers were European-Americans, 5.1% Asians, 2.5% Latinos, 1.3% African Americans, and 3.8% other ethnicities. The majority of the mothers were married (96.2%) and had college education or higher (89.9%; $M = 16.48$ years, $SD = 2.82$). About 34% of the mothers were employed full-time when their children were 2½ years old. Parents received \$30 and a free video of the visit for their research participation.

Procedures

At age 2½, the mothers engaged in pretend play with their children using a set of family dolls and toy furniture for about 10 minutes, and the activity was videotaped. Maternal and child verbal and vocal actions were transcribed verbatim from the videos. The accompanied nonverbal actions (e.g., facial expressions, gaze direction, and gestures such as shrugging shoulders) and contextual information (e.g., pretend actions and objects used) were noted. Joint actions (e.g., singing together) and joint focus of attention between mother and toddler were also noted. The Computerized Language ANalysis (CLAN) program of the Child Language Data Exchange System (CHILDES; MacWhinney, 2000) was applied to derive the frequency of communication acts and mean length of utterance (MLU). At age 4, the children were tested individually for ToM development.

Measures

Coding pretense speech sophistication—To examine pretense speech as a possible covariate, maternal and toddler speech utterances were coded based on Fenson's (1984) coding scheme. Each maternal and toddler utterance during the pretend play session was identified as non-play speech (e.g., “*Sit on your chair.*”), play-related speech (e.g., “*This doll is big.*”), or one of the 9 levels of pretend play speech. The different levels reflect the emerging pretense sophistication in the underlying structures of decontextualization (moving from using real-life objects to substitutes to imagined objects), decentration (shifting from self-directed to other-directed actions to actions through another and then to actions with

¹TOM development at age 2½ was not included as a covariate in this study. This exclusion was due to both theoretical and empirical considerations. The ToM tasks implemented in this study are commonly used verbal procedures for assessing preschoolers' explicit FBU. Children under age 3 are thought to have implicit false belief understanding. At the theoretical level, it has been argued that implicit and explicit understanding of mind may be two qualitatively different systems (e.g., Apperly & Butterfill, 2009; San Juan & Astington, 2012). As such controlling implicit understanding at age 2½ in predicting explicit understanding at age 4 would be an effort in vain. Empirically, none of the nonverbal FBU procedures used under age 3, such as violation-of-expectation, anticipatory looking, and interactive paradigms (see Baillargeon et al., 2010, for a review), has demonstrated cross-time predictive validity in predicting verbal FBU performance (see Thoermer et al., 2012, for an exception). In addition, earlier findings also suggest that controlling early ToM may not be fruitful: (1) the contribution of early language to later ToM is stronger than the reverse association (Hughes, 2011; Milligan et al., 2007), (2) language training improves ToM performance but false belief training has no influence on language (Hale & Tager-Flusberg, 2003), and (3) early FBU does not predict mothers' later mental-state talk (e.g., Symons et al., 2006; Taumoepeau & Ruffman, 2008) even when the child's age, language skills, inner-state talk, and earlier FBU performance as well as maternal education level and non-inner-state speech were controlled (Ruffman et al., 2002). Therefore, instead of controlling for TOM at age 2½, 7 variables known to be associated with TOM development were included as the potential covariates in this study.

imagined characters), sequencing (progressing from single actions to combinations), and planning (moving from spontaneous to organized actions) (Fein, 1981; McCune-Nicolich, 1981). These 9 levels of pretense speech include self-directed pretense (Level 1; e.g., “*Me thirsty.*”), passive other-directed pretense (Level 2; e.g., “*I feed baby.*”), object-directed pretense (Level 3; e.g., “*Pie is hot.*”), active other-directed pretense (Level 4; e.g., “*Baby’s crying.*”), substitution (Level 5; e.g., “*Let’s make this knife a fishing pole.*”), single-scheme combination (Level 6; e.g., “*Put the bear to bed, now the doll.*”), multi-scheme combination (Level 7; e.g., “*It’s raining. Put on a hat.*”), intentional or planned actions (Level 8; e.g., “*Let’s give the bear a drink.*”), and invention/imaginary (Level 9; e.g., “*Birds are watching us.*”). Thirty percent of the transcripts were randomly selected and coded by an independent coder for reliability checks. The average intraclass correlation coefficients were .90 and .93 for maternal and toddler speech, respectively. An average level of pretense speech was derived separately for mothers and toddlers to be tested as the covariate in subsequent analysis.

Coding collaborative communication acts—Mother-child conversation was segmented into communication turns. A turn is defined as the communication acts of one speaker bounded by those of another speaker (Shatz & Gelman, 1973) or a significant silence of 5 seconds or longer. The mother or the child was considered to take a communication turn even if only one word was uttered. One or more communication acts may be contained in each communication turn. The pragmatic function of each communication act by the mother or toddler was classified separately. Classification of communication acts was based on verbal content, tone of voice, facial expressions, overall intent of the speaker, and/or pause (1 second or greater).

