Where Will the Dinosaur Look for His Ball? --Children's False Belief Understanding and the Mental State Verb "*yi3wei2* 以為"

恐龍會去那裡找它的球呢？—兒童對他人錯誤認知及「以為」的瞭解

吳信鳳*

INTRODUCTION

While most adults may appreciate the humor in the above episode, a few may not, either because they don't think it is funny or they simply don't get it. Even fewer, perhaps, wouldn't understand the story at all: why would the salesman and his wife behave in such a peculiar way. These people don't have an idea

as to what the salesman and his wife were thinking when they did what they did.

The ability of humans to communicate with one another is to a large extent due to our understanding of each other's experiences, thoughts, desires, feelings, intentions, beliefs, and so forth. We anticipate responses and interact smoothly after developing the ability to understand other people's internal or mental states. During election campaigns, for example, politicians tend to carefully draft their statements according to what they think the voters would like to hear. Without knowledge of their voters' needs or thoughts, they are more likely to lose the election. In the same way, colleagues must understand each other's concerns on the job in order to work together efficiently. Interpersonal communication would fail if the ability to understand other people's mental states is not developed properly or is in disorder.

Shatz (1994) refers to the understanding of others' mental states as "second-order thinking -- thinking about the thoughts of others" (P. 143). Second-order thinking is a crucial part of one's social cognition, and it is almost impossible for one to function normally in daily life without it. For second-order thinking to develop, one needs to have a "theory of mind" (Astington, 1993;

Astington, Harris, & Olson, 1988) - an understanding that people have mental states which include desires, intentions, thoughts and beliefs, and that people's actions are related to their internal states, and that their internal states can be different from one's own. In the above story of the salesman and his wife, most adults can gauge what the couple were thinking and how they responded to the knock at the door. Obviously both the wife and the husband had cheated on each other previously and were afraid of being caught.

Children's understanding of false beliefs

While adults are generally quite competent in second-order thinking, exercising it regularly in everyday life, it is a difficult task for young children, especially children at the preschool level. It is believed that the development of a theory of mind (TOM hereafter) is closely tied to maturational factors, i.e., it is age-related. With a developed theory of mind, an adult is much better able to anticipate other people's thoughts and behavior. Aside from experiences and knowledge of various forms of social intricacies, what makes it possible for most adults to glean the humor of the salesman story is their ability to put themselves "in other people's shoes," or in Chinese, to be able to "she4shen1 chu3di4" (設身處

地）（吳麗芬，1996). Children are certainly less experienced socially, but the fundamental reason for them not to understand the story is that their **theory of mind** is underdeveloped or not as sophisticated.

The term "children's theory of mind" is worth some clarification. It does not mean that the child is really developing a theory in its scientific sense, but rather "a way of thinking and talking about self and others that involves mental states" (Moore & Frye, 1991, p. 1, note 1). While Moore and Frye's interpretation of children's TOM is a sensible one, the term "theory" in TOM is appropriate in this context. In making sense of the world as well as people's internal worlds, children are constantly making and testing hypotheses in their own way. They gather evidence, form generalizations, generate rules, modify prior knowledge, and eventually "a theory" is established. In this sense they are actually developing or creating their own theories, not in a strictly scientific sense, but nonetheless in a "quasi-systematic" way given children's limited cognitive and social resources.

Based on the evidence of a variety of studies (Astington, 1993; Astington & Gopnik, 1988; Baron-Cohen, Leslie, & Frith, 1986; Flavell, Green, & Falvell, 1995; Gopnik & Astington, 1988; Hirschfeld & Gelman, 1994; Perner, Leekam, & Wimmer, 1987;

Wimmer & Perner, 1983), children's TOM is not fully developed until 4 or 5 years old. In other words, children under 4 or 5 may not have acquired an ability to understand other people's thinking or to engage in mental perspective taking, i.e., to think about what goes on in another person's mind.[1]

A key measure of children's TOM development is their ability to understand that another person may hold a **false belief**, i.e., others' beliefs or ideas may not match reality. Most studies of false belief typically follow the original false belief paradigm devised by Wimmer and Perner (1983). Usually presented in a story, false belief tasks ask children to make a prediction as to how one of the characters will behave at the end of the story and the children's judgment will reveal their ability to engage in mental perspective taking, i.e., to think about what goes on in another person's mind. There are two prototypical false-belief tasks that are generally considered as the "definitive" tests of false belief understanding.

(1) Unexpected content tasks

In unexpected content tasks, the child is presented a box or container such as a lunch box. The child is then asked what he/she thinks there is inside the box. After the child responds, the

child is then allowed to open the box, only to find something unexpected inside such as toys. Then the child is asked about someone else who has never seen inside the box: "What will she think is in the box, food or toys?" In Perner, Leekam, and Wimmer's (1987) study, the children were shown a Band-Aid box with crayons inside, so the question was: "What will she think is in here, Band-Aids or crayons?"

(2) Unexpected transfer tasks

In unexpected transfer or change of location tasks, a character (a toy or a doll) puts an object in one of two locations. While the character is away the item is removed from the original location. The child tested is asked where the character will look when he/she comes back. Most of this type of tasks follow the prototypical change of location task in Wimmer and Perner's (1983) study in which a character named Maxi puts his chocolate in the drawer and his mother moves it to the cupboard when Maxi is out. The child tested is asked: "Where will Maxi look for his chocolate, in the drawer or in the cupboard?"

An appropriate or correct answer to the unexpected content task is to say that the next child will think there are Band-Aids in the box, since he or she wouldn't know what's inside the box

before opening it. A correct response to the unexpected transfer task depends on the child's understanding of what Maxi will be thinking. By answering that Maxi will look in the original location (drawer), the child demonstrates that he or she realizes Maxi's belief about the location of the chocolate is different from his or her own. Correct answers to these two false belief tasks will suggest whether the child has acquired TOM or not. The proper prediction reveals that this child has an understanding that other people's actions are related to their internal states and that their internal states can be different from one's own. This understanding is related to two abilities in successful second-order thinking: (1) the ability to take a different perspective, and (2) the ability to make an accurate assessment of others' internal states.

The amount of research on TOM and children's understanding of false belief have proliferated in the past two decades in the areas of child development, cognitive and developmental psychology, psycholinguistics, and other relevant areas. A meta-analysis by Wellman, Cross, and Watson (1999) on research of false belief understanding using the two tasks described above has found 177 separate studies in recent years. The findings all point to the same result: TOM ability is age-related and it is generally developed between 3 - 5 years of age.

Is TOM development universal?

Inquiries about whether such development is the same in children across the world led to many cross-linguistic studies, adding to the large store of research conducted of English-speaking children. The results show that Chinese[2], Japanese, and British 3-year-olds experience similar difficulties in TOM-related tasks (Flavell, Zhang, Zou, Dong, & Qi, 1983; Harris & Gross, 1988). Avis and Harris's (1991) study with Baka children in West Africa has generated similar results too. They argue that TOM development in children between the ages of 3 and 5 is generally universal.

There are also several studies (Goetz, 1999; Lee, Olson, & Torrance, 1999; Tardif & Wellman, 2000) of Chinese and Chinese/English bilingual children's performance in TOM tasks. Their results also corroborate the developmental pattern of other studies. Goetz (1999) tried to prove a TOM advantage of bilingual children, but her hypothesis was not fully supported by the results. In Goetz's study, the performance of the three groups of children -- (1) Mandarin-Chinese monolinguals in Beijing, China, (2) English monolinguals in the U.S., and (3) Chinese/English bilinguals in the U.S., did not differ from one another. Actually, the 3 and 4 years

old monolingual and bilingual children in her study presented striking similarities in TOM performance across various linguistic communities/cultures.

Lee, Olson, and Torrance (1999) and Tardif and Wellman (2000) have both presented linguistic analyses on Chinese mental state verbs. Lee et al. (1999) dealt with manipulations of Chinese mental state verbs in administering the false belief tasks given to Chinese-speaking children with a view to assessing the impact of these verbs on children's performance in the false belief tasks. Tardif and Wellman focused on Mandarin- and Cantonese-speaking children's developmental profiles of mental state terms such as *xiang3* 想 or *zhi2dao4* 知道. Their study of Chinese-speaking children's acquisition of mental state expressions shows a developmental pattern similar to that in English, with early use of desire terms like *yao4* 要 or *xiang3 yao4* 想要 followed by mental state references about beliefs or knowledge like *zhi1dao4* 知道 or *xiang1xin4* 相信. However, the Chinese-speaking children used desire terms much earlier, and the use of mental terms was very infrequent, even for Mandarin-speaking adults.

Languages worldwide all contain expressions referring to

needs, feelings, emotions, beliefs, thinking, and knowing. Researchers (Bretherton, 1991; Hogrefe, Wimmer, & Perner, 1986; Moore, Bryant, & Furrow, 1989, Wellman, Harris, Banerjee, & Sinclair, 1995) have observed that most children acquire these terms and meanings in a similar order. A theory of mind about others' desires and emotions develops prior to a TOM about beliefs and knowledge. Tardif and Wellman (2000) believe that desires and emotions may be cognitively and representationally more accessible to young children. For young children, it is easier to understand what other people want or like than what they know or believe in. Wantings or feelings are experiences a child can easily relate to since very young age (I like chocolate. He hates dogs.). An understanding of another's thinking or knowledge requires a more representational understanding of those mental states, and is thus more cognitively demanding.

Tardif and Wellman's (2000) study suggests a consistency in the overall sequence of the development of TOM, i.e., a TOM of desires and emotions develops before that of beliefs and thoughts, but there are variations in the timing of beginning and end points in children's TOM development across cultures. Goetz's (1999) study on Chinese and English speaking preschoolers also gives no support to the position that characteristics of a language may

influence children's TOM development. The cross-linguistic and cross-cultural studies cited (Flavell, Zhang, Zou, Dong, & Qi,1983; Harris & Gross, 1988; Avis and Harris, 1991) have all pointed to the evidence that TOM development tends to be universal. A biological account (Baron-Cohen, Leslie, & Frith, 1986; Leslie, 1987, 1988; Sabbagh & Taylor, 2000) would argue that these near universal patterns are an indication of the maturation of an underlying TOM module or the neuro-biological maturation of some processes involved in cognitive function.

WHY IS TOM IMPORTANT?

Facing the great abundance of research, one cannot help asking: why has children's TOM engaged so much research effort? What is the significance of TOM? As illustrated in the previous review, children's TOM refers to their ability to think about other people's mental states, or their understanding of other people's minds, including others' emotions, desires, feelings, knowledge, beliefs, and thinking. Why is such an ability or understanding in children important? Moore and Frye (1991) give two basic and related reasons below.

