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False belief understanding in Cantonese-speaking children*

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ABSTRACT

The present study investigates the performance of 96 Cantonese-speaking three- to five-year-old preschoolers on three false belief tasks – a deceptive object, a change of location, and an unexpected contents task encompassing a variety of task factors. Most importantly, the research examines the possibility that false belief performance depends on specific linguistic factors such as the type of verb used in the test question – an explicitly false vs. a neutral belief verb. Cantonese was chosen as particularly useful for examining this question because it explicitly codes belief status as either neutral (*nam5*) or false (*ji5wai4*), and because it offers additional linguistic and cultural contrasts to research conducted on false belief with children learning English and other Indo-European languages. As expected, a strong age effect was found, as well as a significant advantage for children who received the explicit false belief (*ji5wai4*) wording and for those who were asked to explain rather than predict the protagonist's actions. Interestingly, there was also a strong task difference with children performing better on the deceptive object task than on the other two false belief tasks. We argue that these results point both to universal trajectories in theory of mind development and to interesting, but localized, effects of language and culture on children's false belief understanding.

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INTRODUCTION

A theory of mind involves thinking about people's actions and behaviours in terms of their underlying mental states. Arguably, a theory of mind is at the heart of human social cognition (Flavell & Miller, 1998). Much research in the past two decades has shown that, from 3;0 to 6;0, children's theory of mind undergoes rapid development and transformation. During that period, children make a transition from assuming that all individuals act under the same information and motives as one's self to realizing that there are sometimes mismatches between one's own and other people's internal states and that, in fact, internal representations of the world may differ from external realities. What accounts for these changes in the preschool years? In addressing this question, interest has recently burgeoned in how language experiences and language abilities might impact on children's development of a theory of mind (e.g. Tager-Flusberg, 1997; Astington & Jenkins, 1999; de Villiers & de Villiers, 2000). In the present paper, we examine this question with regards to how Cantonese-speaking children perform on prototypic theory of mind tasks – false belief tasks.

A typical false-belief task presents a child with the following scenario (Baron-Cohen, Leslie & Frith, 1985): Sally puts her marble in the basket and leaves the room to play. While she is away (and cannot see) Ann moves the marble from the basket to a box. Sally returns. Where will Sally think her marble is, in the basket or in the box? Four- and five-year-olds often pass such tasks, judging that Sally will think the marble is in the basket although it is really in the box. These correct answers provide evidence that the child knows that mental states can dramatically diverge from reality. Many younger children, typically three-year-olds, fail such tasks – they assert Sally will think the marble is in the box where it really is. Empirically, false belief performance correlates appropriately with other theory of mind achievements (e.g. Gopnik & Astington, 1988), with other social cognitive competences (Astington & Jenkins, 1995) and with differences in children's social-interactive behaviours (e.g. Chandler & Lalonde, 1994; Slomoski & Dunn, 1996).

False belief tasks come in a large number of varieties, designed in part to simplify task demands or to control for one possible artifact or another. However, a recent meta-analysis (Wellman, Cross & Watson, 2001) of more than 150 false-belief studies revealed that, uniformly, children go from below-chance to above-chance performance in the preschool years. At the same time, however several factors change the RATE at which false belief understanding appears. In particular, country does – children in various countries achieve false belief understanding, on average, at different ages (4;0 versus 5;0 versus 6;0) although on parallel developmental trajectories. These findings raise the issue of how early enculturation experiences, and, in particular, early language experiences, impact children's understanding of persons and minds.

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Relations between language and theory of mind development

Interest in the relationship between children's language and their theory of mind focuses on several questions. There is a general question about whether language, and normal language development in particular, is necessary for theory of mind and false belief understanding. The evidence here suggests that theory of mind development, as marked by false belief understanding, is dependent upon an adequate amount of exposure to talk and, more specifically, talk about mental states. For example, deaf children of hearing parents are greatly delayed in false belief understanding in relation to hearing children and also in relation to deaf children of deaf (signing) parents (Peterson & Siegal, 1995; Gale, de Villiers, de Villiers & Pyers, 1996). Once deaf children start to sign and become exposed to more complex language, including mental state language, through signing, their false belief understanding catches up accordingly. Evidence of this type suggests that language has, at the least, a very broad-ranged and global facilitating effect on ToM development such that individuals with severely limited linguistic exposure or abilities have great difficulty developing a complex ToM involving concepts such as false belief.

Cross-linguistic differences and lexical effects on false belief performance

A different set of questions involves hypotheses about the role of specific linguistic elements in facilitating (or encumbering) false belief understanding and theory of mind more generally. In this vein are hypotheses about how particular languages carve up the world of mental states and how this might be related to children's theory of mind development. English, for example, has several ways of talking about the mental states of thinking and knowing, including 'think,' 'believe,' 'guess,' 'know,' and so on, each of which involves differences in the thinker's certainty and other aspects of their mental states (Moore, Bryant & Furrow, 1989). Other languages also carve up the domain of mental life into various linguistic terms, some of which are very similar to English and some of which are quite different.

More specifically, in English, belief terms such as *think* and *believe*, are neutral with respect to whether the person's belief is true or false. If told that 'Joe thinks the ball is red,' it may be red or blue. Some languages, including Chinese languages, include terms to designate beliefs that are decidedly false. The appearance of such terms has several intriguing implications. Most generally, there is the possibility that acquiring a language that lexically marks beliefs as false may aid children in coming to understand false belief, and in particular the divergence between beliefs and reality. This represents a particularly plausible hypothesis about the role of specific linguistic elements in fostering more general theory of mind

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understandings. Thus, in much the same way that acquiring specific lexical items (e.g. more and more individual verbs) might spur syntactic development (e.g. children's development of a generalized tense marking rule, Tomasello, 1992), specific lexical items might also spark specific conceptual developments. At the extreme, perhaps children learning such a language never evidence difficulty with false belief because their language clearly marks this distinction. Alternatively, understanding false belief may be enhanced, but more modestly. Or, the presence of explicit false belief terms may provide no enhancement whatsoever.