The coding categories for collaborative communication acts were adopted from the Psychosocial Processes Coding Scheme (Leaper, 1987, 2000; Leaper & Gleason, 1996), which was originally designed to analyze expressions of directness and assertion as well as affiliation and involvement during peer interaction or social interactions between parents and young children. Communication acts in speech occurring during play were classified into mutually exclusive and exhaustive categories as collaborative or non-collaborative. Collaborative acts were those high in directness and affiliation (Leaper, 1987, 2000; Leaper & Gleason, 1996), including: (a) *inform*: providing related information or making descriptions or evaluations about activities or play objects (e.g., “*The bear has a bottle.*”); (b) *guide/request*: providing suggestions, proposals, clarifications and/or corrections, asking directions, or seeking task-related help (e.g., “*Put the cup here.*” or “*Can you cover him with a blanket?*”); and (c) *support/confirm*: exhibiting explicit agreement, appreciation, and/or willing acquiescence, showing understanding or emotional support, expressing shared amusement, or praising (e.g., “*I know you can.*” or “*You are such a good helper!*”). A non-collaborative communication act was classified when (1) the verbal and nonverbal communication acts were contradictory or mismatched; for example, while retrieving a plate for herself, the mother said to her child “*Can you give me a plate?*”, or (2) when the communication acts could not be classified as one of the three collaborative communication acts described above. Two undergraduate coders worked together as a team in coding the communication acts. All disagreements in coding were resolved through conferencing.

Twenty percent of the transcripts were randomly selected and coded by the first author for reliability checks. The average inter-rater agreement was 87.6% and the kappa was .83. To control for variations in the length of pretend play among dyads, the frequency of maternal/toddler communication act was computed as rate per minute for subsequent analysis.

Theory of mind tasks—During the preschool years, children make sequential progressions in diverse aspects of ToM understanding. A “standard” way to assess ToM development is through FBU tasks. Unexpected location, content, and identity (i.e., appearance vs. reality) are the “standard” FBU tasks (Wellman, Cross, & Watson, 2001). Also, the ability of making predictions and interpretations about the behavior of others is the hallmark of ToM understanding (Liszkowski, 2013). Thus, children were tested using a battery of 4 different FBU tasks adapted from early studies to capture these conceptual content. Although some parts of the tasks (e.g., materials and names and actions of story characters) were modified, the general framework of the scenarios and the questions asked remained true to the original tasks. A test question was coupled with at least one control question. The child must correctly answer both control and test questions in order to pass the question set. Each task is summarized below.

Unexpected content tasks (Perner, Leekman, & Wimmer, 1987): In this set of tasks, the child was first shown a prototypical container (an “M&M” chocolate box) and asked what was in the container. After a plastic fish inside of the container was revealed, the child was asked a question about his/her own false belief (e.g., “*What did you think was inside?*”), which was coupled with a reality control question (“*What is really and truly inside?*”). Next, the child was introduced to a puppet named Charley and asked what the puppet would predict about the content inside the container (“*What does Charley think is in the box?*”), which was followed with a control question (“*What is really and truly inside?*”). One point was given when the child correctly respond to each question set about his/her own false belief or about other’s false belief (total scores: 0–2). Forty-one children (52.6%) failed both question sets, 15 (19.2%) scored 1 point, and 22 (28.2%) scored 2 points.

Unexpected location task (Wimmer & Perner, 1983): This task was used to evaluate children’s prediction of a person’s behavior based on a mistaken belief about the changed location of a hidden object. The story character Mary left a blue marker in a box; and later, Mary’s brother, Sam, moved it to a different location while Mary was absent. In this task, the test question was to ask the child to make an inference from an attributed false belief to the story character’s behavior (“*Where will Mary look for the blue marker?*”) with two control questions (“*Where is the blue marker really?*” and “*Where did Mary put the blue marker?*”). One point was given when the child responded correctly to the question set (scores: 0–1). Thirty-six children (46.2%) passed the task.

Appearance-reality tasks (Flavell, Flavell, & Greene, 1983): This set of tasks was to assess children’s ability to describe the differences between an object’s real nature and appearance (a candle looked like a cryon). The child was first asked to answer a set of questions about his/her own belief about the appearance and true identity of candle/crayon, which was followed by a second set of questions predicting a puppet’s belief. One point was

given when the child performed successfully on each question set (total scores: 0–2). Twenty-six children (33.3%) failed both question sets, 19 (24.4%) scored 1 point, and 33 (42.3%) scored 2 points.

Explanation and prediction tasks (Bartsch & Wellman, 1989): This set of tasks was to test children's ability to differentiate and explain their own viewpoint from that of others. The child was shown an empty prototypical box (i.e., band-aid box) and a plain box of the same shape and size with band-aids inside. The child was asked to predict which box a story character, a child named Charlie, would choose to find band-aids (prediction condition). Next, the child was introduced to another character, a toy Panda named Ling-Ling, and asked why this character had chosen the band-aid box (explanation question). A control question was asked after both the prediction and explanation questions. One point was given when the child responded correctly to each question set (total scores: 0–2). Twenty-three children (29.5%) failed both question sets, 34 (43.6%) scored 1 point, and 21 (26.9%) scored 2 points.

