

# Structure and Context Effects in Scope Ambiguity Resolution\*

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In this study we report data from three experiments designed to examine how Mandarin Chinese-speaking children and adults interpret scopally ambiguous sentences with negation and a numerically quantified object noun phrase similar to English sentences like “The boy did not ride two cows”. Our results from Experiments 1 and 2 differ from what Lidz & Musolino (2002) found in English and Kannada in two respects. First, English- and Kannada-speaking adults have easy access to both of the two interpretations of the sentences, but Mandarin-speaking adults have a strong preference to the narrow-scope reading of the numeral. Second, although English- and Kannada-speaking children prefer the narrow-scope reading of the numeral, which corresponds to the surface syntactic position, Mandarin-speaking children display a different pattern, i.e. they do not have problems accessing the wide-scope reading of the numeral. In addition, the results from Experiment 3 demonstrate that both children and adults are sensitive to the salience of the events in the context. Specifically, by manipulating the order of events in the stories, children are able to overcome their bias toward a preferred reading. Regarding the cross-linguistic differences on scope ambiguity resolution by children and adults between Mandarin and English/Kannada, it is argued that the discrepancy may arise due to the differences on the structure of quantified noun phrases and/or the structure of negative sentences among the languages.

Key words: language acquisition, ambiguity resolution, quantifier scope, negation, Mandarin Chinese (Taiwan)

## 1. Introduction

So long as the environment provides linguistic input, every normal child can acquire at least one language. A Mandarin-speaking child eventually has to know that a sentence like (1a) can be true in two situations,<sup>1</sup> but (1b) and (1c) allow only one interpretation.

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- (1) a. mei-zhi xiong dou zai chi yi-kuai dangao  
       every-CL bear all ASP eat a-CL cake  
       a'. Every bear is eating a cake.<sup>2</sup>  
       b. (you) yi-kuai dangao bei mei-zhi xiong chi le  
       have a-CL cake by every-CL bear eat ASP  
       b'. A cake was eaten by every bear.  
       c. laoshi jiegei yi-ge xuesheng mei-ben shu  
       teacher lend a-CL student every-CL book  
       c'. The teacher lent a student every book.

Specifically, Mandarin-speaking children learn that (1a) can be true in a situation in which every bear is eating a possibly different cake<sup>3</sup> (i.e. the universal wide-scope reading, 'every > a'), or in a situation in which there exists a cake that all the bears are eating (i.e. the existential wide-scope reading, 'a > every'). In contrast, (1b) and (1c) only allow the existential wide-scope reading. Sentence (1b) can be true only when there is a specific cake that was eaten by all the bears, and the only situation that makes

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<sup>1</sup> In earlier literature (e.g., Huang 1982, Lee 1986), active sentences like (1a) were considered as having only the universal wide-scope reading. A recent study on Chinese adult judgment (Lee 1996) and the results from adult controls in Su (2001) both showed that for active sentences like (1a), Mandarin-speaking adults did allow the existential wide-scope reading. In Liu (1997), it was argued that for a sentence like (1a), the interpretation in which every bear is eating the same cake is a scope-independent reading, and is always one of the interpretations for such sentences.

<sup>2</sup> In traditional linguistic literature, the corresponding English sentence for (1a) (as in (1a')) is considered ambiguous, allowing both the universal wide-scope reading and the existential wide-scope reading. However, as pointed out in Hornstein & Pietroski (2002), that sentence can also be true in situations other than the two mentioned above. Therefore, according to them, the two interpretations only show that the sentence can be true in several situations, but not a real ambiguity in the sense that it can be associated with alternative underlying forms. Since some of the situations mentioned in their study which make the sentence true in English are not applicable to the corresponding Mandarin sentence, in this study we shall follow previous literature in considering only the two interpretations, i.e. the universal wide-scope reading 'every > a', and the existential wide-scope reading 'a > every'.

<sup>3</sup> Both the universal wide-scope reading and the existential wide-scope reading are true in a situation in which all the bears are eating the same cake. That is to say, the existential wide-scope reading entails the universal wide-scope reading, but not vice versa.

sentence (1c) true is one in which there is a specific student that gets all the books. English-speaking children, however, eventually come to know that sentences (1a') and (1c') allow basically the same interpretations as the Mandarin counterparts, but sentence (1b') is ambiguous. In addition to the existential wide-scope reading, sentence (1b') also allows the universal wide-scope reading, i.e. it can also be true in a situation in which for each bear, there is a cake eaten by that bear.