If enhancement occurs, then it could conceivably be of two types. First, children's understanding and performance could be generally affected – the presence of an explicitly marked false belief term could influence performance on tasks that use the term, but also on tasks that do not use the term. Alternatively, the influence might be more specific such that the term facilitates false belief performance only when it is used in the task. Preliminary evidence of this sort has already been found in a cross-linguistic study by Shatz, Martinez-Beck, Diesendruck & Akar (2003), which suggests that children who speak languages with explicit false belief terms (Puerto Rican Spanish and Turkish) pass only certain false belief tasks earlier than those who speak languages that do not mark false belief explicitly (English, Brazilian Portuguese). Specifically, the false belief tasks they pass are the ones that use the marked false belief term in the test question (i.e. 'falsely think' vs. 'think'), whereas the children's performance on other tasks (e.g. 'look for' questions) appears to show no relative advantage.

Chinese languages (both Mandarin and Cantonese) are important languages in which to examine these issues precisely because they are languages in which separate lexical items for belief exist, including items that both do and do not explicitly mark false beliefs, but also because the syntactic structure for mental verbs is more straightforward than English and many other languages (Tardif & Wellman, 2000). Nonetheless, only a couple of studies have examined false belief understanding in Chinese children (Chen & Lin, 1994; Lee, Olson & Torrance, 1999). Both of these have examined only Mandarin and found that Mandarin-speaking children's false belief performance appeared to be no better than their English- or German-speaking counterparts. Like English- and German-speaking children, Chinese three-year olds' false belief performance was below chance. Indeed, Chen & Lin found that their four-year olds were still at chance on these tasks and suggested that Chinese children may even be delayed on theory of mind tests because Chinese child-rearing practices emphasize the consequences of one's actions rather than the intentions or internal states involved when the action was carried out. Lee *et al*. (1999), using tasks that were more typical of the false belief tasks used in the existing theory of

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mind literature, found that Chinese four-year-olds performed at or above chance, and appeared to be developing false belief at roughly the same time that English-speaking children do. However, only the Lee *et al*. (1999) study systematically varied the verb that was used to indicate the belief state of the main protagonist in their tasks. In fact, it is not clear WHICH verb was used to indicate 'thinking' and believing in the Chen & Lin study, whereas in Lee *et al*.'s study, the verb used in the false belief task had a clear effect. Specifically, the four-year-olds performed at or above chance ONLY when the marked verb, *yi3wei2*, was used, whereas they were below chance when the neutral verb, *xiang3*, was used. Adults performed at ceiling when either verb was used and freely chose either verb as acceptable for filling in a blank test sentence from their experimental protocol, but also agreed that the marked verb, *yi3wei2*, was the most appropriate in the false belief context.

There are two interpretations of the finding that children did better on false belief tasks when the verb *yi3wei2* rather than *xiang3* was used. One is that since *yi3wei2* specifically marked false belief, it enhanced children's false belief performance. Alternatively, these data could be showing that *xiang3* impeded false belief performance, rather than that *yi3wei2* enhanced it. In particular, Mandarin is interesting in the fact that many words, and the *xiang3* verb in particular, are polysemous. *Xiang3*, as described by Tardif & Wellman (2000), can be used to refer to 'thinking' or 'believing,' but it is also used to refer to 'wanting' and 'missing (someone),' which is more indicative of desire. The great polysemy of the neutral belief verb, *xiang3*, in Mandarin, could plausibly mean that it increases the difficulty of children's understanding and responding correctly to the target question. Thus, it is possible that the four-year-olds' below-chance responding in BOTH Chen & Lin's study and in Lee *et al*.'s '*xiang3*' condition could be reflective of a difficulty Chinese children have when faced with this verb in a false belief task.

Fortunately, Cantonese differs from Mandarin in that it has two neutral belief verbs, *soeng2*, which is the same character as the Mandarin verb *xiang3* and similarly polysemous with both desire and belief meanings, but also *nam5*, which is a unique Cantonese verb and means only 'to think' or 'to consider.' That is, *nam5* can refer neutrally to beliefs and to 'thinking,' but not to 'wanting.' Cantonese also has a verb *ji5wai4*, which means to falsely believe and is written with the same characters as the Mandarin verb *yi3wei2* used in Lee *et al*.'s study. A comparison between the less polysemous 'think' verb, *nam5*, and the false belief verb, *ji5wai4*, together with an explicit comparison between the belief verbs and a different version of the task which uses neither verb can thus be more precisely informative about the nature of these potential effects on children's false belief understanding.

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Task effects on false belief performance?

The recent literature on false belief, supported also by Wellman *et al.*'s (2001) meta-analysis, makes it clear that an informative understanding of false belief requires examining performance on a variety of false-belief tasks and formats. Lee *et al.*'s study used three different types of false belief tasks: a change of location task (like the Sally-Ann task described earlier), an unexpected contents task, and a deceptive object task. (We will describe these task differences in more detail in our Method.) In the present study we also used multiple false belief tasks (a deceptive object task, an unexpected contents task, and a change of location task) as well as varying the verb used in the false belief test questions. In addition, we investigated performance when the child was asked to PREDICT versus to EXPLAIN the protagonist's actions.

