INDIVIDUAL DIFFERENCES IN 4-YEAR-OLDS’ THEORY OF MIND:
CONTRIBUTIONS OF THE PRAGMATIC FUNCTIONS OF
COLLABORATIVE MOTHER-CHILD COMMUNICATION

by
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ABSTRACT

The present study attempted to extend the literature by examining the contribution of pragmatic functions of collaborative mother-child communication to individual differences in children’s theory of mind in the physical and affective domains. The first goal was to examine the use of collaborative communication acts by mother and child individually at age 2½ and their associations with children’s false belief understanding at age 4. Focusing on mother and child as a unit, the second goal was to examine dyadic collaborative communication (where sequenced verbal and nonverbal actions by mother and child are logically or thematically connected) and its association with children’s theory of mind development.

Participants were 79 children (42 boys) and their mothers. They participated in this study as part of a larger longitudinal study. The data collection took place first when the children were 30 months and again 4 years of age (ages 47 to 57 months). At 30 months, toddlers and their mothers engaged in pretense play in the contexts of teaching and doll play. At age 4, children were tested individually for affective and physical false belief understanding. Maternal education and child language skills (indexed by mean length of utterances) served as the covariates in all analyses.
At age 4, children performed better at the physical than affective false belief tasks. At the individual level, although mothers used more frequent overall and specific collaborative communication acts than their toddlers during interaction, the frequency of toddlers’ overall collaborative communication acts observed at age 2½ predicted children’s physical, but not affective, false belief understanding at age 4. Moreover, both mothers’ and toddlers’ frequent use of collaborative communication acts of confirmation and support and cognitive terms embedded in collaborative communication acts predicted children’s greater physical, but not affective, false belief scores. Finally, the contribution of toddlers’ collaborative communication acts to their affective and physical false belief understanding was independent of that of their mothers.

At the dyadic level, whereas the occurrence of emotion-related topics within mother-toddler collaborative communication episodes predicted children’s affective false belief understanding, the occurrence of contrastive perspectives as well as simple and advanced collaborative strategies used by the dyads predicted children’s physical false belief understanding. Furthermore, based on domain specific measures, the contribution of dyadic measures of collaborative communication to children’s affective false belief understanding was independent of that of individual measures.

The present findings added new information to the literature highlighting the developmental associations between the pragmatic functions of mother-child collaborative communication and children’s theory of mind development. Findings lend support to the idea that the pragmatic aspect of language is related to young children’s theory of mind development in both physical and affective domains. Limitations of the present study, suggestions for future research, and implications for applied practice are discussed.
INDEX WORDS: Theory of Mind, Social Constructive Theory, Pragmatics, Mother-Child Communication Acts, Mother-Child Collaboration
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CHAPTER 1
INTRODUCTION

With age, children come to realize that their mental activity is not obvious to another person. They also come to understand that their own and others’ mental states such as intentions, emotions, desires, and beliefs may be different. Children’s ability to understand mental activities and impute mental states is known as “theory of mind.” The development of theory of mind in children involves the acquisition of a complex representational system including memory, language, executive functioning, and problem-solving abilities (Perner, 1991). Children’s theory of mind is important for social development because they use information about mental states to interpret others’ behavior, to regulate social interactions (Astington, 2003; Astington & Gopnik, 1991; Dunn, 1991; Raver & Leadbeater, 1993), and to infer cultural meanings (Bruner & Feldman, 1994; Feldman, 2000). Individual differences in children’s theory of mind are related to social skills even after age and language ability are controlled for (Frith, Happé, & Siddons, 1994; Watson, Nixon, Wilson, & Capage, 1999). Whereas advanced theory of mind development tends to be a reliable predictor of social competence in young children (Capage & Watson, 2001), poor theory of mind development is likely to result in maladaptive social behaviors such as peer rejection, poor communication, and aggression (Badenes, Estevan, & Bacete, 2000).

In early childhood, children come to understand that people can have false beliefs. Various false belief tasks have been developed to examine a child’s ability to attribute a false belief to himself/herself or to others. Children’s performance on the false belief tasks is considered as an indicator of theory of mind development. The false belief tasks used in earlier studies consist of questions about the false mental representation of objects and/or locations of
objects. Only a handful of studies have examined children’s false belief understanding of affect (e.g., Davis, 2001; Friend & Davis, 1993; Gross & Harris, 1988; Hughes & Dunn, 1998). Available evidence suggests that although children’s false beliefs about the physical and the psychological world are correlated and develop in a similar fashion, they show slightly better understanding of false beliefs in the physical domain than in the affective domain. However, the contributors to children’s theory of mind development may differ according to the domain. Moreover, meta-analysis has shown that children overwhelmingly progress from consistently failing to consistently passing false belief tasks between the ages of 2½ and 5. Age 4, prior to most children passing false belief tasks, is an appropriate time point to examine individual differences in development. Therefore, the present study focused on individual differences in 4-year-old children’s false beliefs in both affective and physical domains.

Several theories have been developed to explain the mechanisms of theory of mind development in early childhood. Whereas some theories highlight cognitive processes within the individual child, other theories emphasize interpersonal processes between the child and other people. Theory-theory, modularity theory, and simulation theory, for example, take a within-individual approach. Theory-theory claims that the developmental process of a child’s understanding of mental states is similar to a “paradigm shift” in the history of science (Flavell, 1999; Perner, 1991; Gopnik, & Wellman, 1994; Wellman, Cross, & Watson, 2001). Children apply newly acquired theory to understand mental activity and discard the old theory used previously. Modularity theory explains that children have an innate mental module or a set of modules of understanding of mind (Baron-Cohen, 1995; German & Leslie, 2001). Modularity theorists view the development of theory of mind as a result of successively maturing representation modules with evolutionary roots. According to the simulation theory, children’s
understanding of mind is promoted by simulation processes (Gordon, 1992; Harris, 1991; Wellman, 2002). Children project themselves into the other’s situation. By attributing their own experience to imagine another person’s intentional stance, children begin to learn the meanings of mental activity.

Even though the above mentioned theoretical perspectives recognize that information generated from social interaction is important for theory of mind development, the direct contribution of social interaction processes is not emphasized. By contrast, some other theories postulate that social influences make a direct contribution to children’s understanding of mind. For example, Carpendale and Lewis (2004) proposed a social constructive perspective as a theoretical framework to explain the development of social understanding in children. According to this perspective, the knowledge of understanding others is gradually constructed within social relationships through cooperative interactions between children and their significant social partners such as parents (Carpendale & Lewis, 2004). Based on the construct of intersubjectivity, defined as “an interaction state of shared involvement in a reciprocal exchange” (Loots, Devisé, & Sermijn, 2003), several theorists such as Meltzoff (1985), Trevarthen (1980), and Stern (1985) view that the origin of mind is gradually reconstructed through dyadic, dialogic, and representational experiences (Beebe, Sorter, Rustin, & Knoblauch, 2003). In addition to cognitive processes, social processes are described as necessary for children to develop an understanding of others’ mental states.

This social constructive theory is supported by empirical research. A series of studies by Dunn (e.g., Dunn, 1991; Dunn, Brown, Slomkowski, Telsa, & Youngblade, 1991; Youngblade & Dunn, 1995) demonstrated that cooperation and conflict with a sibling and talk with mother and a sibling about emotions and desires are important for theory of mind development. It is
suggested that interactions with family, peers, and others involve talk about inner states,
engagement in pretend play, argument about disagreements, exposure to deception, and
construction of collaborative narratives (Dunn, 2000), and these social experiences provide a rich
source of information for children to learn about mental representation in social contexts.
Although available evidence suggests the influences of multiple social agents, parents are
believed to have the most powerful and crucial influence on children’s theory of mind
development due to biological, cultural, and societal factors (cf. Grusec & Kuczynski, 1997).

Harris (2005) and Dunn (2004) believe that maternal verbal input to children can promote
their understanding of mental states, especially false beliefs. Previous studies on the relationship
between mother-child communication and children’s theory of mind have focused on the
semantic contents (e.g., mental-state related words; Adrián, Clemennte, & Villanueva, 2007;
Meins, Fernyhough, Wainwirhgt, Gupta, Fradley, & Tuckey, 2002; Symons, Fossum, & Collins,
2006) or syntactic structures (mental state words as the main verb; de Villiers & de Villiers,
2000; Tager-Flusberg, 2000) in maternal speech. However, the contribution of language use
from a social pragmatic perspective has not been examined extensively. The social pragmatic
model, which supports the view of talk as social interaction, demonstrates the relevance of an
analysis of communicative acts between parent and child to children’s understanding of mind
(Turnbull & Carpendale, 1999). Verbal dialogue is a form of symbolic communication that leads
to the creation of interpersonal meaning (Loots et al., 2003; Ninio & Snow, 1996) and is a tool
for conveying the fact that people have different points of view. As Harris (2005) pointed out,
“the simple count of mental state terms may not be a sensitive measure of effective maternal
input even if it is a useful correlate” (p.77). Results of psychoneurological studies on the
relationship between language and children’s theory of mind suggest that pragmatics and
communicative intentions may be strongly associated with theory of mind development (Ferstl & von Cramon, 2002; Kobayashi, Glover, & Temple, 2007).

Pragmatics refers to how language is used in the context, which includes the structural analysis of texts, the function of language usage, the analysis of how people engage in conversation and so on (McTear & Conti-Ramsden, 1992). Pragmatic intents or attitudes communicated through linguistic or extralinguistic (e.g., tone of voice and gestures) channels (or more often a mixture of both) may be the underlying source of children’s theory of mind development. In order to communicate appropriately and effectively in interpersonal situations, it is necessary to recognize the conversational partner’s beliefs, feelings, and intentions (McTear & Conti-Ramsden, 1992). Breakdown in communication may occur when the speaker fails to recognize the partner’s desire to continue or terminate the interaction, belief or disbelief in the content of verbal message, and/or nonverbal cues indicating intentions (Fernandez, 2007).

Communicative acts are the intended social functions of linguistic and extralinguistic actions, which can be classified in terms of the extent of influence (direct vs. nondirect) and involvement (affiliation vs. distancing; Leaper, 1991). According to the combination of these two dimensions, collaborative communication acts are defined as high in direct influence and moderate to high in affiliation. Collaborative communication acts convey the reference, action, intention, and perception of one partner to another (Tomasello, Carpenter, Call, Behne, & Moll, 2005; Harris, 1999). Through collaborative communication acts, two partners create an opportunity to justify their positions, to share activity or situations, and to listen to the other’s perspective. Collaborative communication acts are often used to construct a joint topic and to solve a problem, which include information seeking, suggestion, and reflection of sharing or mutuality (Leaper & Gleason, 1996). Carpendale and Lewis (2004) theorized that collaboration
between mother and child can facilitate a child’s understanding of other people’s points of view. However, the linkage between collaborative mother-child communication and mind understanding in children has not been investigated extensively. Taking a social pragmatic approach, this study sought to understand the contribution of mother-child collaborative communication observed at age 2½ to later individual differences in children’s theory of mind assessed at age 4.

Pretending is a ubiquitous activity of early childhood. By age 2 or 2½, children show their understanding of others’ pretense actions as not real (Harris & Kavanaugh, 1993). It involves abundant communicative acts used to create and share mentally constructed worlds with play partners (Lillard, 2007). Shared understanding between two partners sustains their play within the frame of pretense. Various aspects of pretend play such as mental state reasoning, perspective or role taking, and communicative signals of pretense may support children’s understanding of others’ minds. Object substitutions (e.g., banana as telephone), imaginary play (i.e., pretending to be a talking fish), and role assignments in pretense (e.g., “You be a daddy”) are associated with children’s understanding of mental states (Leslie, 1987, 1988). In particular, children who displayed frequent jointly constructed pretense in their play performed better on theory of mind tasks (Schwebel, Rosen, & Singer, 1999; Hughes, Fujisawa, Ensor, Lecce, & Marfleet, 2006). Evidence suggests that the ability to integrate conflicting mental representations, which is associated with children’s understanding of false beliefs, develops through jointly constructed pretense (Schwebel et al., 1999). During joint pretense, children must share a pretend belief with a partner and focus on the establishment of agreement with the partner despite contrasting perspectives. Collaborative communication acts such as clarification and explanation
may help distinguish one’s own belief from another person’s. Thus, the present study examined mother-child collaborative communication in pretend contexts.

Focusing on semantics, previous studies on the association of mental state language with theory of mind understanding have suggested that the use of mental state terms in mother-child communication predicts children’s frequent talk about mental states and advanced theory of mind (e.g., Hughes & Dunn, 1998; Jenkins, Turrell, Kogushi, Lollis, & Ross, 2003; Ruffman, Slade, & Crowe, 2002; Ensor & Hughes, 2008). For example, utterances referring to cognitive terms are strongly related to physical false belief understanding (Jenkins et al., 2003; Hughes & Dunn, 1998), whereas utterances referring to emotion or desire are strongly related to emotional understanding (Racine, Carpendale, & Turnbull, 2007; Taumoepeau & Ruffman, 2006). Further, parents’ talk about emotions based on the story character’s belief during a storybook task predicted advanced physical false belief in children (Racine et al., 2007). However, in another study, maternal talk including emotion terms was not related to children’s false belief concurrently or longitudinally (Ensor & Hughes, 2008). It appears that the findings on the association of mother-child discourse containing emotional and cognitive lexical terms with children’s mind and emotion understanding are mixed. It is not clear whether there are differential and specific linkages between lexical references to cognition or emotion in mother-child discourse and children’s understanding of mind and emotion.

Thus, the first goal of the present study was to examine the contribution of the use of collaborative communication acts by mother and child individually at age 2½ observed in pretense contexts to children’s understanding of physical and affective false beliefs at age 4. It was expected that the greater frequency of maternal and child collaborative communicative acts would be associated with children’s greater theory of mind development. In addition, the present
study explored whether maternal and child collaborative communication acts containing inner state terms make independent contributions to children’s false belief understanding. Finally, the domain specific associations of individual collaborative communication acts containing lexical terms of cognition (e.g., “think” and “believe”) or emotion (e.g., “happy” and “excited”) with children’s affective and physical false belief understanding were examined in this study. It was expected that maternal and child collaborative communication acts containing cognitive state terms would show a stronger association with children’s physical false belief understanding, whereas those containing emotion words would show a stronger association with children’s affective false belief understanding.

Communication between mother and child is a bidirectional process involving joint engagement and mutual responsiveness, which is not the same as the sum of individual communication acts by mother and child. The same individual communication act may have different meanings within different dyadic turns (Leaper, 1991; Thompson & Walker, 1982). Dyadic measures reflecting the cause and consequence of dyadic process go beyond the measures of what or how much individuals do (Dowdney, Mrazek, Quinton, & Rutter, 1984). “Connectedness,” defined as a speaker’s speech acts that are semantically related to another speaker’s prior utterance (e.g., Dunn & Brophy, 2005; Dunn & Cutting, 1999; Ensor & Hughes, 2008), has been found to be related to children’s advanced performance on physical false belief tasks and emotional understanding (Ensor & Hughes, 2008). However, semantically connected utterances by individuals may simply reflect their sensitivity and responsiveness to the verbal content of communication. As a measure of individual communicative and linguistic competence, semantically connected utterances by individuals do not capture the reciprocity and mutuality between partners or reflect the extent of their shared understanding. A dyadic analysis of mother-
child collaborative communication focusing on the logical or thematic connection and sequencing between two partners’ communication turns may be better in capturing mother-child co-construction processes (Lindsey & Mize, 2001; Turnbull & Carpendale, 1999).

Accordingly, in the present study, collaborative mother-child communication was examined at two separate levels: (a) the mother and the child as two separate individuals, and (b) the mother-child dyad as one unit. At the individual level, as described above, the use of collaborative communication acts by mother and child was identified separately for each individual. At the dyadic level of analysis, collaborative communication episodes were identified as sequenced turns of mother and child communicative acts that are logically and/or thematically related, and continued for at least three turns. Children who experienced longer connected episodes between friends were likely to score higher on both affective perspective-taking and physical false belief tasks (Slomkowski, & Dunn, 1996). Children who frequently engaged in semantically connected conversations with their mothers were more successful in passing theory-of-mind tasks (Brophy & Dunn, 2002; Hughes, Dunn, & White, 1998). Even though these studies primarily focused on individuals’ skills in connecting with their partner, the findings point to the fact that communication involves more than just two separate individuals and that the extent to which two partners are tuning in to each other’s interests and intentions need to be considered. Therefore, the second goal of the present study was to investigate the contribution of collaborative communication observed between mother and child at the dyadic level at age 2½ to children’s understanding of physical and affective false beliefs at age 4. In addition, the thematic topic for each episode of the connected and sequenced turns between mother and child was identified and further classified as emotion- or cognition-centered. Similar to the specificity of association at the individual level, it was expected that the greater frequency of collaborative
communication episodes with a shared topic on cognition would be associated with children’s advanced physical false belief understanding, whereas those centered on emotion would be associated with children’s advanced affective false belief understanding.

During an episode of dyadic collaborative communication, two partners may use pragmatic strategies connecting communication turns in order to establish and maintain shared understanding. For example, in pretend play with siblings, children used simple strategies such as introducing, describing, and imitating as well as advanced strategies such as extending and clarification to establish shared meanings (Howe, Petrakos, Rinaldi, & LeFebvre, 2005). Further, the sophistication in the use of pragmatic strategies varies between children and their play partner, either a sibling or a peer. Dyads using both simple and advanced strategies to construct shared meaning were more likely to engage in frequent joint pretense and employ mental state language (Farver, 1992; Göncü, 1993; Howe et al., 2005). However, it is relatively unknown how mothers and their children use pragmatic strategies to construct collaborative communication and whether pragmatic strategies used in collaborative communication varying in sophistication would be differentially associated with children’s theory of mind development. Thus, this study examined the pragmatic strategies used by mother-child dyads during collaborative communication at age 2½ and their links to later children’s affective and physical false beliefs understanding at age 4.

Speech utterances without explicit mental state terms such as “think” or “want” may also represent cognitive activity or mental states. An experimental study has shown that discourse training without using direct mental terms such as “think” or “know” leads to an increase in false belief test scores (Lohmann, & Tomasello, 2003). Similarly, in another experimental study, only children who received information of a new construal of the situation (e.g., why their answers
were wrong) improved their false belief understanding (Clements, Rustin, & McCallum, 2000). These studies suggested that perspective taking, particularly, appreciation of multiple perspectives, is critical for theory of mind development. Contrastive utterances are speech acts representing perspectives that are different between one’s own mental state and that of the partner (Sabbagh & Callanan, 1998). By age 3, contrastive perspective appears in children’s talk and increases with age (Bartsch & Wellman, 1995; Sabbagh & Callanan, 1998). Without mental state lexicons, one could present different perspectives, for example, “First it is a soup, and now it is a juice.” (Lohmann & Tomasello, 2003). Within a collaborative communication episode, sequenced communicative acts by mother and child may reflect different mental states or contrasting perspectives. For example, during pretend play, one may say “The bear is hungry,” whereas the other may say, “The bear is sleeping.” The presence of contrastive perspectives in collaborative communication may evoke children’s recognition that other people may want or expect different things from them, which may help them understand that people may have different intentions and motives (Harris, 2005; Thompson, 2000). Therefore, the present study investigated contrastive perspectives embedded in dyadic collaborative communication and their contributions to children’s understanding of affective and physical false beliefs.