In addition to the sentences containing a universal quantifier and an existential quantifier as in (1), English and Mandarin also display similarities and differences in interpreting sentences with negation and a numerically quantified noun phrase (QNP), as illustrated in (2).

- (2) a. lanjingling meiyou zhuadao liang-zhi niao  
       smurf       did not catch two-CL bird  
       a'. The smurf did not catch two birds.  
       b. lanjingling meiyou chi mei-kuai pisa  
       smurf       did not eat every-CL pizza  
       b'. The smurf did not eat every slice of pizza.  
       c. lanjingling meiyou zhuadao mou-zhi niao  
       smurf       did not catch a certain-CL bird  
       c'. The smurf did not catch a certain bird.  
       d. mei-ge lanjingling dou meiyou zhuadao niao  
       every-CL smurf all did not catch bird  
       d'. Every smurf did not catch the bird.

The interpretations allowed for (2a), (2a'), (2b), (2b'), (2c) and (2c') are the same in both English and Mandarin. Both sentences in (2a) and (2a') are ambiguous. They can mean either it is not the case that the smurf caught two birds (i.e. the negation wide-scope reading, 'not > two'), or there exist two birds that the smurf did not catch (i.e. the QNP wide-scope reading, 'two > not'). For the negation wide-scope reading, it can be true in situations in which the smurf caught zero, one, three, or more birds. The sentences in (2b), (2b'), (2c) and (2c') are not ambiguous. Sentences (2b) and (2b') only allow the negation wide-scope reading, i.e. they can only mean that the smurf ate some pizza, but not every pizza. Sentences (2c) and (2c') only allow the QNP wide-scope reading; i.e. they can only mean that there exists a specific bird that the smurf did not catch. English and Mandarin differ in how the sentences in (2d) and (2d') are interpreted. Sentence (2d) in Mandarin is not ambiguous. It only means that none of the smurfs caught the bird (i.e. the universal quantifier has scope over negation). However, sentence (2d') is ambiguous in English. In addition to the universal wide-scope reading, it can also mean that not

every smurf caught the bird (i.e. the negation wide-scope reading).

It has been well known that children's linguistic environment does not provide them with reliable negative evidence to correct their structurally ill-formed sentences (e.g., Brown & Hanlon 1970, Marcus 1993). In addition, the positive evidence they receive from adults only informs them of the acceptable interpretations allowed by the sentences in the target language. Therefore, it has been an important research issue for psycholinguists as to what constitutes the initial state for language acquisition. That is to say, whether children are conservative learners relying only on positive evidence (e.g., Baker 1979) and do not overgeneralize, and whether there are any universal principles as well as language specific parameters to guide children through the acquisition process if they do make semantic overgeneralization errors<sup>4</sup> in order to converge on the adult grammar.

Previous studies on the acquisition of quantifier scope can be summarized as follows. For Chinese, Lee (1986) found that in a picture identification task, although adults consistently gave the universal wide-scope reading 80% of the time for sentences like (1a), children gave this interpretation at most 35% of the time. In an act-out task, Mandarin-speaking adults gave the universal wide-scope reading 95% of the time, whereas children assigned this interpretation no more than 62% of the time. For English, in a picture identification task, adults gave the universal wide-scope reading 67% of the time, and children in each age group demonstrated a preference for this reading, too (with the 3 year-old group as an exception). For the 8 year-olds, the acceptance of this reading was even as high as 95%. In an act-out task, English-speaking adults gave this interpretation 95% of the time, and children from 5 to 8 years old all assigned this reading at least 68% of the time. Based on the results from Mandarin-speaking children and the youngest English-speaking children, that is, the initial phase of children's development was dominated by what appears to be a narrow scope interpretation of the universal quantifier, Lee (1986) took this as evidence that the existential quantifier yi-CL-N '*a N*' was initially interpreted referentially as a non-operator, thus leading to a scope independent reading of the sentences, which is equivalent to the narrow-scope reading of the universal quantifier (p.353). In addition, it was also proposed that the fact that English-speaking children's acceptance of the universal wide-scope reading increased more dramatically than their Mandarin-speaking counterparts suggested that some kind

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<sup>4</sup> It is pointed out by one of the anonymous reviewers that although previous studies found adults do not provide negative evidence for children's ill-formed sentences, it is not certain whether negative semantic evidence does not exist for children, either. However, even if such negative semantic evidence exists, there still is no warrant that all the children who allow the non-adult interpretations utter the sentences in the contexts not acceptable for adults in order to be corrected.