Research on false belief, just as all research on theory of mind, has typically examined children's judgments and predictions. For example, children are asked to judge where Sally thinks her marble is, the box or the basket? Much less is known about children's explanations; in contrast to the more than 150 studies testing children's false-belief predictions included in the meta-analysis by Wellman *et al.* (2001) only four or five studies have contrasted children's false-belief predictions with explanations (e.g. Bartsch & Wellman, 1989; Wimmer & Weichbold, 1994; Robinson & Mitchell, 1995; Wimmer & Mayringer, 1998). Intriguingly, Bartsch & Wellman (1989) found an advantage for explanation over prediction in their study – children who failed to correctly predict an actor's action based on their false belief, could nonetheless provide false-belief explanations when asked to explain an actor's anomalous action. This advantage was confirmed by Robinson & Mitchell (1995; but see Wimmer & Mayringer, 1998). An advantage for explanations is sensible on the construal that mental state understandings (that is, theory of mind) constitute a foundational causal-explanatory reasoning system. If so, then this understanding should be especially important for, and especially revealed by, children's explanations.

In general, a comprehensive examination of the relationship between Chinese-speaking children's false-belief reasoning and language needs to include explanation tasks as well as prediction tasks. No studies have yet done this. Moreover, the apparent facility young children have with theory of mind explanations may prove to be peculiar to English-speaking children. English-speaking children are arguably bombarded by questions, including 'how come' and 'why' questions, from their caretakers. They come to use explicit causal connectives (because, why, so, how) very early (Hood & Bloom, 1979) and ask 'why' questions frequently and about a variety of different phenomena (Callanan & Oakes, 1992; Hickling & Wellman, 2001). Chinese languages, although they have similar causal structures available,

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typically do not express these causal connectives explicitly (Li & Thompson, 1981; Gelman & Tardif, 1998). Moreover, Chinese children are argued to be delayed in their acquisition of 'why' questions, and at least one author's explanation for this is simply that Chinese parents and nursery schools do not ask their children many 'why' questions, nor do they promote the asking of such questions by the child (Miao, 1986). In other research (Tardif, 1997), Chinese caregivers have been found to issue many fewer justifications and explanations when disputing with their toddlers than American or British caregivers in comparable situations. Thus, comparing false-belief explanations and predictions for Chinese speaking children provides an important opportunity to test more generally findings indicative of an early emergence of explanation within children's language and reasoning. For our study, it is also important that the explanation questions do not themselves include mental state terms, even though they do ask about the actions and intentions of the protagonists. Thus, the explanation version of the false belief question provides an additional look at children's performance in a version of the task that does not involve the use of either the neutral or the explicit false belief verb.

To summarize, we examined Cantonese-speaking children's false belief understanding across three false belief tasks, varying the sort of verb that was used in our prediction tasks, including both a 'neutral' and a 'false belief' mental state verb, to examine whether or not specific lexical marking of the falsity of a belief would have an effect on children's false belief performance. In addition, we conducted a comparison of predictions versus explanations to further examine this effect as well as to more comprehensively examine the nature of children's false-belief reasoning.

METHOD

Participants

A total of 96 preschool-aged children recruited from Cantonese-speaking nursery schools in Hong Kong participated in this study. There were 32 children in each group of three- (*M* age = 3;8, range 3;2·2 to 3;11·19), four- (*M* age = 4;6, range 4;0·4 to 4;11·15), and five-year-olds (*M* age = 5;6, range 5;1·17 to 6;0·4), with 16 males and 16 females in each group. An additional 8 children were tested, but not included in the results because they were unable or too shy to give responses to the experimenter's questions.

Design and materials

Three tasks were used to examine these Cantonese-speaking children's false belief understanding – a deceptive object task, an unexpected contents task,

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and a change of location task. In the deceptive object task, children were asked questions about a pen that looked liked a lollipop. Children were first asked what the object was (a lollipop) and then shown it was a pen that could be used to draw. In the unexpected contents task, a Smarties box that contained pencils was shown to the children. A Winnie the Pooh puppet was then used for asking false belief questions about the contents of the Smarties box. In the change of location task, a 'Sally and Ann' (*KeiKei* and *YanYan* in Cantonese) type of storybook with coloured illustrations about the transfer of a ball from a square box to a round box was used.

All children received all three tasks and, across tasks, all participants received both prediction and explanation questions. For the deceptive object task, we manipulated only the mental state verb, *nam5* (to think/believe) or *ji5wai4* (to falsely think/believe), that was used in the question. For the unexpected contents and change of location tasks, we manipulated both the mental state verbs and whether we asked a prediction versus an explanation question. Thus, half of the participants answered prediction questions about the unexpected contents task and explanation questions about the change of location task, whereas this was reversed for the other half of the participants. For the unexpected contents/change of location prediction questions, half of the children received *nam5*, whereas the other half received *ji5wai4*. The mental state verb that was used for a particular child was kept consistent across tasks in order to reduce the potential confusion from switching verbs across tasks. To control for possible effects of task order, the order of the three tasks and the pairings of mental state verbs to tasks and orders was counterbalanced across participants, with no significant effects of order or pairings observed.

Procedure

All children were tested individually in a room of their kindergarten and all of their responses were audiotaped. At the beginning of the experiment, children were told they were going to play a question-answering game with the experimenter.

In the deceptive object task, children were first shown the lollipop-looking pen and asked to say what it was. Then the experimenter opened the cap of the pen and drew an apple on a piece of paper. After putting away the piece of paper, the pen was returned to its original lollipop-looking state. Finally, the child was asked, using either *nam5* (to think/believe) or *ji5wai4* (to falsely think/believe), what he/she THOUGHT the item was when he/she first saw it. Afterwards, the child was asked what the item really was, and this was considered to be a control question. This procedure is similar to the deceptive object false belief task used in Gopnik & Astington's (1988) study.