A theory of mind makes an enormous difference to the

> child. . . . it transforms the way children are able to see other people and make sense of what they are doing. Of course, it also makes a difference to our understanding of the child. (p. 2)

On the one hand, children's acquisition of TOM changes qualitatively the way children think about the world. On the other hand, an exploration of TOM would increase our understanding of its nature and development, and accordingly our understanding of the child. Commenting further on the utility of a TOM to the child, Moore and Frye (1991) point out its social and cognitive functions. First, a TOM is obviously a powerful social tool, which makes possible "the explanation, prediction, and manipulation of the behavior of others" (p. 3). Secondly, the acquisition of a theory of mind is "instrumental in the development of particular forms of reasoning," (p.3) thus representing an important step in children's cognitive development. Children's performance of TOM-related tasks is significant to us because it could serve as a cognitive guide for explaining developmental changes in the child's responses to situations where they must consider what other people are actually thinking and doing -- an issue common to almost all of the child's social encounters.

Research on children's TOM is highly significant because it is closely related to children's **cognitive, social, and linguistic** development. Cognitively, TOM acquisition is an important and reliable index of a child's intellectual development. In studying children's mind, one needs to understand how children think about the people around them and how children make sense of reality. Drawing implications from research on children's language acquisition (see 吳信鳳, 2000a, 2000b, for a summary of language learning theories), a child, when learning languages, does much more than just listen and imitate. Exposed to various language input and interactions, the child is making hypotheses, generalizing rules for the language, establishing his/her "grammar" - a more or less systematic and coherent linguistic system of a language. In other words, the child is learning the language by making sense of both its regularities and inconsistency through a highly complicated but creative process.

In much of the same vein, children's cognitive development is an amazing undertaking of children's pursuit of internal consistency and coherence with the amorphous experiences they are facing in the world. In the development of reasoning, each child goes through a more or less similar process of making hypotheses, generating rules, establishing internal consistency, and gradually

making a transition from a reality-bound, intuitive way of thinking, to a highly abstract, logical, and adult-like thinking. In the pursuit of internal coherence and consistency, each child draws on his or her own experiences and cognitive resources, however limited they may be, and each adopts particular strategies. Owing to the highly individualized nature of each child's experiences and cognitive capabilities, each would present unique patterns in reacting to and interacting with the world in this unfolding process. The pace of development is also quite varied.

Children's theory of mind is thus developed as well as created by children as part of their cognitive development. Accordingly, there are several important characteristics in the nature of children's TOM development. First, it is a mental phenomenon constantly in progress. It would thus be inappropriate to say a child has or doesn't have a theory of mind since its acquisition is a gradual development. Secondly, there are tremendous individual differences in the process. Each child proceeds through this development based on one's personal circumstances, at one's own pace, drawing on one's particular experiences with the world. Thirdly, it involves a great deal of creativity on the part of the child. In trying to make sense of people's internal worlds, children try different strategies. When

things don't make sense to them, i.e., when they are "off balance," they would come up with whatever explanations to "convince" themselves as well as others in order to maintain, in Piaget's term, their intellectual "equilibrium." The whole process is like a car race in which each child is driving a different car at a different speed with varying sophistication of driving skills, but in which almost all of them would make it to the end in the race.

Many studies in children's TOM performance have focused solely on the pass or fail dichotomy, checking whether children have achieved TOM or not based on the test results. They tend to miss the **progressive**, **individualistic**, and **creative** nature of children's TOM development. The dichotomous measurement, while at best serve to indicate children's TOM performance at a specific point, are hopelessly inadequate in explaining the developmental nature of children's TOM, not to mention the variability and creativity in the change over time of children's mind. Some studies, by manipulating different test stimuli, concentrated on enhancing children's TOM performance as if that had been the ultimate purpose for TOM research. While it is justifiable to look for explanations for TOM performance using experimental procedures, it tends to miss the forest for the trees and even be pointless if a better performance is the only goal for this line of

research.

Another major argument among researchers regarding TOM acquisition is whether it is part of children's general cognitive development, or it is a module, some specific mechanism independent of the general cognition.[3] Leslie (1987, 1988, 1991), a strong supporter of the modularity account, argues that the development of TOM is a result of biological maturation of a specific module, which resides in a certain area of the brain. If this particular area is impaired or under-developed, it results in autism. In other words, the fundamental deficit of autism is the failure of autistic children in developing the biological prerequisites for a theory of mind. Based on the evidence that autism arises from a specific cognitive defect and particular biological abnormalities associated with it, Leslie and other modularity theorists (Baron-Cohen, 1994; Brothers & Ring, 1992) have proposed the existence of a "theory of mind module." TOM-related tasks such as false belief tests would thus serve as a good diagnostic tool for potential autism.

Sabbagh and Taylor's (2000) study provides neurological evidence in favor of Leslie's claim. They tested 23 right-handed college students with electrophysiological (ERP) measurement on a false-belief and a false-photograph task -- one required

engagement in mental representation of false belief and the other called only for non-mental photographic representation. Their ERP data suggest the possibility of a radially oriented generator within the left frontal lobe of the brain. Bishop (1992) also proposes a biological account of TOM and autism, indicating their relatedness to abnormalities of certain brain structures involved in information-processing abilities.

Socially, TOM is a necessary and powerful tool for carrying out crucial social functions. If we break basic social behaviors into two forms: cooperation and competition, the understanding of other people's needs, desire, beliefs, thoughts, intention, and knowledge plays a central role in either form of social interactions (Moore & Frye, 1991). In cooperative interactions, one has to have the ability to take into account the needs and desires of others as well as to assess their beliefs and knowledge in order to maintain a supportive and altruistic relationship. In competition, it is essential for one to be able to recognize the conflicts of needs and desires coming from different beliefs and knowledge of the competitors. To be in an advantageous position (or to avoid losing, e.g., when a child is caught having candies before meal) in a competitive scenario, one of the first strategies a child develops is deception, of which an overt behavior is lying (Chandler, Fritz, &

Hala, 1989; Moore & Frye, 1991; Wimmer & Perner, 1983). The act of lying requires the "liar" to give someone else a false belief or a misrepresentation of reality. To be able to lie "successfully," one needs to know first others HAVE mental states and they can be manipulated to have false beliefs.

TOM ability is also a diagnostic tool for measuring children's development of social cognition (Wellman, Cross, & Watson, 1999) and is considered a precursor of mature communication (Shatz, Wellman, & Silber, 1983). As mentioned earlier, smooth social communication depends on the exercise of the second order thinking, which requires the development of a theory of mind. The understanding that one's interlocutor has thoughts, beliefs, and intentions is a fundamental basis for true participation in mature human communication (Dennett, 1979; Shatz, 1983a, 1983b; Shatz, Wellman, & Silber, 1983). If one's TOM is not developed or impaired, one may have difficulty in communications and other relevant daily operations. For example, in the unexpected transfer task, autistic children tend to perform like typical 3-year-olds regardless of their age, unable to realize that the absent child has a false belief about the location of the candy (Baron-Cohen, Leslie, & Frith, 1986; 許月琴,1999). Autistic children's inability to understand that others have mental states

causes them to interact in an asocial and inappropriate way.

Linguistically, a number of studies have suggested that language ability is closely tied to performance of false-belief tasks (Goetz, 1999; de Villiers & Pyers, 1996; Jenkins & Astington, 1996; Peterson & Siegal, 1995; Shatz, Martinex, Diesendruck, & Akar, 1995; Welch-Ross, 1997). Jenkins and Astington (1996) have found that general language ability and verbal memory are significant predictors of false belief understanding, and that children are not able to pass false belief tasks before they reach a certain threshold score on the Test of Early Language Development. On the other hand, the findings of Welch-Ross (1997) indicate that theory of mind scores are not related to linguistic skills as measured by the mean length of utterance (MLU), arguing that it should be specified which particular language abilities are related to children's false belief understanding.

The linguistic account also examines the relationship between the cognitive aspect of TOM and its linguistic representations. Researchers examine TOM development and the acquisition of mental state expressions such as "think," "know," "believe," and relevant syntactic constructions with a view to understanding the interrelations of TOM language and thought. One major claim is that certain linguistic forms or constructions

may facilitate or enable TOM development (Astington & Jenkins, 1995; de Villiers & Pyers, 1996; de Villiers & de Villiers, 2000).

In investigating the role of language in the development of false belief understanding, de Villiers (1997) has noticed that young children below 3½ tend to misrepresent the structure of embedded complements such as: "He said he drank milk." As a result, children have a difficulty with questions such as: "What did he say he drank?" For many young children, the above question would be the same as: "What did he drink?" (see also Wimmer & Hartl, 1991; Riggs & Robinson, 1995). Young children who have such difficulties tend to consistently fail the false belief tasks. De Villiers and de Villiers (2000) conclude that the problem is a linguistic one. Young children have a clause structure that lacks some crucial feature, namely, whatever it is that allows the embedded proposition to be false but does not violate the overall truth value of the sentence. As for which particular language structure or form encodes such propositional attitude about understanding of other people's false beliefs, de Villiers and de Villiers (2000) appoint a full, tensed complemental that-clause headed by a mental state verb such as "think," "guess," "assume," and etc. An example of such construction is: "He thought that his mother had been out."

LANGUAGE AND THOUGHT IN CHILDREN'S TOM

Linguistic determinism: Language determines thought

The claim of de Villiers and de Villiers (2000) clearly puts them in the camp of linguistic determinism, a strong version of the linguistic relativity hypothesis proposed by Benjamin Lee Whorf in 1956 (see Wu, 1994 for a detailed introduction of the hypothesis). Proponents of linguistic determinism would argue that language to a large extent determines thought. In the context of TOM development, researchers (de Villiers, 1997; Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991) advocating such a position would argue that language development facilitates social cognition and development of a theory of mind. Olson (1988) also advocates the view that language is the primary phenomenon, proposing that the awareness of mental states depends on the acquisition of a meta-language for talking about propositions. Consequently, children must first acquire necessary linguistic representations to make it possible for them to be able to conceptualize the mental states of other people.

Cognitive determinism of language development: Cognition drives language

Quite a few researchers hold the opposing view to the linguistic determinism account of TOM language and thought. From the broader context of children's language and cognitive development, Cromer (1991) and Tager-Flusberg (1994, 1997) strongly argue that it is cognition that determines language, not the other way around. They contend that conceptual understandings of the mind develop first and are the basis onto which language maps. Regarding the specific interrelations of TOM and its corresponding linguistic expressions, researchers (Bretherton & Beeghly, 1982; Shatz, Wellman, & Silber, 1983; Wellman, 1990; Bartsch & Wellman, 1995) believe that understanding of beliefs and states of mind is prerequisite for correctly using the linguistic forms that express those concepts.

It is generally believed that children's understanding of mental states emerges out of the interaction between maturing cognitive capacities (e.g., innate modules and the role of maturation, Leslie, 1994; cognitive development of different levels of representation, Perner, 1991; working memory development, Olson, 1993) and social awareness from interaction with others

(Shatz, 1994). In other words, the cognitive capability for understanding of mental states and the linguistic expressions necessary for descriptions of it should develop more or less simultaneously, i.e., comprehension and production of mental state understanding develop at similar rates, making the linguistic mapping of mental terms onto mental states feasible.

Therefore, in many cases the emergence of children's talk about mental states, using verbs such as "need," "think," "know," and "remember," has been taken as a marker of their growing underlying conceptual understanding of a variety of mental states in themselves and others.