of lexical idiosyncrasy may exist between English ‘*a*’ and Mandarin ‘*yi*’ (p.359). Similar findings were also reported in Chien (1994) and Lee (1996) for Mandarin and Philip (1995) for English regarding the different preferences on scope ambiguity resolution from children acquiring the two languages. What is noteworthy is that both (1a) and (1a’) can be true in situations with the universal wide-scope reading and the existential wide-scope reading. It is hence a puzzle why Mandarin-speaking children and English-speaking children have different preferences for the interpretations of the sentences.

There are two possible reasons for the discrepancies between previous studies on English and Mandarin: one is that the sentences used were ambiguous, and the other is that the tasks used were less than optimal. The tasks used in the previous studies were either act-out or picture identification. However, these tasks do not provide subjects with any contextual support for interpreting the test sentences, so these tasks do not fulfill presuppositions that might be associated with the test sentences. Moreover, when the test sentences are ambiguous, subjects are forced to choose one of the interpretations. Therefore, what is obtained is actually the subjects’ preference for one interpretation over the others. It is unwarranted to conclude that subjects lack any specific readings of the test sentences (see Crain & Thornton 1998). To avoid these problems, Su (2001) used unambiguous double object sentences like (1c) and (1c’) (i.e. *laoshi jiegei yi-ge xuesheng mei-ben shu* ‘The teacher lent a student every book’) in a Truth Value Judgment task (Crain & McKee 1986, Crain & Thornton 1998) to examine English-speaking and Mandarin-speaking children’s interpretations.

The results in Su (2001) showed that Mandarin-speaking children correctly accepted the existential wide-scope reading for sentences like (1c) 100% of the time (vs. adults’ 98%), and rejected the universal wide-scope reading about 78% of the time (vs. adults’ 93%). However, English-speaking children demonstrated a different pattern of interpretations from adults for sentences like (1c’). They incorrectly accepted the universal wide-scope reading about 72% of the time (vs. adults’ 0%), and rejected the existential wide-scope reading about 52% of the time (vs. adults’ 0%). Since (1c) and (1c’) are unambiguous in Mandarin and English (i.e. they only allow the existential wide-scope reading), the results from English-speaking children thus raise a learnability issue—namely, how do English-speaking children abandon the non-adult reading?

Su (2001) further examined whether the difference in the way Mandarin-speaking children and English-speaking children interpret (1c) and (1c’) can be attributed to the lexical idiosyncrasy between English ‘*a*’ and Mandarin ‘*yi*’. The test sentences used were sentences with negation and a QNP with ‘*a*’ or ‘*yi*’ as in (3).

- (3) a. milaoshu            meiyou    qi        yi-zhi    gou  
          Mickey Mouse   did not    ride    a-CL    dog  
       a'. Mickey Mouse did not ride a dog.

Sentences like (3a) and (3a') are ambiguous in both Mandarin and English. They can mean either there exists a dog that Mickey Mouse did not ride (i.e. the QNP wide-scope reading, 'a > not'), or that Mickey Mouse did not ride any dog (i.e. the negation wide-scope reading, 'not > a'). The results showed that English-speaking children accepted the QNP wide-scope reading only about 33% of the time, but Mandarin-speaking children accepted the reading about 77% of the time, and accepted the negation wide-scope reading only about 26% of the time. Based on the results, Su (2001) proposed that since 'yi' is the numeral "one" in Mandarin, Mandarin-speaking children in the earliest stage consider it to mean "exactly one". As for the English indefinite 'a', although most of the time it also means "one", but since English has another word for the numeral 'one', English-speaking children in the earliest stage of development distinguish 'one' from 'a' and consider the former to mean "exactly one", but the latter to mean something similar to "any".

If the account of Su (2001) is correct, then English-speaking and Mandarin-speaking children should behave similarly in interpreting sentences with negation and a QNP other than the indefinite 'a' and 'yi'. That is to say, children acquiring the two languages should have the same interpretation for sentences like (4a) and (4a').

- (4) a. lanjingling    meiyou    zhuadao    liang-zhi    niao  
          smurf            did not    catch        two-CL    bird  
       a'. The smurf did not catch two birds.