**Purpose of the Study**

In sum, the present study was an attempt to extend the literature by examining the contributions of pragmatic functions of collaborative mother-child communication to individual differences in children’s theory of mind. The pragmatic functions of collaborative mother-child communication were examined at an individual and a dyadic level. At the individual level, the use of collaborative communication acts by mother and child were the focus of investigation. The independent contribution of individual maternal and child collaborative communication acts
to children’s physical and affective false belief understanding development was examined. Additionally, the specificity of the association of maternal and child collaborative communication acts containing lexicons of cognition or emotion with children’s affective and physical false beliefs understanding was also examined.

At the dyadic level, the pragmatic functions of communication between mother and child were examined on the basis of collaborative communication episodes. The thematic topic of emotion or cognition emerging from dyadic collaborative communication episode was identified and its specific relation to affective and physical false beliefs understanding in children was examined. In addition, this study investigated the contribution of pragmatic strategies used by mother-child dyads to maintain collaborative communication as well as contrastive perspectives embedded in dyadic collaborative communication at age 2½ to children’s physical and affective false belief understanding at age 4.
CHAPTER 2
REVIEW OF THE LITERATURE

Several empirical studies have shown that children’s false belief understanding is related to their language, social competence, and communicative competence. False belief understanding is strongly related to language ability, even after the children’s age is controlled for (Astington & Jenkins, 1995; Jenkins & Astington, 1996; Ruffman et al., 2002). Young children’s theory of mind has also been found to be related to later friendships and moral judgments and justifications during school years (Dunn, Brown, & Maguire, 1995; Dunn, Cutting, & Demetriou, 2000; Dunn, Cutting, & Fisher, 2002). Maladaptive development in children’s theory of mind may lead to rejection, poor communication, and aggressive behavior in peer interaction (Badenes et al., 2000; Capage & Watson, 2001). Children who pass false belief tasks and show greater understanding of others’ mental state were more likely to be popular among peers and less likely to engage in aggressive behaviors. Children’s theory of mind is also associated with their cooperative behavior such as altruistic or empathic behaviors (Frye & Moore, 1991; Moore & D’Entremont, 2001). A study on the relations between children’s theory of mind and school performance has shown that children who develop an earlier false belief understanding report positive perceptions of schoolwork, teacher-child interaction, and peer relations and are rated as more socially competent by their teachers (Astington, & Pelletier, 2005). Given its developmental significance, the present study was an attempt to examine the development of individual differences in children’s understanding of mind.

Defining and Assessing Theory of Mind
The term “theory of mind” has been defined differently in the developmental literature. First, the term refers to children’s knowledge and use of memory strategies, perception, attention, and problem solving in the meta-cognition area (e.g., Wellman, 1985). The term also refers to an inference system used to predict behavior by attributing mental states to people (e.g., Premack & Woodruff, 1978). Based on the second definition, contemporary researchers view children’s “theory of mind” as an ability to understand humans as mental beings who have beliefs, emotions, desires, and intentions and as an ability to reason and interpret behaviors and interactions by taking account of their own and others’ mental states (Astington & Baird, 2005). The ability to consider diverse beliefs and desires (such as thinking, knowing, wanting, remembering, hoping, and fearing) and take account of other types of mental states (such as perception, intentions, and emotions) is central to theory of mind development.

Wimmer and Perner (1983) were the first to design false belief tasks assessing children’s “theory of mind.” In the classical false belief task, the child who just witnessed an object being moved to a new location is asked to predict where a person who did not see the move will look for the object. By answering the question correctly, the child is expected to demonstrate an understanding that people will act upon their own beliefs even if the beliefs are false. Several false belief tasks have been developed since, including location change, unexpected contents, appearance-reality, and prediction of others. Designed to assess the development of children’s prediction and explanation of what people would think and do, false belief tasks are accepted as a conceptually valid evaluation of theory of mind competencies in children (Carpendale & Chandler, 1996; Flavell & Miller, 1998). These false belief tasks, however, are restrictive to the investigation of children’s understanding of false beliefs about the physical world (Davis, 2001).
Gross and Harris (1988) extended their false beliefs tasks to include the assessment of psychological world such as emotions. In their study, they found that children show better false belief understanding about objects or object locations than about emotions. However, some researchers believe that children’s performance at the false belief tasks are dependent on the context or provided information (Gopnik & Astington, 1988; Moore, Pure, & Furrow, 1990; Sullivan & Winner, 1991). Using physical and affective false belief tasks with a similar structure, a study by Davis (2001) showed that children’s understanding of others’ false belief and knowledge of representational change tend to develop concurrently and similarly in both physical and affective domains. Because previous studies have mainly tested children’s understanding of the physical world, little is known about children’s false belief development in the affective domain. Thus, the present study focused on children’s theory of mind development in both affective and physical domains.

Developmental and Individual Differences in Theory of Mind

The latest research findings suggest that the development of theory of mind may begin in infancy. Infants can imitate others, attend to others’ goals, and demonstrate a rudimentary understanding of others’ intentions (Meltzoff, 1985; Trevarthen, 1998). By 18 months, toddlers begin to understand the desires of others (Repacholi & Gopnik, 1997). At around 24 months of age, toddlers can express their desires by using the verb “want” in everyday conversation (Bartsch & Wellman, 1995). A meta-analysis further reveals that there is a systematic progression in children’s false belief understanding between 2½ and 5 years of age (Wellman, et al., 2001). Three-year-olds can distinguish between pretend and real events (Wellman & Estes, 1986) and can predict and explain emotional reactions based on their beliefs (Wellman & Estes, 1986; Wellman & Banerjee, 1991; Zaitchik, 1990). Although 3-year-olds tend to fail the false
belief task of location change, the concept that others have different beliefs begins to emerge. By age 4, children know that others’ mental states may be different from their own perceptions through seeing, talking, or touching. They can predict others’ behaviors or beliefs and distinguish reality from appearance in various situations (Wellman & Woolley, 1990).

Generally speaking, 4- to 5-year-olds would take others’ mental states, such as thoughts, imaginations, beliefs, and knowledge into consideration (Wellman, 2002). Children who pass false belief tasks are more likely to talk about a person’s beliefs, desires, or reasons for emotions (e.g., Bartsch & Wellman, 1995; Moses & Flavell, 1990; Perner, 1991). Although children’s theory of mind systematically improves with age during preschool years, considerable individual differences are found (e.g., Astington & Jenkins, 1995; Bartsch & Wellman, 1995; Dunn et al., 1991).

Previous studies have shown that individual differences in children’s theory of mind are related to the presence of older siblings and kin (Lewis, Freeman, Kyriakidou, & Maridaki-Kassotaki, 1996), parenting style (Hughes, Deater-Deckard, & Cutting, 1999; Ruffman, Perner, & Parkin, 1999; Vinden, 2001), parent-child conversation (Sabbagh & Callanan, 1998), attachment (Fonagy, Redfern, & Charman, 1997; Meins 1997; Meins, Fernyhough, Russell, & Clark-Carter, 1998; Symons & Clark, 2000), mother’s education (Cutting & Dunn, 1999), and family socioeconomic circumstances (Holmes, Black, & Miller, 1996). Furthermore, mother-child interactions have been examined to show the influence of social factors on children’s mind understanding (e.g., Cutting & Dunn, 1999; de Villiers, 2000; Meins et al., 2002; Ruffman et al., 2002).

Theories on the Development of Theory of Mind
Several theories have been proposed to address the development of theory of mind in children. Whereas theories such as modularity theory, theory-theory, and simulation theory highlight cognitive processes within the child, other theories such as social constructive theory emphasizes interpersonal processes between the child and other people. Different theoretical perspectives on the development of theory of mind in children will be reviewed below.

Modularity Theory

Modularity theorists like Leslie (1994; Leslie & Roth, 1994) believe that young children’s theory about mental representations is not acquired by apparent effort or explicit teaching. Rather, it is a result of maturation of one or more innate modules. It is believed that children are born biologically prepared to develop an understanding of mind. An innate model or a set of modules is triggered at some point in a child’s development (Gopnik & Wellman, 1994). Modularity theorists explain these developmental changes as a series of mechanisms evolved over time (Flavell, 1999; Scholl, & Leslie, 1999). For example, the first mechanism, called theory of body mechanism, develops early in the first year (Flavell, 1999). A baby can recognize that people have an internal source of energy that allows them to move on their own. The theory of mind mechanism (ToMM), evolved later in the first year, allows the infant to interpret others as agents who can perceive the environment and have intentions. During the second year of life, ToMM allows children to represent others as holding propositional attitudes such as pretending, believing, imaging, desiring, and so on. Therefore, theory of mind is the unfolding of an innate module that allows young children to attend to behaviors and infer mental states.

Modularity theory introduces the idea of Selection Processing (SP) to explain children’s individual differences on false belief tasks. Similar to the executive function of inhibitory control, Selection Processing (SP) allows children to inhibit possible alternatives for the belief to select
the correct one in false belief tasks (Scholl & Leslie, 1999). Depending on the maturation level of selection processing, normally developing 3-year-olds can pass or fail false belief tasks. That is, different performances at false belief tasks reflect not a developing ToMM, but a developing SP. However, modularity theory views that the environment or social interaction does not affect the innate modular capacity of theory of mind because the essential character of the innate modular is fixed.

*Theory-Theory*

Theory-theorists claim that children’s development of understanding of mental states is similar to the process of theory formation in science. Developmental change occurs as a result of the acquisition of more advanced capability to represent mental states or the modification of theories in the face of evidence that does not match with the current principles of understanding (Gopnik & Wellman, 1992, 1994; Wellman, 1992). They also argue that children’s theory of theory of mind satisfies three conditions for constituting an informal theory: First, entities such as beliefs, desires, and thinking are only applied to mental domains. Second, causal principles are used only in the theory’s domain. Lastly, knowledge about the mind is organized and interconnected with different mental states (Flavell, 1999).

Theory-theory view suggests that there are different stages or milestones in children’s theory of mind development resulting from the shifts in representational understanding (Bartsch & Wellman, 1995; Gopnik, Slaughter, & Meltzoff, 1994; Perner, 1991). For example, children’s theory of mind progresses from a ‘desire psychology’ stage demonstrating an elementary conception of simple desires, emotions, and perceptual experience or attention at age 2, to a ‘desire-belief psychology’ stage beginning to understand and talk about mental states such as beliefs and desires at age 3, to an ‘adult belief-desire psychology’ stage displaying a better
understanding of others’ mental states and the effects of the person’s mental states on their behaviors at around age 4 (Bartsch & Wellman, 1995; Flavell, 1999).

Theory-theorists believe that past experience provides children with information that helps their current theory of mind development. Their view on the role of experience is similar to Piaget’s equilibration theory, in which experiences are believed to cause disequilibrium. Children revise and improve their current theory of mind and move to a new or higher stage of equilibrium (Flavell, 1999). Theory-theory underscores social experience as information source. However, its focus on changes in cognitive structures within the child overshadows the effect of interpersonal processes on theory of mind development (Gellatly, 1997).

Simulation Theory

According to simulation theory, children develop their theory of mind through a simulation process (Goldman, 1992; Harris, 1992). That is, children imaginatively project themselves into another person’s mind or use their own mind to simulate another person’s thoughts. Children are able to predict and consider possible situations that are different from the reality as they become more flexible in imagination. During false belief tasks, children can predict what others would think about an object by imagining or mentally simulating what they themselves would think if they were in his or her stance (Flavell, 1999).

Harris (1992) believes that such mental simulation processes are important for the acquisition of social cognitive understanding and skills. In particular, he proposed that a critical precondition for understanding of others’ mental states is the participation in information exchange through conversation (Harris, 1996). Although theory-theory and simulation theory differ in their explanation of the development of theory of mind, they are similar in highlighting the formative role of experience in theory of mind development and the functional role of
fundamental cognitive change in false belief task performance. Harris’ simulation theory implicates the relevance of children’s conversation with others to their theory of mind development.

*Social Constructive Theory*

Carpendale and Lewis (2004) proposed a constructive perspective suggesting that children gradually construct their theory of mind through their experiences of interaction with others. Differing from the above mentioned cognition-based theories, drawn from Wittgenstein’s (1958) private language argument and Chapman’s (1991, 1999) reformulation of Piagetian theory, this alternative perspective centers on the social dimension of development. A social dimension of children’s theory of mind is added and integrated with cognitive processes.

Social constructive theory consists of two fundamentals (Carpendale & Lewis, 2004). First, social interaction is essential for children’s construction of cognitive, social, and moral knowledge. Social processes begin with dyadic interactions between infants and their caregivers. Through communicative interactions, children construct a new conception of the world and develop complex social skills (Chapman & Carpendale, 1999). When encountering various people, children begin to realize that others sometimes may have beliefs about the world that are different from their own. As a result, children change their expectations and beliefs as they gain social experience.

Second, children’s understanding of mind unfolds gradually through social interaction, which is gradually extended from dyadic interaction between infant and caregiver to triadic referential interaction between infant, caregiver, and objects. In contrast to theory-theory, social constructive theory believes that children’s acquisition of knowledge is context dependent. For example, evidence indicates when children are exposed to the protagonist’s explicit motive or
actively engaged in the task procedure, they were more likely to pass the false belief task (e.g., Freeman, Lewis, & Doherty, 1991; Hala & Chandler, 1996; Wellman et al., 2001). Also, children’s performances at the laboratory-based false belief tasks are different from the results from naturalistic observations (Carpendale & Lewis, 2004).

Fonagy and colleagues (Fonagy, Gergely, & Target, 2007) also suggest that the sense of subjective self, termed as subjectivity, is constructed through parent-child interaction. Particularly, caregiver’s pedagogical communicative acts centering on the child’s thoughts and feelings are expected to make an essential contribution to mind understanding in children. In Fonagy et al.’s conceptualization, the caregiver, especially the mother, assumes the role of a tutor teaching the child about the representations of internal states during interaction. Communication between mother and child becomes a potential source of information about the social world that children can internalize (see Meins, 1997; Vygotsky, Rieber & Carton, 1987). According to Fonagy et al. (2007), the quality of the caregiver-child communication may influence children’s mental activity such as perceiving and interpreting human behaviors or intentional mental states.

Although both Fonagy et al. (2007) and Carpendale and Lewis (2004) highlight the social constructive processes between the child and caregiver, they are different. Whereas Fonagy et al. (2007) place an emphasis on the role of parents as teachers, Carpendale and Lewis (2004) underscore the importance of a cooperative relationship between children and parents where both make an equal contribution to the construction of social understanding. Taken together, social constructive perspectives provide a theoretical basis for investigating mother-child communication as a significant contributor to children’s mind understanding. Taking a social constructive approach, the present study explores the role of collaborative mother-child communication in children’s false belief understanding in both affective and physical domains.
Pretense and Theory of Mind

Pretending and understanding others’ mind have a similar representational structure that is required to pass false belief tasks: children must understand that one can represent reality one way when in fact it is another (Leslie, 1987; Sobel, & Lillard, 2002). Pretend play allows children to integrate conflicting mental representations, which may facilitate their understanding of false beliefs (Schwebel et al., 1999). One study further demonstrates that it is jointly constructed pretend play but not solitary pretend play that was related to children’s greater performance at the physical false belief tasks (Schwebel et al., 1999). It was found that children’s role enactment (acting out the character without specifically naming the role; for example talking in a deep voice as a superhero) as well as children’s role statement (specifically stating the role; for example, the child announces “I am a superhero now”) were associated with better performance on theory of mind. Children who engaged in frequent jointly pretense play made more mental state talk referring to their own or another’s thought (Hughes & Dunn, 1997) and performed better at theory of mind tasks (Schwebel et al., 1999; Hughes et al., 2006). Cooperative pretend play, which involves discussing a joint pretend episode, assuming a pretend role, or following the suggestion of a playmate, was strongly and positively associated with children’s theory of mind and emotion understanding (Dunn & Cutting, 1999).

During joint pretense with peers, children with contrasting perspectives must focus on identifying and achieving intersubjective agreement and come to share a pretend belief with a partner (Schwebel et al., 1999; Rosen, Schwebel, & Singer, 1997; Lillard, 2007). Through collaborative communication in pretense play, children practice the use of verbal and nonverbal cues in expressing beliefs and emotions, learn to distinguish their own belief from another person’s belief, and gain an understanding that shared understanding may be achieved by
resolving disagreements. The present study, thus, examines mother-child collaborative communication in the context of pretense play.

Pragmatic Functions of Mother-Child Talk and Theory of Mind

It is argued that verbal communication helps children construct and support their ‘theory’ of beliefs (Bartsch, 2002). Children may acquire an awareness of different viewpoints, meaning of concepts, and representations of mental states through participation in conversational exchanges (Montgomery, 2005). Conversations with others about past and current events provide children with an opportunity to interpret the mental world. Conversations may remind children that people have desires, beliefs, and intentions that could be the same or different from their own (Harris, 2005). Studies on the role of language in children’s theory of mind development have focused on either the structure or the semantic content of language (Astington & Baird, 2005).

Focusing on lexical items referring to mental states and activities, preschool-aged children who engaged in frequent, rich, and varied conversation with their mothers about mental and affective states at home tend to be more advanced in mind understanding (Dunn et al., 1991; Dunn & Hughes, 1998). Other studies examining semantic aspects of language have also demonstrated the links between children’s theory of mind and maternal use of mental state language including cognitive process terms (e.g., know and think), desire state terms (e.g., want, and need), and affect state terms (e.g., sad and mad) during free play (Meins et al., 2002; Symons et al., 2006), book-reading or story-telling (Adrián, Clemente-Rosa, Villanueva, & Rieffe, 2005; Garner, Jones, Gaddy, & Rennie, 1997; Symons, Peterson, Slaughter, Roche, & Doyle, 2005), and other tasks in which parents and children jointly attend to and discuss a referent (e.g., a picture) (Ruffman et al., 2002; Taumoepeau & Ruffman, 2006). Maternal talk about mental
states have been found to be correlated with advanced false belief test performance by children (Brown, Donelan-McCall, & Dunn, 1996; Dunn et al., 1991; Meins & Fernyhough 1999; Ruffman et al., 2002). It has been suggested that mothers who talk more to their children about inner states may help them better understand emotions and beliefs. A study examining maternal cognitive state verbs also found that mothers’ use of cognitive verbs predicts children’s mind understanding (Adrián, Clemente, & Villanueva, 2007). In a study by Meins et al. (2002), children whose mothers made appropriate mind-related comments about their child’s psychological state or behavioral activity were more advanced in theory of mind development, as compared to children whose mothers’ comments were inappropriate. Research on the linkage between maternal talk and children’s understanding of mind provides clear evidence that mother-child communication contributes to children’s theory of mind development.