Linguistic masking of conceptual understandings: Cognition masked by language

A third group of researchers (Freeman, Lewis, & Doherty, 1991; Goetz, 1999; Siegal & Peterson, 1994) hold the linguistic-masking position in the issue of language and thought in TOM. They contend that children's conceptual understandings of the mind develop first, but their underlying competence may be masked or delayed by linguistic complexity and pragmatic features, a position very much in accord with the weak version of the linguistic relativity hypothesis, i.e., language, though not

determining thought, tends to affect the thought processes or reasoning. Therefore, in an experimental context, children's TOM ability may be underestimated by the language used in the theory of mind tests.

Among the three views of the language and thought in TOM development, this study holds a position similar to that of the cognitive determinists and challenges the linguistic relativists' views, both its strong (determinists' claim) and the weak (linguistic masking effect) version. Regarding the linguistic masking of conceptual understanding, Shatz, Wellman, and Silber (1983) have examined early use of mental terms in the natural language of very young children from 2 years 4 months to 4 years old. In their longitudinal study, they also analyzed the syntactic constructions frequently associated with references to people's false beliefs such as "contrastives" (e.g.: He didn't know before, but he knew now). Shatz, Wellman, and Silber (1983) conclude that the child has considerable experience with the vocabulary and syntax necessary for describing mental state before he/she begins to produce such expressions. In other words, the child had the linguistic skills well in advance of his first production of utterances expressing mental state. There is no evidence that the child's ability to understanding other people's mind is in any way delayed by a lack

of linguistic skills, namely, the claim that children's TOM is masked by linguistic deficits has found no support from the acquisition data of mental state terms.

As for the determinists' proposal, theirs may be a position seriously challenged. The position is also easily argued against in that there may be other potential contributing factors affecting children's TOM performance other than the linguistic construction of complementation as proposed by de Villiers and de Villiers (2000). Before one can rule out the rival factors, it is hard to establish a causal link between a particular linguistic structure and certain cognitive capability. Linguistic forms and functions emerge from conversational and pragmatic demands in communication. In other words, linguistic competence is driven by communicative and semantic needs (Shatz, 1994; Peterson & Siegal, 1995), not the other way around. It would be untenable to argue that proper use of a language structure could begin before one has developed an understanding of its meaning. Moreover, a child has a variety of ways to express mental world without acquisition of a particular structure like complementation. Without having mastered the complement structure, a child could still express the sentence, "He said he drank milk" through circumlocutions such as "He told his mommy. He drank milk. But he drank juice, not milk" or simply

"He lied. He didn't drink milk."

However, de Villiers and de Villiers' (2000) argument is well worth further investigation. There has been increased interest in examining which particular aspects of language may be fundamentally involved in theory of mind development and in specifying more clearly the precise nature of the relation between language and theory of mind.

According to de Villiers and de Villiers (2000), the child has no other way of expressing "real world" semantics until the complementation with mental verbs is acquired in the child's grammar. In a way the "possible world" semantics expand the child's repertoire of linguistic representations, and via those representations, new ways of reasoning become a possibility. Their longitudinal and cross-sectional studies of deaf and normal preschoolers on false belief tasks lend strong support to their argument. Tested at different times, the children were consistently able to make use of the complement structure before being able to reliably succeed in false belief tasks.

Mental state terms in Chinese

If de Villiers and de Villiers' (2000) position is proven to be plausible, Chinese may actually be a good testing ground for their

hypothesis. There is a particular mental state verb in Chinese, *yi3wei2* 以為, which has precisely the semantic and grammatical attributes needed for testing the Whorfian hypothesis in this context. The Chinese mental verb has a clear false belief connotation and it almost always precedes an embedded complement such as the example below.

- 我還以為你忘了呢！[4]

  I still thought you forget le (perfective aspect marker) ne (tone of voice particle)!

  (I thought you had forgotten! [but you had not])

A study of Chinese children's TOM development and *yi3wei2* 以為 may thus provide valuable cross-linguistic evidence for the hypothesis as well as for the TOM research[5].

According to Wu (1994), *yi3wei2* 以為 is one of the linguistic markers in Chinese for counterfactual (contrary-to-fact) expressions. A precise translation or the best gloss of *yi3wei2* 以為 in English may be "mistakenly or wrongly thought." In addition to being a mental state verb, *yi3wei2* 以為 has a particular grammatical constraint: it is rarely phrased without being in a

complement construction. In other words, *yi3wei2* 以為 has to be and can only be followed by a clausal complement; no other grammatical component could fulfill the specific grammatical constraint. In the above example, "you have forgotten" is the clausal complement in which a contrary-to-fact statement or a contradiction of reality is presented. Without the clausal complement, "I mistakenly thought" 我以為 would be an incomplete sentence and would not make sense.[6] It is clearly a lexicalized mental state verb that requires complemental construction linguistically to make sense. In this case then, acquisition of *yi3wei2* 以為 could be considered a fundamental threshold or earmark for measuring children's understanding of counterfactual concept and may affect their performance on false belief tasks.

To address the issue of whether the expression of mental reference is masked or delayed by linguistic deficits, Shatz, Wellman, and Silber (1983) have also examined the kinds of syntactic constructions used to express mental state and then looked for evidence of their productivity elsewhere. If the syntactic forms (e.g., complementation) most associated with the expression of mental state such as *yi3wei2* 以為 are not readily

available to the child, there would be evidence that linguistic measures may be masking or affecting the child's performance in TOM tasks. In contrast, if there proves no deficiencies with the linguistic requisites, the use of linguistic measures would be more justifiable.

Research questions

This study examines children's acquisition of false belief understanding and its related linguistic expressions as well as how the cognitive component of TOM interacts with its linguistic representations. Specifically, this research aims to answer the following questions:

1. Is children's performance in false belief tasks related to their age? In other words, is there a developmental trend in children's theory of mind?
2. Is children's performance of the false belief tasks correlated with their acquisition of corresponding linguistic representations? Specifically, is Chinese-speaking children's performance related to their understanding of the mental state verb *yi3wei2* 以為? Additionally, what is the relation between children's general language ability and their TOM ability?

A study was conducted to address the above research

questions. It investigated Chinese-speaking children's TOM development through their responses to the false belief tasks. The children's comprehension and production of *yi3wei2* 以為 were also examined to understand children's TOM from it's linguistic account.

THE STUDY

FALSE BELIEF UNDERSTANDING AND *YI3WEI2* 以為

Method

Participants

Sixty-eight Chinese-speaking children from 3 kindergartens and preschools in Taipei and Taoyuan, Taiwan were interviewed and tested. The children's ages ranged from 3½ years (3 years and 4 months) to 5½ years old, with a mean age of 4½ years old (4 years and 5 months). They were divided into two age groups for analysis and comparison: 37 younger and 31 older children. There was a roughly equal number of boys and girls. The table below shows the children's age (in months) and sex.

Table 1. The children participated in the study

	Younger Children 3½ to 4½ years	Older Children 4½ to 5½ years	Total 3½ to 5½ years
Age Range	40 - 54 months	55 - 66 months	40 - 66 months
Mean Age	48 months	59 months	53 months
# of Boys Girls	21 16	17 14	38 30
# of Children	37	31	68

The children's age sampling is different from previous studies of TOM (Goetz, 1999; Gopnik & Astington, 1988; Wimmer & Perner, 1983), which typically divided the subjects by their years into 3-, 4- or 5-year-old (36, 48, or 60 months) groups. This study deliberately excluded children just turned 3 in that it is well documented that there is very little variation in their performance of false-belief tasks. In general, children under 40 months typically "fail" such tasks, as they either have difficulty in responding to the tasks and test questions or else give consistently incorrect answers. De Villiers and de Villiers (2000) have also observed that children under 3½ generally have difficulty understanding the linguistic structure of complementation. Notable TOM

development seems to begin in children aged 3½ years and above.

Materials

Two sets of materials were used to test children's understanding of false belief. For the unexpected transfer task, stuffed toy animals were used to act out the story. For the unexpected content task, various containers were used. The test materials were selected for their appropriateness of carrying out the tasks. They were also selected for appealing shape, color, and familiarity for children.

Procedures

Each child was interviewed individually by the author for a 15- to 20-minute session. During the session, the child was tested using the two standard false belief tasks adapted from Wimmer and Perner's (1983) paradigm: (1) unexpected content and (2) unexpected transfer (or unseen displacement). In addition, comprehension of *yi3wei2* 以為 was assessed through questions during the unexpected content test. All the sessions were video-taped for analysis.

a. Unexpected content and comprehension of *yi3wei2* 以為:

Each child was shown two items: (1) a crayon box with chocolate bars inside, and (2) a pencil case with bread sticks inside (pencil cases are commonly used by school children in Taiwan). The child was given one item at a time. First the child was asked what the item was and what was inside before he or she opened it. When the child opened the item and found the unexpected content, the experimenter asked the child what did he or she think was inside it before opening it. The conversation went typically as follows:

Experimenter (Exper hereafter): 這是什麼？(What is this?)

Child: 這是蠟筆盒。(It's a crayon box.)

Exper: 妳/你猜裡面是什麼？(Can you guess what is inside it?)

Child: 是蠟筆。(Crayons.)

Exper: 好。妳/你打開看看裡面是什麼。(Ok, open the box and see what's inside.)

The child opens the box and finds chocolate bars.

Exper: 裡面是什麼? (What is inside?)

Child: 是巧克力。(Chocolate.)

The experimenter then put the chocolate back and closed the box so that the child wouldn't be distracted by seeing the chocolate or an open box. The experimenter then proceeded to ask the following questions with the closed crayon box in front of the child.

Test Question 1:

Exper: 妳/你剛剛以為裡面是什麼？(What did you mistakenly think was inside the box a moment ago?)

Child: 是蠟筆。(Crayons.)

Test Question 2:

Exper: 等一下會輪到另外一個小朋友進來玩遊戲。他/她還沒有看到盒子裡是什麼。我會請他/她猜這裡面是什麼。你想（猜）他/她會猜裡面是什麼？(Later there will be another child coming in to play the game with me. He/She hasn't seen what's inside the box. I'm going to ask her/him to guess what's inside. What do you think he/she will say?)

Child: 是蠟筆。(Crayons.) / 是巧克力。(Chocolates.)

The children were interviewed in the same way for the pencil

case, the expected content being pencils and the unexpected content being bread sticks (麵包棒). The order of presentation of the two items were counterbalanced. The first test question tested the child's *yi3wei2* 以為 comprehension and the second question tested his or her understanding of another child's false belief about the content in the box.

b. Unexpected transfer:

For this task, each child was shown a toy dinosaur, a second toy dinosaur looked and dressed like a mother (with an apron), and a toy reindeer. Two stories were acted out in front of the child using the three toy animals. The first story was about the dinosaur (named Dino) who came to hold a false belief about the whereabouts of his ball, which the reindeer had put it in a place other than Dino expected. The child was then asked to predict where the dinosaur would look for the ball. Typically, the story was told as below:

Exper: 恐龍和麋鹿在玩球，他們玩得很高興。恐龍媽媽來了，她跟恐龍說：「恐龍，恐龍，我們要去幼稚園上學嘍！」恐龍就把球收起來放在他的玩具箱，然後就和媽媽上學去了。他去上學的時候就看不到家裡的情

形。麋鹿偷偷地去玩具箱把球拿出來玩，結果不小心把球踢到水溝裡去了。水溝太深了，他撿不到。他怕恐龍罵他，就趕快跑掉去藏起來。後來恐龍回來了，他想要玩球。

(Dino and the reindeer were playing with the ball, and they were having great fun. The mother dinosaur came and told Dino: "Dino, it's time for school. Let's go." Dino put away his ball in his toy box and went with his mother. While they were out, they didn't know what was going on at home, right? At home, the reindeer took the ball from Dino's toy box and played by himself. Oh no! He kicked the ball into the ditch and the ditch was too deep for him to reach the ball. Afraid that Dino would be mad, the reindeer went to hide. Later, when Dino came back from school, he wanted to play with his ball.)