Musolino (1998) found that English-speaking children allow the QNP wide-scope reading only about 50% of the time, i.e. about half of the children's responses interpreted sentences like (4a') as only meaning it is not the case that the smurf caught two birds, and rejected the meaning that there exist two birds that the smurf did not catch. Since in English, negation precedes and also c-commands the QNP in such sentences, it is not clear whether English-speaking children assign the negation wide-scope reading based on linear precedence or on a hierarchical (c-command) relationship. Lidz & Musolino (2002) thus compared how English-speaking and Kannada-speaking children interpreted the corresponding sentences in their languages. The results of that study showed that both English-speaking and Kannada-speaking children tended to accept the negation wide-scope reading (about 80% of the time for English, and 75% for Kannada), but rejected the QNP wide-scope reading (about 65% of the time for English, and 80% for

Kannada). Since in Kannada, an SOV language, the corresponding sentence has the verb and negation following but c-commanding the object QNP, the findings from English and Kannada thus indicate that children rely on the hierarchical relation of c-command, rather than linear precedence, for scope interpretation.

Given the findings in Musolino (1998) and Lidz & Musolino (2002), if the hypothesis of Su (2001) is right, then Mandarin-speaking children should also demonstrate the tendency to assign the negation wide-scope reading to sentences like (4a). However, if Mandarin-speaking children still show a different pattern in interpreting the sentences, the hypotheses of Lidz & Musolino (2002) and Su (2001) will need revision, and some other factors may need to be taken into consideration with respect to children's interpretation of scopally ambiguous sentences.

Another relevant issue to be tackled in the current study is the effect of contextual manipulation on children's interpretation of negative sentences. As clearly illustrated in Gualmini (2004), negative statements are generally used to point out discrepancies between the facts and a listener's presumed expectations, and this felicity condition can influence the judgment of children and even adults. To demonstrate the effect, he conducted a truth value judgment experiment to show that children's non-adult interpretation of sentences like "*The detective did not find some guys*" as reported in Musolino (1998) actually resulted from the failure to satisfy the felicity conditions associated with negative statements. In the experiment, children were divided into two groups and the same story (e.g., a story in which a firefighter plays hide and seek with four dwarves and finds two of them) was paired with two negative sentences which manipulated children's expectations about the final outcome of the story. One negative sentence (e.g., "*The firefighter did not find some dwarves*") truthfully described the final outcome of the story and expressed a mismatch between the final outcome and the expectation built during the story. The other negative sentence (e.g., "*The firefighter did not miss some dwarves*") also truthfully described the final outcome of the story, but failed to express a mismatch between the final outcome and the expectation built during the story. The two sentences differed with respect to their felicity because the story conveyed the expectation that the firefighter would find all the dwarves but not the expectation that he would miss all of them. As a consequence, the sentence "*The firefighter did not find some dwarves*" was felicitous in expressing a mismatch between what happened and what was expected to happen, but the sentence "*The firefighter did not miss some dwarves*" was infelicitous. The results confirmed his hypothesis. Children accepted sentences like "*The firefighter did not find some dwarves*" in 54 out of 60 trials (90%) but only in 30 out of 60 trials (50%) for sentences like "*The firefighter did not miss some dwarves*".

Using a Truth Value Judgment Task (Crain & Thornton 1998), we conducted three experiments to examine Mandarin-speaking children's and adults' interpretations of

ambiguous sentences with negation and a QNP as in (4a) (i.e. *lanjingling meiyou zhuadao liang-zhi niao* ‘The smurf did not catch two birds’). The first two experiments were similar to Lidz & Musolino (2002). In the first experiment, the narrow-scope reading of the numeral in sentences like (4a) was true (abbreviated as Nt), and the wide-scope reading of the numeral was false (abbreviated as Wf). In the second experiment, the wide-scope reading of the numeral was true (abbreviated as Wt), and the narrow-scope reading of the numeral was false (abbreviated as Nf). The third experiment also corresponded to the context in which the wide-scope reading was true but the narrow-scope reading false (i.e. WtNf) as in the second experiment, but with some modifications on the arrangement of the sequence of events in the stories.

## 2. Experiment 1

In this experiment, we tested Mandarin-speaking children’s and adults’ interpretations of ambiguous sentences like (5) containing negation and an object QNP in a context in which the narrow-scope reading of the numeral is true. That is to say, in the story for (5), it is not the case that the little boy rode two cows, because he only rode one of them.

- (5) xiao    nanhai    meiyou    qi    liang-tou    niu  
       little   boy       did not   ride   two-CL    cow  
       ‘The little boy did not ride two cows.’