Overall, 26 children (33.3%) failed all 4 task sets, 21 (26.9%) passed 1 task set, 12 (15.3%) passed 2 task sets, 9 (11.5%) passed 3 task sets, and 10 (12.8%) passed all 4 task sets. Marked individual differences among children were observed in this sample, which were similar to those reported in earlier research (e.g., Flavell et al., 1983; Friedman, Griffin, Brownell, & Winner, 2003; Wimmer & Perner, 1983). The correlations among the 4 ToM task scores ranged from .27 to .57 (p 's < .05) and the Cronbach's α was .78. Factor analysis² further revealed that one-dimension solution fit well with the observed data (the respective loadings were: .728, .465, .655, and .548), which had an Eigenvalue of 2.34 and explained 59.9% of the variance. Following previous studies (e.g., Hughes, Jaffee, Happe, Taylor, Caspi et al., 2005; Slaughter, Peterson, & Moore, 2013), a sum score was created as the index for ToM performance by summing across the task scores³ (scores: 0–7). The sum score not only captured a variety of conceptual content, but also provided a continuous variable for detecting individual differences.

Results

Descriptive Analysis

Descriptive statistics for family demographic variables, toddler and maternal language complexity (indexed by MLU), toddler and maternal pretense speech complexity, toddler and maternal communication acts, and FBU scores are summarized in Table 1. Boys' and girls' FBU scores were not significantly different. Data from both boys and girls were combined for all subsequent analyses.

²Standard factor analysis assumes the input variables with a multivariate normal distribution. Because the FBU task scores were ordinal variables, the CATPCA procedure in SPSS Categories Module designed for principal component analysis of categorical variables was used for analysis. Two categorical factor analyses with the input of 4 task scores and 7 question-set scores were run separately. In both analyses, the scores loaded on one dimension. The results from the 4 task scores were summarized in the text. Results for the 7 question-set scores are available from the first author.

³Results from two meta-analysis studies provided further justifications for this decision. First, Wellman et al.'s (2001) study showed that preschoolers' FBU performance is not influenced by type of task, type of question, nature of the protagonist, or nature of the target object. Second, Milligan et al.'s (2007) study further demonstrated that there is no difference in the relation between different types of FBU tasks and children's language ability.

Covariates of FBU scores—Consistent with previous studies, child and maternal MLU scores as well as maternal education level were positively correlated with the FBU score (see Table 2). In addition, the average levels of maternal and toddler pretense speech were also positively correlated with the FBU score (see Table 2). Therefore, these 5 variables were included in the subsequent analyses as covariates. The child's age (in months) and the number of siblings when performing the FBU tasks at the 4-year visit were not significantly correlated with the FBU score. Almost half (46%) of the children in this study were the only child in their family. All children in this study turned age 4. Restricted variabilities may explain the attenuated effects of age and siblings on children's ToM performance.

Maternal and toddler communication acts—During pretend play, both mothers, $t(77) = 23.74, p < .001$, and toddlers, $t(77) = 2.13, p < .05$, exhibited significantly more collaborative than non-collaborative acts. Specifically, mothers used more *guide/request* than *inform*, $t(77) = 8.61, p < .001$, which was more frequent than *support/confirm*, $t(77) = 7.18, p < .001$. By contrast, toddlers used more *inform* than *support/confirm*, $t(77) = 4.05, p < .001$, which was more frequent than *guide/request*, $t(77) = 3.44, p < .01$ (see Table 1). Overall, mothers exhibited more collaborative acts than their toddlers, $t(77) = 16.17, p < .001$, whereas toddlers engaged in more non-collaborative acts than their mothers, $t(77) = 5.81, p < .001$ (see Table 1).

Moreover, increased non-collaborative acts in mothers were significantly correlated with greater non-collaborative acts in their toddlers (see Table 2). Mothers' collaborative acts, however, were differentially correlated with their toddlers' collaborative acts. Specifically, mothers' increased use of *inform* was associated with toddlers' decreased *guide/request*. Mothers' increased *guide/request* was related to their toddlers' increased *support/confirm* and non-collaborative acts. And mothers' greater use of *support/confirm* was correlated with their toddlers' increased *support/confirm* and overall collaborative acts. Finally, the three collaborative acts by mothers and by toddlers were not significantly correlated with each other, suggesting that they are distinctively different in nature.