Test Question 1:

Exper: 現在聽好喲！我要問妳一個問題，恐龍會去那裡邊找他的球呢？ (Now, listen to me carefully. Where will Dino look for his ball?)

Child: 水溝/玩具箱。(The ditch / toy box.)

Test Question 2:

Exper: 為什麼會去水溝/玩具箱找呢？

(Why would Dino go to the ditch / toy box to look for it?)

The second story followed more closely the original unexpected transfer task. Dino received a chocolate bar as a birthday present from the reindeer and he put it in a green drawer. While he was out playing with the reindeer, the dinosaur mother removed the chocolate bar and put it in a red box. For this task, an appropriate explanation for the answer was also required. After the child answered the first test question asking where Dino would look, he/she was asked to explain/justify the answer.

The order of telling the two stories was properly counterbalanced. Furthermore, to rule out the possibility that the children were given too much to remember, before the child

answered the major test questions, three memory test questions were asked:

(1) Where did Dino put his ball before he went out for school?

(2) Who removed the ball after Dino left?

(3) Where is the ball now?

To reduce the potential anxiety of being asked questions by a stranger, the experimenter/author visited the young children's kindergartens a half day once per week for four weeks prior to the formal interview. The prior visits made the children familiar with the experimenter. By the time the interview was conducted they were quite familiar with the experimenter and her way of interacting with them, making them more willing to talk with her and answer her questions.

Measures

(1) General language ability

The level of linguistic maturity or proficiency of the children who participated in this study was not measured in any standardized language tests owing to a lack of appropriate language ability tests in Chinese. Information about the children's

linguistic performance was requested from the teachers at the preschools. The teachers were asked to evaluate children's general language ability using a 5-level evaluation sheet for each child, level 5 representing superior language ability and level 1 standing for below average language development. The children's general language ability distribution is shown in the table below.

Table 2. The children's general language ability distribution

Level	Younger Children 3½ (40 months-4½ (54 months)	Older Children 4½ (55 months-5½ (66 months)	Total
5	4* (11%)	8 (26%)	12 (18%)
4	13 (35%)	11 (36%)	24 (35%)
3	14 (38%)	10 (32%)	24 (35%)
2	5 (14%)	1 (3%)	6 (9%)
1	1 (2%)	1 (3%)	2 (3%)
Total	37	31	68

*Number of children; number in parentheses is column percentage.

In addition to the general verbal ability, the teacher was also asked if any particular children were cognitively underdeveloped or emotionally unstable. The author, who interviewed all the children in this study, was also responsible for screening any possible

cases of language delay, or children with cognitive as well as emotional problems by close observation during the interview and pre-interview stay (one half day each week for four weeks) at the preschools. Altogether two children, who were found to be potentially delayed in their language development both by their teachers and the author, were excluded from the data analysis. Even though no systematic investigation was carried out to assess the children's language and intellectual development, proper precaution was taken to ensure their basic communicative and cognitive functions.

(2) Scoring of false belief tasks

Considering the different nature and demands of the two false belief tasks, this study scored the unexpected content and unexpected transfer differently and separately first, then pooled them for comparisons afterwards.

1. Unexpected content & comprehension of *yi3wei2* 以為

One point was given for comprehension of *yi3wei2* 以為 by answering the first test question "What did you mistakenly think was inside the box a moment ago?" with 蠟筆(crayons) for the first item or 鉛筆(pencils) for the second item. Zero points were given

for answering the unexpected item 巧克力(chocolate) or 麵包棒 (bread sticks). Children were given 1 point on the unexpected content task if they responded to Test Question 2, "What would the next child guess is inside?" with 蠟筆(crayons) or 鉛筆(pencils) and 0 points were given for answering 巧克力(chocolate) or 麵包棒 (bread sticks).

2. Unexpected transfer

For the unexpected transfer, a more elaborate 4-point scoring scheme (from 0 to 4) was developed with a view to fully reflecting the variability of children's performance patterns in the data (also see the Appendix). A child would get 2 points for correctly predicting the location where the dinosaur would look for his ball, namely, in the toy box, by either pointing to it or telling it verbally, or both pointing and telling. The child would get another 2 points for giving a reasonable explanation for the dinosaur's action, for example:「因為他早上離開的時候把球放在那裡啊！因為他不知道球已經被麋鹿踢到水溝裡去了。」(He looked there because he put it there in the morning when he left / because he didn't know the ball was kicked into the ditch by the reindeer). Thus, 4 points were given for correct prediction and appropriate explanation or

justification.

If the child made the correct prediction but didn't give an appropriate explanation (e.g., by replying: "I don't know" or being silent), he/she would get 2 points only. Two points were also given if a child gave a good explanation but made the wrong prediction, but it was considered unlikely, and would be treated as an exception.

A score of 1 or 3 was given for partially correct answers. A child would get 1 point for providing a plausible, if not reasonable, explanation such as: 「因為他先去玩具箱看了一下。」(Because he went to the toy box first to take a look). Children would get 3 points if they made the correct prediction but provided only a partial or incomplete explanation such as 「因為他就是知道啊！」(Because he just knew). The different combinations of the 4-point-scoring scheme is tabulated below.

Table 3. Scoring scheme of children's performance of the unexpected transfer task

Total Score	Prediction		Explanation		
	Correct	Incorrect	Appropriate	Incomplete but Plausible	None
4 points	2		2		
3 points	2			1	
2 points	2				0
1 point		0		1	
0 point		0			0

Half of the children were presented with the unexpected content task first while the other half with the unexpected transfer task first. In each of the tasks, there were two variants. In the unexpected content, the two items shown to each child were the crayon box and the pencil case; in the unexpected transfer, two stories (Dino playing the ball, and Dino's birthday present) were told to each child. The final scores of the two tasks were averaged over the two variants.[7]

Reliability

Consistency of scoring was checked through interrater agreement. Percent of agreement was calculated to assess

inter-rater reliability. The author and another native speaker of Mandarin Chinese scored 50% of the video-taped testing sessions randomly selected. The percentage of agreement between the two Chinese raters was 92%. After the reliability check, the author then proceeded to code the remaining half of the data. Disagreement and ambiguity were resolved through discussions between the two raters or through a reexamination of the video-tapes.

Analyses

The dependent variable in this study is the children's performance of the two false belief tasks: (1) unexpected content (1 for correct answers, 0 for incorrect answers) and (2) unexpected transfer (0-4 points). There are two major independent variables: (1) age (younger versus older) and (2) comprehension of *yi3wei2* 以為 (1 for comprehension, 0 for incomprehension). Additionally, the children's general language ability (level 1-5) was the control variable. The Pearson Chi-square test of independence, analysis of variance, and logistic regression were used for the statistical analyses.

Almost all the relevant studies show that boys and girls perform similarly on TOM-related tasks. A preliminary analysis of

this study also confirmed the same result, thus sex difference was not considered further.

Results

(1) *Yi3wei2* 以為 comprehension

Yi3wei2 以為 comprehension results show a remarkable uniformity. Of the 68 children, only three incorrectly answered the question: "What did you mistakenly think is inside the box?" with the name of the unexpected item that the child saw after opening the box (chocolate or bread sticks). These three happened to be the youngest (44, 41, and 40 months) in the whole group. This result suggests that children between 3½ and 5½ generally have no difficulty comprehending the meaning of *yi3wei2* 以為. However, it is uncertain children below 3½ would understand an *yi3wei2* 以為 question as readily. The lack of variation in the children's comprehension of *yi3wei2* 以為 made it pointless to include it in the subsequent analyses. Therefore, this variable was set aside from the analysis.

(2) Task 1: Unexpected content task

As shown by the table below, overall there are more children (39) passing this task (57%, n=68), but within the two groups of

children the pattern is different. In the older group, many more children passed the task (passing rate 77%, n=31), whereas in the younger group, more failed the task (failure rate 59%, n=38). In other words, the older children gave significantly more correct answers than the younger children did in this task (older 77%, n=31, versus younger 41%, n=37, X^2=9.38, df=1, p<0.002).

Table 4. Task 1 performance -- The unexpected content

Task 1: Unexpected Content	Younger Children 3½ (40 months-4½ (54 months)	Older Children 4½ (55 months-5½ (66 months)	Total
Pass	15 (41%)*	24 (77%)	39 (57%)
Fail	22 (59%)	7 (23%)	29 (43%)
Total	37	31	68

*Table entry indicates number of children; the number in parentheses is column percentage.

However, based on the individual Chi-square test result (X^2=7.53, df=4, p<0.11), the children's general language ability was not significantly related to their performance of the unexpected content task[8]. To further examine the interrelationship of age, general language ability, and the test scores, a logistic regression model was fitted with test score as the dependent variable, age as

the predictor, and language ability as a control variable. The result again shows a strong age effect (β_1=1.49, p<0.008, odds ratio = 4.46) controlling for general language ability (β_1=0.62, p<0.04, odds ratio = 1.86). This suggests that after the child's general language ability is taken into consideration, the odds of an older child passing the unexpected content task were almost 4.5 times greater than of a younger child.

(3) Task 2: Unexpected transfer task

The descriptive statistics of the results are presented in the table below. Overall, about one fourth (27%, n=68) of the children got a full score of 4 points, meaning that they both predicted the location correctly and provided appropriate explanations. This subgroup of children had not only developed a consistent understanding of false belief, but also had acquired an adequate verbal ability to talk about it. However, one third (34%, n=68) of the children scored 0, indicating that they may have acquired neither an understanding of other people's false beliefs nor the verbal ability to comment on it. Another one fourth (22%, n=68) of the children scored 1 point. The children in this cell may or may not understand other people's false beliefs, but they certainly were trying to make sense of it to the experimenter as well as to

themselves. Five children scored 2 points for the correct prediction of location but didn't provide an appropriate explanation. As expected, none of the children scored 2 points for a proper explanation but missed the prediction. Ten percent of the children who scored 3 points made the right prediction, but provided incoherent though still plausible explanations.

Table 5. Task 2 performance -- The unexpected transfer

Task 2: Unexpected Transfer	Younger Children 3½ (40 months-4½ (54 months)	Older Children 4½ (55 months-5½ (66 months)	Total
4 points	7* (19%)	11 (35%)	18 (27%)
3 points	4 (11%)	3 (10%)	7 (10%)
2 points	1 (2%)	4 (13%)	5 (7%)
1 point	8 (22%)	7 (23%)	15 (22%)
0 point	17 (46%)	6 (19%)	23 (34%)
Total	37	31	68

*Table entry indicates number of children and the number in parentheses is column percentage.