According to Lidz & Musolino (2002), this interpretation is what 4-year-old English- and Kannada-speaking children assign to sentences like (5) since the negation c-commands the QNP. If children’s initial interpretation for scopally ambiguous sentences like (5) is determined by structurally c-command relation between negation and the QNP, this should also be the interpretation Mandarin-speaking children initially assign to sentences like (5).

## 2.1 Method

### 2.1.1 Participants

For the first experiment, we tested 25 Mandarin-speaking children (14 girls and 11 boys) between the ages of 4;1 to 5;8 (mean age 4;10) and 40 adults. As indicated in Lidz & Musolino (2002) and also according to our experiences, we did not include younger children because children under 4 years old usually are not able to participate in this kind of experiment partly due to the complexity of a Truth Value Judgment Task and



partly due to the requirement that children must be able to count in order to understand the test sentences. All the adult participants were undergraduate students at National Taiwan Normal University in Taipei and the child subjects were recruited from the daycare center at the same university.

### 2.1.2 Procedure

We tested the child and adult subjects using a Truth Value Judgment Task (Crain & Thornton 1998) which involves two experimenters—one acting out the stories using toys and props, and the other one playing the role of a puppet (in this study Big Bird) who watches the stories with the subject. At the end of each story, the puppet makes a statement regarding what he thinks happened in the story, and the subject has to decide whether the puppet’s statement is TRUE and reward him with a bite of an ice cream, or WRONG and punish him with a bite of an onion. If the subjects think the puppet’s statement is wrong, they will have to provide an explanation to justify their answers.

The child subjects were tested individually in a room in the daycare center. Children who were too shy to communicate with the experimenters or gave incorrect answers to the two pretest stories did not complete the whole session. The adult subjects were shown a videotaped version of all the stories witnessed by the children and were given an answer sheet to indicate whether they thought the puppet’s statement was right or wrong and also to provide a justification for the answer.

### 2.1.3 Materials

The experiment included eight trials administered in a pseudo-random order—two practice trials, three experimental trials, and three filler trials that were items from an unrelated experiment. The practice trials were made obviously false in the context of the stories<sup>5</sup> so that subjects knew the puppet could say something wrong, and only those children who correctly rejected at least one of the two practice trials and could correctly justify their answers were included in the data analysis. In this experiment, the wide-scope reading of the numeral was false (i.e. Wf) and the narrow-scope reading was true (i.e. Nt). This narrow-scope reading of the numeral corresponds to the isomorphic interpretation since the negation both precedes and c-commands the QNP.

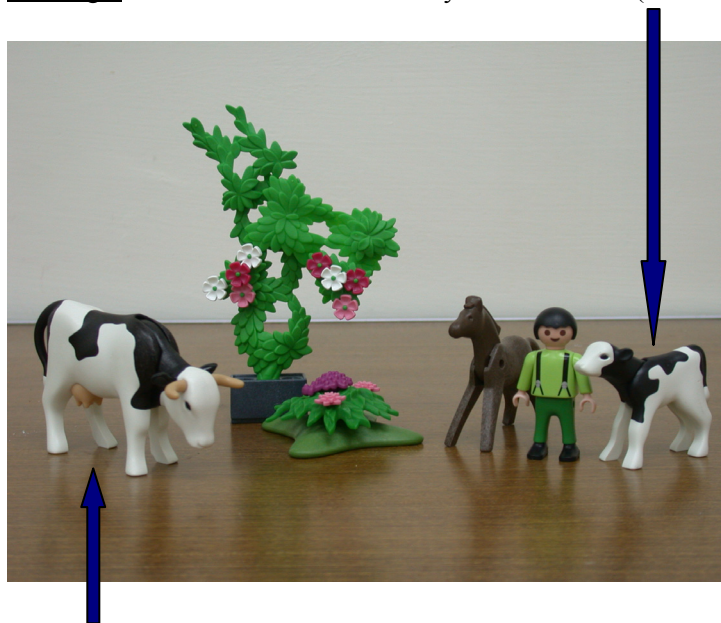
The scenario of the test stories was similar to Lidz & Musolino (2002) except that

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<sup>5</sup> One of the practice trial was ‘xiaoxiong weini meiyou chi shuiguo’ (Winnie the Pooh did not eat fruit) presented after a story in which Winnie the Pooh ate a pineapple and an orange, and the other practice trial was ‘Hamutailang chidiao le xiaoxiong de dangao’ (Hamutailang ate the bear’s cake) presented after a story in which Hamutailang did not eat the bear’s cake.