During conversation, interlocutors communicate through both linguistic and extralinguistic channels. Although spoken language is the primary means for communication, it is often accompanied with nonverbal actions such as posture, hand movement, and eye gaze (McTear & Conti-Ramsden, 1992). One approach to analyzing conversation is the examination of social or pragmatic functions of linguistic messages accompanied with nonverbal actions, known as communicative or speech acts (Garvey, 1982; McTear & Conti-Ramsden, 1992; Ninio & Snow, 1996). Pragmatic functions of language use involve knowledge beyond semantics and syntax. Speech utterances that do not include a mental state verb can also represent mental states such as beliefs or desires (Astington, & Baird, 2005). For example, when one person says, “Please give me some water,” it can be rephrased as “I want some water.” Further, speech without mental state terms may not only represent mental states, but also suggest false beliefs and/or highlight contrasting perspectives. For example, one states, “The baby is hungry”
(meaning “I think the baby is hungry.”), and the other replies “The baby is sleepy.” Even though these utterances do not involve mental states in either their semantic contents or syntactic structures, they represent two persons’ different beliefs. Further, two contrasting perspectives are revealed in these utterances – whereas one person believes the baby is hungry, the other person thinks the baby is sleepy (Lohmann & Tomasello, 2003; Sabbagh & Callanan, 1998). In such case, one person’s statement may represent a false belief.

According to Ninio and Snow (1996), what and how children may construct through their communication depends on the pragmatic ability of both children and their conversation partner. During communication, both partners need to be aware of and keep track of the other’s beliefs and intentions. An experimental study showed that a discourse only training without using the direct mental terms such as “think” or “know” leads to a significant improvement in preschoolers’ false belief task performance (Lohmann & Tomasello, 2003). However, social pragmatic aspects of mother-child communication have been largely ignored in previous studies investigating the role of language and conversation in individual differences in children’s theory of mind. This study focuses on the pragmatic aspects of mother-child collaborative communication in an attempt to further understand the importance of social experience to children’s theory of mind development.

Communicative Acts

People often communicate more than what are explicitly stated. A social pragmatic perspective of communication centers on the intended meaning of the sent message. Communicative acts refer to the social actions that are accomplished through the use of language and accompanied by extralinguistic signals (McTear & Conti-Ramsden, 1992), which can be further classified along the dimension of influence and involvement (Leaper, 1991). The
influence dimension assesses the degree to which a communicative act asserts the self and directly influences the other (direct) or minimizes the self and indirectly influences the other (nondirect). The involvement dimension refers to the degree to which a communicative act moves the speaker closer to the other (affiliation) or separates the speaker from the other (distancing). Collaborative communication acts are direct and affiliative, through which the partners understand each other’s perspectives fully and can arrive at solutions to conflicts (Haslett, 1983). Collaborative communication acts not only convey the speaker’s reference about the value, the goal, the action, the intention, and the perception of others, but also require the motivation to share with these things in interaction with others (Tomasello et al., 2005; Harris, 1999; Verba, 1993). Collaborative communication acts are often used to exchange information and construct a joint topic (Leaper & Gleason, 1996), which may stimulate both partners’ awareness about the other’s desires and intentions and create a chance for sharing perceptual and/or cognitive points of view (Hughes et al., 2006). Thus, Chapman (1991, 1999) argued that knowledge of the world develops through coordinating other people’s perspectives with one’s own. Cooperative communication is expected to facilitate our social understanding.

Several studies have documented that preschoolers’ cooperative play behaviors with siblings and friends are positively related to their frequent use of false belief explanations or mental state terms (Dunn et al., 1991; Brown et al., 1996). Cooperative conversation with mothers, siblings, or peers has also been found to promote children’s false belief understanding (Meins et al., 2002; Ruffman et al., 2002; Welch-Ross, 1997), working memory (Sabbagh & Callanan, 1998), and internalization of social understanding (Symons, 2004). Studies on parent-child relationship and parenting behavior have also suggested that maternal collaboration may support children’s theory of mind. For example, children whose parents are emotionally warm
and are sensitive and responsive to their needs were found to show greater theory of mind understanding (Cahill, Deater-Deckard, Pike, & Hughes, 2007; Hughes et al., 1999). In contrast, high levels of parent-child disengagement and negativity are likely to be related to low levels of theory of mind understanding (Cahill et al., 2007). Moreover, previous studies on the relationship between emotion talk and emotional understanding as well as perspective taking showed that communication about emotion in a collaborative situation help children better understand that emotions are complex and that emotions are based on beliefs (Bradmetz & Schneider, 1999; Racine et al., 2007; Peterson & Slaughter, 2003).

Communicative acts such as informing (e.g., giving related information or making descriptive or evaluative statements), guiding (e.g., making suggestions, proposals, clarifications, or corrections), requesting (e.g., asking for information and requesting direction or support), confirming (e.g., indicating agreement with the other’s ideas or initiatives), or supporting (e.g., showing understanding, providing emotional support, expressing amusement, or giving praise) are often used to establish mutual coordination (de Rosnay & Hughes, 2006; Garvey, 1990; Göncü, 1993). Collaborative communication acts may also facilitate emotional openness between partners and the accuracy in their interpretation of each other’s actions and intents (Kampen, 2006).

A study examining the relationship between referential communication and preschoolers’ theory of mind showed that children with the highest level of theory of mind used frequent simple directives as well as directives with descriptive information (Resches & Pérez-Pereira, 2007). It has been suggested that the link between directive use and theory of mind ability could be due to children’s better understanding of the goal of the task, their own role in the task, and their partner’s needs, which all assure a shared understanding with their partner (Resches & Pérez
Pereira, 2007). Children also use communicative acts of confirm or request to collaborate with their parents during play or conversation (Leaper & Gleason, 1996; Kampen, 2006). Parents may also use mental state language to inform, guide, request, confirm, or support their children (Dunn & Brophy, 2005; Nelson, Skwerer, Goldman, Henseler, Presler, & Walkenfeld, 2003). Taken together, it is expected that early maternal and child collaborative communication acts contribute positively to later children’s theory of mind development. The present study will investigate the independent contribution of individual maternal and child collaborative communication acts to children’s theory of mind development.

**Inner-State Terms Contained in Speech**

By 2 years, children use the terms to refer to person’s inner state distinct from their external behaviors, physical features, and facial expressions (Wellman, 2002). As reviewed above, the semantic content of maternal and child speech is linked to children’s theory of mind development. For example, the utterances including cognitive terms (e.g., think and know) are more strongly related to social cognitive development such as physical false belief understanding (Ensor & Hughes, 2008; Jenkins et al., 2003), whereas the utterances containing emotion (e.g., happy and sad) or desire (e.g., want and like) lexical terms are more strongly related to emotion understanding (e.g., Racine et al., 2007; Taumoepeau & Ruffman, 2006). However, children’s talk about cognitive activities predicted their advanced understanding of both mind and emotion (Hughes & Dunn, 1998). Yet, parents’ talk about emotions based on the story characters’ beliefs during a storybook task were found to be associated with children’s greater physical false belief understanding (Racine et al., 2007). Still, maternal talk including only emotion lexical terms without explanations did not correlate with children’s physical false belief understanding (Ensor & Hughes, 2008). Together, the findings regarding the association of the lexicons of emotion and
cognition with children’s understanding of emotion and mind are mixed. It is unclear whether
cognition and emotion lexical terms are specifically and respectively associated with affective
and physical domains of false belief understanding. Therefore, the present study investigates the
specificity in the contribution of maternal and child collaborative communication acts containing
cognition or emotion lexicons with children’s affective and physical false belief understanding. It
is expected that collaborative communication acts containing emotion terms would contribute to
children’s affective understanding, whereas collaborative communication acts containing
cognition terms would contribute to children’s physical false belief understanding.

Dyadic Collaborative Communication

The social mind is a dyadic one (Raver & Leadbeater, 1993). Communication between
mother and child is a bidirectional process involving joint engagement and mutual
responsiveness, which is not the same as the sum of individual communication acts. How a
mother and child respond to each other contributes to the interaction (Turnbull & Carpendale,
1999). Shared activity or joint attention between mother and child on the same subject has been
viewed as a precursor to language acquisition, emotion understanding, representation
development, and understanding of others’ mental states (Gardner, 1994; Racine & Carpendale,
2007). When the child begins to understand and use words as instruments for communication,
the topic of joint attention can be created in a linguistic way (Tomasello & Farrar, 1986). During
conversation, mothers and children talk about substantive connections to the world such as
people’s activity, goals, beliefs, and desires (Döbert, 2004). Mother-child “connectedness,”
defined as a speaker’s speech acts that are semantically related to another speaker’s prior
utterance (e.g., Dunn & Brophy, 2005; Dunn & Cutting, 1999; Ensor & Hughes, 2008), has been
found to be related to children’s advanced performance on physical false belief tasks and
emotion understanding (Ensor & Hughes, 2008). Children who experienced longer connected episodes with a friend were likely to score higher on both affective perspective-taking and physical false belief tasks (Slomkowski, & Dunn, 1996). Children who engaged in frequent semantically connected conversations with their mothers were more likely to pass theory-of-mind tasks (Brophy & Dunn, 2002; Hughes et al., 1998). Mothers’ cognitive mental state language occurring within a semantically connected conversation turn predicted children’s understanding of mind and emotion (Ensor & Hughes, 2008).

Semantically connected utterances by mother and child may simply reflect their sensitivity and responsiveness to the verbal content of communication. To construct shared meaning, the two partners must adjust their mental state positions, share activities or situations, and listen to each other’s perspective (Racine & Carpendale, 2007). A dyadic analysis of collaborative communication focusing on the logical and/or thematic connection and sequencing between the two partners’ turns may be better in capturing mother-child co-construction processes and reflecting the extent to which they tune in to each other’s interests and intentions (Lindsey & Mize, 2001; Turnbull & Carpendale, 1999). Mother-child collaborative communication episodes can be identified as sequenced turns of mother and child communicative acts that are logically and/or thematically related and continued for at least three turns.

Based on the topic or theme of a dyadic communication episode, it can be further classified as cognitive, affective, or non-mental (e.g., factual topic) (Howe, 1991; Verba, 1993). Cognitive episodes refer to those with a topic denoting mental activity such as thoughts, memories, ideas, beliefs, or knowledge. Episodes focusing on elaboration or clarification in order to avoid or resolve misunderstanding may be identified as cognition-centered. Finally, episodes
involving presentation and exchange of ideas for make-believes through language or action (e.g., symbolic substitution, imaginary events, or a fantasy theme) can also be identified as with a shared cognitive topic. An affective episode refers to the communication and discussion centering on the representation or description of emotions and physiological states of mother, child, or a third party (e.g., others, a doll).

Collaborative communication with a topic focusing on affective or cognitive states allows children to engage in metarepresentational thinking (Sabbaagh & Callanan, 1998) and to connect their mental experience to the contexts in which mental state are discussed (Montgomery, 2005). Connected and sequenced communication about cognitive activity and emotional experience may help children articulate and elaborate their understanding of representation and the represented, which are both important to theory of mind development (Lillard, 1993; Peterson & Slaughter, 2003). Engaging in collaborative communication with their mothers centering on a topic related inner states may help children develop more advanced perspective-taking ability, which is highly related to false belief task performance (Lillard, 1993; Howe, 1991). However, previous research has mainly focused on the use of inner state language by mother and child. Little is known about whether extended exchanges between mother and child with a thematic topic on cognitive activities and emotional experiences would contribute to specifically and respectively to children’s affective and physical false belief understanding. Therefore, the present study will investigate whether there are specific links between mother-child dyadic collaborative communication centering on cognition and emotion and physical and affective false belief understanding in children.

**Collaborative Pragmatic Strategies**
The occurrence of a collaborative communication episode is largely dependent on the success or failure of two partners’ use of pragmatic strategies to construct shared understanding. Research on peer pretend play has revealed that preschoolers use a variety of pragmatic strategies such as introduction, repetitions, elaboration of semantic elements, extension, and acceptance of suggestion to create shared understanding with their play partners within and outside of the play frame (Farver, 1992; Göncü, 1993). A study by Howe et al. (2005) examined the construction of shared meaning in sibling pretend play and found that children’s frequent use of pragmatic strategies, particularly, more advanced strategies to create a shared topic were related to greater pretense play and use of mental state language, which are both related to children’s social understanding. When negotiating a common point of view, younger children often use simple pragmatic strategies such as introducing (e.g., calling for attention, suggesting a new play theme) or following (e.g., description of action, imitation, response to other’s clarification), whereas older children often use extending (e.g., addition of new information to the current topic or theme, explanation, or justification) or clarification (questions leading to share understanding or agreement, request for help, conciliation/compromise). These pattern of collaborative pragmatic strategies may serve the functions of not just maintaining involvement by accepting the other’s position willingly and fully, but also adding a new dimension to the partner’s idea and extending the partner’s idea. During mother-child communication, children whose mothers talk about mental states in a clarifying manner showed more advanced theory of mind relative to their peers (Slaughter, Peterson, & Mackintosh, 2007). Mothers’ elaborated mental state talks, defined as explicit articulation or elaboration of the locus and nature of mental states, predicted children’s advanced false belief (Peterson & Slaughter, 2003). A recent review on the elaborative style of maternal reminiscing talk suggests its link to not only memory
development and literacy skills, but also to the understanding self, other, and mind in preschoolers (Fivush & Sales, 2006). Compared to simple pragmatic strategies such as imitation and repetition, more advanced pragmatic strategies such as elaboration and extension may help partners understand each other’s mental state fully and maintain their current focus of attention. Together, it is expected that pragmatic strategies used to create and maintain collaborative communication would support children’s understanding of mind. Therefore, the present study will examine pragmatic strategies used in mother-child collaborative communicative episodes at age 2½ and their contribution to children’s false belief understanding at age 4.

**Contrastive Perspectives**

The dyadic analysis of collaborative communication between mother and child provides the opportunity to examine the occurrence of contrastive talks within connected and sequenced turns. Contrastive perspectives occur when one speaker explicitly refers to a perspective that is different from the other’s perspective about the same topic. For example, during pretense play, the mother says “You have some milk” and, the child replies “No, it’s juice.” Contrastive perspectives can also occur when the speaker refers to a difference between two people’s mental state. For example, during pretense play, the mother says “The boy is sad because he got a sweater for Christmas. But his sister is happy about getting a sweater.” Contrastive talks may also occur when the speaker refers to a difference between two different perspectives. For example, during pretense play, the child says “We are just pretending. It’s an apple, but it is not a real one.” Maternal self-reports on the use of contrastives were found to be correlated with children’s advanced false belief performance (Peterson & Slaughter, 2003). Contrastive talks occurring in parent-child conversation contribute to children’s theory of mind development (e.g., Brown et al., 1996; Sabbagh & Callanan, 1998; Slaughter et al., 2007). Contrastive perspectives
occurring within mother-child collaborative communication may be an opportunity for children to articulate and compare different views of a given topic (Harris, 2005), which is similar to the nature of mental representation required in theory of mind tasks. Thus, the present study will examine the occurrence of contrastive perspective during mother-child collaborative communication at age 2½ and its association with children’s false belief understanding at age 4.

The Present Study

As reviewed above, it is theorized that children’s theory of mind is constructed through mother-child collaborative communication. The present study builds on existing research on the contribution of maternal and child mental state talks to children’s theory of mind development by investigating the pragmatics of collaborative communication between mother and child as well as the interaction between the semantics and pragmatics of mother-child collaborative communication. In this study, the examination of semantic and pragmatic aspects of mother-child collaborative communication involves two separate units of analysis: the mother and the child individually as well as the mother and the child as dyad.

The first goal of this study was to examine the use of collaborative communication acts by mother and child individually at age 2½ and its association to children’s false belief understanding at age 4. It was hypothesized that individual maternal and child collaborative communication acts containing the lexicon of cognition and emotion at age 2½ respectively predicted children’s advanced physical and affective false belief understanding at age 4.

Focusing on mother and child as a unit, the second goal of this study was to examine dyadic collaborative communication (where sequenced verbal and nonverbal actions by mother and child are logically or thematically connected) and its association to children’s theory of mind development. It was hypothesized that frequent collaborative communication between mother
and child predicts later children’s advanced false belief understanding. Specifically, frequent mother-child collaborative communication with a shared topic centered on emotion and cognition at age 2½ was expected to be related to respectively children’s greater affective and physical false belief understanding at age 4. Additionally, the present study investigated pragmatic strategies used by the mother and child to establish and maintain collaborative communication as well as contrastive perspectives embedded in collaborative communication and their contributions to children’s false belief understanding. It was expected that the greater use of advanced pragmatic strategies (e.g., elaboration as opposed to repetition) and contrastives (i.e., two contrasting mental states or perspective) in collaborative communication were associated with children’s greater performance at false belief tasks.
CHAPTER 3

METHODS

Participants

Participants were 79 four-year-olds (42 boys and 37 girls; ages 47 to 57 months) and their mothers. They participated in this study as part of a larger longitudinal study. Approximately 87.3% of the mothers were European-Americans, 5.1% Asian/Pacific Islanders, 2.5% Latin Americans, 1.3% African Americans, and the remaining 3.8% other ethnicity. The majority of the mothers (89.9%) had at least college education \( M = 16.48 \) years, \( SD = 2.82 \) and were married (96.2%). About 34% of the mothers were full-time employed when their children were 30 months old. Parents received $30 and a free videotape of the visit for their participation in the study.

Procedure

Data collection. The data collection took place when the children were 30 months of age (ages 27 to 36 months) and again at age 4 (ages 47 to 57 months). At 30 months, toddlers and their mothers participated in teaching and doll play interactions. For the teaching interactions, the mother was asked to teach her child to play pretend: (1) “picnic,” during which the mother taught her child to take food and silverware from a picnic basket, to set down some food and silverware for both of them, and to pretend to eat and drink; and (2) “bear goes to bed,” during which the mother taught her child to put a bear in the bed with its head on the pillow, to place a small blanket on the bear, and to pat the bear to sleep. Each teaching task lasted for 3.5 minutes. During doll play, the mother was asked to play with her child with a set of family dolls as she normally would for about 10 minutes. The mother-child teaching interactions and doll play were
videotaped. The mean duration of total three episodes was 17 minutes. At age 4, children were tested individually for affective and physical false belief understanding (see details below).

Transcripts. The mother’s and the child’s verbal and vocal actions during the teaching and doll play episodes were first transcribed verbatim from the videotapes. The accompanied nonverbal actions such as facial expressions, gaze direction, and gestures were also noted. The contextual information such as pretend actions, objects used, joint focus of attention, and joint actions (e.g., singing together) between mother and child were also noted. And the transcripts were formatted for the Computerized Language ANalysis (CLAN) program of the Child Language Data Exchange System (CHILDES; MacWhinney, 2000) to yield children’s language ability (Mean Length of Utterances) and the frequency of inner state terms (see Appendix A).