A comparison of the younger and older children in the table cells above reveals a clear diagonal pattern: the highest percentage of older children falls into the 4-point cell (35%, n=31), while the highest percentage of the younger ones falls into the

0-point cell (46%, n=37). This pattern indicates that there is a higher percentage of older children showing a fully developed understanding of another's false belief and the ability to explain it verbally than that of younger children who haven't acquired both abilities. Again, the age effect stands out in their performance of false belief understanding. Interestingly, about one fourth of each of the two groups scored 1 point for providing plausible justifications but missing the prediction of location. This high percentage of both older and younger children scoring 1 point may reflect some general inclinations of their mind.

A 2 (age) x 5 (general language ability) general factorial analysis of variance (ANOVA) was performed for Task 2 with age and general language ability as fixed factors and the test scores (5 levels: 0-4) as the dependent factor. Contrary to the results of Task 1, no significant effect of age was found, $F(1, 62) = 2.53$, $p<0.12$, but general language ability proved to have an effect on the performance, $F(4, 62) = 4.06$, $p<0.005$. A post hoc analysis shows that children's general language ability ranked at the highest level (rank 5) performed very differently from each of the other 4 ranks with a p-value less than 0.03 (rank 1), 0.06 (rank2), 0.003 (rank4), and 0.009 (rank4) respectively. To perform well on the unexpected transfer task, based on this finding, a child tends to

have excellent linguistic dexterity.

The test scores of Task 2 (unexpected transfer) were then collapsed into two levels for further statistical analyses and for later comparisons (1-pass, collapsed from 2, 3, and 4; 0- fail, from 0 and 1)[9]. The scoring thus reverts back to a parsimonious scheme as adopted by most of TOM studies. In the two-by-two contingency table below, significantly more older children passed the task than the younger ones (older 58%, n=31, versus younger 32%, n=37, X^2=4.49, df=1, p<0.03).

Table 6. Task 2 performance (2 levels) -- The unexpected transfer

Task2 (2 levels): Unexpected Transfer	Younger Children 3½ (40 months-4½ (54 months)	Older Children 4½ (55 months-5½ (66 months)	Total
Pass	12 (32%)*	18 (58%)	30 (44%)
Fail	25 (68%)	13 (42%)	38 (56%)
Total	37	31	68

*Table entry indicates number of children; the number in parentheses is column percentage.

These children's general language ability is also significantly related to their Task 2 performance (X^2=10.7, df=4, p<0.03). A logistic regression model was again fitted with Task 2 (2 levels) as the dependent variable, age and language ability (2 levels: rank 5

versus rank 1-4 combined) as independent variables. The results present a similar pattern to those from the previous ANOVA model (Task 2, 5 levels), no significant effect of age (β_1=0.90, p<0.08, odds ratio=2.46) is found when general language ability is taken into consideration (β_1=2.05, p<0.01, odds ratio = 7.8). The model indicates that the odds for a child ranking 5 in general language ability is 7.8 times greater than of a child of lower ranks (1-4 combined).

(4) Comparison of Task 1 and 2 across children

A comparison of the 2 tasks lent evidence to the hypothesis that overall the unexpected transfer (2 levels) was significantly more difficult than the unexpected content (Task 1 passing rate = 57%, n=68, Task 2 passing rate = 44%, n=68; X^2=14.82, df=1, p<0.001). The level of difficulty of the two tasks is different within the two groups of children, but not significantly so. For the younger children, the two tasks were equally difficult, with both passing rates below the chance level of 50% (Task 1, 41%; Task 2, 32%). For the older children, Task 1 was relatively easy for them (77%), but the passing rate dropped to 58% for Task 2.

As a group, the children who passed Task 1 have a mean age of 56 months or 4 years 8 months, those who passed Task 2

have a mean age of 56 months too. Within each group, the mean ages of the children who passed or failed the two tasks are not significantly different from each other, except for Task 2 in the younger group (47 versus 50.5 months, $t=2.32$, $p<0.03$). Across the two tasks, only 2 younger children (40 and 44 months) in the entire group failed the 3 memory check questions. Other children didn't present a memory overloading problem for either task.

(5) Children's production of *yi3wei2* 以為:

Given the result of the comprehension of *yi3wei2* 以為 presented earlier, it is suggested that Chinese-speaking children above 3½ years generally understand what *yi3wei2* 以為 means and they have little difficulty responding to questions containing the term. Owing to the lack of variation in the data, children's comprehension of *yi3wei2* 以為 is considered to be independent of their false belief understanding. While 3½ to 5½ years old Chinese-speaking children still present quite a variation in their performance of false belief tasks, their comprehension of *yi3wei2* 以為 is almost unanimous. This evidence strongly suggests that comprehension of *yi3wei2* 以為 is acquired prior to the development of false belief understanding.

The findings of Lee et al (1999), however, show that Chinese children tend to perform better on false belief tasks using the words *yi3wei2* 以為 than expressions like *cai1* 猜 (guess) or *xiang3yi1xiang3* 想一想 (think about). Their study has at most tested the cueing effect of *yi3wei2* 以為, i.e., whether the inclusion of the wording elicited better performance. The findings in the study of Lee et al. (1999) is assuming that Chinese children have no problems comprehending *yi3wei2* 以為, an assumption not clearly established or tested in their study. Thus their finding may not provide an answer to whether Chinese children's comprehension of *yi3wei2* 以為 is correlated with their performance on TOM-related tasks.

To further unravel the issue, Chinese children's **production** of *yi3wei2* 以為 should be an important area for investigation. At what time Chinese-speaking children start to talk with *yi3wei2* 以為 may provide solid evidence for explaining the relationship between language and thought in TOM. When children actually start to use *yi3wei2* 以為 in their spontaneous speech, it is a clear indication that they are capable of complement structure inherently required in using the term, i.e., they have acquired a language form to encase the meta-representational reasoning in TOM (Olson,

1988; Gopnik & Astington, 1988) and to be able to reflect on it verbally.

a. Children's production of *yi3wei2* 以為 in this study

However, the elicitation of *yi3wei2* 以為 has proven to be very difficult. It is hoped that in the second (open-ended) test question of the unexpected transfer task, the child, in response to the request of an explanation for his or her prediction, may choose to use *yi3wei2* 以為 as the most precise way to justify the answer. A reasonable answer would be: 「因為恐龍以為球還在玩具箱裡面。」(Because the dinosaur mistakenly thought the ball was still in the toy box). However, out of the 68 children, only 3 of them responded to the question using *yi3wei2* 以為 in a complement construction.

The first child was a girl 5 years and 2 months old. When I asked her to explain why the dinosaur would look for his ball in the toy box, she responded without hesitation: 「因為他不知道球掉到水溝裡。他去上學的時候放在這裡（指玩具箱），他以為還在這裡。」(Because he didn't know the ball was thrown into the ditch. He put the ball in here [pointing to the toy box] before he went to school. He mistakenly thought the ball was still there). Not only

has she appropriately justified the dinosaur's predicted action, but she also pointed out the logical sequence of the event. Such a "standard" and adult-like answer clearly demonstrates maturity of her understanding of the dinosaur's false belief. The girl's general language ability was ranked the highest level (level 5) by her teacher. The same teacher also observed that one characteristic in the interactions of the girl and her parents was that the parents talked to her in an adult way, i.e., they didn't seem to adjust their language when talking to her.

The second child who responded to the question with *yi3wei2* 以為 was only 4 years and 2 months old. This girl's general language ability was ranked at the third level and she was generally quite reticent in her interactions with the teachers and the experimenter. When asked to justify her prediction, she readily answered: 「因為它以為在這邊（指玩具箱。）」 (Because it [mistakenly] thought it was in here. [pointing at the toy box at the same time]). The third child, however, appeared to be as verbally sophisticated as the first child. Without hesitation, this 4 years and 9 months old girl explained the dinosaur story by saying: 「他不知道。他以為還在呀！」 (He didn't know [it was in the red box). He [mistakenly] thought it was still in the green box). This same

girl visited my office on a personal occasion. She saw a towel of the same color as hers at home and said to me :「我以為妳把我家裡的毛巾帶到辦公室來了。」(I [mistakenly] thought you brought my towel from home to your office). Hoping to further elicit her productive use of *yi3wei2* 以為, I replied:「妳為什麼會這樣以為呢？」(Why would you [mistakenly] think this way?), and she appropriately responded: 「因為它們的顏色一樣啊！」(Because they are the same color!).

In similar naturalistic environments, it is observed that *yi3wei2* 以為 is an infrequent expression in young children's speech. Informal interviews with the preschool teachers and parents also confirmed the above observation. A mother recalled her 5-year-old daughter using *yi3wei2*以為 in her false belief about the mother's presence in the house: 「我以為妳在家。」 (I thought you were home). A preschool teacher with more than 10 years of teaching experience also commented on the use of *yi3wei2* 以為.

> It is rather infrequent. The few incidents I could recall were children around 4½ or 5 years old saying to me: 「我以為妳是我媽媽。」(I thought you were my mother) when they mistakenly called me mommy. When they did that, they seemed very embarrassed, but the sentence came rather naturally to them. (Interview, June 23, 2000)[10]

These observations are quite revealing. Two phenomena of children's use of *yi3wei2* 以為 are worth noting. First, both of them didn't recall hearing children produce *yi3wei2* 以為 anytime before 4½; secondly, once children start to use the word, they use it in much the same way as adults do linguistically and pragmatically (for adults' use of *yi3wei2* 以為, see Wu, 1994 and 吳信鳳, 1997).

b. Children's production of *yi3wei2* 以為 in two data sets

Two sets of transcripts of Chinese children's spontaneous speech were also analyzed to further investigate the production of *yi3wei2* 以為. The first set is Chang's (2000) narrative accounts of 16 Mandarin-speaking preschool children in Taipei. The longitudinal data was collected in four time points with a

three-month interval. The children were 3½ years old when first interviewed and 4 years and 3 months at the last interview (i.e., Time 1: 42 months; Time 2: 45 months, Time 3: 48 months, Time 4: 51 months). Each audio-taped session of story-telling activity lasted between 60 to 90 minutes. Altogether there were more than 64 hours of transcripts. The second set of transcripts searched for use of *yi3wei2* 以為 was taken from Guo's (1994) discourse study on modality in Chinese with 3 groups of children aged 3, 5, and 7 years old in Beijing, Mainland China. Each age group consisted of 3-4 children, who were video-taped while interacting with one another in free activities. Each session was also about one hour long. There were 12 sessions for each group and a total of 36 hours of transcripts.