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In the unexpected contents task, children were asked to say what they *thought* (*nam5/yi5wai4*) was inside of a Smarties tube. The tube was then opened and its contents were revealed to the children. After confirming that the children knew the true contents (pencils) of the tube, a Winnie the Pooh doll appeared and the children were told that Winnie the Pooh had not seen inside the tube and thus did not know the contents of the tube. For the prediction condition, children were simply asked what Winnie would ***think*** (*nam5/yi5wai4*) was inside the tube and why. For the explanation condition, the Smarties tube was also presented and its contents revealed, as above. However, instead of asking the children what Winnie would *think* when he appeared, the experimenter told children that Winnie the Pooh was very happy and made him run towards the Smarties tube. Then they were asked WHY he ran so happily towards the tube. Children who failed to give an explanation were asked if Winnie the Pooh knows the contents of the tube and then given a second chance to explain. All answers were recorded and both 'first' (initial response to why Winnie was happy) and 'best' (response after being asked if Winnie knows the contents of the tube) answers were used in the analyses.

In the change of location task, the children were told a story about two girls, *YanYan* and *KeiKei* with coloured illustrations in a storybook. This story is almost identical to the one used by Baron-Cohen *et al*. (1985). In the story, *YanYan* puts her ball in the square box and goes outside. In her absence, *KeiKei* moves the ball to the round box. Children were given either a prediction or an explanation test question at the end of the story. In the prediction task, children were asked both a false belief test question, 'Where does *YanYan* ***think*** (*nam5/ji5wai4*) her ball is?' and a memory control question, 'Where did *YanYan* put her ball?'

In the explanation version of the change of location task, children were given an extra page of the storybook which showed *YanYan* going to search for her ball in the square box. We then asked WHY *YanYan* went to look for her ball in that box. Children who were unable to provide an adequate explanation the first time were asked a memory control question, then given a second chance to explain why *YanYan* would look in the square box. Again, all answers were recorded and both the 'first' and the 'best' answers (for children who did not give an adequate explanation to the first question and received additional prompts) to the explanation questions were used in the analyses.

Scoring

In the deceptive object task, children were scored as being correct if they answered what they *thought* the item (a lollipop) was correctly on the test question. Their responses to the control question were scored as 'pass' if

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they answered that the item was REALLY a pen, and as 'fail' if they failed to answer or answered that it was a lollipop or other esoteric answers. Although over 90 percent of the children (84% of three-year-olds, 100% of four-year-olds, and 94% of five-year-olds) passed the control question, responses to the test question were analysed for both all children in the sample and only for those who passed the control question.

In the change of location and unexpected contents tasks, there were both prediction and explanation questions, with half the children receiving each task in prediction form and the other half receiving it in explanation form. For PREDICTION questions, correct answers scored one mark and incorrect answers scored no marks. For EXPLANATION questions, correct explanations involved statements that *YanYan* did not know that the ball was transferred:

(1) *keui5* (*YanYan*) *m4 zi1 go3 bo1bo1 bai2 dzo5 hai2 jun6 hap8*.
(3PS NEG know – CL ball put ASP at round box)
('She doesn't know the ball has been put in the round box.')
(2) *jan1wai4 keui5 ji5wai4 go3 bo1bo1 hai2 dzeng3fong1 hap8 do6*.
(because 3PS falsely-believe – CL ball at square box there)
('Because she thought the ball was in the square box.')

Or, for the change of locations task, that Winnie-the-Pooh thought there was candy in the box:

(3) *keui5 soeng5 sik9 loi2minh6 di1 tong6*.
(3PS want/think eat inside – CL(PL) candy)
('He wanted to eat the candy inside.')

Incorrect explanations were those that indicated YanYan had knowledge of where the ball was now located (4) or that Winnie-the-Pooh knew there were pencils inside the box (5).

(4) *jan1wai4 KeiKei fong4 dzo5 hai2 jun6 hap8*.
(because KeiKei put ASP at round box)
('Because KeiKei put it in the round box')
(5) *jan1wai4 keui5* (*Winnie*) *ji5wai4 jau5 but7*.
(because 3PS false-believe have pen/pencil)
(because he [falsely] believes there are pencils).

As with the prediction questions, a correct answer scored 1 mark and an incorrect answer scored no marks. However, for the 'best' answer scores, children were given multiple opportunities to answer the explanation question and asked prompts highlighting the anomaly of the protagonists' behaviour, as described above, if they did not answer these questions adequately on the first trial. The procedures closely parallel those used by Bartsch & Wellman (1989) in their study comparing predictions with

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explanations. Both children's 'first' and 'best' answers to these questions were scored. Again, although over 90 percent of the children passed the control question (81 percent of three-year-olds and 100% of four- and five-year-olds), responses to the test question were analysed both for all children in the sample and for those who passed the control questions only.

RESULTS

A repeated measures analysis of variance was first performed on all of the prediction tasks, with task (deceptive object, unexpected contents/change of location) as a within-subject variable and age, gender, and wording (*nam5/ji5wai4*) of the false belief statement as between-subject variables. Note that for the overall ANOVA examining task effects, children's performance on the deceptive object task was initially contrasted as a within-subjects variable with their performance on EITHER the unexpected contents or change of location task. Then, given that children performed only one of these two tasks, performance on the unexpected contents and change of location tasks was contrasted via a between-subjects categorical variable that specified which of these two tasks was performed by each child. In addition, a number of task-specific ANOVAs were conducted to examine the effects of type of question (prediction vs. explanation), age, gender, and wording (*nam5/ji5wai4*) effects within each task. Given this design, some conditions (e.g. '*nam5*' wording with unexpected contents prediction form) resulted in only 8 children per age group, whereas other conditions ('*nam5*' wording with deceptive object task) had 16 children per age group. This nesting of conditions, although complicated, allowed us to examine important contrasts both within and across subjects with respect to task and language variations and thus provided the most informative design for our study.