Maternal and child verbal and nonverbal actions were segmented into communication turns. A communicative turn is defined as the communication acts of one speaker bounded by another speaker’s communication acts (Shatz & Gelman, 1973) or a significant silence of 5 seconds or longer. The mother or the child is considered taking a communication turn even if only one word is uttered. In addition, because both nonverbal and vocal signals can convey communicative meaning or intentional social acts, the mother or the child exhibiting these acts or cues were also considered as holding the floor for a turn. Nonverbal communicative acts included (a) conventional signals such as pointing, nodding, or head shaking; (b) vocalizations such as laughing or crying, and (c) observation of the partner’s behavior. In cases where a turn included several utterances or nonverbal communicative acts, the turn was further segmented on the basis of the message unit which was defined as individual speech acts, or utterances bounded by their intonation contour or by a pause of 1 second or greater. After each segmented verbal or nonverbal communicative act as a message unit was identified, its pragmatic function was further
classified at the individual level. Next, based on the logical or thematic connection between sequenced turns by mother and child, collaborative communication episodes and their topics were further identified at the dyadic level. Each episode of collaborative communication was further classified for embedded collaborative pragmatic strategies and contrastive perspectives (see details below).

Measures

**Individual Collaborative Communication Acts**

*Identification of collaborative communication acts.* The Psychosocial Processes Coding Scheme (PPCS; Leaper, 2000; Leaper & Gleason, 1996) was modified and used to classify the pragmatic functions of maternal and child verbal and nonverbal communication acts. The PPCS is based on a conceptualization of communicative acts along two dimensions—involvement and influence. The influence dimension assesses the degree to which a communicative act asserts the self and directly influences the other (direct) or minimizes the self and indirectly influences the other (nondirect). The involvement dimension refers to the degree to which a communicative act moves the speaker closer to the other (affiliation) or separates the speaker from the other (distancing). According to the combination of affiliation and directness, different communicative acts can be identified.

Collaborative communicative acts are those high on directness and affiliation, which include the following: (a) *inform:* providing related information or making descriptions or evaluations about the activity or play objects (e.g., “I do not have any food on my plate.”); (b) *guide/request:* providing suggestions, proposals, clarifications, and/or corrections, asking directions, or seeking task-related help (“We’re going to have a picnic.”; “Can you cover him up with a blanket?”); (c) *confirm/support:* making explicit agreement, appreciation, and/or willing
acquiescence, showing understanding or emotional support, expressing shared amusement, or praising (“I know you do”; “You are such a good mother”). Collaborative communication acts of mother and child were coded separately. Communicative acts were excluded if mothers or children simply repeated themselves. The frequencies of all collaborative communication acts were summed. The frequency of collaborative communication acts by mother and child was computed separately as rate per minute and used in subsequent analysis.

A coding manual (see Appendix B) was used for the training and coding of maternal and child collaborative communication acts. Twenty percent of the transcripts were randomly selected and coded by an independent coder for reliability check. The average inter-rater agreement was 87.63% and the kappa was .83.

Identification of inner-state terms. Based on earlier studies of mental-state language, inner-state terms refer to desire (“want,” “wish”), intention (“gonna,” “trying”), belief/cognitive activity (“know,” “think”), and affect (“happy,” “sad”) (Montgomery, 2005; Bartsch & Wellman, 1995; Hughes et al., 2006). In this study, maternal and child communicative acts involving cognitive and affective state terms were identified separately. Cognitive state terms were used to refer to genuine mental activities or acts used to process information mentally such as “think,” “believe,” “know,” “remember,” “forgot,” “mean,” “understand” and their variations. However, if the term “know” was used without any elaboration (e.g., “I don’t know,”), it was not coded as cognitive state terms because it simply meant “I can’t answer” (Bartsch & Wellman, 1995; Shatz, Wellman, & Silber, 1983).

Affective state terms referred to emotional states such as “happy,” “sad,” “feel,” “cross,” “angry” and their variations. Inner-state terms referring to physiological states or connoting observable emotional actions such as “cry,” “smile,” “laugh,” “ill,” “hurt” (Howe, 1991) were
included as affective state terms. During the doll play episode, mothers and children often talked about “happy birthday.” If utterances were used to label the event or situation (e.g., “They must have ‘happy birthday party’,”) or to sing the happy birthday song, the term “happy” was excluded as affective state terms.

The CLAN program of the Child Language Data Exchange System (CHILDES; MacWhinney, 2000) was used to identify inner state terms. The frequencies of communicative acts involving affective and cognitive terms were tallied separately for mother and child. The frequency of communicative acts involving each type of inner state terms was then computed separately for mother and child as rate per minute and used in subsequent analysis.

**Dyadic Collaborative Communication**

*Identification of collaborative communication episodes.* Based on previous research (Brophy & Dunn, 2002; Callanan, Shrager, & Moore, 1995), collaborative communication episodes were defined as sequenced turns of maternal and child verbal and nonverbal actions that are logically and/or thematically related and continue for at least three turns. In each collaborative communication episode, both mother and child provided evidence of continued joint focus of attention or actions through extension of each other’s ideas and actions, maintained shared understanding, and/or made attempts to repair misunderstandings. When judging the connection between turns, in addition to the content of speech and nonverbal behaviors (e.g., pointing, nodding, or eye contact), the three other indicators were acknowledgements, initiation of a relevant next turn, and continued attention (see Appendix C).

Based on Clark and Brennan’s (1991) contribution model, the starting point of a collaborative communication episode is an initiation turn in which the speaker initiates a new topic that is unrelated to the partner’s previous turn, but is successful in eliciting a logically,
thematically, and/or semantically related response from the partner. A collaborative communication episode is terminated, when the shared topic or theme is shifted from a continued topic to a non-relevant topic or when the partner is unresponsive to the previous turn.

Because of the difficulties involved in identifying the beginning and ending of dyadic collaborative communication, a team method was used. Two coders worked together as a team to identify the collaborative communication episodes. Coding was done on the basis of the transcripts. However, in the event of questions or disagreements, videotapes were viewed as an aid to coding. All disagreements in coding were resolved through discussion before a final decision was made. The total frequency of collaborative communication episodes was tallied and rate per minute was derived to be used in subsequent analysis.

Identification of collaborative communication topics. The relevance of a collaborative communication episode to affective or cognitive state was determined by its topic or theme (see Appendix C). Cognitive episodes referred to the topics of collaborative communication episodes denoting mental activities such as thoughts, memories, ideas, beliefs, or knowledge of the mother, the child, and/or a third party (e.g., others, a doll), centering on elaborating or clarifying the partner’s actions to avoid or resolve misunderstanding, or focusing on pretense enactment (e.g., symbolic substitution, imaginary events, or a fantasy theme). Affective episodes were the discussion or communication of the emotional and/or physiological state of the mother, the child, or the third party (e.g., others, a doll). The collaborative communication episodes with topics focusing on factual talk, orienting utterances, repetition of other, or self-repetitions (Ruffman et al., 2002) were excluded.
The frequency of collaborative communication episodes with a topic/theme on affective or cognitive state was tallied separately and rate per minute was further derived to be used in subsequent analysis.

**Identification of collaborative communication strategies.** Based on the coding schemes designed by Göncü (1993), Farver (1992), and Howe et al. (2005), pragmatic strategies used to construct a shared topic or theme during a collaborative communication episode were classified as simple or advanced (see Appendix C). Imitation and repetition, passive maintenance, and revision were coded as simple strategies. Extension of semantic elements, explanation and elaboration, and support and supplement were coded as advanced strategies (see Table 1). The frequency of simple and advanced collaborative strategies occurring within a collaborative communication episode was tallied separately. A sum across all collaborative communication episodes was further computed and derived as rate per minute to be used in the subsequent analysis. Twenty percent of transcripts were randomly selected and coded by an independent coder for reliability check. The average inter-rater agreement was 96.52% and the kappa was .93.
Table 1

**Definitions and Examples of Collaborative Strategies Coding Schemes**

<table>
<thead>
<tr>
<th>Simple</th>
<th>(1) Imitation and repetition: Repeating and reiterating previous utterance or action by the partner without adding any new information.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(2) Passive maintenance: Responses used to passively maintain or confirm a shared topic/theme: (a) acceptance: Explicit approval of the partner’s idea (e.g., “yes”) or simple following of the partner’s suggestion or action, and (b) conciliations: submission or compliance to the partner’s will (e.g., after discussing the placement of a toy chair, one says “alright” in a resigned tone of voice).</td>
</tr>
<tr>
<td></td>
<td>(3) Revision: Changing the partner’s idea with no explanation or elaboration (e.g., “No, it’s milk, not juice”).</td>
</tr>
</tbody>
</table>

| Advanced        | (1) Extension: Adding new information and/or expectations to the partner’s idea expressed in the previous turn by (a) extending partner’s previous contribution through explicit or implicit agreement and adding new information (e.g., the mother holds the teddy doll and says “It’s a bear” and the toddler responds “That’s a baby bear”), and (b) building on to the partner’s previously expressed idea (e.g., the toddler pretends pouring into a cup and says “I want some juice” and the mother responds by pretending pouring into her own cup and says “I want some milk”). |
|                 | (2) Explanation and elaboration: Verbal statements or nonverbal actions used to explain or elaborate previous actions in order develop a shared understanding about joint attention and/or action (e.g., “The baby needs a bottle because he is hungry.”). |
|                 | (3) Support and supplement: Statements or actions used to show support and provide supplementation to those of the partner’s, including giving objects or making statements to reflect joint activity, teaching, or helping (e.g., “Let me show you how to do it.” or “We are going to make a picnic table.”). |
Identification of contrastive perspectives. Contrastives refer to communicative acts which distinguish one’s thoughts and beliefs from other states of affairs (see Appendix C). Contrastive perspectives include contrasting belief with reality (“I don’t think there is grandmother”), contrasting desire with outcome (“I don’t want pink fork. I want blue one”), contrasting one’s own mental state at one time with a later changed state (“This is a blanket,” covering the baby doll, and then, “It can be a rug” putting the rug on the floor), contrasting one’s own mental state with another’s mental states (when the mother made the mother doll sit on the toy chair and then put the baby doll on the mother doll’s lap, the child said, “The mommy (is) eating the baby’s cake.” The mother said “She got a new piece.”) and so on (Bartsch & Wellman, 1995). Each occurrence of the first three types of contrastives was counted as one time and the last individual contrastives (contrasting one’s own mental state with another’s mental states) as two (because there were two contrastive utterances). The contrastive was distinguished from conflicts. Conflicts were defined as “the parties have two different action proposals, and they argue about and defend their respective action proposals by citing the desires that motivate the actions” (Bartsch & Wellman, 1995, p. 116). The occurrence of contrastive perspectives in a collaborative communication episode was identified and tallied. Rate per minute was derived to be used in the subsequent analysis.

Twenty percent of the sample was randomly selected and coded by two independent coders for checking interobserver reliability. The average of inter-rater agreement was 89% and the average kappa was .85.

Theory of Mind Tasks

Both affective and physical false belief tasks were administered at the 4-year visit.
Affective false belief task (see Appendix D). Following the physical false belief tasks, affective false belief tasks were implemented to assess children’s knowledge of appearance-reality, understanding of display rules of emotions, and awareness of the false beliefs of others (Davis, 2001). The tasks consisted of a battery of two negative emotion tasks and two positive emotion tasks. A child was presented a doll named Jenny or Benny (the doll’s name matches the child’s sex) with either a happy face or a sad face. The child was asked how she/he thought Jenny/Benny felt. Then, the child was told that Jenny/Benny’s real emotion differed from the facial expression and the reason was also given. Next, the child was asked a memory control question to see whether she/he remembered Jenny’s/Benny’s real feeling. If the child answered it incorrectly, he or she was told again Jenny/Benny’s real emotion and the memory control question was repeated. The memory control question was followed by the representational change question by asking the child how he/she thought Jenny/Benny felt inside before the story. For the false belief question, the child was asked how a doll felt before the experimenter told the child about the doll’s emotion. Last, the memory control question was asked one more time. A score of one was given when both the control questions and the false belief question were answered correctly. The score range for the affective false belief tasks was from 0 to 8.

Physical false belief task (see Appendix E). Physical false belief tasks consisted of a battery of 4 tasks, including the unexpected contents task (Perner, Leekman, & Wimmer, 1987), change of location task (Wimmer & Perner, 1983), appearance-reality task (Flavell, Flavell, and Greene, 1983), and explanation and prediction task (Bartsch & Wellman, 1989). In the unexpected task, the child was shown a prototypical container (an “M&M” container) and asked what was in the container. In the unexpected content task, after the item inside of the container (a plastic fish) was revealed, the child was asked to recall what she/he thought the content was and
to predict what another would say about the content inside the container. The change of location task was conducted by using two dolls. A marker hidden by one doll was changed to a different location by the second doll. The child was asked to predict where the first doll would look for the marker. In the appearance-reality task, the child was asked to recall her/his own belief about a candle that looked like a crayon and to predict a puppet’s belief about the true identity of candle/crayon. The explanation and prediction task was implemented to ask children to explain the actions of a puppet with respect to a given false belief and to predict how a puppet would behave. An empty prototypical box (i.e., band aid box) and a plain box of the same shape and size containing the contents of the prototypical box were presented to the child. The child was asked to explain why a puppet would look in the prototypical box for the target contents and to predict where a naïve puppet would look for the target contents. To reduce the chance of random guessing, each task included at least one control question after each false belief question (Perner et al., 1987). Control questions were asked to test the memory and/or the reality of the original story. When the child correctly answered both the control question and the false belief question, a score of one was given. The range of aggregated scores for physical false belief tasks was from 0 to 7.

Statistical Analysis

Since play sessions varied in length, frequency per minute was computed for all observational measures. Preliminary analyses were performed to examine the association of child age, sex, number of siblings, child language ability (e.g., Mean Length of Utterance), and maternal education with children’s affective and physical false belief scores. Since significant associations with outcome variables were found in child language ability and maternal education, they were included in subsequent analysis as covariates (see Table 4).
To examine the first sets of research questions regarding the contribution of individual collaborative communication acts of mother and child at age 2½ to later children’s theory of mind at age 4, bivariate and partial correlations (controlling for child language ability and maternal education) between individual collaborative communication acts of mother and child with children’s affective and physical false belief task scores were computed. In addition, to examine the domain specific associations of inner-state terms (i.e., individual collaborative communication acts referring to affective or cognitive states) with children’s physical and affective false belief understanding, bivariate and partial correlations (controlling for child language ability and maternal education) were computed. Finally, to explore whether maternal and child collaborative communication acts contributed independently to children’s physical and affective false beliefs, both general (based on overall indices) and domain specific (based on indices within each specific domain) models of hierarchical regression were performed.

To investigate the second sets of research questions regarding the contribution of dyadic collaborative communication to children’s theory of mind, bivariate and partial correlations (controlling for children’s language ability and maternal education) of the frequency of mother-child collaborative communication episode, the frequency of episode topic centering on affective discussion or cognitive activity, the frequency of simple and advanced collaborative strategies, and the occurrence of contrastive perspectives with the affective and physical false belief task scores were conducted. Next, to systematically examine the contribution of collaborative communication at the dyadic level, both general (based on overall indices) and domain specific (based on indices within each specific domain) models of hierarchical regression were performed to investigate the additional contribution of dyadic measures of mother-child collaborative communication that was above and beyond that of individual measures.
CHAPTER 4
RESULTS
Preliminary Analysis

Demographic Variables

Descriptive statistics for mother, child, and family demographic variables are summarized in Table 2. Children’s mean age at the first visit was 2½ years and their mean age at the second visit was 4 years and 2 months. The majority of children (87.3%) were European Americans. The majority of mothers (89.9%) had a college education and was married (96.2%). Approximately one third of the mothers were employed full time.

Table 2

Descriptive Statistics for Demographic Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>N (%)</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child’s age at the first visit (months)</td>
<td>30.43</td>
<td>1.52</td>
<td></td>
<td>27-36</td>
</tr>
<tr>
<td>Child’s age at the second visit (months)</td>
<td>50.06</td>
<td>2.45</td>
<td></td>
<td>47-57</td>
</tr>
<tr>
<td>Number of siblings</td>
<td>.56</td>
<td>.75</td>
<td></td>
<td>0-3</td>
</tr>
<tr>
<td>Mother’s education (years)</td>
<td>16.48</td>
<td>2.82</td>
<td></td>
<td>9-27</td>
</tr>
<tr>
<td>Mother’s employment status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time</td>
<td>27 (34.2%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part time</td>
<td>25 (31.6%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not employed</td>
<td>27 (34.2%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother’s Marital status (married)</td>
<td>76 (96.2%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Table Continues)
Table 2
Continued.

<table>
<thead>
<tr>
<th>Variables</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnicity</td>
<td></td>
</tr>
<tr>
<td>European American</td>
<td>69 (87.3%)</td>
</tr>
<tr>
<td>African American</td>
<td>1 (1.3%)</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>4 (5.1%)</td>
</tr>
<tr>
<td>Latin American</td>
<td>2 (2.5%)</td>
</tr>
<tr>
<td>Other</td>
<td>3 (3.8%)</td>
</tr>
</tbody>
</table>

*Child Outcome Variables*

Means, standard deviations, and statistical range for affective and physical false belief task scores assessed at age 4 and toddlers’ language ability (indexed by Mean Length of Utterances) assessed at age 2½ are summarized in Table 3. Independent–samples *t* tests were conducted to reveal gender differences in affective and physical false belief understanding scores. Results showed that boy’s and girls’ affective, *t* (76) = .81, *ns*, and physical, *t* (77) = -.88, *ns*, false belief scores were not significantly different. Thus, data from boys and girls were combined for all subsequent analysis. In addition, children performed better at the physical than affective false belief tasks, *t* (77) = 4.69, *p* < .01.
Table 3

*Descriptive Statistics for Children’s Outcome Variables*

<table>
<thead>
<tr>
<th>Variables</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective False Belief (N = 79)</td>
<td>2.33</td>
<td>1.89</td>
<td>0-7</td>
</tr>
<tr>
<td>Girl (n = 37)</td>
<td>2.32</td>
<td>1.56</td>
<td>0-6</td>
</tr>
<tr>
<td>Boy (n = 42)</td>
<td>2.33</td>
<td>2.15</td>
<td>0-7</td>
</tr>
<tr>
<td>Physical False Belief (N = 78)</td>
<td>3.28</td>
<td>2.32</td>
<td>0-7</td>
</tr>
<tr>
<td>Girl (n = 36)</td>
<td>3.64</td>
<td>2.36</td>
<td>0-7</td>
</tr>
<tr>
<td>Boy (n = 42)</td>
<td>2.98</td>
<td>2.27</td>
<td>0-7</td>
</tr>
<tr>
<td>Language Ability (MLU)</td>
<td>2.77</td>
<td>.62</td>
<td>1.44-4.53</td>
</tr>
</tbody>
</table>

The literature has demonstrated that children’s age, maternal education, number of siblings, and language skills are associated with their false belief understanding. In the present study, Pearson product-moment correlations were computed to examine the associations of these variables with affective and physical false belief scores assessed at age 4 (see Table 4). Children’s affective and physical false belief scores in the current sample did not systematically covary with their age and the number of siblings. By contrast, the higher levels of maternal education were significantly correlated with children’s greater affective and physical false belief understanding. Also, children’s greater language ability (indexed by Mean Length of Utterances) was significantly correlated with their better physical, but not affective, false belief scores. Thus, mothers’ education and children’s language ability were included as covariates in the subsequent analysis. Lastly, children who performed better on the physical false belief tasks had higher affective false belief scores.
Table 4

**Correlations of Mother, Child, and Family Demographic Variables with Affective and Physical False Belief Scores and Correlations between Affective and Physical False Belief Scores**

<table>
<thead>
<tr>
<th></th>
<th>Affective False Belief</th>
<th>Physical False Belief</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother’s education</td>
<td>.38**</td>
<td>.30**</td>
</tr>
<tr>
<td>Number of siblings</td>
<td>.13</td>
<td>-.09</td>
</tr>
<tr>
<td>Children’s age at testing</td>
<td>.16</td>
<td>-.08</td>
</tr>
<tr>
<td>Children’s language ability</td>
<td>.18</td>
<td>.40**</td>
</tr>
<tr>
<td>Affective false belief score</td>
<td>-</td>
<td>.36**</td>
</tr>
</tbody>
</table>

**p<.01

Measures of Mother-Toddler Communication

Descriptive statistics for all measures derived from the observation of mother-toddler communication are summarized in Table 5. Correlations between mothers’ and toddlers’ collaborative communication acts are reported in Table 6.