A search for children's use of *yi3wei2* 以為 in the first set of transcripts (Chang, 2000) generated 8 instances by 5 children (3 of them said it twice). No *yi3wei2* 以為 was found in Time 1 when the children were 3½ years or 42 months old, 2 were found in Time 2 by the same child, and 6 instances were found in Time 3 and 4. Several examples are: 「我就以為媽媽被壞人捉走了」(I then [mistakenly] thought [that] Mommy was taken away by the bad guys) (Time 2, 45 months), 「他還以為那個老師是大怪物」(He

[mistakenly] thought [that] the teacher was a big freak) (Time 3, 48 months), and「而且他以為是怪獸」 (Also, he [mistakenly] thought [that it] was a monster) (Time 4, 51 months).

A computer search in the second set of data (Guo, 1994) has found only one utterance of *yi3wei2* 以為 by the 3-year-old group (with a mean age of 3½): 「你以為我真找呢啊！」(You [wrongly] thought [that] I was truly looking for it, didn't you?) Spoken by a 3-year-old, this remark is amazingly sophisticated grammatically and pragmatically. However, this single example may not be extrapolated to the Chinese children's general use of *yi3wei2* 以為 at this age. Ten entries were found from the 5-year-old group and 8 from the 7-year-old group transcripts.

With the dialectical variations between Taiwan and Mainland China, the use of *yi3wei2* 以為 by children in these two areas are quite similar syntactically with the mental state verb followed by an embedded complement clause such as in this sentence by a 5-year-old in Beijing: 「我還以為剛才你們黏的呢！」(I [mistakenly] thought [that] you glued it just now!). However, there seem to be a few more elliptical cases found in Beijing children than in Taipei children, such as「我還以為是真的呢！傻瓜。」I [mistakenly] thought [it] was real. Stupid me), and 「小蚯蚓！我還以為是破繩子呢！」

(A little earthworm! I [mistakenly] thought [it] was [a piece of] broken rope!).

The results of children's production of *yi3wei2* 以為 from the computer search show that children as young as 45 months (Time 2), or 3 years and 9 months, start to use the expression in daily communications, but the majority of children start using *yi3wei2* 以為 in their speech around the first few months after their fourth birthday. Another phenomenon is worth noting. No erroneous use of *yi3wei2* 以為 has been found among any of the children in any of the contexts. In other words, this expression has always been used properly by children in terms of its false belief intent and syntactic constraint (embedded complement); no anomalies in the use of yi3wi2 以為 have ever been found in either its elliptical or well-formed cases.

GENERAL DISCUSSION

This study, like most of the previous research, has found a strong developmental trend in children's understanding of false beliefs. The older children performed consistently better than the younger children across tasks. Within the younger group, the children just below 4 (47 months) tended to fail false belief tasks,

especially the unexpected transfer; while children several months past their fourth birthday (50.5 months or 4 years 2.5 months) had better chances of passing it. Therefore, the false belief understanding involved in the unexpected transfer task does not seem to take place until children are in their early fours. Such timing is very close to Chang's (2000) Time 4 (51 months or 4 years 3 months) when children are found to use *yi3wei2* 以為 in their spontaneous speech more frequently.

While far from being conclusive, the finding of children's comprehension and production of *yi3wei2* 以為 suggests that Chinese children are able to comprehend *yi3wei2* 以為 around 3½ or earlier, about one year before the development of their understanding of false beliefs (between 4 years 3 month to 4 years 8 months in this study). The children in this study almost uniformly understood the meaning of *yi3wei2* 以為, but their performance of false belief understanding was quite uneven. Moreover, children younger than 3½ may not fully understand what *yi3wei2* 以為 means, but they generally do not understand others' false beliefs either. Whether such an observation could point to a correlation between *yi3wei2* 以為 and false belief understanding is open for further investigation. Studies with children younger than

3½ are needed to verify such a claim. However, granted that the comprehension of *yi3wei2* 以為 is a prerequisite for false belief understanding since one clearly develops prior to the other, but why is there a one-year lag? What are children waiting for? Are they waiting for other cognitive/linguistic/social factors to come in line? All these questions demand future research to give a clearer picture than the one we have had up until now.

The age when Chinese children are capable of using *yi3wei2* 以為 as a productive vocabulary (4 years and 3 months and after) is slightly earlier than or coincides roughly with the time when children start to have false belief understanding. It seems that linguistic expressions conveying false beliefs such as *yi3wei2* 以為 come about in children's speech at a time when false belief understanding is also developing. Again, before other rival factors could be ruled out, children's production of *yi3wei2* 以為 can not be proved to facilitate false belief understanding. Whether the development of false belief understanding is related to the acquisition of *yi3wei2* 以為 is thus still unknown.

However, the results of *yi3wei2* 以為 in this study converge to suggest that *yi3wei2* 以為 is an infrequent expression in young children's spontaneous speech. On average, it takes around six

months to one-year for *yi3wei2* 以為 to emerge from a child's "passive" vocabulary to a "productive" one.[11] However, it seems that once *yi3wei2* 以為 is uttered in children's speech, it takes on its false belief intent in meaning and well-formed complementation syntactically. The acquisition of *yi3wei2* 以為 appears to be an all-or-none phenomenon since children either don't use it in their speech, or they use it appropriately with almost no errors. Future research in the nature of *yi3wei2* 以為 acquisition and its interim stages is needed.

Taking children's age and general language ability together, the age effect is much more obvious in the unexpected content (Task 1) than in the unexpected transfer (Task 2). While children's general language ability has an impact on both tasks, it is a much more powerful predictor in Task 2. The results suggest that for Task 1, given general language ability, the older the children, the better the performance; but for Task 2, given the age group, the more verbal a child is, the better the performance. This may be related to the stronger narrative element in Task 2 with the dinosaur stories. Similar to Jenkins and Astington's (1996) finding, this study has also found that children's general language ability is related to their TOM ability. However, Goetz (1999) and

Welch-Ross (1997) have found no relationship between children's general language ability and false belief understanding. The 5-level language measure used in this study is far less sophisticated to reflect the full spectrum of children's linguistic proficiency, but for lack of a better measurement in Chinese, the measure could still reflect the children's language ability to some extent.

Of the two tasks, Task 2 has proven to be more difficult than Task 1, especially for the younger children. This is probably due to the extra cognitive, linguistic and emotional demands in Task 2. Children were required to keep the situation in mind for a while before they were asked to make a prediction, but children tend to be impulsive in such situations (Piaget, 1929). In general, withholding a response is intrinsically difficult for young children, given their limited internal and external resources. In administering Task 2, many children who failed the task appeared to be impulsive in picking up the ball out of the ditch or in pointing to the red box instead of patiently watching the story play out. They couldn't wait to help the dinosaur find the ball or chocolate. It didn't concern them where the dinosaur thought the ball was, but rather where the ball really was and how to get it to him. Therefore, the **inhibition** or self control required for Task 2, not the

memory load, may partially account for the poor performance of these children in Task 2.

However, considering these children's behavior from a practical point of view, they were actually quite efficient in "getting things done." It is obviously an efficient and time-saving solution to find the ball. From a child's view, finding the ball was the most important concern for the dinosaur, not the guesswork about where it might look or should look. Were the children too pragmatic to give the correct answer? Did their pragmatic competence override their potential understanding of other people's false belief? These questions are posed not to contradict the results, but to consider the results in different terms. Using his or her own knowledge of the location of the ball is a logical way for a child to react, and the child reasons by his or her own logic.[12] Sometimes, it seems more important to observe what the child does than what he or she does not do.

Children's failure in false belief tasks thus shouldn't be interpreted as a deficiency, but an interesting response/reaction through which the progressive, individualistic, and creative nature of children's TOM development may be revealed. The 5-point scoring scheme for Task 2 has well reflected this. Of the five levels, the responses scored 1 point are by far the most intriguing.

This one point shows children's creativity in trying to "invent" (Piaget, 1929) in response to uncertain or embarrassing situations. For example, when asked why would the dinosaur look for his ball in the ditch instead of the toy box, many children gave the pre-causal answer: 「因為它想玩球啊！」 (Cause he wants to play with the ball). The experimenter pushed further for a logical explanation: 「但是他怎麼知道要到水溝找呢？他出去了啊！他沒有看到球被丟到水溝裡去了。」(But how did he know it's in the ditch? He had been away and he didn't know the ball had been thrown into the ditch). The children produced various "inventive" answers, for example, 「因為他知道呀！他回家之後先問麋鹿，然後他就知道球掉到在水溝裡了。」 (Cause he knew. He came back and checked with the reindeer first, then he found out the ball had been thrown into the ditch.), 「因為他從外面回來的時候看到水溝裡有球。」(Because he saw the ball in the ditch on the way home from outside) ,「因為恐龍忘記他把球放在玩具箱裡了。」(Because the dinosaur forgot that he had put the ball in the toy box). A 4½ years old girl, out of embarrassment and eagerness to make it right, came up with the most ingenious answer: 「因為他在這邊啊！[指椅子背後]有漏洞啊！他可以從漏洞裡偷看到啊！」 (Because he's

here! [pointing to the back of her chair] It has a hole! He could sneak and see through the hole). In her explanation, this girl knowingly juxtaposed the space in a pretend world (where the dinosaur was put away when he was "away") with the actual space (behind the chair) and invented an element in the story (the imaginary hole) to make it possible. She stuttered a bit in saying all this, but then seemed relieved as though she had convinced herself of it.

It was fascinating to see how eager and how serious the children were in trying to give seemingly plausible explanations to try to justify their answers. Amazingly, most of their justifications, as illustrated by the above examples, were plausible and viable to the occasion In other words, they didn't just come up with something that didn't make sense. In this way, they succeeded in giving a possible answer to "pull it through," or to fit into their "theories" of mind.

For the children who made the wrong prediction, the open-ended question was offering them a chance to make up a story that could smooth out any differences between false beliefs and their awareness that something in the story did not fit[13]. This unfitting part was the dislocation of the ball. At their age and even much younger, children can offer an explanation to make things fit

in their own way. This is an invention, a very important part of their intellectual and social development. The interesting thing is that the child's plausible explanation is to serve the purpose of maintaining his false belief, not taking the dinosaur's point of view as a starting point. In other words, the ball is already in the ditch, so an explanatory story can ensure that the dinosaur goes there to find it. This may provide a good explanation to the inhibition or pragmatic inquiries raised earlier in this section. In this study, about one quarter of both the younger and older children scored 1 point, meaning these children failed the prediction of the location, but came up with a plausible explanation to justify their incorrect prediction. This high percentage of children scoring 1 point may reflect some general inclinations of their mind, and it also reveals the creative and individualistic nature of children's TOM.

Another interesting and confounding factor in the children's performance is that children young or old may have answered the questions in a way to fit with the experimenter's expectations.[14] Very often children are capable of anticipating what answer the teacher or an adult would prefer. A girl 4 years and 4 months old, when asked where the dinosaur would look for the chocolate, pointed to the green drawer (the correct prediction). When the experimenter incidentally paused a moment and asked her for an

explanation, she immediately changed her mind and pointed to the red box, sensing that the pause must mean disapproval. Later she even claimed that she had pointed to the incorrect location at the outset. Children may try to come up with all sorts of explanations to "cover up" their slips, to justify their behavior. The preschool teachers and some parents also concurred with such a tendency in children. Socially children are concerned about how other people think of them or how they are perceived by the peers or teachers (e.g., as being smart or dumb), and whether they have fulfilled the expectations of the teachers and parents. In turn, such a tendency proofs precisely a theory of mind in children about other people's emotions and feelings which, according to research findings (see, e.g., Bretherton, 1991; Wellman, Harris, Banerjee, & Sinclair, 1995), are usually developed prior to a TOM of other people's knowledge or false beliefs .