the wide-scope reading of the numeral was taken into consideration as a possible outcome at some point of the story based on the experimental design outlined in Crain & Thornton (1998). In the story corresponding to the example in (5), a little boy comes to a ranch where visitors can ride animals. He first sees two cows, but since he is not very interested in cows, he does not ride them. He then sees a horse and rides it. After riding the horse, since it is still too early to go home, he decides to ride the two cows. He rides the little cow, but then since the big cow looks scary with the sharp horns, he does not ride it. Note that the possible outcome (i.e. the wide-scope reading of the numeral) was considered when at first the little boy said he was not interested in riding the two cows. According to what happened at the end of the story, the wide-scope reading of the numeral for the test sentence was false because there was only one cow (not two) that the boy did not ride. On the other hand, the narrow-scope reading of the numeral was true since it was indeed not the case that the boy rode two cows for he only rode one of them. Fig. 1 corresponds to the scene at the end of the story described above. The statements made by the puppet on each of the test and practice trials are given in Table 1, and the detailed plots for each test story can be found in Appendix A.

Reading 1: It is not the case that the boy rode two cows (not > two) = TRUE



Reading 2: There are two cows that the boy did not ride (two > not) = FALSE

**Figure 1:** “The boy did not ride two cows.”—wide scope false/narrow scope true condition

**Table 1:** Test and practice trials used in Experiment 1

|            |                                               |         |      |            |           |
|------------|-----------------------------------------------|---------|------|------------|-----------|
| Test 1     | 小男孩                                           | 沒有      | 騎    | 兩頭         | 牛         |
|            | xiao nanhai                                   | meiyou  | qi   | liang-tou  | niu       |
|            | little boy                                    | did not | ride | two-CL     | cow       |
|            | ‘The little boy did not ride two cows.’       |         |      |            |           |
| Test 2     | 白雪公主                                          | 沒有      | 買    | 兩瓶         | 花         |
|            | baixue gongzhu                                | meiyou  | mai  | liang-ping | hua       |
|            | Snow White                                    | did not | buy  | two-CL     | flower    |
|            | ‘Snow Whit did not buy two vases of flowers.’ |         |      |            |           |
| Test 3     | 小女孩                                           | 沒有      | 吃    | 兩塊         | 餅乾        |
|            | xiao nühai                                    | meiyou  | chi  | liang-kuai | binggan   |
|            | little girl                                   | did not | eat  | two-CL     | cookie    |
|            | ‘The little girl did not eat two cookies.’    |         |      |            |           |
| Practice 1 | 小熊維妮                                          | 沒有      | 吃    | 水果         |           |
|            | xiaoxiong weini                               | meiyou  | chi  | shuiguo    |           |
|            | Winnie the Pooh                               | did not | eat  | fruit      |           |
|            | ‘Winnie the Pooh did not eat fruit.’          |         |      |            |           |
| Practice 2 | 哈姆太郎                                          | 吃掉      | 了    | 小熊         | 的 蛋糕      |
|            | hamutailang                                   | chidiao | le   | xiaoxiong  | de dangao |
|            | Hamutailang                                   | eat up  | ASP  | bear       | of cake   |
|            | ‘Hamutailang ate up the bear’s cake.’         |         |      |            |           |

## 2.2 Results and discussion

The dependent measure used throughout the current study was the proportion of YES responses to the negation wide scope. In Experiment 1, Mandarin-speaking adults accepted the negation wide-scope reading 72% of the time (86 out of 120 items), and children accepted the reading 35% of the time (26 out of 75 items). The difference between the acceptance rate from adults and children was significant,  $t(63)=3.96$ ,  $p<0.001$ . The justification reasons children and adults provided when rejecting the puppet’s statement were all because the little boy rode one of the two cows.

The results from this experiment showed that, unlike what was found in Lidz & Musolino (2002), in which English- and Kannada-speaking children and adults did not have difficulty accessing the negation wide-scope reading, Mandarin-speaking adults and children demonstrated a relatively low percentage of acceptance for that reading, with the acceptance rate from adults still significantly higher than that from children. The results from Mandarin here were comparable to what was found in Su (2001), in

which Mandarin-speaking adults accepted the negation wide-scope reading (i.e. Tigger did not jump over any of the three fences) for sentences like (6) significantly higher than children (89% vs. 26%,  $t(39)=7.869$ ,  $p<0.001$ ). Although Mandarin-speaking adults' acceptance rate for (6) was higher than that for (5), children seemed to have difficulty getting the narrow-scope reading of the numeral for both sentences. The results from Mandarin-speaking children do not support the prediction of the hypothesis in Lidz & Musolino (2002) as the negation both precedes and c-commands the object QNP.