*Mothers’ individual collaborative communication acts.* Mothers used significantly more frequent collaborative than non-collaborative communication acts during interaction with their toddlers, \( t (78) = 28.22, p < .001 \). Further, one-way repeated-measures ANOVA revealed that mothers preferred certain specific collaborative communication actions, Wilks’s \( \Lambda = .22, F(2, 77) = 140.06, p < .001 \). Follow-up pair-wise comparisons indicated that maternal Guide/Request was the most frequent one, and Inform was more frequent than Confirm/Support, \( t (78) = 13.17, p < .001 \) and \( t (78) = 6.43, p < .001 \). Finally, mothers used more cognitive than affective terms in their collaborative communication acts, \( t (78) = 12.26, p < .001 \).

*Toddlers’ individual collaborative communication acts.* Toddlers also engaged in more frequent collaborative than non-collaborative communication acts, \( t (78) = 5.10, p < .001 \). Further,
one-way repeated-measures ANOVA revealed that toddlers showed a differential pattern in their individual collaborative communication acts. Results from follow-up pair-wise comparisons indicated that Inform was more frequent than Confirm/Support, $t(78) = 2.95, p < .01$, which was more frequent than Guide/Request, $t(78) = 5.50, p < .001$. Finally, there was no significant difference in the frequency of cognitive and affective terms used by toddlers in their collaborative communication acts, $t(78) = 1.88, ns$.

Mothers’ versus toddlers’ collaborative communication acts. Mothers engaged in more frequent overall collaborative communication acts than did their toddlers, $t(78) = 19.36, p < .001$. Specifically, mothers engaged in more frequent Inform, $t(78) = 4.74, p < .001$, and Guide/Request, $t(78) = 21.66, p < .001$, communication acts than did their toddlers. Mothers also used slightly more frequent Confirm/Support communication acts than did their toddlers, $t(78) = 1.90, p < .10$. 
Table 5

*Descriptive Statistics for Individual and Dyadic Measures of Mother-Child Communication at Age 2½*

<table>
<thead>
<tr>
<th>Variables</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual Level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Collaborative</td>
<td>3.80</td>
<td>1.53</td>
<td>1.10-10.17</td>
</tr>
<tr>
<td>Collaborative</td>
<td>13.80</td>
<td>3.21</td>
<td>6.74-22.05</td>
</tr>
<tr>
<td>Communication Acts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inform</td>
<td>3.73</td>
<td>1.45</td>
<td>1.24-8.45</td>
</tr>
<tr>
<td>Guide/Request</td>
<td>7.69</td>
<td>2.48</td>
<td>3.34-14.32</td>
</tr>
<tr>
<td>Confirm/Support</td>
<td>2.38</td>
<td>1.17</td>
<td>.49-6.14</td>
</tr>
<tr>
<td>Inner-State Term Used</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive</td>
<td>.81</td>
<td>.48</td>
<td>.06-2.07</td>
</tr>
<tr>
<td>Affective</td>
<td>.16</td>
<td>.16</td>
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<tr>
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<td>1.23</td>
<td>.54-6.14</td>
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<td>.78</td>
<td>.05-4.18</td>
</tr>
<tr>
<td>Confirm/Support</td>
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<td>1.19</td>
<td>.36-5.98</td>
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<tr>
<td>Inner-State Terms Used</td>
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<td></td>
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</tr>
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<td>.15</td>
<td>0-.70</td>
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<tr>
<td>Affective</td>
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<td>.07</td>
<td>0-.24</td>
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*(Table Continues)*
Table 5

*Continued.*

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<td>1.05-3.58</td>
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<td>Topics of Collaborative Episodes</td>
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<td>Cognition-related</td>
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<td>.36</td>
<td>.28-2.19</td>
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<td>.03</td>
<td>.04</td>
<td>0-.18</td>
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<td>Pragmatic Strategies Used</td>
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<td>3.34-14.99</td>
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<td>Advanced</td>
<td>12.36</td>
<td>3.64</td>
<td>4.30-20.80</td>
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<tr>
<td>Contrastives Used</td>
<td>.27</td>
<td>.23</td>
<td>0-.98</td>
</tr>
</tbody>
</table>

Correlations between mothers’ and toddlers’ collaborative communication acts. As summarized in Table 6, mothers’ frequent non-collaborative communication acts were associated with toddlers’ frequent non-collaborative communication acts. Although the frequencies of mothers’ and toddlers’ overall collaborative communication acts were not related, mothers’ frequent guiding/requesting was positively related to toddlers’ confirming/supporting. Moreover, mothers’ and toddlers’ use of affective- and cognitive-related terms were significantly correlated within the same domain.

Dyadic collaborative communication acts. Mother-toddler dyads were more likely to engage in collaborative communication episodes with topics centering on cognition than on emotion, $t(78) = 31.22, p < .001$. Moreover, mother-toddler dyads employed more advanced than simple pragmatic strategies to construct and maintain their collaborative communication episodes, $t(78) = 13.36, p < .001$. Finally, contrastive perspectives did not occur frequently
during mother-toddler collaborative communication episodes, which was similar to previous findings with 3-year-olds (Brown et al., 1996; Sabbagh & Callanan, 1998).

Table 6

**Correlations between Maternal and Toddler Collaborative Communication Acts**

<table>
<thead>
<tr>
<th></th>
<th>Non-Collaborative</th>
<th>Collaborative</th>
<th>Child Communication Acts</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Overall Inform</td>
<td>Guide/Request</td>
<td>Confirm/Support</td>
</tr>
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<td>Non-Collaborative</td>
<td>.34**</td>
<td>-.04</td>
<td>-.01</td>
</tr>
<tr>
<td>Collaborative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Inform</td>
<td>.12</td>
<td>.09</td>
<td>-.16</td>
</tr>
<tr>
<td>Guide/Request</td>
<td>-.06</td>
<td>-.08</td>
<td>-.02</td>
</tr>
<tr>
<td>Confirm/Support</td>
<td>.25*</td>
<td>.01</td>
<td>-.15</td>
</tr>
<tr>
<td>Cognitive terms</td>
<td>-.12</td>
<td>.32**</td>
<td>-.08</td>
</tr>
<tr>
<td>Used</td>
<td>-.15</td>
<td>.11</td>
<td>.05</td>
</tr>
<tr>
<td>Affective terms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used</td>
<td>-.05</td>
<td>-.11</td>
<td>-.01</td>
</tr>
</tbody>
</table>

* p<.05    **p<.01

Individual Collaborative Communication Acts and Children’s False Belief Understanding

The first set of research questions in this study focused on the contribution of individual collaborative communication acts of mother and child at age 2½ to later children’s false belief tasks scores at age 4. Pearson correlations were first computed to examine the bivariate associations of individual collaborative communication acts of mother and child with children’s
affective and physical false belief scores (see Table 7). Partial correlations controlling for the covariates of child language ability and maternal education were also computed (see Table 7).

**Maternal Collaborative Communication Acts**

It was hypothesized that mothers’ more frequent collaborative communication acts would be positively associated with children’s higher affective and physical false belief scores. This hypothesis was largely unsupported. It was found that, similar to non-collaborative communication acts, mothers’ overall and specific collaborative communication acts were not significantly associated with children’s affective and physical false belief scores (see Table 7). The only exception was the positive correlation between maternal collaborative communication acts of confirming/supporting and children’s physical false belief understanding (see Table 7). Mothers’ frequent confirming/supporting acts observed at age 2½ predicted children’s more advanced physical false belief understanding at age 4, with or without partialling out the covariates of maternal education and child language ability.

Furthermore, it was expected that mothers’ frequent use of emotion- and cognition-related terms in their collaborative communication acts would be predictive of children’s greater affective and physical false belief scores, respectively. This hypothesis was partially confirmed. It was found that mothers’ frequent use of cognitive, but not affective terms, was associated with children’s better performance at the physical false belief tasks, with or without controlling for maternal education and child language ability (see Table 7). This pattern of specificity in association, however, was not found in the relationship between mothers’ use of affective terms at age 2½ and children’s performance at the affective false belief tasks at age 4 (see Table 7).

**Toddlers’ Collaborative Communication Acts**
Toddlers’ more frequent use of non-collaborative communication acts predicted their lower physical false belief scores. However, after controlling for children’s language ability and maternal education, this negative correlation became non-significant.

It was hypothesized that children’s frequent collaborative communication acts at age 2½ would be associated with their greater affective and physical false belief scores at age 4. This hypothesis was partially supported. The frequency of children’s overall collaborative communication acts at age 2½ was positively correlated with their physical false belief scores at age 4, with or without controlling for the covariates of maternal education and child language ability. Before controlling for the covariates, the positive correlation between toddlers’ collaborative communication acts of informing and their physical false belief scores was marginally significant. Moreover, similar to the pattern found with mothers, toddlers’ more frequent communication acts of confirming and/or supporting was significantly related to their greater physical, but not affective, false belief scores before controlling for maternal education and child language ability. This pattern of specificity in association, however, was not found in the relationship between the frequency of collaborative communication acts by toddlers at age 2½ and later their performance at the affective false belief tasks (see Table 7).

With respect to inner-state terms used in collaborative communication acts, it was expected that children’s frequent use of emotion- and cognition-related terms would be respectively associated with their later greater affective and physical false belief understanding. Similar to the findings with mothers, children who used more cognition-related terms in their collaborative communication acts at age 2½ showed more advanced physical, but not affective, false belief understanding at age 4. This positive correlation became marginally significant after partialling out maternal education and child language ability (see Table 7). Moreover, similar to
the findings with mothers, the use of affective terms at age 2½ by toddlers was not significantly associated with later their performance at the affective false belief tasks (see Table 7).

Table 7

*Correlations between Measures of Individual Collaborative Communication Acts and Affective and Physical False Belief Understanding*

<table>
<thead>
<tr>
<th>False Belief Tasks</th>
<th>Affective</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maternal Communication Acts</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Collaborative</td>
<td>.05 (.10)</td>
<td>-.14 (-.04)</td>
</tr>
<tr>
<td>Collaborative</td>
<td>-.08 (-.02)</td>
<td>.01 (.17)</td>
</tr>
<tr>
<td>Inform</td>
<td>-.15 (-.11)</td>
<td>.05 (.18)</td>
</tr>
<tr>
<td>Guide/Request</td>
<td>-.08 (.01)</td>
<td>-.14 (.01)</td>
</tr>
<tr>
<td>Confirm/Support</td>
<td>.14 (.05)</td>
<td>.27 * (.23*)</td>
</tr>
<tr>
<td><strong>Inner-state terms used</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive</td>
<td>.19+ (.11)</td>
<td>.46*** (.38**)</td>
</tr>
<tr>
<td>Affective</td>
<td>-.04 (-.09)</td>
<td>.09 (.04)</td>
</tr>
<tr>
<td><strong>Child Collaborative Communication Acts</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Collaborative</td>
<td>-.08 (-.00)</td>
<td>-.33** (-.18)</td>
</tr>
<tr>
<td>Collaborative</td>
<td>.18 (.19)</td>
<td>.26* (.25*)</td>
</tr>
<tr>
<td>Inform</td>
<td>.13 (.14)</td>
<td>.21+ (.15)</td>
</tr>
<tr>
<td>Guide/Request</td>
<td>.17 (.15)</td>
<td>.09 (-.01)</td>
</tr>
<tr>
<td>Confirm/Support</td>
<td>.03 (.06)</td>
<td>.13 (.24*)</td>
</tr>
<tr>
<td><strong>Inner-state terms used</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive</td>
<td>.11 (.06)</td>
<td>.28* (.20+)</td>
</tr>
<tr>
<td>Affective</td>
<td>.04 (.02)</td>
<td>.13 (.07)</td>
</tr>
</tbody>
</table>

+ p < .10   * p < .05   ** p < .01   ***p < .001

Note. Values reported in parentheses are partial correlations controlling for maternal education and child language ability.
Independent Contributions of Mothers’ and Toddlers’ Individual Collaborative Communication Acts to Children’s False Belief Understanding

To assess the independent contribution of individual collaborative communication acts to children’s false belief understanding at age 4, both the general and domain specific models were tested. The general models tested the independent contribution of mothers’ and toddlers’ overall collaborative communication acts to children’s affective and physical false belief understanding (see Table 8), whereas the specificity models tested the independent contribution of mothers’ and toddlers’ domain-specific collaborative communication acts to the respective affective and physical false belief understanding (see Table 9).

**General Models**

Two separate hierarchical multiple regression analyses were conducted to investigate whether toddler and maternal collaborative communicative acts would make independent contributions to later children’s false belief understanding. Specifically, it was expected that children’s overall collaborative communication acts would contribute to their affective and physical false belief scores that would be independent of mothers’ overall collaborative communication acts. The results are summarized in Table 8.

With respect to children’s affective false beliefs, children’s language ability and maternal education were entered at Step 1 as the covariates, $F (2, 76) = 7.19, p < .01$. The variable of mothers’ overall collaborative communication acts was entered at Step 2. Results showed that mother’s overall collaborative communication acts did not add an additional contribution to children’s affective false belief, $F (1, 75) = .05, ns$. Finally, the variable of toddler collaborative communication acts was entered at Step 3. The additional contribution of toddlers’ overall collaborative communication acts was marginally significant, $F (1, 74) = 3.22, p < .10$. 
Thus, there was a trend that children’s overall collaborative communication acts made an independent contribution to later their affective false belief understanding, which was above and beyond that of their mothers.

With respect to children’s physical false beliefs, as in the previous regression model, children’s language ability and maternal education were entered at Step 1 as covariates, $F (2, 75) = 10.83, p < .01$. The variable of maternal overall collaborative communication acts was entered at Step 2. Results showed that maternal overall collaborative communication acts did not make an additional contribution to children’s physical false belief, $F (1, 74) = 2.22, ns$. Finally, the variable of toddlers’ overall collaborative communication acts was entered at Step 3. Results showed that the additional contribution of toddlers’ overall collaborative communication acts to their physical false beliefs was marginally significant, $F (1, 73) = 3.74, p < .10$. Thus, similar to the findings with affective false belief understanding, it was a trend that the contribution of children’s overall collaborative communication acts to later their false belief understanding development was independent of that of their mothers.
Table 8

*General Models of Hierarchical Regression Testing Independent Contributions of Mothers’ and Toddlers’ Overall Collaborative Communication Acts to Children’s False Belief Understanding at Age 4*

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Predictors</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$\beta$ at Final Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective False Belief</td>
<td>1. Covariates:</td>
<td>.16**</td>
<td>.16**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Child’s Language Ability</td>
<td></td>
<td></td>
<td>.06</td>
</tr>
<tr>
<td></td>
<td>Mother’s Education</td>
<td></td>
<td></td>
<td>.38**</td>
</tr>
<tr>
<td></td>
<td>2. Maternal Collaborative Communication Acts</td>
<td>.16**</td>
<td>.00</td>
<td>-.06</td>
</tr>
<tr>
<td></td>
<td>3. Toddler Collaborative Communication Acts</td>
<td>.20**</td>
<td>.04+</td>
<td>.20+</td>
</tr>
<tr>
<td>Physical False Belief</td>
<td>1. Covariates:</td>
<td>.22**</td>
<td>.22**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Child’s Language Ability</td>
<td></td>
<td></td>
<td>.37**</td>
</tr>
<tr>
<td></td>
<td>Mother’s Education</td>
<td></td>
<td></td>
<td>.27**</td>
</tr>
<tr>
<td></td>
<td>3. Toddler Collaborative Communication Acts</td>
<td>.28**</td>
<td>.04+</td>
<td>.20+</td>
</tr>
</tbody>
</table>

$+$ $p<.10$  * $p<.05$  ** $p<.01$

*Domain Specific Models*

To further investigate whether the independent contribution of maternal and toddler collaborative communication acts to children’s affective and physical false belief understanding were domain specific, two separate hierarchical regression analyses were conducted (see Table 9).

In the prediction of children’s affective false belief understanding, child language ability and maternal education were entered Step 1 as covariates. The frequency of affective terms used by mothers was entered at Step 2, which did not make an additional contribution to the model, $F$
The frequency of affective terms used by toddlers was entered at Step 3, which also did not make an additional contribution to the model, $F(1, 74) = .24, ns$. Thus, the specificity model for testing the independent contribution of mothers’ and toddlers’ communicative acts within the emotion domain was not supported by the data.

In predicting children’s physical false belief understanding, the covariates of child language ability and maternal education were entered at Step 1. The frequency of cognitive terms used by mothers was entered at Step 2, which made a significant contribution to the model, $F(1, 75) = 12.22, p < .01$. Next, the frequency of cognitive terms used by toddlers was entered at Step 3, which did not make an additional contribution to the model, $F(1, 74) = .87, ns$. Thus, the specificity model for testing the independent contribution of mothers’ and toddlers’ communicative acts within the cognitive domain was not supported by the data.

Table 9

*Domain Specific Models of Hierarchical Regression Testing Independent Contributions of Mothers’ and Toddlers’ Overall Collaborative Communication Acts to Children’s False Belief Understanding at Age 4*

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Predictors</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$\beta$ at Final Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective False Belief</td>
<td>1. Covariates:</td>
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<td>.16**</td>
<td>.13</td>
</tr>
<tr>
<td></td>
<td>Child’s Language Ability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mother’s Education</td>
<td></td>
<td></td>
<td>.37**</td>
</tr>
<tr>
<td></td>
<td>2. Mother Affective Terms Used</td>
<td>.17**</td>
<td>.01</td>
<td>-.10</td>
</tr>
<tr>
<td></td>
<td>3. Toddler Affective Terms Used</td>
<td>.17**</td>
<td>.00</td>
<td>.06</td>
</tr>
</tbody>
</table>

(Table Continues)
Dyadic Collaborative Communication and Children’s False Belief Understanding

The focus of the second sets of research questions was to examine the contribution of dyadic measures of mother-child collaborative communication at age 2½ to later children’s affective and physical false belief understanding at age 4. Pearson correlation analyses were first conducted to investigate the bivariate associations of dyadic measures of collaborative communication with children’s affective and physical false belief scores (see Table 10). Partial correlations controlling for child language ability and maternal education were also conducted (see Table 10).
Table 10

*Correlations between Dyadic Collaborative Communication and Children’s Affective and Physical False Belief Understanding*

<table>
<thead>
<tr>
<th>False Belief Tasks</th>
<th>Affective</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaborative Episodes</td>
<td>.01 (.06)</td>
<td>.04 (.15)</td>
</tr>
<tr>
<td>Collaborative Topics</td>
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<td></td>
</tr>
<tr>
<td>Cognition-related</td>
<td>.00 (.09)</td>
<td>.06 (.17)</td>
</tr>
<tr>
<td>Emotion-related</td>
<td>.18 (.24*)</td>
<td>.11 (.16)</td>
</tr>
<tr>
<td>Collaborative Strategies Used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple</td>
<td>.01 (.05)</td>
<td>.05 (.24*)</td>
</tr>
<tr>
<td>Advanced</td>
<td>.01 (.04)</td>
<td>.12 (.21+)</td>
</tr>
<tr>
<td>Contrastives Used</td>
<td>.17 (.17)</td>
<td>.28* (.28*)</td>
</tr>
</tbody>
</table>

Note. Values reported in parentheses are partial correlations controlling for maternal education and child language ability.