Linking Maternal and Toddler Communication Acts to False Belief Understanding

Maternal communication acts—Correlational analysis revealed that more frequent maternal non-collaborative acts were significantly correlated with a lower FBU score, whereas overall maternal collaborative acts were not significantly correlated with the FBU score (see Table 2). After partialling out the covariates, however, the pattern was reversed: the total frequency of maternal non-collaborative acts was no longer significantly correlated with the FBU score (*partial* $r = -.03, ns$) and greater maternal overall collaborative acts were significantly correlated with an increased FBU score (*partial* $r = .25, p < .05$). Additionally, mothers' *support/confirm* remained to be significantly correlated with an increased FBU score (see Table 2), even after the covariates were partialled out (*partial* $r = .40, p < .01$). On the other hand, maternal *inform* and *guide/request* were not significantly correlated with the FBU score both before and after partialling out the covariates.

Together with non-collaborative acts, regression analysis revealed that the three maternal collaborative acts explained a total of 27% of variance in the FBU score, $F(4,73) = 6.75, p$

< .001. Further, a hierarchical regression analysis was conducted to reveal whether the effect of maternal collaborative acts on the FBU score was over and above that of maternal non-collaborative acts. Including the 5 covariates, there were a total of 9 predictors in the model. Given the concern for statistical power, residualized FBU scores after controlling for the 5 covariates were first derived to serve as the dependent variable⁴. After maternal non-collaborative acts were entered at Step 1, three maternal collaborative acts were entered at Step 2, which made a significant improvement to the model, $F(3, 72) = 4.26, p < .01$ (see Table 3). Of the three maternal collaborative acts, *support/confirm* emerged to be the only significant predictor. More frequent maternal supporting/confirming statements predicted children's better FBU score.

Toddlers' communication acts—Toddlers' more frequent non-collaborative acts were correlated with a lower FBU score, whereas their more frequent collaborative acts were correlated with a higher FBU score (see Table 2). Specifically, better FBU scores were correlated with both toddlers' overall (*partial* $r = .32, p < .01$) and *support/confirm* (*partial* $r = .32, p < .01$) collaborative acts, even after the covariates were taken into account. However, toddlers' collaborative acts of *inform* was no longer correlated with a better FBU score after the covariates were controlled (*partial* $r = .19, ns$).

Together with non-collaborative acts, regression analysis indicated that the three toddler collaborative acts explained a total of 30.3% of the variance in children's FBU score, $F(4, 72) = 7.93, p < .001$. A hierarchical regression model was further conducted to reveal whether toddlers' collaborative acts would predict the FBU score that was over and above their non-collaborative acts. Again, the residualized FBU score after controlling for the 5 covariates served as the dependent variable in the regression model. After toddler non-collaborative acts was entered at Step 1, three toddler collaborative acts were entered at Step 2, which made a significant improvement to the model, $F(3, 72) = 3.62, p < .05$ (see Table 3). Similar to the finding with mothers, only *support/confirm* emerged to be the significant predictor. More frequent supporting/confirming utterances by toddlers predicted their better FBU score at age 4.

Putting together the findings on mothers and toddlers, the first hypothesis was supported that collaborative communication acts predicted FBU score, even after controlling for non-collaborative acts and the covariates. The findings that *support/confirm* acts by mothers and toddlers were the strongest predictors of FBU provided a clear answer to the second research question about the specificity of different collaborative communication acts in relation to ToM.

Independent and Joint Contributions of Maternal and Toddler Collaborative Acts

A third hierarchical regression was conducted to examine the relative and joint effects of maternal and toddler collaborative acts in predicting the residualized FBU score. To

⁴Regression models with 5 covariates included as the predictors and the original FBU score as the dependent variable were also run and yielded similar results to those with the residualized FBU as the dependent variable. For simplicity, only the results with the residualized dependent variable are summarized in this report. The results with covariates included in the models are available from the first author.

minimize the multicollinearity between linear and interaction terms, all maternal and toddler collaborative acts serving as the predictors in the regression analysis were first centered (Aiken & West, 1991). The interaction term between the maternal and toddler collaborative acts was then created using the centered variables. Maternal collaborative acts were first entered at Step 1. Toddler collaborative acts were entered at Step 2, which made a significant improvement to the model, $F(1, 74) = 6.50, p < .05$ (see Table 3). Thus, the third hypothesis was confirmed that collaborative acts by toddlers would make a significant independent contribution to ToM development above and beyond that of their mothers. To test for the fourth hypothesis of joint effect between mothers and toddlers, the interaction term was entered at Step 3, which was also significant, $F(1, 73) = 10.66, p < .01$. The co-constructive hypothesis, thus, was confirmed that joint collaborative acts by mothers and toddlers contributed to ToM performance.

In probing the significant interaction effect, the slopes for the associations between maternal collaborative acts and children's FBU scores at low (i.e., 1 *SD* below the mean), moderate (i.e., around the mean), and high (i.e., 1 *SD* above the mean) levels of toddlers' collaborative acts were separately tested by simple regression analyses (Aiken & West, 1991). As shown in Figure 1, at high levels of toddler collaborative acts, greater maternal collaborative acts were associated with significantly increased FBU scores ($\beta = .52, p < .001$), whereas at both moderate ($\beta = .16, ns$) and low ($\beta = -.19, ns$) levels of toddler collaborative acts, the association between maternal collaborative acts and the FBU score was not statistically significant. Only when toddlers engaged in high levels of collaborative acts, mothers' high levels of collaborative acts had a positive effect on the FBU score.