Task effects

The first set of analyses involved a comparison of children's answers to the prediction questions, regardless of wording, across all tasks. The results reported below and in all Tables and Figures are for those children who passed the control questions only, but identical effects were found when the entire sample of children was entered into the analyses. As can be seen in Table 1, children's performance improved with age in all three false belief tasks, $F(2, 63) = 17{\cdot}89$, $p < 0{\cdot}0001$. However, there was also a highly significant task effect (deceptive object vs. change of locations/unexpected contents), $F(1, 63) = 26{\cdot}20$, $p < 0{\cdot}0001$, and a significant task by age interaction, $F(2, 63) = 6{\cdot}19$, $p < 0{\cdot}005$. The deceptive object task ($n = 96$, with 87 children passing both control questions) was easier than the unexpected contents ($n = 48$, n = 43 passing control questions) and change of location

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TABLE 1. *Mean scores on deceptive object, unexpected contents, and change of location false belief tasks, excluding subjects who failed control questions*

Task	Three-year-olds	Four-year-olds	Five-year-olds
Deceptive object	0·36 (0·49) N = 25	0·88 (0·34) N = 32	0·73 (0·45) N = 30
Unexpected contents	0·08 (0·29) N = 12	0·31 (0·48) N = 16	0·73 (0·46) N = 15
Change of location	0·00 (0·00) N = 13	0·19 (0·40) N = 16	0·60 (0·51) N = 15

($n = 48$, n = 43 passing control questions) tasks. This effect was strong and clear (power = 0·999, eta^2 = 0·294), with performance on the deceptive object task well above chance and approaching ceiling by age four, $t(31) = 6·31$, $p < 0·0001$. However, no further differences were found between the unexpected contents and change of location task, either in the full analysis comparing the categorical between-subjects variable, or when a separate univariate ANOVA was run on these two tasks alone.

Effects of Mental State Verbs **nam5** *and* **ji5wai4**

In the overall repeated measures ANOVA with performance on the prediction version of the false belief tasks as dependent variables and age, gender, wording, and unexpected contents/change of location as independent variables, there was also an effect of wording, with children who received the marked '*ji5wai4*' wording performing better than children who received the neutral word '*nam5*' in the false belief test question, $F(1, 63) = 6·15$, $p < 0·05$. No interactions between wording and age or task were evidenced. However, given the existence of a main effect of task and the unequal numbers of children in each condition, it is reasonable to examine the effect of wording in each of the tasks independently.

In the deceptive object task, as can be seen in Figure 1a, both age, $F(2, 83) = 9·66$, $p < 0·0001$, and wording effects $F(1, 83) = 3·97$, $p < 0·05$, were found and this was true for the whole sample and when the children who failed the control question were deleted from analysis. Interestingly, there were no differences between verbs for the four-year-olds, although both the three- and the five-year-olds clearly performed better on the false belief verb, *ji5wai4*, than on the neutral verb, *nam5*, and an age by wording interaction failed to reach significance.

In the unexpected contents task, both age and wording again showed significant main effects, $F(2, 36) = 21·55$ and $F(1, 36) = 5·49$, ps $< 0·0001$ and 0·05, respectively. As with the overall analyses and the deceptive object task, children got better with age and the children who received the false

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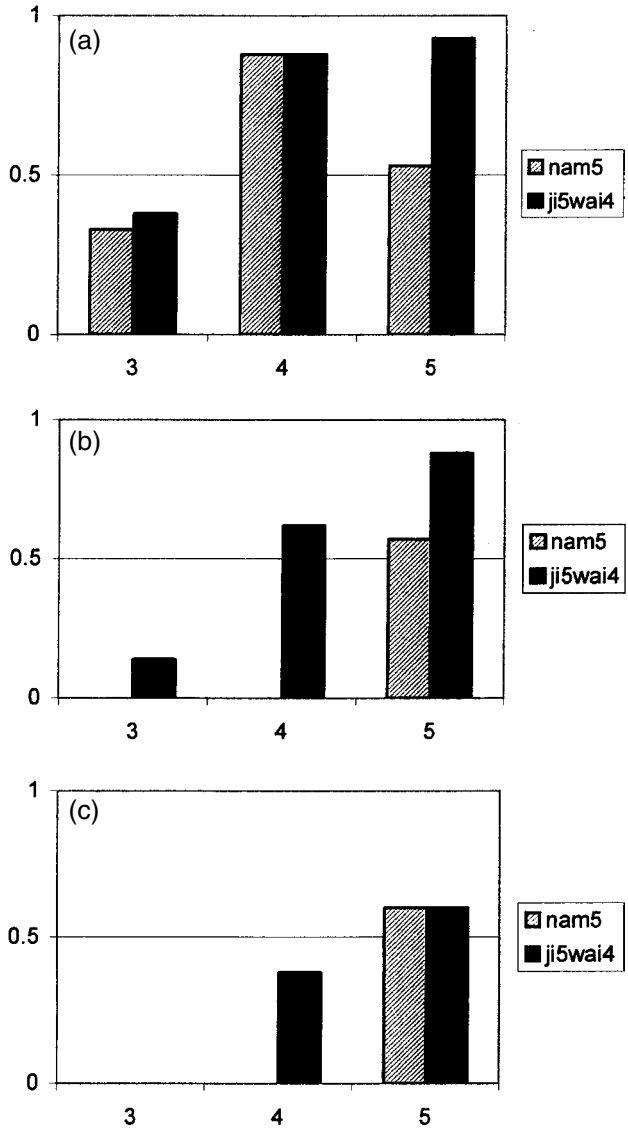


Fig. 1. Mean scores of *nam5* vs. *ji5wai4* in (a) deceptive object task, by age, excluding children who failed control questions; (b) unexpected contents task, by age, excluding children who failed control questions; (c) change of locations task, by age, excluding children who failed control questions.