*Collaborative Episodes*

It was hypothesized that frequent mother-toddler collaborative communication episodes would predict later children’s more advanced affective and physical false belief understanding. However, this hypothesis was not supported. Mother-toddler dyads who engaged in more frequent collaborative episodes during play did not predict later children’s more advanced affective and physical false beliefs, with or without controlling for maternal education and child language ability.
**Episode Topics**

It was also expected that when mother-toddler dyads engaged in collaborative episodes centering on emotion- and cognition-related topics at age 2½, children later would show better performance at affective and physical false belief tasks respectively at age 4. It was found that when toddler-mother dyads engaged in collaborative communication topics centering more on emotion-related topics, children tended to perform better at affective, but not physical, false belief scores at age 4. This positive association was significant even after the effects of maternal education and child language ability were partialed out. However, mother-toddler dyads’ frequent engagement in cognition-related collaborative communication topics was not linked to later children’s affective or physical false belief understanding, with or without partialling out maternal education and child language ability.

**Pragmatic Strategies Used**

It was expected that mother-toddler dyads’ greater use of advanced, but not simple, collaborative strategies would be associated with later children’s greater performance at false belief tasks. However, contrary to the prediction, the frequent use of both simple and advanced pragmatic strategies was associated with later children’s greater physical false understanding when maternal education and child language ability were controlled for. Whereas the partial correlation between the frequency of simple pragmatic strategy used by mother-toddler dyads and children’s physical false belief scores was significant, the partial correlation between the frequency of advanced pragmatic strategy used and children’s physical false belief scores was only marginally significant. However, the frequency of simple or advanced pragmatic strategies used by mother-toddler dyads was not linked to later children’s affective or physical false belief scores, with or without partialling out maternal education and child language ability.
Contrastives Used

It was hypothesized that the greater use of contrastives within collaborative episodes by mother-toddler dyads would predict later children’s more advanced affective and physical false belief understanding at age 4. This hypothesis was partially supported. After paritalling out maternal education and child language ability, mother-toddler dyads’ greater use of contrastives in collaborative communication episodes was associated with later children’s higher physical, but not affective, false belief scores.

Independent Contributions of Individual and Dyadic Measures of Collaborative Communication to Children’s False Belief Understanding

Correlational analysis was performed to reveal the bivariate associations between individual and dyadic measures of collaborative communication between mothers and their toddlers (see Table 11). Mothers’ and toddlers’ overall collaborative communication acts were significantly correlated with the dyadic measures of collaborative communication. Specifically, mothers’ guiding/requesting and toddlers’ confirming/supporting were moderately correlated with dyadic measures such as the frequency of collaborative episodes and cognitive topics as well as the frequency of simple and advanced pragmatic strategies used. Mother’s frequent use of cognitive terms was positively related to frequent contrastives observed within collaborative communication.
Table 11

Correlations between Individual and Dyadic Measures of Collaborative Communication

<table>
<thead>
<tr>
<th></th>
<th>Collaborative Episodes</th>
<th>Cognitive Topics</th>
<th>Emotion Topics</th>
<th>Simple Strategies</th>
<th>Advanced Strategies</th>
<th>Contrastives</th>
</tr>
</thead>
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<td></td>
<td></td>
</tr>
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<td>-.08</td>
<td>-.03</td>
<td>.30**</td>
<td>.15</td>
<td>.09</td>
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<td></td>
</tr>
<tr>
<td>Overall</td>
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<td>.42**</td>
<td>.15</td>
<td>.51**</td>
<td>.59**</td>
<td>.04</td>
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<td>Inform</td>
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<td>.23*</td>
<td>.06</td>
<td>.21</td>
<td>.16</td>
<td>.12</td>
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<tr>
<td>Guide/Request</td>
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<td>.37**</td>
<td>.18</td>
<td>.43**</td>
<td>.52**</td>
<td>-.07</td>
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<tr>
<td>Confirm/Support</td>
<td>.17</td>
<td>.08</td>
<td>-.03</td>
<td>.25*</td>
<td>.31**</td>
<td>.11</td>
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<td>Cognitive terms Used</td>
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<td>.19</td>
<td>.06</td>
<td>.04</td>
<td>.31**</td>
<td>.23*</td>
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<td>Affective terms Used</td>
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<td>.08</td>
<td>.23*</td>
<td>-.12</td>
<td>.13</td>
<td>-.05</td>
</tr>
<tr>
<td><strong>Child</strong></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Non-Collaborative</td>
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<td>-.05</td>
<td>.09</td>
<td>.22</td>
<td>.33**</td>
<td>-.08</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
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<td>.23*</td>
<td>.58**</td>
<td>.41**</td>
<td>.29*</td>
</tr>
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<td>Inform</td>
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<td>.27*</td>
<td>.29*</td>
<td>.22</td>
<td>.03</td>
<td>.31**</td>
</tr>
<tr>
<td>Guide/Request</td>
<td>.31**</td>
<td>.12</td>
<td>-.15</td>
<td>.19</td>
<td>.24*</td>
<td>.10</td>
</tr>
<tr>
<td>Confirm/Support</td>
<td>.40**</td>
<td>.37**</td>
<td>.16</td>
<td>.56**</td>
<td>.45**</td>
<td>.06</td>
</tr>
<tr>
<td>Cognitive terms Used</td>
<td>.07</td>
<td>.09</td>
<td>.03</td>
<td>.08</td>
<td>.12</td>
<td>.22</td>
</tr>
<tr>
<td>Affective terms Used</td>
<td>.14</td>
<td>.08</td>
<td>.25*</td>
<td>-.08</td>
<td>.13</td>
<td>.06</td>
</tr>
</tbody>
</table>

* p < .05       **p < .01

To further examine whether dyadic measures of collaborative communication acts would make an independent contribution to children’s false belief understanding at age 4 that was above and beyond that of individual measures, both general and domain specific models were
tested. The general models tested the independent contribution of overall dyadic measures of mother-toddler collaborative communication to children’s affective and physical false belief understanding, whereas the specificity models tested the independent contribution of domain-specific dyadic measures to the respective affective and physical false belief understanding.

**General Models**

To examine whether the overall dyadic measures of collaborative communication would make an independent contribution to children’s false belief understanding development that was above and beyond that of individual measures, two separate hierarchical regression analyses were conducted. The results are summarized in Table 12.

Table 12

**General Models of Multiple Regression Testing Independent Contributions of Dyadic Measures of Collaborative Communication to Children’s False Belief Understanding**

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Predictors</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$\beta$ at Final Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective False Belief</td>
<td>1. Covariates:</td>
<td>.16**</td>
<td>.16**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Child’s Language Ability</td>
<td></td>
<td></td>
<td>.04</td>
</tr>
<tr>
<td></td>
<td>Mother’s Education</td>
<td></td>
<td></td>
<td>.38**</td>
</tr>
<tr>
<td></td>
<td>2. Individual Measures:</td>
<td>.20</td>
<td>.04</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maternal Collaborative Communication Acts</td>
<td></td>
<td></td>
<td>-.05</td>
</tr>
<tr>
<td></td>
<td>Toddler Collaborative Communication Acts</td>
<td></td>
<td></td>
<td>.20</td>
</tr>
<tr>
<td></td>
<td>3. Dyadic Measures:</td>
<td>.21</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Collaborative Episodes</td>
<td></td>
<td></td>
<td>-.06</td>
</tr>
<tr>
<td></td>
<td>Contrastives Used</td>
<td></td>
<td></td>
<td>.13</td>
</tr>
</tbody>
</table>

(Table Continues)
In the model predicting children’s affective false belief understanding, children’s language ability and mothers’ education were entered at the Step 1, $F (2, 76) = 7.19$, $p < .01$. Mothers’ and toddlers’ overall collaborative communication acts were included in the next step. Results showed that the frequency of children’s overall collaborative communication acts was not a significant predictor, $F (2, 74) = 1.64$, $ns$. The frequency of overall dyadic measures of mother-toddler communication, namely the frequency of dyadic episodes and contrastives used, were entered at the Step3. Results revealed that these dyadic variables did not make a significant additional contribution to children’s affective false belief understanding, $F (7, 67) = .91$, $ns$. Thus, the general model was not supported by the data. Dyadic measures of mother-toddler
communication did not make an additional contribution to later children’s affective false belief understanding that was above and beyond that of individual measures.

In the model predicting children’s physical false belief understanding, children’s language ability and mothers’ education were entered at Step 1, \( F(2, 75) = 10.83, p < .01 \). The overall individual measures of collaborative communication acts by mothers and toddlers were entered at Step 2. Their contribution was only marginally significant, \( F(2, 73) = 3.02, p < .10 \). Finally, the two overall dyadic measures of mother-toddler communication were entered at Step 3, which did not make a significant additional contribution, \( F(7, 66) = .74, ns \). Thus, using the overall measures as indices, the general model was not supported by the data. Dyadic measures of mother-toddler communication did not make an additional contribution to later children’s physical false belief understanding that was above and beyond that of individual measures.

**Domain Specific Models.**

To further investigate whether the independent contribution of dyadic measures of mother-toddler collaborative communication to children’s affective and physical false belief understanding was domain specific, two separate hierarchical regression analyses were conducted (see Table 13).

In the model predicting of children’s affective false belief understanding, child language ability and maternal education were entered at Step 1 as covariates. The frequencies of affective terms used by mothers and toddlers within collaborative communication acts were entered at Step 2, which did not make a significant contribution to the model, \( F(2, 74) = .39, ns \). The frequency of emotion-related topics created by mother-toddler dyads during collaborative communication episodes was entered at Step 3, which made a significant additional contribution to prediction, \( F(1, 73) = 5.58, p < .05 \). Thus, the domain specific model for testing the
independent contribution of dyadic measures of mother-toddler collaborative communication within the emotion domain was supported by the data.

In the model predicting children’s physical false belief understanding, child language ability and maternal education were entered at Step 1 as covariates. The frequency of cognitive terms used by mothers and toddlers were entered at Step 2, which made a significant additional contribution to the model, \( F(2, 73) = 6.45, p < .01 \). Next, the frequency of cognition-related topics created by mother-toddler dyads was entered at Step 3, which did not make a significant additional contribution to prediction, \( F(1, 72) = .41, ns \). Thus, the domain specific model for testing the independent contribution of dyadic measures of mother-toddler collaborative communication within the cognition domain was not supported by the data.

Table 13

**Domain Specific Models of Multiple Regression Testing Independent Contributions of Dyadic Measures of Collaborative Communication to Children’s False Belief Understanding**

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Predictors</th>
<th>( R^2 )</th>
<th>( \Delta R^2 )</th>
<th>( \beta ) at Final Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective False Belief</td>
<td>1. Covariates: Child’s Language Ability, Mother’s Education</td>
<td>.16**</td>
<td>.16**</td>
<td>.14</td>
</tr>
<tr>
<td></td>
<td>2. Individual Measures: Maternal Affective Terms Used, Toddler Affective Terms Used</td>
<td>.17</td>
<td>.01</td>
<td>-.14</td>
</tr>
<tr>
<td></td>
<td>3. Dyadic Measure: Emotion-Related Topic</td>
<td>.23*</td>
<td>.06*</td>
<td>.26*</td>
</tr>
</tbody>
</table>

(Table Continues)
Table 13
Continued.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Predictors</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$\beta$ at Final Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical False Belief</td>
<td>1. Covariates: Child’s Language Ability, Mother’s Education</td>
<td>.22**</td>
<td>.22**</td>
<td>.29**</td>
</tr>
<tr>
<td></td>
<td>2. Individual Measures: Mother Cognitive Terms Used, Toddler Cognitive Terms Used</td>
<td>.34**</td>
<td>.12**</td>
<td>.30**</td>
</tr>
<tr>
<td></td>
<td>3. Dyadic Measure: Cognition-related Topics</td>
<td>.34</td>
<td>.00</td>
<td>.07</td>
</tr>
</tbody>
</table>

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

Summary

Using both individual and dyad as the unit of analysis, this study examined the association of mother-toddler collaborative communication at age 2½ with later children’s affective and physical false belief understanding at age 4. Children’s language ability (MLU) and mothers’ education served as covariates in the analysis.

At the individual level, although mothers used more frequent overall and specific collaborative communication acts than their toddlers during interaction, the frequency of toddlers’, but not mothers’, overall collaborative communication acts at age 2½ predicted children’s physical false belief understanding at age 4. In particular, both mothers’ and toddlers’ frequent use of collaborative communicative acts of confirmation and support predicted children’s greater physical false belief scores. In addition, although the frequent use of emotional terms by mothers and toddlers did not predict children’s affective false belief understanding,
their frequent use of cognitive terms did predict children’s physical false belief understanding. Finally, results from the general and domain specific models demonstrated that the contribution of toddlers’ collaborative communication acts to their affective and physical false belief understanding was independent of that of their mothers.

At the dyadic level, the frequency of collaborative episodes and episodes with cognition-related topics did not predict children’s false belief understanding. However, whereas the occurrence of emotion-related topics in mother-toddler collaborative communication predicted children’s affective false belief understanding, the occurrence of contrastive perspectives as well as simple and advanced collaborative strategies by the dyads predicted children’s physical false belief understanding. Finally, based on the overall indices, the contribution of dyadic measures of collaborative communication to the prediction of children’s affective and physical false belief understanding was not independent of that of individual measures of collaborative communication acts. By contrast, based on the domain specific measures, the contribution of dyadic measures of collaborative communication to the prediction of children’s affective false belief understanding was independent of that of individual measures.
CHAPTER 5
DISCUSSION

The major aim of this study was to examine the association of mother-toddler collaborative communication at age 2½ with later children’s affective and physical false belief understanding at age 4. Results from the bivariate correlations demonstrated that the pragmatic functions of collaborative communication between mothers and their toddlers, including individual collaborative communication acts, terms and contrastives used in collaborative communication, and frequency of collaborative strategies, were related to children’s physical, but not affective, false belief understanding. It was further found that based on the overall, but not domain-specific, indices, the contribution of children’s collaborative communication acts to their affective and physical false belief understanding was fairly independent of that of their mothers. Finally, on the basis of the domain-specific indices, dyadic measures of mother-toddler collaborative communication added an additional contribution to children’s affective, but not physical, false belief understanding that was beyond individual measures. The implications of current findings, limitations of this study, and suggestions for future studies are discussed below.

Role of Age, Gender, Language Competence, and Family Demographics in Children’s False Belief Understanding

In this study, children’s false belief scores assessed at age 4 did not systematically vary with their age, gender, and number of siblings. Mothers’ education level did, however, predict children’s affective and physical false belief scores. Additionally, the sophistication of children’s language at age 2½ was significantly related to their physical, but not affective, false belief scores. These results are largely consistent with the results from previous studies (Dunn et al,
By age 5, most children come to understand others’ mental states. However, among children there is a large age range of 4 years for them to pass the false belief tasks (e.g., Astington & Jenkins, 1995; Bartsch & Wellman, 1995; Dunn et al., 1991). Previous studies reported that children with kins or older sibling had more advanced false belief understanding (e.g., Jenkins & Astington, 1996; Lewis et al, 1996; Youngblade & Dunn, 1995). Because most of the children in this study were first borns, very few of them had siblings. The restricted variability in family size may attenuate the strength of the relationship between the number of siblings and children’s false belief performance.

Children of mothers with higher education tended to be more advanced in language (Hoff, 2003). Even though most of the mothers (90%) in this study had college education, maternal education was still a strong predictor of children’s affective and physical false belief understanding. This finding is also consistent with previous studies (e.g., Cutting & Dunn, 1999; Ensor & Hughes, 2008; Ruffman, Slade, & Crowe, 2002). Whereas some studies have found that children’ language ability was significantly related to their physical, but not affective, false belief understanding (e.g., Astington & Jenkins, 1999; de Villiers, 2000; Jenkins & Astington, 1996; Meins, et al., 2002), some other studies have reported that children’s verbal ability contributed to their false beliefs about emotions (Cutting & Dunn, 1999). The inconsistencies in previous findings may be a result of differences in the formats and procedures between affective and physical false belief tasks (Davis, 2001). The affective and physical false belief tasks in the present study had the similar format. After ruling out the confounding factor, maternal education was associated with both affective and physical domain of theory of mind development.
Children’s Affective versus Physical False Belief Understanding

In this study although 4-year-olds’ performance at the affective and physical domain of theory of mind development was moderately correlated, they showed better physical than affective false belief understanding, which was consistent with findings from several previous studies (e.g., de Rosnay, Pons, Harris, & Morrell, 2004; Gross & Harris, 1988). Such pattern, however, contradicted to Davis’ (2001) argument that children would show similar levels of performance when the tasks in the affective and physical domains are comparable in content and format. In the present study, although the affective false belief tasks had a similar structure (representational change and others’ false belief) to that of the physical false belief tasks, they were not identical. The questions of affective false belief tasks were presented in the format of abstract stories, whereas the physical false belief tasks involved object manipulations with visual information available. The affective false belief tasks might be more challenging for children.

Children at age 4 may have difficulties understanding emotional display rules that were necessary for passing the affective false belief tasks. Almost all four-year olds correctly answered the protagonist’s real emotions. However, they typically failed to answer false belief related questions, which need some basic understanding of emotion display rules (e.g., although it is funny to see someone fall on his face, it is not polite to laugh when a person is tripped over by a banana peel; Harris & Gross, 1988). Even children ages 5-8 performed better when answering questions about physical facts as compared to questions about emotions (Parker, MacDonald, & Miller, 2007).

The frequency of collaborative episodes centering on emotion-related topics predicted children’s affective false belief understanding. This result supported the argument that emotion-related conversations provide children with an effective context for children to understand that a
given emotional encounter can be appraised in several different ways (Harris, 1999; Oppenheim, 2006). Supportive and validating mutual exchanges with mothers about emotions enable children not only to better understand the labeling, causes, and consequences of emotions, but also to differentiate their own from others’ emotions (Dunn, 2004; Stein & Miller, 1993).