Discussion

The present study was an attempt to extend the literature on the role of conversational pragmatics in predicting preschool ToM development by focusing on the contribution of collaborative communication between mothers and toddlers at age 2½. Consistent with the previous findings (for a review, see Hughes, 2011), higher maternal education and greater complexity in maternal and toddler speech were correlated with better FBU scores. Higher levels of maternal and toddler pretense speech were also correlated with higher FBU scores. After ruling out these 5 potential confounding factors, the link of mother-toddler collaborative communication to preschoolers' ToM performance was tested rigorously in this study. Four main findings emerged. First, collaborative acts by mothers and toddlers significantly predicted children's better FBU at age 4, and their effects were over and above that of non-collaborative acts. Second, maternal and toddler collaborative acts of *support/confirm*, but not *inform* or *guide/request*, consistently predicted better FBU at age 4, even after controlling for the covariates. Third, even though toddlers engaged in less collaborative acts than their mothers, their contribution to FBU was over and above that of their mothers. Finally, high levels of toddler collaborative acts combined with high levels of maternal collaborative acts predicted better FBU. These findings are discussed below.

Maternal and Toddler Collaborative Acts During Pretend Play

Pretend play in young children involves not only sophisticated representational thinking, but also social and communication skills (Lillard, 2007a). In essence, play partners need to respond to each other with reciprocal and/or complementary actions to the implicit message, “*this is pretend*,” through the use of communication pragmatics (Bretherton, 1989). By age 2, children are relatively experienced with pretend play. Mothers tend to use overt social signaling (e.g., smiling and sound effects) to sensitize their toddlers’ awareness of the pretend actions (Lillard, Nishida, Massaro, Vaish, Ma et al., 2007; Lillard & Witherington, 2004). In this study, the three collaborative acts used by mothers were distinctively in nature, suggesting that they might serve different functions. Mothers used collaborative acts of *guide/request* most frequently. It can be speculated that these pragmatic messages are designed to complement maternal social signals in order to maintain their toddlers’ joint attention and enhance their understanding of intention (Lillard, 2007b).

It was found that toddlers engaged in more collaborative than non-collaborative acts, and they also used collaborative acts of *inform* more frequently than *support/confirm* and *guide/request*. These patterns appear to suggest that toddlers are capable of using communication pragmatics to signal the frame of pretend play. By exerting an effort to ensure that their mothers understood their intent, they explicitly negotiated and maintained the continuity of the pretend scenario.

Finally, the significant within-the-dyad correlations for maternal and toddler collaborative *support/confirm* and non-collaborative acts may indicate the strong reciprocal nature of these communication acts. Moreover, maternal *guide/request* was associated with both increased non-collaborative and *support/confirm* acts in toddlers, which suggests that the same maternal/toddler communication acts may elicit different responses from the partner. The temporal relations between maternal and child communication acts and the moderators that trigger the differential responses will need to be explored in future research.

Contribution of Maternal and Toddler Collaborative Acts to Theory of Mind Development

Maternal and toddler collaborative and non-collaborative communication acts together explained a comparable and substantial proportion (27% and 30.3%, respectively) of the variance in children’s FBU score, which is markedly stronger than the overall correlation ($r = .43$ or 18% of the variance) between child language abilities focusing on semantics and syntax and FBU performance derived from a meta-analysis (Milligan et al., 2007). Even after the effects of the covariates (including maternal and child language) were excluded, maternal and toddler communication acts still explained a substantial amount of the variance (15% and 20%, respectively) in the FBU score.

The positive finding between collaborative communication acts and ToM development provides credence to the social constructive perspective, specifically, the usage account of ToM development (Liszkowski, 2013). Direct experience with conversation is a powerful exercise of “mind reading.” In order to successfully infer the partner’s mental state, constant updates are required (Siegal & Surian, 2006). Brain research supports this argument. Participation in communication with a person with higher linguistic ability (e.g., mother)

requires stronger activation in brain areas within the classical ToM network (Ackeren, Casasanto, Bekkering, Hagoort, & Rueschemeyer, 2012; Willems, Ludovica, D'Esposito, Ivry, & Casasanto, 2011). Partners with different linguistic skills can achieve successful cooperation through the process of constant alignment of representations (Pickering & Garrod, 2004).