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belief (*ji5wai4*) verb in the test question performed better than the children who received the neutral verb (*nam5*), as shown in Figure 1b.

In the change of location task, age again showed a significant main effect, $F(2, 33) = 6{\cdot}87$, $p < 0{\cdot}005$, but wording failed to reach significance. As can be seen in Figure 1c, even though the difference between the change of location and the unexpected contents tasks were not significant, it appears that a wording effect may have been masked by rather poor performance overall on this task, given that not even the five-year-olds performed above chance on this task. Nonetheless, the direction of differences are the same as in the other two tasks, with more of the four-year-old children who received the '*ji5wai4*' wording passing the false belief test question than those who received the '*nam5*' wording, χ^2 (df = 1, N = 16) = 3·69, $p = 0{\cdot}055$, and equal numbers of the three- and five-year-olds passing the question, regardless of wording.

Prediction vs. explanation effects

There remains the issue of how prediction questions compare to asking children to explain the protagonist's behaviour. In this study, each child answered one of the unexpected contents or change of location tasks in a prediction format and the other in an explanation format. Thus, it was possible to examine both task (unexpected contents vs. change of location) and question type (prediction vs. explanation [first vs. best]) effects in this nested between-within design. Moreover, it was possible to examine this manipulation both as a between-subjects (different children given the same task in a prediction vs. explanation form) and as a within-subjects (same children given different tasks in a prediction vs. explanation form) effect. However, the results for these two ways of considering the problem were identical, both with the whole sample and with only the sub-sample of children who passed the control questions. Specifically, we observed both a question type main effect, $F(2, 168) = 20{\cdot}48$, $p < 0{\cdot}0001$ and a question type by task interaction, $F(2, 168) = 3{\cdot}20$, $p < 0{\cdot}05$, in addition to the usual main effect of age, $F(2, 84) = 22{\cdot}95$, $p < 0{\cdot}001$. As can be seen from Figures 2a and 2b, asking children to EXPLAIN, rather than to PREDICT, was particularly helpful for the change of location task, with children more likely to pass the false belief task when comparing 'first' explanations to predictions and an even larger difference when comparing their 'best' explanations to predictions, Scheffe $ps < 0{\cdot}05$.[1] Nonetheless, offering the children a chance to

[1] This was confirmed by a repeated measures ANOVA with predictions vs. only the 'first' explanations as the question type factor, where the question type and age main effects remained, $F(1, 74) = 8{\cdot}28$ and $F(2, 74) = 27{\cdot}98$, $ps < 0{\cdot}01$, but the interaction between question type and task failed to reach significance. Note also that the difference between the first and best explanations was greater in the change of location task than in the unexpected contents task.

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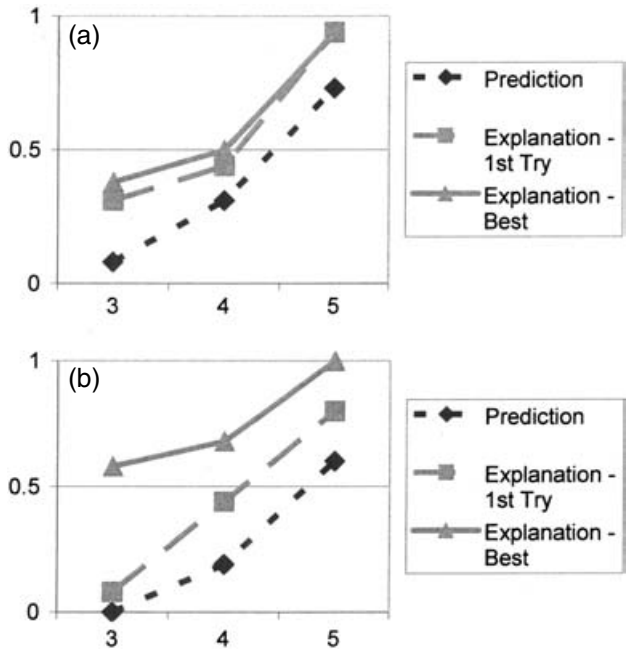


Fig. 2. Mean scores of prediction vs. explanation (1st and best) condition in (a) unexpected contents task, excluding children who failed control questions; (b) change of locations task, excluding children who failed control questions.

explain the protagonist's actions and intentions boosted performance at all ages, and did not change the general trajectory of performance from rather consistent failure at age 3;6 to chance or above-chance performance at ages 4;6 and 5;6. Additionally, note that giving children the opportunity to explain rather than predict in the unexpected contents and change of location tasks does not improve them beyond the level of performance obtained in the deceptive object task. Finally, comparing the prediction versus explanation responses of the groups of children who received '*nam5*' versus '*ji5wai4*' independently did not change this overall pattern of explanations being easier than prediction. Thus, like the wording effect, the prediction vs. explanation effect was robust across the children in our study.

In a separate analysis, we also examined the words that children used to explain WHY Winnie was so happy when running towards the box and why *YanYan* looked in the square, not the round, box for her ball. Although we expected to find differences in the use of *nam5* and *ji5wai4* by age and condition, the use of these more complex mental state terms was limited to a total of only five children (two three-year-olds and three five-year-olds) in the change of location task and only nine children (four four-year-olds and

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five five-year-olds) in the unexpected contents task, with a slight, but statistically insignificant, tendency for the older children to use *ji5wai4* rather than *nam5* in both of these tasks. We also found that the older children used more mental state verbs overall and verbs that specified beliefs (*zi1*-knowing, *nam5*-thinking, *gu2*-guessing, and *ji5wai4*-falsely-thinking), in particular, as opposed to verbs that indicated desires (*soeng2* + *V*/*jiu6* + *V*-want to) or actions (*luo2*-grab, *wun2*-look for, *heoi4-go*), although this was only significant for the change of location task, $\chi^2_{(df=6,N=96)} = 24{\cdot}33$, $p < 0{\cdot}0001$. Again, this suggests that explanations are easier, even for those children who are not yet facile with the proper mental state terms to describe the protagonist's beliefs.