Maternal and Toddler Collaborative Communication Acts and Children’s False Belief Understanding

*Individual Collaborative Communication Acts*

Based on the social constructive theory (Carpendale & Lewis, 2004), this study examined the association of maternal and child individual collaborative communication acts with children’s false belief understanding. At the individual level, it was found that although mothers used more frequent overall and specific collaborative communication acts than their toddlers, the frequency of toddlers’, but not mothers’, overall collaborative communication acts at age 2½ predicted children’s physical false belief understanding. The positive association between toddlers’ collaborative communication acts and theory of mind development can be explained by the previous finding that preschoolers’ communicative efficiency tend to be associated with their collaborative efforts in inferring the interlocutor’s intentions and needs (Clark & Wilkes-Gibbes, 1986; Resches & Pérez Pereira, 2007).

Given the theoretical and empirical emphases on the contribution of maternal input to children’s theory of mind development (Fonagy et al., 2007; Meins et al., 2002; Ruffman et al., 2002; Sharp & Fonagy, 2008), the lack of association between maternal collaborative communication acts and children’s false belief understanding was unexpected. Upon close examination, despite that mothers’ overall collaborative communication acts did not predict children’s physical false belief understanding, their specific collaborative acts of
confirming/supporting did. Through the acts of confirming and supporting, communicative intents and contextual cues can be clearly conveyed (Farroni, Csibra, Simion, & Johnson, 2002). As a result, mothers’ behaviors, feelings, or beliefs can be best understood by their young children (Fonagy et al., 2007). The established intersubjectivity with their mothers may be effective in helping children further understand thoughts and intents in others.

Moreover, similar to the finding with mothers, after child language skills and maternal education were controlled for, children who showed greater explicit support and confirmation when collaborating with their mothers demonstrated more advanced false belief understanding in the physical domain. As suggested by Ensor and Hughes (2008), the communication acts of confirming/supporting enable conversational partners to not only reduce their negativity or conflict, but also construct a shared point of view. It is suggested that through the process of constant alignment of representations, even communication partners with different linguistic skills can achieve successful cooperation (Branigan, Pickering, & Cleland, 1999; Pickering & Garrod, 2004).

Other specific collaborative communication acts by mothers and toddlers, such as informing, guiding, or requesting, were not related to children’s theory of mind. Supporting or confirming communication acts offer reassurance to the partner, which are considered to be highly affiliative (Leaper, Leve, Strasser, & Schwartz, 1995). On the contrary, communication acts such as informing, guiding, or requesting are considered highly self-assertive (Leaper et al., 1995). As compared to self-focused communication acts, other-focused communication acts may be more efficient in creating a shared understanding between communication partners, which may in turn, facilitate children’s understanding of others’ mind.

*Inner-State Terms Used*
The present findings showed that frequent use of cognitive terms by mothers and toddlers in their collaborative communication acts was associated with children’s better physical false belief understanding at age 4. It has been argued that mere exposure to inner state terms embedded in conversations may not be sufficient for promoting children’s theory of mind (de Villiers, 2000; Harris, 2005). Empirical findings data also confirmed that the simple frequency count of inner-state terms used by mothers such as cognitive, desire, or affective states was not predictive of children’s later theory of mind (Meins et al., 2002; Slaughter et al., 2007; Symons et al., 2006). However, when cognitive terms were used by mothers to clarify situation or when desire terms were used appropriately (Meins et al., 2002), they were predictive of children’s false belief understanding (Peterson, & Slaughter, 2003; Slaughter et al., 2007; Symons et al., 2006). This suggests that it is when and how, but not simply whether or how frequently, inner-state-terms were used that matters. Ensor and Hughes’ (2008) recent study reported that the frequency of maternal and child references to cognition, desires, and emotions within connected conversation turns was significantly related to children’s false belief understanding. The findings of this study further confirmed the need to consider the role of social context. It is through contingent and attuned verbal and nonverbal exchanges with a social partner, children gradually understand the meaning of mental terms and gain mentalistic experiences. During collaborative communication with a partner, children can not only communicate what they think, but also learn about how others may think (Montgomery, 2005).

Independent Contributions of Mothers’ and Toddlers’ Collaborative Communication Acts to Children’s Affective and Physical False Belief

Several theoretical models have focused on the significance of parental input to children’s theory of mind development. For example, maternal mind-mindedness proposed by
Meins et al. (2002) highlights caregivers’ ability to treat children as intentional agents who have mentalistic capacities and to scaffold children’s understanding of their own behaviors as mental states. Parental reflective functioning outlined by Fonagy and Target (1997) emphasizes the role of parents in mirroring and connecting natural experiences for children to better understand mental states and emotions. Pedagogical stance theorized by Fonagy et al. (2007) underscores the role of mothers who are believed to be biologically prepared to act and communicate efficiently as a teacher to facilitate children’s social knowledge. The present study further examined the role of children during collaborative communication in their theory of mind development.

Results from the general models with overall indices and domain-specific models with indices of a specific domain, after partialling out maternal education and child language competence, showed a trend that the contribution of toddlers’ collaborative communication acts to their false belief understanding was independent of that of their mothers. Results from this study suggested that parental input may not be sufficient in explaining individual differences in children’s theory of mind and that both mothers and children contribute to theory of mind development in early childhood. Young children are not simply passive recipients of parental inputs.

The meeting of two minds requires the efforts of both partners. During collaborative communication, young children actively provide feedback, in the form of assenting, confirming, or supporting their mothers’ ideas, plans, behaviors, or references. It has been suggested that a child is a psychological agent who “can reason about either his/her own or other people’s explicit goals, intentions, and beliefs.” (Sharp & Fonagy, 2008, p.1) Children’s collaborative
communication acts may not only clarify their references to individuals or objects, but also extract and confirm the partner’s thoughts and perceptions.

Given that collaborative communication acts performed by toddlers are important to their own theory of mind development, future research is needed to investigate the characteristics of children that may alter the quality of their communication actions. For example, children’s inhibitory control may be an important variable. According to Moses et al. (2005), in addition to working memory, inhibitory control is particularly critical to theory of mind development. Recent research has suggested that children with advanced executive skills are likely to demonstrate greater social and communication skills. They can control their impulse to coordinate with others’ activity and maintain their attention to interaction, and thus have more opportunities for observing social interaction and learning about other people’s minds (Hughes, 1998; 2002; Moses, Carlson, & Sabbagh, 2005). Further, inhibitory control may contribute to children’s ability to translate their conceptual knowledge into successful task performance, which may be necessary for their acquisition of mental state concepts. Individual differences in children’s inhibitory control may also serve as a moderator altering the relationship between mother-child collaborative communication and children’s mind understanding.

In addition, it has been reported that parenting style is related to individual differences in children’s theory of mind development (Hughes et al., 1999). For example, mind-mindedness, an indicator of mothers’ sensitivity, was found to be positively linked to children’s theory of mind (Meins et al., 2002). Parents’ parenting style such as levels of responsiveness, warmth, or control may also further serve as a moderator in altering the association between mother-child collaborative communication and children’s theory of mind. It is likely that high or low quality of parenting would respectively strengthen or attenuate the association between parental
communication acts and children’s theory of mind development. Future studies on the role of parents in children’s theory of mind development may also need to consider other personal factors that may influence parents’ collaborative communication acts such as their parenting beliefs, emotional states, and personality.

Cultural context may also be another factor that needs to be considered in future research. For example, within western cultures, authoritative parenting has been reported to be positively contributed to children’s theory of mind development (Fonagy et al., 1997; Meins, 1997). By contrast, authoritarian parenting requiring conformity in children’s was found to be associated with Korean children’s better performance on theory of mind tasks. Thus, cultural differences may exist for identifying an ideal communication style that promotes children’s understanding of others (Vinden, 2001).

Dyadic Collaborative Communication and Children’s Affective and Physical False belief

Frequency and Topics of Collaborative Episodes

Almost all the episodes of collaborative communication between mother and toddler focused on cognitive-related themes involving pretending and/or reminiscing the past. However, it was found that the total frequency of collaborative episodes and episodes with cognitive topics did not predict children’s later false belief understanding development. This may be because the frequency measure of cognitive episodes did not reflect the quality and complexity of cognitive-focused activities. For example, a pretense act may include a simple pretense action (e.g., pretend to eat a toy apple) or a sequenced role play involving complex cognitive processes (e.g., using dolls to remember and discuss past events). Further, previous studies demonstrated that the social and non-social format of pretense activity differentially associated with children’s theory of mind development. For example, frequent joint pretend play with a partner predicted
children’s greater false belief understanding, whereas solitary pretence, imaginativeness, and play transformations did not (Hughes et al., 2006; Schwebel et al., 1999).

Some researchers suggest that different theory of mind tasks may tap different aspects of cognitive capabilities (Astington & Gopnik, 1988; Gopnik & Slaughter, 1991). A study by Schwebel et al. (1999) found that toddlers’ jointly constructed pretense with peers was only significantly related to the appearance/reality distinction task, which requires differentiation between the apparent and real identity of ambiguous objects, but not to the other false belief tasks such as the unexpected displacement task. In the present study, children’s theory of mind development was indexed by a composite score of several different false belief tasks. The association of the frequency of collaborative episodes and topics with children’s theory of mind may be specific to certain false belief tasks.

**Pragmatic Strategies Used**

The present study examined how mothers and children establish and maintain collaborative communication and its association with children’s false belief understanding. It was hypothesized that frequent advanced, not simple, strategies, would predict children’s greater affective and physical false belief understanding. Although mother-toddler dyads used significantly more advanced than simple pragmatic strategies during collaborative communication, \( t (78) =13.36, p<.001 \), after child language ability and maternal education were partialled out, it was unexpectedly found that both simple and advanced strategies were positively related to children’s physical false belief understanding.

Preschool children were more likely to use simple than advanced pragmatic strategies with peers during play (Göncü, 1993; Howe et al., 2005). Simple pragmatic strategies such as imitating, repeating, or passively responding to the partner may be developmentally appropriate
for toddlers to use for maintaining collaboration with their mothers and developing mutual understanding and shared meaning (Göncü, 1993; Howe et al., 2005). With the help of mothers, joint activities created and maintained by advanced strategies such as extending, explaining, or supplementing the partner’s acts may not only help children gain clarification about the ongoing communication, but also develop a shared understanding with their partner (Kaye & Charaney, 1980). Shared understanding created and maintained by both simple and advanced pragmatic strategies appear to be conducive to young children’s understanding of others’ mind.

**Contrastives Used**

Contrastives are conceptual and representational distinctions that are explicit contrasts between desires and reality or between two individuals’ different desires or preferences (Wellman, 2002). By age 2, children are able to use words to refer to other people’s internal experiential states that are distinctly different from their external behaviors, physical features, and facial expressions. During collaborative communication with their mothers, children may have the opportunities to articulate and compare different views of a given topic by through contrastives (Harris, 2005). Focusing on contrastive perspectives presented within connected, sequenced turns, this study found that children who experienced more contrastive perspectives during collaborative communication with their mothers performed better at the physical false belief tasks.

During collaborative episodes between mothers and their toddlers, several different types of contrastives occurred, including thought-reality contrastives, desire-outcome contrastives, and individual contrastives contrasting one’s thought or belief to other’s thought or belief (Bartsch & Wellman, 1995; Sabbagh & Callanan, 1998). The positive association found between the occurrences of contrastive during collaborative communication and later children’s
false belief performance suggested that a zone of proximal development might be created by parents to talk with their children about other’s belief and thoughts (Vygotsky, 1986). With maternal scaffolding, children could better focus on the representational nature of their own and others’ mind, and later “internalize” this representational understanding (Sabbagh & Callanan, 1998).

Independent Contribution of Dyadic Collaborative Communication to Children’s Affective and Physical False Belief

Using both individual and dyadic measures, this study examined the association of mother-toddler collaborative communication at age 2½ with later children’s affective and physical false belief understanding at age 4. Based on the indices of overall measures, it was found that collaborative communication assessed at the dyadic level did not make an additional contribution to children’s affective or physical false belief understanding that was above and beyond that of individual measures. Similarly, results from regression models based on the domain-specific indices also revealed that collaborative communication assessed at the dyadic level did not make an independent contribution to children’s affective or physical false belief understanding. The only exception was that the frequency of collaborative episodes centering on emotion made an independent contribution to children’s affective false belief understanding that was over and above that of individual measures.

By focusing on the sequenced talk, by which parents and children respond to each other, both partners’ contribution to communication can be assessed (Turnbull & Carpendale, 1999). Dyadic measures make it possible to capture collaborative topics or theme. However, the lack of significant association between dyadic measures and children’s false belief understanding may be due to some measurement issues. For example, the frequency measure of episode and episode
topic were composite indices combining several different aspects and levels of cognitive activity with different collaboration quality. As a result, variability among dyads might not be adequately assessed. To reveal specific associations between dyadic measures of mother-child collaborative communication and later children’s theory of mind development, the measures may need to be unpacked to better reflect the specificity of joint activity between mother and child. Also, the dyadic measures of pragmatic strategies and contrastives were the composite scores of maternal and child indices. This may not be the best way to derive dyadic measures. Other assessment methods such as subjective ratings and real-time co-occurrence measures may be more efficient in capturing variations among dyads.

Study Limitations, Future Directions, and Implications

Findings from this study provided new information to the literature that mother-toddler collaborative communication contributes to children’s theory of mind development. However, it should be noted that this study has limitations that need to be addressed in the future. First, the generalizability of the current findings needs to be tested with populations with different social and cultural backgrounds. Ninety percent of the mothers in this study had college education, which may constrain the variability in maternal and children’s communication acts. In the present study, collaborative communication acts took up the largest proportion in mothers’ communication acts. Studies of maternal speech have reported that mothers with a college degree used significantly richer vocabularies and longer utterances when talking to their children than did mothers with a high school degree (e.g., Hoff, 2003; Hoff & Tian, 2005). Samples with a diverse socioeconomic status and education level would increase the variety of maternal and child collaborative communication acts. Greater individual differences may lead to stronger
associations between collaborative communication acts and children’s theory of mind development.

Second, mother-child collaborative communication was only observed in the context of pretend play. In particular, in two of the three conditions observed in this study, mothers were asked to teach their toddlers pretend play with a specific theme (e.g., picnic). As a result, the topics and strategies of mothers-child communication episodes were constrained. Individual differences among dyads would be more likely to be amplified when they are observed in communication contexts that allow for creativity, such as book reading or problem solving tasks. The role of social context in the association between pragmatic functions of mother-child collaboration communication and children’s theory of mind development should be systematically examined in future studies. In addition to the context of communication, the partner of communication may also change the nature and characteristics of collaborative communication. A study on children’s conversations with friends, siblings, and mothers reported that mental state terms embedded in child-friend conversation were more likely to have cooperative and conversational functions than those in mother-child conversation (Brown et al., 1996). Whether and how the quality of relationship with communication partner is associated with the children’s collaborative communication and their understanding of others’ mind should also be examined in future studies.

Third, the present study examined the topic, strategies, and contrastives as dyadic measures of the functional use of language. These measures tend to overlook the effectiveness and affective quality of dyadic mother-child communication. That is, dyadic measurement in the present study did not reflect the qualitative aspect of communication, such as the level of comprehension by partners, the exchange of affect, and the sophistication of mental state
reasoning. Effective and positive communication may allow children better understand that people have false belief and that their false beliefs have an effect on their behavior. Children’s characteristics such as inhibitory control and communication skills may further alter the structure of mother-child collaborative communication such as sequences of mother-child communication acts. Therefore, in addition to the qualitative aspect, the structural aspect of dyadic collaborative communication and its contribution to children’s theory of mind development can be further researched in the future.

Moreover, the present study investigated the development of children’s theory of mind in two different domains: affective and physical. It is worth noting that there were differential associations of maternal use of inner-state terms and the topic of dyadic communication with children’s theory of mind development. Although it has been suggested that theory of mind in different domains may be developed in a similar fashion (Davis, 2001), theory of mind in different domains may demand different reasoning skills (Harwood & Farrar, 2006). Future research is needed to systematically examine whether and how different collaborative communication actions are associated with children’s physical and affective false belief understanding.

Finally, individual differences in theory of mind development are related to children’s social development (Frith et al., 1994; Watson et al., 1999). Children who perform well on the theory of mind tasks display greater perspective taking abilities and social competence such as prosocial behaviors, whereas children who perform poorly on the tasks are likely to show maladaptive social behaviors including peer rejection, poor communication, and aggression. To prevent problem behaviors in children who have deficits in theory of mind development,
intervention programs may be designed and implemented to foster their competence in social understanding.

Notwithstanding limitations of the present study, the current findings of positive contribution of collaborative communication to children’s theory of mind development have important implication for parents, teachers, as well as professionals in educational settings and healthcare services. The present study demonstrated that frequent confirming/supporting communication acts by mothers and toddlers and contrastives embedded in collaborative communication episodes predicted children’s advanced physical theory of mind. Mothers’ and children’s confirmation and support to the partner may provide direct feedback about their perception, desire, or beliefs on the situation and send a clear message that they are on the same page. Evidence from training studies (Lohmann & Tomasello, 2003; Melot & Angeard, 2003; Slaughter & Gopnik, 1996) also supports the speculations that linguistic feedback can help children better understand their experience, beliefs, and how the beliefs are formed. Thus, providing training to parents about when and how to provide confirmation and support during conversation with children may enhance children’s social understanding. Moreover, the results of the present study are consistent with the previous report that the use of inner state terms or talk about emotion were related to children’s advanced understanding of others’ behavior or feelings. Educators and practitioners may be encouraged to use inner state terms or emotion talk during conversation with children

Most of the studies on preschoolers’ theory of mind development are based on research from white, middle to upper-middle class samples. According to the studies with children from low-income families, their performance on theory of mind tasks was lower than the age norms (Massoff, 2007; Weimer & Guajardo, 2005). With continued investigation of the underlying
factors that contribute to children’s theory of mind development, early educators and policy makers may consider the enhancement of positive parenting skills by focusing on collaborative parent-child communication in a low income group such as those participate in the Head Start program.
References


APPENDIX A

Glossary for Making and Understanding the Transcripts

**Verbal**: The content of what is being said.

**Nonverbal**: Nonverbal behavior or nonverbal cues refer to voice tone, body, facial and other cues that convey communicative meaning.

**Interpersonal meaning**: The purpose of the coding system is to code communicative act at the level of interpersonal meaning. Interpersonal meaning includes the information that is being conveyed about the relationship between the interactants in the communication (e.g., hostility, cooperation). Meaning is conveyed through content as well as nonverbal cues to emotions and feelings present in the individual.

**Cultural informants**: An approach to coding described by Gottman (1984) in which coders share both an understanding of some of the universal signs and signals in human communication as well as sharing cultural specific understanding of the individuals they are coding. Cultural informants use all available cues (e.g., verbal, nonverbal and context) to infer interpersonal meaning. In the collaborative communication acts coding, verbal and nonverbal communicative acts are used to create the coding and are used to infer the psychological meaning of the interactants’ behaviors.

**Message units**: Coding unit for individual communication act

*Message units* were individual speech acts, or utterances, bounded by their intonation contour. These included single sounds, sentence fragments, and complete sentences.