Not all collaborative acts were equally effective in accelerating ToM development. Even though confirming feedback does not provide new information, reiteration can generate metacognitive experiences in children, allowing them to acquire insights and generalize knowledge to new situations (Melot & Angeard, 2003). Maternal and toddler *support/confirm*, the least frequent collaborative acts, were the most salient contributor to children's ToM development. Given that a significant positive correlation was found between maternal and toddler *support/confirm* but not between any other types of collaborative acts, it appears that such collaborative acts encourage contingent and attuned exchanges. Supportive and confirming utterances disclose the speaker's interest in or understanding of the partner's mental state. The sent message may not only reflect the speaker's comprehension of the partner's actions and thoughts (Fernyhough, 2008), but also offers reassurance to the partner about other-focused awareness. Other-focused communication may reduce negativity and conflict, which, in turn, increase efficiency in constructing shared perspectives (Hughes et al., 2006).

Toddlers in this study did not benefit as much from their experiences with self-focused collaborative acts as with other-focused collaborative acts in developing ToM. Despite collaborative in nature, *guide/request* statements are based on one's own perspective rather than on that of the partner, which is highly self-assertive in nature (Leaper, 2000). The sent message represents the intent of control by requiring the partner to adopt an alternative perspective. Similarly, *inform* statements deliver the speaker's intent directly to the partner without requiring feedback. The conveyed message also tends to be self-focused. The less pronounced effect of self-focus collaborative acts might also because they can be expressed with different emotional overtones: positive (e.g., "*Put the cup here, please!*") or negative (e.g., "*Don't put the cup here!*"). In light of the recent finding that maternal negativity predicts reduced ToM competence in preschoolers (Rohrer, Cicchetti, Rogosch, Toth, & Maughan, 2011), it is plausible that the promoting effect of self-focused collaborative acts is mitigated by emotional negativity. Future research should further examine the role of expressed emotion in communication acts on ToM development.

Children as Active Agents in Their Own Theory of Mind Development

Previous theorization on ToM development highlights the importance of maternal role in verbal input (e.g., Ensor & Hughes, 2008; Taumoepeau & Ruffman, 2008), mentalization (e.g., maternal mind-mindedness) (Meins et al., 2002; Meins et al., 2003), and tutoring (Fonagy et al., 2007). The pivotal role of children as active agents in their own development was largely overlooked. Toddlers in this study engaged in less than half of the collaborative acts by their mothers, but they made an independent contribution to FBU that was over and above that of their mothers. Instead of being passive recipients of maternal input, children are *psychological agents* (Sharp & Fonagy, 2008; Symons, 2004) who actively contribute to

their own development. Evidence from this study further suggests that it is through collaborative acts of *confirm/support* that children actively “share” and learn about others’ minds.

Previous studies show that parental scaffolding processes such as distancing, explanatory, and elaboration facilitate ToM development in preschoolers (e.g., Galende, de Miguel, & Arranz, 2012; Taumoepeau & Reese, 2013). The significant joint (i.e., interaction) effect between maternal and toddler collaborative acts on FBU found in this study that only when toddlers engaged in high levels of collaborative acts, higher levels of maternal collaborative communication contributed to better ToM development. The scaffolding effect of maternal collaborative acts on ToM development is contingent on toddlers’ collaborative acts. This finding clearly indicates that parental scaffolding may be necessary but not sufficient for ToM development. Collaborative acts by mothers and toddlers may not only reflect mothers’ active role in eliciting children’s attention to different viewpoints, accommodating children’s interests or attentional focus, and/or elaborating discourse with children (cf. Hughes, 2011), but also indicate toddlers’ willingness to make substantive connections with their mothers. Indeed, Turnbull and Carpendale (1999) assert that children’s understanding of mind is a product of *co-construction* with their parents. Children’s ToM is more likely to develop in a context of reciprocal teaching and learning experiences. The unidirectional maternal input model does not adequately address the question of *how* children come to understand minds during social encounters. In future work, it would be useful to examine how maternal and child co-regulated communication pragmatics, such as turn taking, coordinated negotiation, and contingent responding and repairing, contribute to ToM development.

A cautionary note should be made, however, about the inference of a causal link between early collaborative communication acts and later ToM performance. Because of its correlational design, this study is unable to rule out the possibility that toddlers with better mind reading abilities are better at interpreting and understanding others’ perspectives, and thereby, they are more likely to communicate with collaborative acts, which in turn, further promote their ToM development. To ascertain the causal relation of conversational pragmatics with ToM skills, it is important to explore child-driven effects in future studies with experimental designs. Unlike naturalistic studies, random assignment and controlled manipulation can rule out the possibility that advancement in ToM is due to prior ToM understanding.