Children who scored 3 points made the correct prediction but provided an incomplete or inappropriate explanation, such as: 「他就是知道啊！因為他想玩球啊！」(He just knew. Because he wanted to play with the ball). These children may have a developed TOM but an undeveloped verbal ability to express it. Or, they may have simply passed this task by chance (i.e. a wild

guess). Their TOM ability may not have been fully developed or stabilized to give a consistent or predictable performance in these tasks. Another possibility is that these children may be still in the process of acquiring necessary linguistic forms to give accounts for their successful performance. The performance of this group of children may in a way lend support to the linguistic masking hypothesis, i.e., a linguistic immaturity may mask or affect TOM performance. However, the number of children who scored 3 points is relatively too small (7) to represent a prevailing phenomenon in the language and thought of TOM. Based on the results, the interpretations of different scores in the scoring scheme for the unexpected transfer task are summarized in the Appendix.

As for the unexpected content task, it requires the child to have a representational change (Gopnik & Astington, 1988; Astington & Gopnik, 1988) first about the unexpected item, then to anticipate the false belief of another child about the content. Older children generally perform this task quite well, but not the younger ones. The difficulty seems to lie in the unusual test question: "Can you guess what will be the guess of the next child?" Many younger children in this study didn't seem to know what they were asked to do, even though efforts were made to make the question as clear as possible. On the one hand, younger children

are not accustomed to being asked to guess what other people would guess; on the other hand, the test question may be grammatically and semantically difficult for them.

CONCLUSION

TOM development in children has become a central concern in the past two decades because it touches upon key areas of children's development in their preschool years. The performance of TOM-related tasks has thus been considered as a bench mark for children's cognitive, social, and linguistic development. This paper has examined Chinese-speaking children's TOM ability, specifically their understanding of others' false beliefs, and how the particular linguistic expression in Chinese *yi3wei2* 以為 is related to the understanding. More sensitive measures were developed to capture the rich variations of children's mind operations.

The results of the study indicate that there is a strong developmental trend in Chinese-speaking children's false belief understanding. Their general language ability correlates with their performance on the false belief tasks, but a comprehension of *yi3wei2* 以為 does not. The children's productive use of *yi3wei2* 以為 is observed to emerge around 4 years and 3 months, about the

same time they start to develop false belief understanding, but no direct causal link could be drawn between children's false belief understanding and their use of the mental state verb *yi3wei2* 以為 before other contributing factors are pinpointed and ruled out.

Though it still leaves unanswered the question whether *yi3wei2* 以為 is a prerequisite of Chinese-speaking children's TOM development, i.e., whether the acquisition of relevant linguistic forms has an impact on specific cognitive development, this study has provided important evidence as a basis for further exploration. First, it is observed that Chinese-speaking children understand *yi3wei2* 以為 quite early (generally before they are 3½ years old), prior to their development of false belief understanding. Secondly, the acquisition of *yi3wei2* 以為 seems to be an all-or-none phenomenon. To understand better the language-thought issue in TOM, the nature and processes of *yi3wei2* 以為 acquisition are well worth future investigations.

An even more significant finding of this study resides in the qualitative analysis of children's responses to the false belief tasks, i.e., their own accounts of their theories of mind. It has clearly revealed the progressive, individualistic, and creative nature of children's TOM development. More in-depth analyses along this

line would be needed if children's TOM is to be better understood. Some researchers have also claimed that the two prototypical false belief tasks may not be the best way of investigating children's TOM. Wellman and his colleagues have shown that children younger than 4 years old do have considerable knowledge about mental states and thinking processes, although they may not perform successfully on false belief tasks (Wellman, Cross, & Watson, 1999). Under some circumstances, even 3-year-olds are capable of predicting other people's behavior based on these people's desires. Naturalistic observations further reveal that children appear to be thinking and talking about mental states before they pass false belief tasks (Bretherton, McNew, & Beeghly-Smith, 1981; Shatz, Wellman, & Silber, 1983; Tardif & Wellman, 2000). Although such observations are open to stringent verification, they are suggestive of young preschoolers' awareness of the existence of mental life. Chandler et al. (1989) criticize the false belief tasks as too demanding for young children and argue instead for deception to be the criterion of understanding of mental states. If a child's mind is to be understood in proper perspectives, more naturalistic investigations and a wide spectrum of testing criteria other than false belief tasks are clearly needed in future research.

TOM research touches children's cognitive, social, and linguistic development. There are many more issues to be unraveled to elucidate how these important developments in children come about. The internal worlds of people are areas not easily observable; it is therefore not a simple undertaking for either the child or the adult. Nevertheless, studies of children's communication and language development may offer an access to the nature and processes of TOM development. In a systematic review of the early communication literature, Bretherton (1991) has found that infants as young as 9 months begin to be aware of the mental states of others when they begin to communicate with other people. Communication requires inter-subjectivity, i.e., shared representation and reference (Cole & Cole, 1996). For example, if a mother hands an item to her one-year-old, the baby and the mother would look at the item together and the baby would try to receive it. Both the mother and the baby share a common reference and both know the intention of the action, which is a demonstration of inter-subjectivity and a form of communication. That there is successful communication at the age of 9 months implies that a baby has some awareness of what the other wants. Bretherton goes on to infer that the development in the child's TOM is closely related to the increasing precision and power of the

child's fast-developing linguistic abilities. To echo Bretherton's inference, this study would adopt the same position as the passage below that the nature and development of children's **theory of mind** and **language** are inextricably related. The study of either would have to complement the other.

> We will make little progress in understanding how theory of mind is acquired unless we investigate more closely how development of a theory of mind relates to development of language.
>
> Bartsch & Wellman, 1995, p. 209

REFERENCES

Chinese References:

吳信鳳（1997）。「中國人的假設思維一報紙文字分析研究」。本土心理學研究，第七期，中國人的思維方式，楊國樞主編（69 - 125 頁）。台北：台灣大學心理學系本土心理學研究室。

吳信鳳（2000a）。「語言學習理論與小學英語教學」。國立台北大學學報，第二期，107 - 161 頁。台北：國立台北大學。

吳信鳳（2000b）。「綠影搖曳中一群四歲兒童的家—美國加州大學柏克萊分校附設學前班之研究、課程、及語文教學」（上）及（下）。教育研究雜誌，第 73 期，5 月號，19 - 31 頁（上），及第 74 期，6 月號，25 - 42 頁（下）。台北：元照出版公司。

吳麗芬（1996）。「設身處地」的能力及其在幼稚園教育實施上的意義。幼教學刊，民 85，第 4 期，頁 32—39。

許月琴（1999）。心智理論(Theory of Mind)在自閉症兒童溝通上的應用。國小特殊教育，第 27 期， 民 88 年 6 月， 頁 57-59。

English references:

Astington, J. W. (1993). The child's discovery of the mind. Cambridge, MA: Harvard University Press.

Astington, J. W., & Gopnik, A. (1988). Knowing you've changed your mind: Children's understanding of representational change. In J. W. Astington, P. L. Harris, & D. R. Olson (Eds.), Developing theories of mind (pp. 193-206). Cambridge, UK: Cambridge University Press.

Astington, J. W., & Jenkins, J. M. (1995). Language and theory of mind: A theoretical review and a longitudinal study. Paper presented at the biennial meeting of the Society for Research in Child Development, Indianapolis, IN.

Astington, J. W., Harris, P. L., & Olson, D. R. (1988). Developing theories of mind. New York: Cambridge University Press.

Avis, J., & Harris, P. L. (1991). Belief-desire reasoning among Baka children: Evidence for a universal conception of mind. Child Development, 62, 460-467.

Baron-Cohen, S. (1994). How to build a baby that can read minds: Cognitive mechanisms in mind reading. Cahiers de Psychologie Cognitive, 13, 513-552.

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1986). Mechanical behavioral and intentional understanding of picture stories in autistic children. British Journal of Developmental Psychology, 4, 113-125.

Bartsch, K., & Wellman, H. M. (1995). Children talk about the mind. New York: Oxford University Press.

Bishop, D. (1992). Autism and frontal-limbic functions. Journal of Child Psychology and Psychiatry, 34, 279-294.

Bretherton, I. (1991). Intentional communication and the development of an understanding of mind. In D. Frye & C. Moore (Eds.), Children's theories of mind: Mental states and social understanding (pp. 49 - 76). Hillsdale, NJ: Lawrence Erlbaum.

Bretherton, I., & Beeghly, M. (1982). Talking about internal states: The acquisition of an explicit theory of mind. Developmental Psychology, 18, 906-921.

Bretherton, I., McNew, S., & Beeghly-Smith, M. (1981). Early person knowledge as expressed in gestural and verbal communication: When do infants acquire a "theory of mind"? In M. Lamb, & L. Sherrod (Eds.), Social cognition in infancy. Hillsdale, NJ: Lawrence Erlbaum.

Brothers, L., & Ring, B. (1992). A neuroethological framework for the representation of minds. Journal of Cognitive Neuroscience, 4, 107-118.

Chandler, M. J., Fritz, A. S., & Hala, S. (1989). Small scale deceit: Deception as a marker of 2-, 3-, and 4-year-olds' early theories of mind. Child Development, 60, 1263-1277.

Chang, C. J. (張鑑如) (2000). Narrative performance across contexts and over time: Preschool Chinese children and mothers. Unpublished doctoral dissertation, Harvard Graduate School of Education, Cambridge, MA.

Cole, M., & Cole, S. R. (1996). The development of children (3rd Edition). New York: W. H. Freeman and Company.

Cromer, R. (1991). Language and thought in normal and handicapped children. Oxford: Blackwell.

De Villiers, J. G. (1997). On acquiring the structural representations for false complements. In B. Hollebrandse (Ed.), New perspectives on language acquisition. University of Massachusetts Occasional Papers in Linguistics, GLSA, Amherst, MA.

De Villiers, J. G., & de Villiers, P. A. (2000). Linguistic determinism and the understanding of false beliefs. In P. Mitchell & K. J. Riggs (Eds.), Children's reasoning and the mind (pp. 191-228). East Sussex, UK: Psychology Press.

De Villiers, J. G., & Pyers, J. (1996). Complementing cognition: The relationship between language and theory of mind. In Proceedings of the 21st annual Boston University Conference on Language Development. Somerville, MA: Cascadilla Press.

Dennett, C. C. (1979). Brainstorms. Sussex: Harvester Press.

Dunn, J., Brown, J., Slomkowski, C., Tesla, C., & Youngblade, L. (1991). Young children's understanding of other people's feelings and beliefs: Individual differences and their antecedents. Child Development, 62, 1352-1366.

Flavell, J. H., Green, F. L., & Flavell E. R. (1995). Young children's knowledge about thinking. Monographs of the Society for Research in Child Development, 60 (1), Serial no. 243.