- (6) tiaotiaohu meiyou tiao guo yi-ge langan  
 Tigger did not jump over one-CL fence  
 'Tigger did not jump over a fence.'

In the next experiment, we investigate whether Mandarin-speaking children and adults have access to the wide-scope reading of the numeral for a sentence with negation and an object QNP.

### 3. Experiment 2

From the results of Experiment 1, it was demonstrated that Mandarin-speaking children's acceptance of the negation wide-scope reading for sentences with negation and an object QNP was significantly lower than adults'. The results we obtained from Mandarin displayed conspicuous differences from Lidz & Musolino's (2002) results from English and Kannada in two respects. First, English- and Kannada-speaking adults accepted this reading at least 85% of the time, but the acceptance percentage from Mandarin-speaking adults was lower. Second, unlike English- and Kannada-speaking children, who accepted the narrow-scope reading of the numeral at least 75% of the time, Mandarin-speaking children did not seem to prefer that reading. In Experiment 2, we further investigate whether Mandarin-speaking adults and children will have easier access to the wide-scope reading of the numeral for a sentence like (7), i.e. in a story in which there are two kittens the little girl does not feed (but she feeds the other two).

- (7) xiao nühai meiyou wei liang-zhi maomi  
 little girl did not feed two-CL kitten  
 'The little girl did not feed two kittens.'

According to Lidz & Musolino (2002), 4-year-old English- and Kannada-speaking children had difficulty accessing this reading (only 33% and 23% of the time, respectively) because this reading corresponds to a non-isomorphic interpretation. However, since

Mandarin-speaking children did not seem to show preference to the isomorphic, narrow-scope reading of the numeral, it is worth examining whether they have different preference on scope ambiguity resolution from English- and Kannada-speaking children.

### 3.1 Methods

#### 3.1.1 Participants

For Experiment 2, we tested 19 Mandarin-speaking children (8 girls and 11 boys) between the ages of 4;2 to 5;11 (mean age 5;1) and 26 adults. All the adult participants were undergraduate students at National Taiwan Normal University and the child subjects were recruited from the daycare center at National Taiwan University in Taipei. None of the participants took part in Experiment 1.

#### 3.1.2 Procedure

The procedure used in this experiment was the same as in Experiment 1.

#### 3.1.3 Materials

As in Experiment 1, this experiment also included eight trials administered in a pseudo-random order—two practice trials, three experimental trials, and three filler trials that were items from an unrelated experiment. Only those children who correctly rejected at least one of the two practice trials and could correctly justify their answers were included in the data analysis. In this experiment, the wide-scope reading of the numeral was true (i.e. Wt) and the narrow-scope reading was false (i.e. Nf). This wide-scope reading of the numeral corresponds to the non-isomorphic interpretation as the object QNP follows and is c-commanded by the negation.

In the scenario of the test story corresponding to the sentence in (7), a girl is getting milk from a cow. A woman then shows up and asks the girl if she can feed the four hungry kittens with milk. The girl agrees to feed all four of them. After she feeds the first two kittens, no milk is left, and hence she cannot feed the other two. Therefore, the wide-scope reading of the numeral is true for this story because there were two kittens that the girl did not feed, whereas the narrow-scope reading is false since the girl did feed two of the four kittens. Fig. 2 illustrates the scene at the end of this story. The statements made by the puppet on each of the test and practice trials are given in Table 2, and the detailed plots for each test story can be found in Appendix B.