Limitations, Future Directions, and Implications

With a rigorous control of maternal and toddler covariates, the current findings provide strong support to the social constructive model that ToM development is constructed through cooperative interactions between children and their parents (Carpendale & Lewis, 2004). However, this study has limitations that need to be addressed in the future. First, mothers (90%) in this study were college educated, which may limit the generalizability of the current findings. Future research should include samples with diverse social and economic backgrounds. The effects of social context and partners should also be examined further. Observations of children’s social interactions with different partners varying in ToM

abilities (e.g., Hsu & Janes, 2010), familiarity, and emotional ties in different contexts would illuminate the mechanisms underlying interpersonal processes that enable children to construct an understanding of mind. Culture may also be another factor that needs to be considered in future research (e.g., Lane, Wellman, Olson, Miller, Wang, & Tardif, 2013; Liu, Wellman, Tardif, & Sabbagh, 2008). In Western cultures, authoritative parents, who treat their children as intentional agents and communicate with them in a sensitive and responsive way, encourage children's ToM understanding (e.g., Ensor, Spencer, & Hughes, 2011; Pavarini, de Hollanda Souza, & Hawk, 2013; Erekly-Stevens, 2008). By contrast, authoritarian parenting requiring conformity in children predicts Korean-American children's ToM development (Vinden, 2001). The ideal communication style that promotes children's ToM understanding may vary according to culture.

Because communication processes explain less than half of the total variance in children's FBU, researchers should consider other predictors, such as executive functioning (e.g., Benson, Sabbagh, Carlson, & Zelazo, 2013), temperamental characteristics (e.g., Lane et al., 2013), neural activity (e.g., Liu, Sabbagh, Gehring, & Wellman, 2009), and genetic variations (Lackner, Sabbagh, Hallinan, Liu, & Holden, 2012). Growing evidence indicates that children with advanced executive functioning skills such as inhibitory control (an ability to suppress the dominant response) perform better on FBU tasks. Executive abilities may help child better abstract and reflect on their experience, control their impulses, and coordinate and maintain attention, which may increase the opportunities for them to interact with others and to learn about others' mental states (Benson et al., 2013; Hughes, 2011). Indeed, in our data we found that inhibitory control in children serves as the mediating factor linking maternal/toddler collaborative acts to ToM performance (Sung & Hsu, 2011). Further research is needed for a fuller understanding of the role of executive functioning in communication-ToM relationship.

Finally, acquisition of ToM understanding is an important developmental achievement in preschool years. The central significance of the development of explicit ToM in early childhood is underscored by its real-world implications. Mastery of ToM predicts children's persuasive arguments with peers (Slaughter, Peterson, & Moore, 2013) and maturity in social competence (e.g., Peterson, Slaughter, & Paynter, 2007), whereas poor ToM is associated with peer rejection (e.g., Badenes, Estevan, & Bacete, 2000) and greater risks of bullying victimization and/or perpetration (Shakoor et al., 2012). Application of ToM skills may enhance children's social competence and reduce problem behaviors. Results from this study have important clinical implications for the design and implementation of interventions. First, the strong association of maternal *support/confirm* with ToM performance found in this study may explain why the focus on scaffolding in parent-centered interventions has not yielded complete success. For example, training mothers using elaborated talks with children only benefited ToM development in preschoolers who had low language abilities as toddlers (Taumoepeau & Reese, 2013). Although elaborativeness underscores the importance of additional information may benefit children's mind understanding, confirmation and support without adding new information are equally important to children. In addition to advising parents to engage in elaborated talks with rich causal explanations that are thematically connected to those of their children (e.g., Ensor &

Hughes, 2008), they should also be encouraged to use explicit support and confirmation in their talks. Second, grounded in the theorization that conceptual shift is a cognitive constructive process within the child, training targeting children has typically focused on the provision of exposure to different perspectives, semantic or syntactic inputs, explanations, and/or ToM performance feedback (e.g., Gola, 2012; Hale & Tager-Flusberg, 2003; Lohmann & Tomasello, 2003). Repeated practice with predictions and explanations of others' actions has demonstrated robust training effectiveness (Amsterlaw & Wellman, 2006). Despite improvement in task performance following training, the generalization of learned ToM skills to everyday life is questionable. Also, after training, while some children develop an understanding of ToM, many others still fail to do so. The finding that toddlers' supportive and confirming statements about others' actions predicted their later ToM performance offers an addition to the repertoires of parents, educators, and practitioners by working to empower children's active social participation and boost their collaborative conversational skills. Third, previous training programs targeted either parents or children separately. The joint effect between maternal and child collaborative acts on ToM understanding suggests that family-centered programs with mother-child dyads as the training targets may increase intervention effectiveness.

In conclusion, this study was the first one applying a social pragmatic function approach to investigate the contribution of collaborative communication to ToM development. The findings highlight that children contribute to their own ToM development through *actively* engaging in supportive and confirming conversation and that *co-constructed* collaborative talks between children and mothers further facilitates ToM development.

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Highlights

- The role of social pragmatics of communication in children's ToM is examined.
- Both mothers and toddlers engage in more collaborative communication acts.
- Both maternal and toddler *support/confirming* acts predict children's ToM.
- Toddlers' collaborative acts are unique and independent contribution to ToM.
- Actively co-constructed collaborative talks by both mother and toddler promotes ToM.

Figure 1.

Residualized children's false belief scores as a function of maternal collaborative acts with high, moderate, and low levels of toddler collaborative acts.

Table 1

Means (SD) and Ranges of Maternal and Toddler Demographic, Language Variables, Communication Acts and False Belief Understanding.