DISCUSSION

Overall, four types of effects were found in this study. First, there was a very strong and expected effect of age, such that the younger preschoolers tested tended to perform below chance levels and the older preschoolers tended to perform above chance, across the three tasks in our study. In addition, we found a moderate but highly localized effect of wording across the false belief tasks such that children who received the marked false belief verb (*ji5wai4*) in the prediction questions significantly outperformed those who received the unmarked neutral verb (*nam5*). Third, we found a very strong, but unexpected effect of task, such that the Cantonese-speaking children in this study performed better on a 'deceptive object' false belief task than on either the unexpected contents or the change of location tasks. Finally, we found a strong advantage of explanation over prediction, despite the suggestion that Chinese preschool-aged children may not be familiar with 'why' questions and giving explanations in this type of situation.

These findings speak to a number of issues about false belief understanding in Chinese children and about the relationship between language and children's theory of mind. First, the Cantonese-speaking children in this study showed a general similarity in their false belief understanding to the Mandarin-speaking children examined in Lee *et al.*'s (1999) study and, more distantly, to the over 150 studies of English-speaking children examined in Wellman *et al.*'s (2001) meta-analysis. Specifically, these Chinese children showed a preschool trajectory moving from generally below-chance false belief judgments to increasingly correct, eventually above-chance judgments.

Chinese-speaking children provide a particularly important test of this general pattern because of the presence of marked belief verbs, terms that refer specifically to beliefs that are false. The presence of these terms in Chinese certainly did not mean that very young Chinese children have no difficulty with false belief. Three-year-olds in our sample were consistently

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below chance on false belief tasks; four-year-olds were typically at or below chance. If tested on tasks with the marked verb, children were significantly better in comparison to the neutral belief verb. This finding is similar to that found by Lee *et al.*(1999) for Mandarin-speaking children. Yet, as we argued in the introduction, Cantonese allows for a clearer comparison because the neutral verb '*nam5*' in not polysemous, whereas the Mandarin neutral verb, '*xiang3*,' is polysemous with respect to belief and desire. Note that our data further demonstrate a limited, specific, rather than a general effect. At best, the nature of the lexical effects found in this study suggest specific and local effects of wording ONLY when the marked term is used in the false belief question itself. The wording effects did not alter age trajectories nor did it cause obviously enhanced performance on false belief in conditions that did not use the marked term (i.e. *nam5*). Taken together, our data, and those of Lee *et al.* (1999), clearly demonstrate the specificity of the effect of having a marked term for false belief. It does result in improved performance, relative to an unmarked term. However, it provides no additional benefit to children who speak languages with a marked term when the term is not used (e.g. the 'look for' condition in Shatz *et al.*'s study) and use of the marked term is not sufficient to boost performance beyond other conditions that improve task performance (e.g. the explanation condition in the present study).

Unexpectedly, we found that for these children, a deceptive object false belief task yielded considerably better performance than either the unexpected contents or the change of location tasks. On close inspection, this task advantage for a deceptive object task was also found by Lee *et al.* (1999) for Mandarin, despite large surface differences in the tasks themselves. In our study, the deceptive object was a real object that looked like a lollipop but that the children observed the experimenter use as a pen. In Lee *et al.*'s study, the deceptive object was presented in an illustrated storybook format ('Surprise Picnic') in which a turtle was mistaken for a rock. Yet, in both studies, performance on the deceptive object task was better for '*yi3wei2/ji5wai4*' than for '*xiang3.*' This result is quite different from that reported by Gopnik & Astington (1988), who in fact found the deceptive object question about the child's previous belief to be more difficult for English-speaking children. It is also different from that in Wellman *et al.*'s (2001) meta-analysis, which found, across several studies, no significant differences between the deceptive object task and the unexpected contents or change of location tasks. In contrast to these findings, it appears that Chinese children (but not Anglo-European children) find the deceptive object task to be simpler than other types of false belief tasks.

This finding is additionally surprising when one considers that the surface features of the deceptive object and unexpected content tasks are quite similar. However, conceptually, there is a clear difference between the

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two sorts of tasks. Specifically, the deceptive object task involves a mismatch between an object's presupposed identity and its actual identity. In the unexpected contents task, the difference is between the object's presupposed contents and its actual contents, not its identity *per se*. And, of course, in the change of location task, the object itself remains the same, the difference is in its location.

Why might Chinese children, but not Western children, perform so much better on deceptive object tasks relative to other sorts of false belief? Arguably, an identity change might have much greater consequences for how one interacts with an object than a location or contents change. But such an analysis could apply to Western children, as well as Chinese. The issue of identity, not just what a thing is called, but also how one uses or relates to it, is central in all children's day to day experiences. Nonetheless, we hypothesize that deceptive objects and identities are particularly salient for Chinese children. Why? First, it is our impression from other analyses of Chinese language acquisition (Tardif, in press; Tardif & Wellman, 2000) that the Chinese false belief verb, *ji5wai4/yi3wei2*, is first used in contexts referring to identities and thus may be most easily applied and understood in the deceptive object task because it parallels these contexts of early use. Further research on contexts of use for mental language in Chinese parent–child discourse would be an important topic for future research. In addition, deceptive objects and identities seem remarkably prevalent in Chinese children's storybooks and cartoons. For example, one of the most popular stories that Chinese children have been exposed to, both traditionally and in contemporary Chinese societies, is 'Journey to the West' (*Xi You Ji/Sai Yau Gei*). This saga involves the adventures of a mischievous monkey king, a pig, a monk, their master, and a white dragon horse travelling from China to India to collect Buddhist scriptures. It appears in many versions in storybooks and popular television serials. What is notable about this story, particularly for children, is not the lessons about corrupt monks and the search for Buddhist scriptures, but the numerous tricks and transformations that the monkey, in particular, but all of the main characters, are capable of – from monkey king to handsome young man, to old woman, to silly monk, to beautiful young woman, various animals, and even a Buddhist temple with the monkey's tail as a flagpole that eventually gives him away. By 1;10, over 50% of the children in a norming study of the Putonghua (Mandarin) version of the MacArthur CDI (in progress) were able to say the name of BOTH the Monkey King, *Sun Wu Kong*, and the pig, *Zhu Ba Jie*, and by 2;8, over 95% of the children were able to name them. The salience of this story and its characters in Chinese children's everyday lives and the salience of the transformations in every episode of the story provides one piece of evidence that deceptive objects might be highly familiar and salient to young Chinese children. This is speculation at this