**Communicative turn**: Coding unit for dyadic communication act

*Communicative turn*: A communicative turn is defined as the communication acts of one speaker bounded by another speaker’s communication acts (Shatz & Gelman, 1973) or a
significant silence of 5 seconds or longer. The mother or the child is considered taking a communication turn even if only one word is uttered. In addition, because both nonverbal and vocal signals can convey communicative meaning or intentional social acts, the mother or the child exhibiting these acts or cues will also be considered as holding the floor for a turn. Nonverbal communicative acts include (a) conventional signals such as pointing, nodding, or head shaking; (b) vocalizations such as laughing or crying, and (c) gaze toward the partner. In cases where a turn includes several utterances or nonverbal communicative acts, the turn is further segmented based on the rule that each communicative act is bounded by a pause of 1 second or greater. After each segmented verbal or nonverbal communicative act is identified, its pragmatic function will be further classified at the individual level. Next, based on the logical or thematic connection between sequenced turns by mother and child, collaborative communication episodes will be further identified at the dyadic level.

**Main Line**: lines beginning with * indicate what was actually said. These are called “main lines.” Each main line should code one and only on utterance. When a speaker produces several utterances in a row, code each with a new main line. After the asterisk on the main line comes a three-letter code in upper case letters for the participants who was the speaker of the utterance being coded. The three-letter code comes after a colon and then a tab. Utterances should end with an utterance terminator. The basic utterance terminators are the period (.), the exclamation mark (!), and the question mark (?).

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  e.g., *MOT: let’s make a bed.

  *CHI: yes, picnic!
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**%act**: nonverbal communication acts. Lines beginning with the % symbol can contain anything. Typically, these lines include codes and commentary on what was said. They are called...
“dependent tier” lines. The dependent tiers should be in lowercase letters. This tier describes the actions of the speaker or the listener or the facial expression. Here is an example of text accompanied by the speaker’s actions. The %act tier can also be used in conjunction with the ‘0’ symbol when actions are performed in place of speaking.

e.g., *CHI: 0.

%act: picks an apple.

And this tier can be coded as:

*CHI: 0 [%act: picks an apple] or *CHI: 0 [% picks an apple].

If the child does not respond, do the following:

*MOT: give a plate.

*CHI: 0.

%act: no response

[ ] : An action that occurs with a verbalization but is not a turn (Responses to another’s bid) (e.g., gaze direction, and gestures); Contextual information that shows with a verbalization but is not a turn. (e.g., pretend actions, objects used, joint focus of attention, and joint actions (e.g., singing together) of mother and child.

e.g., *MOT: look at that [= basket]!

*CHI: no [= cries]!

Unintelligible speech: xxx

Letters: Use upper case letters only for proper nouns and the word “I.” Do not use upper case letters of the first words of sentences. This will facilitate the identification of proper nouns.
APPENDIX B

Codes for Individual Collaborative Communication Acts

- Collaborative communicative acts are high assertive and affiliation, which include the following:

  (a) Inform (CI): providing related information or making descriptions or evaluations about the activity or play objects (e.g., “I do not have any food on my plate.”)

  (b) Guide/Request (CGR): providing suggestions, proposals, clarifications, or corrections (“We’re we going to have a picnic.”); asking directions or seeking task-related help (“Can you cover him up with a blanket?”)

  cf. Command/Control: an imperative statement often strongly delivered, or a behavior that would be direct, but delivered with non affiliative way. Typically, the delivery of Command/Control behaviors is rigid or abrupt and the tone of the mother’s voice may reveal a harsh quality often involving yelling, a high pitched intensity, or an angry inflection. However, the interlocutor’s nonverbal behavior can also be characterized as neutral, but not positive.

  (c) Confirm/Support (CCS): making explicit agreement, appreciation, or willing acquiescence (“I know you do”); showing understanding or emotional support, expressing shared amusement, or praising (“You did such a good job”).

  cf. Acknowledge: any behavior that answer, replies, responds or signals that the interlocutor has been listening to the other. This is a minimal response in that deeper understanding is not conveyed. For example, “Uh huh,” “I see” “Okay” “Oh” “Hmm” “(head nodding)”.
(d) Non-collaborative communication acts (NC): A communication act does not belong to three categories above. (1) If verbal communication act does not match with their nonverbal communication act (e.g., The mother request “Can you give a plate?” with taking her plate by herself) or (2) if the verbal communication act is inconcrete or contradictory, (e.g., The mother asks “Do we need some forks?” Child replies, “no enough” with picking a fork and showing little hesitation), these communication acts will be coded as Non-collaborative communication acts.

- Each *CHI and *MOT line is a coding unit for individual collaborative communication acts.
- Collaborative communication acts of mother and child were coded separately.
- Communicative acts were excluded if mothers or children simply repeated themselves.
APPENDIX C

Codes for Dyadic Collaborative Communication Acts

1. Identification of Collaborative Episode

• When the episode begins, the starting utterance row were coded as E*(the number)B.
  When the episode ends, the ending utterance row were coded as E*(the number)E.

• Definition of collaborative episode: it is defined as sequenced turns of maternal and child
  verbal and nonverbal actions that are logically and/or thematically related and continue
  for at least three turns. In each collaborative communication episode, both mother and
  child provide evidence of continued joint focus of attention or actions through extension
  of each other’s ideas and actions, maintaining a shared understanding, and making
  attempts to repair misunderstandings. When judging the connection between turns, in
  addition to the content of speech and nonverbal behaviors (e.g., pointing, nodding, or eye
  contact), three other indicators include acknowledgements, initiation of a relevant next
  turn, and continued attention.

• Start and end of collaborative episode: Based on Clark and Brennan’s (1991) contribution
  model, the starting point of a collaborative communication episode is an initiation turn in
  which the speaker initiates a new topic that is unrelated to the partner’s previous turn, but
  is successful in eliciting a logically, thematically, and/or semantically related response
  from the partner [coded as E#(the number)B]. A collaborative communication episode is
  terminated, when the shared topic or theme is shifted from a continued topic to a non-
  relevant topic or when the partner is unresponsive to the previous turn [coded as E#(the
  number)E].
• Use of Team Method: Because of the difficulties involved in identifying the beginning and ending of dyadic collaborative communication, a team method were used. Two coders work together as a team to identify the collaborative communication episodes. Coding was done on the basis of the transcripts. However, when questions or disagreements arise, videotapes were viewed as an aid to the coding. All disagreements in coding were resolved through discussion before a final decision is made.

• The total frequency of collaborative communication episodes was tallied.

2. Classification of the Topic/Theme of Collaborative Communication Episode as Cognitive or Affective Topic

• Use of Team Method

• Collaborative episode with cognitive topic [coded as C]: Cognitive episodes refer to the topics of collaborative communication episodes denoting mental activities such as thoughts, memories, ideas, beliefs, or knowledge of the mother, the child, and/or a third party (e.g., others, a doll), those centered on elaborating or clarifying the partner’s actions to avoid or resolve misunderstanding, or those centered on pretense enactment (e.g., symbolic substitution, imaginary events, or a fantasy theme).

Reference words

Cognitive state terms are used to refer to genuine mental activity or acts used to process information mentally. They were used to identify whether the topic/theme of each collaborative episode are related to the following cognitive state.

Cognitive state lexical terms: “think,” “believe,” “know,” “remember,” “forgot,” “mean,” “understand,” “assure,” “concentrate,” “distract,” “expect,” “figure,” “guess,”
“idea,” “ignore,” “imagine,” “interest,” “learn,” “pretend,” “recognize,” “trust,” “understand,” “wonder”

- Collaborative episode with affective topic [coded as A]: Affective episodes are those centered on the discussion or communication of the emotional and/or physiological state of the mother, the child, or the third party (e.g., others, a doll).

Reference words
Affective state terms refer to emotional states such as “happy,” “sad,” “feel,” “cross,” “angry” and their variations. Inner-state terms referring to physiological states or connoting observable emotional actions such as “cry,” “smile,” “laugh,” “ill,” “hurt” (Howe, 1991) were included as affective state. It used to identify whether the topic/theme of each collaborative episode are related to the following affective state.


A collaborative episode may include both affective and cognitive topic/theme. In such cases, the collaborative episode was classified as affective topic.

- Collaborative episode with non-mental related Topic [coded as N]: The collaborative communication episodes with topics that do not center on cognitive or affective state and those focusing on factual talk and repetition of other were coded as N.

3. Identification of Collaborative Strategies within Collaborative Communication Episode
• Collaborative strategies are defined as pragmatic strategies that are used to construct shared topic or theme during a collaborative communication episode and are classified as simple or advanced. Imitation/repetition, passive maintenance, and revision will be coded as simple strategies. Extension of semantic elements, explanation/elaboration, and support/supplement will be coded as advanced strategies. The definitions and examples of simple strategies and advanced strategies are the following:

• Simple strategies [coded as S]
  (1) Imitation/repetition: Repeating and reiterating previous utterance or action by the partner without adding any new information.
  (2) Passive maintenance: Responses used to passively maintain or confirm a shared topic/theme: (a) acceptance: Explicit approval of the partner’s idea (e.g., “yes”) or simple following of the partner’s suggestion or action, and (b) conciliations: submission or compliance to the partner’s will
    e.g., after discussing the placement of a toy chair, one says “alright” in a resigned tone of voice
  (3) Revision: Changing the partner’s idea with no explanation or elaboration
    e.g., “No, it’s milk, not juice.”

• Advanced strategies [coded as A]
  (1) Extension: Adding new information and/or expectations to the partner’s idea expressed in the previous turn by (a) extending partner’s previous contribution through explicit or implicit agreement and adding new information (e.g., the mother holds the teddy doll and says “It’s a bear” and the toddler responds “That’s a baby bear”), and (b) building on to one’s previously
expressed idea (e.g., the toddler pretends pouring into a cup and says “I want some juice” and the mother responds by pretending pouring into her own cup and says “I want some milk”).

(2) Explanation and elaboration: Verbal statements or nonverbal actions used to explain or elaborate previous actions in order develop a shared understanding about joint attention and/or action

   e.g., “The baby needs a bottle because he is hungry.”

(3) Support and supplement: Statements or actions used to show support and provide supplementation to the partner’s communication acts include giving objects or making statements to reflect joint activity, teaching, or helping

   e.g., “Let me show you how to do it.” or “We are going to make a picnic table.”

4. Identification of the Contrastive Perspectives within Collaborative Communication

   Episode

Contrastives [coded as C] refer to communicative acts which distinguish one’s thoughts and beliefs from other states of affairs. Contrastive perspectives include contrasting belief with reality (“I don’t think there is grandmother”), contrasting desire with outcome (“I don’t want pink fork. I want blue one”), contrasting one’s own mental state at one time with a later changed state (“This is a blanket,” covering the baby doll, and then, “It can be a rug” putting the rug on the floor), contrasting one’s own mental state with another’s mental states (when the mother made the mother doll sit on the toy chair and then put the baby doll on the mother doll’s lap, the child said, “The mommy (is) eating the baby’s cake.” The mother said “She got a new piece.”) and so on (Bartsch & Wellman, 1995). In the four types of contrastives, the first three types of contrastives were counted as one occurred and the last individual
contrastives (constrasting one’s own mental state with another’s mental states) was counted as two because there were two contrastive utterances. The contrastive was distinguished with conflicts. Conflicts refer to “the parties have two different action proposals, and they argue about and defend their respective action proposals by citing the desires that motivate the actions” (Bartsch & Wellman, 1995, p. 116).

Example 1. During pretend play,

*MOT:    the bear is hungry.

*CHI:    the bear is not hungry/the bear is sleeping.

Example 2. One could present different perspectives about one object “It is a soup, but now it is a juice.”
APPENDIX D

Script for Affective False Belief Tasks

**Task 1. Birthday Gift** (hiding negative emotions)

Jenny/Benny gets a birthday present from her/his aunt. Jenny/Benny opens the present and looks like this on his face [put a happy face on doll’s face].

Question 1. How do you think Jenny/Benny is feeling inside? [ask child to put a face on doll’s chest]

Now I’m going to tell you how Jenny/Benny is really feeling in his/her heart. Jenny/Benny really feels sad because the present is just a baby rattle. But Jenny/Benny doesn’t want her/his aunt to see how s/he feels because s/he doesn’t want to hurt her/his aunt’ feelings.

  Question 2. [take off the old face and ask child to put a new one on doll’s chest] Now, how do you think Jenny/Benny really feels in his/her heart?

  Question 3. [turn the doll away from child] How did you think Jenny/Benny felt, before I told you how s/he really feels in his/her heart? (Representational change)

Susie/Tommy has never been told how Jenny/Benny feels in his/her heart. S/he comes into the room and sees Jenny/Benny for the first time.

  Question 4. [take off the old face and ask child to put a new one on doll’s chest] How will Susie/Tommy think Jenny/Benny feels? (Theory of mind)

**Task 2. Chocolate Cake** (hiding negative emotions)

Jenny/Benny is at a friend’s house and her/his friend’s mother makes a chocolate cake for her/him. Jenny/Benny takes a bit of the cake and looks like this on her/his face [put a happy face on doll’s face].

  Question 1. How do you think Jenny/Benny is feeling inside? [ask child to put a face on
Now I’m going to tell you how Jenny/Benny is really feeling inside. The cake really tasted yucky and Jenny/Benny is really sad that the cake tastes bad. But Jenny/Benny wants to be nice and polite.

Question 2. [take off the old face and ask child to put a new one on doll’s chest] Now, how do you think Jenny/Benny really feels in his/her heart?

Question 3. [turn the doll away from child] How did you think Jenny/Benny felt, before I told you how s/he really feels in his/her heart? (Representational change)

Susie/Tommy has never been told how Jenny/Benny feels in his/her heart. S/he comes into the room and sees Jenny/Benny for the first time.

Q4. [take off the old face and ask child to put a new one on doll’s chest] How will Susie/Tommy think Jenny/Benny feels in his/her heart? (Theory of mind)

**Task 3. Mean boy tripping** (hiding positive emotions)

Jenny/Benny sees a boy in her class trip and fall. S/he walks over to him and looks like this on her/his face [put a sad face on doll’s face].

Question 1. How do you think Jenny/Benny is feeling inside? [ask child to put a face on doll’s chest]

Now I’m going to tell you how Jenny/Benny is feeling in his/her heart. Jenny/Benny doesn’t like the mean boy and she really feels happy that he fell. But Jenny/Benny doesn’t want the boy to know how s/he feels because he may get made and pick on her.

Question 2. [take off the old face and ask child to put a new one on doll’s chest] Now, how do you think Jenny/Benny really feels in his/her heart?

Question 3. [turn the doll away from child] How did you think Jenny/Benny felt, before I
told you how s/he really feels in his/her heart? (Representational change)

Susie/Tommy has never been told how Jenny/Benny feels in his/her heart. S/he comes into the
room and sees Jenny/Benny for the first time.

Question 4. [take off the old face and ask child to put a new one on doll’s chest] How will
Susie/Tommy think Jenny/Benny feels? (Theory of mind)

Task 4. Swimming (hiding positive emotions)

Jenny/Benny class was supposed to have a swimming party but it is raining so they can’t go
swimming. Jenny/Benny looks out the window at the rain and looks like this on his face [put a
sad face on doll].

Question 1. How do you think Jenny/Benny is feeling inside? [ask child to put a face on
doll’s chest]

Now I’m going to tell you how Jenny/Benny is really feeling in his/her heart. Jenny/Benny is
afraid to swim, so s/he really feels happy that it is raining. But Jenny/Benny doesn’t want the
other children to know how s/he feels because they might tease her/him about being afraid.

Question 2. [take off the old face and ask child to put a new one on doll’s chest] Now,
how do you think Jenny/Benny really feels in his/her heart?

Question 3. [turn the doll away from child] How did you think Jenny/Benny felt, before I
told you how s/he really feels in his/her heart? (Representational change)

Susie/Tommy has never been told how Jenny/Benny feels in his/her heart. S/he comes into the
room and sees Jenny/Benny for the first time.

Question 4. [take off the old face and ask child to put a new one on doll’s chest] How will
Susie/Tommy think Jenny/Benny feels? (Theory of mind)
APPENDIX E
Scripts for Physical False Belief Tasks

Task 1. Unexpected Contents (M&M or Fish)

Place container on the table across from the child. Do you see what I have put on the table?

Question 1. What do you think is inside the box [container]? [The child is not to touch the box.]

Okay, you think that there are xx in the box. Let's open it and see. [Together open the box. Take out the item. Show it to the child.]

Question 2. What is really in the container? Let’s put it back behind the line.

Question 3. Before you looked inside, what did you think was in the box?

(Representational change)

Question 4. What is really inside the box?

Look, here is Charley. Charley has not seen this box before. S/he does not know what it is inside this box.

Question 5. What does Charley think is in the box? (Theory of mind)

Question 6. What is really inside the box?

Task 2. Change of Location (blue marker)

[Introduce doll] This is Mary. She likes to draw pictures. Her favorite marker is the blue marker. She likes to draw pictures with her blue marker [simulate drawing with Mary’s hand]. Mary’s mom is calling her, so Mary puts her marker away in the box and goes to her mom. [Simulate putting away marker and have Mary leave]

[Introduce another doll] This is Mary’s brother, Sam. Sam wants to draw a picture with the blue marker. So, he takes the marker out of the box and draws with it [simulate action with Sam’s
hand]. When he is done, he puts the blue marker in his bag and goes to play. [Simulate putting away marker and have Sam leave]

[Place Mary in between bag and box] Mary returns to finish her picture. She wants to use her blue marker.

   Question 1. Where will Mary look for the blue marker? (Theory of mind)

   Question 2. Where is the blue marker really?

   Question 3. Where did Mary put the blue marker?

Task 3. Appearance-Reality (candle/crayon)

[Place the candle on the table across from child] Do you see what I have put on the table?

   Question 1. When you look at this, what do you think it is?

Okay, so it looks like (child’s answer) to you. [hand candle to child] Look at it carefully.

   Question 2. What is it really?

Yes, it is really a candle. [set candle marker back across from child]

   Question 3. When you first saw it, before you touched it, what did you think it was?

   (Representational change)

   Question 4. What is it really?

[Bring Charley to table] Here’s my friend Charley again. He’s never seen this before.

   Question 5. When Charley first sees this, what will Charley think it is? (Theory of mind)

   Question 6. What is it really?

Task 4. Expectation/Explanation (Band-aid box)

[Place band-aids box and a plain box on the table behind the line] I have a band-aid box and I have a plain box.

   Question 1. Where do you think the band-aid is?
[Open each box. Show that the prototypical box is empty but that the expected contents are in the plain box. Close boxes.] [Introduce puppet] Look, here is Charley. Charley has a cut, see? Charley needs a band-aid.

   Question 2. Where is the band-aid really?

   Question 3. Where will Charlie look for the band-aid? (Theory of mind)

   Question 4. Where is the band-aid really?

[Introduce stuffed animal] This is Charley's friend Ling-Ling. Ling-Ling also needs to have a band-aid. [Show Ling-Ling has a missing nose. Move Ling-Ling towards the band-aid box. Mimic that s/he wants to open it.]

   Question 5. Why do you think Ling-Ling is looking in that box? (Theory of mind)

   Question 6. Where is the band-aid really?