Person	Variable	Mean (SD)	Range
Mother	Education (years)	16.49 (2.83)	9–27
	Language (MLU)	4.71 (0.63)	3.17–6.35
	Pretense speech (average)	3.81 (0.39)	2.67–4.73
	Communication Acts (rate per minute)		
	Non-collaborative	3.50 (1.55)	1.32–9.29
	Collaborative: Overall	11.95 (3.24)	5.15–20.24
	Inform	3.68 (1.58)	1.03–8.87
	Guide/Request	6.11 (2.23)	1.68–12.42
	Support/Confirm	2.16 (1.07)	0.40–5.30
Toddler	Language (MLU)	2.80 (0.65)	1.52–4.32
	Pretense speech (average)	3.86 (0.41)	2.00–5.25
	Age at false belief testing (months)	50.03 (2.44)	47–57
	Number of siblings at age 4 visit	0.54 (0.73)	0–3
	Communication Acts (rate per minute)		
	Non-collaborative	4.59 (1.82)	1.02–11.31
	Collaborative: Overall	5.32 (1.96)	0.95–10.55
	Inform	2.46 (1.22)	0.32–5.92
	Guide/Request	1.16 (0.80)	0.00–3.79
	Support/Confirm	1.70 (1.13)	0.10–6.53
	False belief understanding	3.28 (2.32)	0–7
	Girls	3.64 (2.36)	0–7
	Boys	2.98 (2.27)	0–7

Note. MLU=mean length of utterance.

Table 2

Bivariate Correlations Between Maternal and Child Measures.

Partner	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
Mother																	
1. EDU	-																
2. MLU	.12	-															
3. PS	.17	.11	-														
4. NC	-.17	-.43***	-.09	-													
5. OC	-.02	.06	.06	.30**	-												
6. IN	-.18	-.07	.07	.35**	.62***	-											
7. GR	.04	.08	.05	.19	.81***	.18	-										
8. SC	.27*	.12	.17	-.01	.42***	.04	.10	-									
Toddler																	
9. MLU	.16	.46***	.15	-.39***	-.34**	-.24*	.34**	.04	-								
10. PS	-.15	.13	.39***	-.18	.01	.10	-.07	.05	.03	-							
11. Age	.19	.06	.20	-.01	.00	-.11	.05	.08	.06	.16	-						
12. SIB	.11	-.09	-.03	.05	-.02	.03	-.03	-.05	-.08	.12	.26*	-					
13. NC	-.12	-.34**	-.12	.53***	.10	-.04	.23*	-.14	-.50***	-.02	.17	.12	-				
14. OC	-.04	.07	.09	-.12	.09	-.11	-.01	.46***	.27*	.29*	.01	-.03	-.29**	-			
15. IN	-.08	.05	.01	-.11	-.10	-.10	-.16	.17	.34**	.18	-.06	-.01	-.27*	.72***	-		
16. GR	.05	.06	.24*	-.02	-.18	-.25*	-.17	.18	.28**	.29*	.08	-.03	-.05	.54***	.22	-	
17. SC	-.02	.02	-.03	-.07	.40***	.09	.28*	.50***	-.10	.10	.03	-.02	-.18	.58***	.01	-.01	-
18. FBU	.30***	.37**	.25*	-.31**	.08	-.06	-.04	.42***	.45***	.28*	-.08	-.09	-.48***	.39***	.28*	.15	.28*

Note. $N = 78$; EDU = Maternal education level; MLU = Mean length of utterance; PS = Averaged level of pretense speech; NC = Non-collaborative acts; OC = Overall collaborative acts; IN = Inform; GR = Guide/Request; SC = Support/Confirm; Age = Children's age at false belief testing; SIB = Number of siblings at age 4.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 3

Final Models of Hierarchical Regression: Testing the Relative and Joint Contributions of Maternal and Toddler Collaborative and Non-Collaborative Communication Acts to Residualized False-Belief Understanding.

Model	Step	Predictors	Final β	R ²	R ²	F Value
1	1	Mother non-collaborative acts	-.05	.00		.06
	2	Mother collaborative acts: <i>inform</i>	.04	.15**	.15**	3.21*
		Mother collaborative acts: <i>guide/request</i>	.08			
		Mother collaborative acts: <i>support/confirm</i>	.37**			
2	1	Toddler non-collaborative acts	-.18	.08*		6.16
	2	Toddler collaborative acts: <i>inform</i>	.14	.20*	.12*	4.42**
		Toddler collaborative acts: <i>guide/request</i>	-.08			
		Toddler collaborative acts: <i>support/confirm</i>	.33**			
3	1	Mother total collaborative act	.16	.05*		4.13*
	2	Toddler total collaborative acts	.32**	.13*	.08*	5.47**
	3	Mother total collaborative acts x Toddler total collaborative acts	.34**	.24**	.11**	7.68***

* $p < .05$.
** $p < .01$.
*** $p < .001$.