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point, but the consistency of our finding, along with Lee *et al*.'s (1999), together with the salience of identity transformations in Chinese traditional stories and folklore, does suggest this as an important issue to examine in future studies on false belief with Chinese children.

Our data provide no support for the hypothesis that Chinese children might be less proficient at explanations as opposed to predictions, given the smaller number of 'why' questions they are exposed to (Miao, 1986) and the smaller number of opportunities they have had to listen to justifications and explanations in everyday conversations (Tardif, 1997). Instead, like their English-speaking age mates, they evidenced enhanced performance in explanation versions of a false-belief task. Whether English-speaking children's false belief explanations are genuinely SUPERIOR to their false belief predictions is controversial (see e.g. Bartsch & Wellman, 1989; Robinson & Mitchell, 1995; Wimmer & Mayringer, 1998). But, clearly, for English-speaking children both explanations and predictions develop robustly from 3;0 to 5;0, and using the methods of Bartsch & Wellman (1989) at least, explanations are easier. Our study used methods very similar to those used by Bartsch & Wellman (1989) and found a very similar pattern of results. In particular, using these methods, performance on false belief explanation questions were found to be significantly ahead of performance on prediction questions for our sample of Cantonese-speaking children, for both the 'first' and 'best' explanations that children provided when asked why the protagonists acted in the way they did. False-belief understanding is important as a marker for young children's larger social cognition or naïve psychology (Gopnik & Wellman, 1994; Wellman & Gelman, 1998). By terming this reasoning system a naïve theory, or a theory of mind, authors emphasize its presumed function as an explanatory knowledge system that allows children to understand and explain human actions and minds. Our data are thus important in confirming the centrality of children's explanations as they struggle to acquire mental-state understandings, for Chinese- as well as English- and German-speaking children.

We end by returning to questions concerning the relationship between language and theory of mind. Overall, our data demonstrate that language and culture make important contributions in predicting children's theory of mind and, in particular, false belief development. However, beyond the general issue of exposure to mental state talk, the ways they do so are not immediately obvious from a cursory consideration of the relation between language and thought such as that proposed by Whorf (1956). Specifically, we propose that the relation between marked and unmarked terms for false belief is more complex than that one enhances performance or that the other necessarily hinders it. Rather, Chinese-speaking children, like English- or German-speaking children, acquire a package of mental state terms and, in tandem, begin to learn that individual terms map onto individual aspects of

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meaning. Thus, when reasoning about mental states, four- and five-year-old Chinese- (Mandarin and Cantonese) speaking children have learned that the marked verb, *yi3wei2/ji5wai4* refers to a false belief and that *xiang3/nam5* is an unreliable marker of this state. Younger children are neither able to demonstrate a general understanding of false belief, nor do they have the adult-like competence in using the various linguistic cues and terms that differentiate amongst types of beliefs. Rather, it appears that young children are particularly sensitive to the usage of lexical terms in everyday speech and are, as has been shown in many other studies (most clearly by Markman & Wachtel, 1988; Markman, 1989), likely to avoid or limit the use of terms with multiple meanings when given another term that incorporates at least one of these meanings. Thus, using a neutral verb in a false belief context appears to bias them towards interpreting the test question as one that is asked about a TRUE belief, in much the same way that English-speaking children have been argued to misunderstand the question as 'Where does X CORRECTLY think the ball is?' Indeed, in the unexpected contents and change of location tasks, ALL of the 32 three- and four-year-old children who were asked the false belief questions with '*nam5*' gave the true state of affairs as their answer, rather than the false belief. Even though the unmarked term is acceptable for adults in this situation, it appears that young children have particular reluctance in attributing false belief with this term.

In summary, our data are most important in demonstrating the specificity, rather than generality, of influence of marked false belief verbs in a child's language. This specificity has now been demonstrated in three separate studies, ours, Lee *et al.*'s (1999), and Shatz *et al.*'s (2003). Together, these findings show that the effects of language on theory of mind development go beyond the general effect of comparing exposure versus lack of exposure to mental state talk, demonstrated in studies of deaf children (e.g. Peterson & Siegal, 1995; Gale *et al.*, 1996). They also go beyond the effects of exposure to and use of metacognitive vocabulary as a general domain of linguistic experience (e.g. Astington & Pelletier, 1996). In particular, they demonstrate clear, but limited, lexical effects on children's false belief performance. Words for explicitly marking false belief appear to help children to demonstrate false belief understanding, but only when they are used in the test question and only when that understanding is already emergent. In contrast, for children whose native language has multiple words marking different types of beliefs, use of a neutral verb appears to cause difficulty in a false belief task. Nonetheless, the main effects of language shown in this study were of a specific or LOCAL rather than a general nature. Performance was boosted, temporarily, when children received a form of the task that highlighted the falseness of the belief, linguistically, but this factor failed to change the general trajectory of false belief understanding as going from below to above chance in the preschool years.

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