Flavell, J. H., Zhang, X. D., Zou, H., Dong, Q., & Qi, S. (1983). A comparison between the development of the appearance-reality distinction in the People's Republic of China and the United States. Cognitive Psychology, 15, 459-466.

Fodor, J. A. (1983). The modularity of mind. Cambridge, MA: MIT Press.

Freeman, N. H., Lewis, C., & Doherty, M. (1991). Preschoolers' grasp of a desire for knowledge in false-belief reasoning: Practical intelligence and verbal report. British Journal of Developmental Psychology, 9, 139-157.

Goetz, P. J. (1999). A comparison of 3- and 4-year-old English monolinguals, Mandarin monolinguals, and Mandarin-English bilinguals on a series of theory of mind-related tasks. Unpublished doctoral dissertation, University of Michigan, Ann Arbor, MI.

Gopnik, A., & Astington, J. W. (1988). Children's understanding of representational change and its relation to understanding of false belief and the appearance-reality distinction. Child Development, 59, 26-37.

Guo, J. S. (郭建生) (1994). Social interaction, meaning, and grammatical form: Children's development and use of modal auxiliaries in Mandarin Chinese. Unpublished Dissertation, University of California at Berkeley.

Harris, P. L., & Gross, D. (1988). Children's understanding of real and apparent motion. In J. W. Astington, P. L. Harris, & D. R. Olson (Eds.), Developing theories of mind. Cambridge: Cambridge University Press.

Hirschfeld, L. A., & Gelman, S. (Eds.), (1994). Mapping the mind: Domain specificity in cognition and culture. New York: Cambridge University Press.

Hogrefe, G. J., Wimmer, H., & Perner, J. (1986). Ignorance versus false belief: A developmental lag in attribution of epistemic states. Child Development, 57, 567-582.

Jenkins, J., & Astington, J. (1996). Cognitive factors and family structure associated with theory of mind development in young children. Developmental Psychology, 32, 70-78.

Lee, K., Olson, D. R., & Torrance, N. (1999). Chinese children's understanding of false beliefs: The role of language. Journal of Child Language, 26, 1-21.

Leslie, A. M. (1987). Pretense and representation: The origins of "theory of mind." Psychological Review, 94(4), 412-426.

Leslie, A. M. (1988). Some implications of pretense for mechanisms underlying the child's theory of mind. In J. W. Astington, P. L. Harris, & D. R. Olson (Eds.), Developing theories of mind. Cambridge: Cambridge University Press.

Leslie, A. M. (1991). The theory of mind impairment in autism: Evidence for a modular mechanism of development? In A. Whiten, (ed.) Natural theories of mind: Evolution, development, and simulation of everyday mindreading. Oxford: Basil Blackwell.

Leslie, A. M. (1994). Pretending and believing: Issues in the theory of ToMM. Cognition, 50, 211-238.

Moore, C., & Frye, D. (1991). The acquisition and utility of theories of mind. In D. Frye & C. Moore (Eds.), Children's theories of mind: Mental states and social understanding (pp. 1-14). Hillsdale, NJ: Lawrence Erlbaum.

Moore, C., Bryant, D., & Furrow, D. (1989). Mental terms and the development of certainty. Child Development, 60, 167-171.

Olson, D. R. (1988). On the origins of beliefs and other intentional states in children. In J. W. Astington, P. L. Harris, & D. R. Olson (Eds.), Developing theories of mind. Cambridge: Cambridge University Press.

Olson, D. R. (1993). The development of representations: The origins of mental life. Canadian Psychology, 34, 1-14.

Perner, J. (1991). Understanding the representational mind. MIT Press.

Perner, J., & Lang, B. (1999). Development of theory of mind and executive control. Trends in Cognitive Sciences, 3 (9), 1-8.

Perner, J., Leekam, S. R., & Wimmer, H. (1987). Three-year-olds' difficulty with false belief: The case for a conceptual deficit. British Journal of Developmental Psychology, 5, 125-137.

Peterson, C. C., & Siegal, M. (1995). Deafness, conversation and theory of mind. Journal of Child Psychology and psychiatry, 36, 459-474.

Piaget, J. (1929). The child's conception of the world. New York: Routledge.

Riggs, K. J., & Robinson, E. J. (1995). What people say and what they think: Children's judgements of false belief in relation to their recall of false messages. British Journal of Developmental Psychology, 13, 271-284.

Sabbagh, M. A., & Taylor, M. (2000). Neural correlates of theory-of-mind reasoning: An event-related potential study. Psychological Science, 11(1), 46-50.

Schank, R., & Abelson, R. (1977). Scripts, plans, goals, and understanding. Hillsdale, NJ: Lawrence Erlbaum.

Shatz, M. (1983a). Communication. In J. H. Flavell and E. Markman (Eds.), Cognitive development, Handbook of child psychology, 4th ed. New York: Wiley.

Shatz, M. (1983b). On transition, continuity, and coupling: An alternative approach to communicative development. In R. M. Golinkoff (Ed.), The transition from prelinguistic to linguistic communication. Hillsdale, NJ: Lawrence Erlbaum

Shatz, M. (1994). A toddler's life. New York: Oxford University.

Shatz, M., Martinez, I., Diesendruck, G., & Akar, D. (1995). The influence of language on children's understanding of false belief. Paper presented at the Society for Research in Child Development.

Shatz, M., Wellman, H. M., & Silber, S. (1983). The acquisition of mental verbs: A systematic investigation of the first reference to mental state. Cognition, 14, 301-321.

Siegal, M., & Peterson, C. C. (1994). Children's theory of mind and the conversational territory of cognitive development. In C. Lewis & P. Mitchell (Eds.), Children's early understanding of mind: Origins and development. Hillsdale, NJ: Lawrence Erlbaum.

Tager-Flusberg, H. (1994). What language reveals about the understanding of minds in children with autism. In S. Baron-Cohen, H. Tager-Flusberg, & D. J. Cohen (Eds.), Understanding other minds: Perspectives from autism (pp. 138-157). Oxford: Oxford University Press.

Tager-Flusberg, H. (1997). The role of theory of mind in language acquisition: Contributions from the study of autism. In L. Adamson & M. A. Romski (Eds.), Research on communication and language disorders: Contributions to theories of language development. Baltimore, MD: Paul Brookes Publishing.

Tardif, T., & Wellman, H. (2000). Acquisition of mental state language in Mandarin - and Cantonese-speaking children. Developmental Psychology, 36(1), 25-43.

Welch-Ross, M. K. (1997). Mother-child participation in conversation about the past: Relationships to preschoolers' theory of mind. Developmental Psychology, 33, 618-629.

Wellman, H. M. (1990). The child's theory of mind. Cambridge, MA: MIT Press.

Wellman, H. M., Cross, D., & Watson, K. (1999, April). A meta-analysis of theory of mind development: The truth about false-belief. Paper presented at the Society for Research in Child Development, Albuquerque, NM.

Wellman, H. M., Harris, P. L., Banerjee, M., & Sinclair, A. (1995). Early understanding of emotion: Evidence from natural language. Cognition and Emotion, 9, 117-149.

Whorf, L. B. (1956). Language, thought and reality. Edited by J. B. Carroll. Cambridge, MA: The MIT Press.

Wimmer, H., & Hartl, M. (1991). Against the Cartesian view on mind: Young children's difficulty with own false beliefs. British Journal of Developmental Psychology, 9, 125-138.

Wimmer, H., & Perner, W. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. Cognition, 13, 103-128.

Wu, H. F.（吳信鳳）(1994). If triangles were circles,...-A study of counterfactuals in Chinese and in English. Taipei, Taiwan: Crane publisher.

Appendix

The scoring scheme of children's performance on The unexpected transfer task and the interpretations

Score	Scoring Scheme	Interpretation
4	2 points for a correct prediction 2 points for an appropriate explanation	An indication that a child has developed a false belief understanding and is able to justify it verbally.
3	2 points for a correct prediction 1 point for an incomplete but plausible explanation	An indication that a child has developed a false belief understanding, but is not able to justify it verbally.
2	2 points for a correct prediction, but with no or implausible explanation	A child may or may not have developed a false belief understanding. This child may have passed the false belief task by chance.
1	Incorrect prediction 1 point for a plausible explanation	An indication that a child may not have developed a false belief understanding, but is able to justify his or her answer with a plausible explanation.
0	Incorrect prediction without an explanation	An indication that a child may not have developed a false belief understanding.

Notes

[1] This description of children's "cognitive deficit" may be in similar accord with Piaget's (1929) claim of young children's egocentrism, or their inability to "decenter" from their own perspectives. However, such classical Piagetian assertions have been seriously challenged. Therefore, it is a deliberate decision not to bring in Piaget's concept of decentering or egocentrism here to avoid further ramifications.

[2] These studies were conducted with Chinese children from Mainland China.

[3] A module usually means a standardized unit in a system designed for easy assembly. In this context, it means a system with its fast, encapsulated processing of a specific type of stimulus input (Fodor, 1983).

[4] With its function as a time deixis, the adverb *hai2* (還) 'still,' when used together with *yi3wei2* (以為) as in *hai2yi3wei2* (還以為) 'had thought' is another authentic counterfactual marker in Chinese.

[5] Chinese children here refer to children in Taiwan who speak Mandarin Chinese.

[6] On some occasions such sentences may be phrased in elliptical forms such as 我以為是女的(I [mistakenly] thought was female). When *yi3wei2* 以為 is interpreted as an equivalent to *ren4wei2* 認為 in examples like 本人以為這件事做得不夠周到 (I personally believe/think this is not done in a well thought-out way), it loses its false belief intent. But such a case is quite rare and is used mainly for stylistic variations rather than for communicative purposes. Y*i3wei2* 以為 and various Chinese counterfactual

markers are discussed at greater length in Wu, 1994.

[7] In general, the children's performance on the two variants of each task was quite consistent. Most of them either failed or passed both variants. In a few cases of fractions after averaging over the two variants, the experimenter and author re-examined the video-tape and gave a reasonable integral score to the performance.

[8] This may be attributed to the missing values and small numbers of children in several cells.

[9] Chi-square tests and analysis of variance (ANOVA) models were calculated for Task 2 (5- level scoring) on age (2) and general language ability (5 levels). Owing to the limited sample size divided into multiple cells or categories, the results are hard to interpret.

[10] I'm indebted to the preschool teacher, Ms. Pan, Ye-fen (潘葉棻) at the Kindergarten affiliated with National Chengchi University (政治大學實驗小學幼稚園), for sharing with me her experience on Chinese children's use of *yi3wei2* 以為 and for her very insightful comments on my study in the interview.

[11] Tardif and Wellman's (2000) study of Mandarin- and Cantonese-speaking children also indicates that other mental state verbs in Chinese are found to be infrequent in the speech of young children.

[12] I am grateful for the comment by Hsueh, Yeh (薛燁) to this insight (personal communication, June 1, 2000).

[13] The observation was comments contributed by Hsueh, Yeh (薛燁) (personal communication, June 1, 2000).

[14] I am indebted to Sylvia Chiu (邱美和) at Soochow University for bringing this point to my attention (May 24, 2000).