Reading 1: It is not the case that the girl fed two kittens (not > two) = FALSE



Reading 2: There are two kittens that the girl did not feed (two > not) = TRUE

**Figure 2:** “The girl did not feed two kittens.”—wide scope true/narrow scope false condition

**Table 2:** Test and practice trials used in Experiments 2 and 3

|        |                                             |         |         |            |        |
|--------|---------------------------------------------|---------|---------|------------|--------|
| Test 1 | 小姐                                          | 沒有      | 買       | 兩頂         | 帽子     |
|        | xiaojie                                     | meiyou  | mai     | liang-ding | maozi  |
|        | lady                                        | did not | buy     | two-CL     | hat    |
|        | ‘The lady did not buy two hats.’            |         |         |            |        |
| Test 2 | 小狗                                          | 沒有      | 抓到      | 兩隻         | 兔子     |
|        | xiaogou                                     | meiyou  | zhuadao | liang-zhi  | tuzi   |
|        | dog                                         | did not | catch   | two-CL     | rabbit |
|        | ‘The dog did not catch two rabbits.’        |         |         |            |        |
| Test 3 | 小女孩                                         | 沒有      | 餵       | 兩隻         | 貓咪     |
|        | xiao nühai                                  | meiyou  | wei     | liang-zhi  | maomi  |
|        | little girl                                 | did not | feed    | two-CL     | kitten |
|        | ‘The little girl did not feed two kittens.’ |         |         |            |        |

|            |                                       |         |     |            |
|------------|---------------------------------------|---------|-----|------------|
| Practice 1 | 兔子                                    | 沒有      | 吃   | 西瓜         |
|            | tuzi                                  | meiyou  | chi | xigua      |
|            | rabbit                                | did not | eat | watermelon |
|            | ‘The rabbit did not eat watermelon.’  |         |     |            |
| Practice 2 | 小男孩                                   | 騎       | 了   | 摩托車        |
|            | xiao nanhai                           | qi      | le  | muotuoche  |
|            | little boy                            | ride    | ASP | motorcycle |
|            | ‘The little boy rode the motorcycle.’ |         |     |            |

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### 3.2 Results and discussion

In this experiment, Mandarin-speaking adults accepted the wide-scope reading of the numeral 31% of the time (24 out of 78 items), and children accepted the reading 63% of the time (36 out of 57 items). The difference between the acceptance rates from children and adults was significant,  $t(43)=2.83$ ,  $p<0.01$ . The justification reasons for rejecting the puppet’s statement provided by children and adults were all because the girl did feed two of the four kittens. In Su (2001), it was also found that the acceptance rate from Mandarin-speaking children for the wide-scope reading of the numeral (i.e. there exists one dog that Mickey Mouse did not ride) for sentences like (8) was higher than that from adults (77% vs. 64%), although the difference was not significant ( $t(39)=1.12$ ,  $p>0.05$ ).

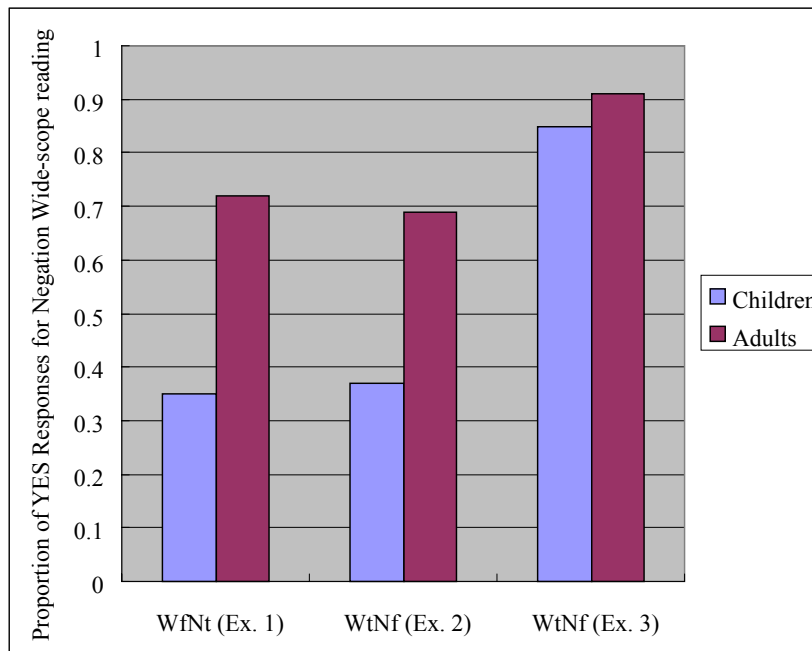
- (8) milaoshu            meiyou    qi    yi-zhi    gou  
 Mickey Mouse    did not    ride    one-CL    dog  
 ‘Mickey Mouse did not ride a dog.’

The results of this experiment also differ from Lidz & Musolino (2002) in that English- and Kannada-speaking adults accepted the wide-scope reading of the numeral 93% and 87.5% of the time respectively, whereas Mandarin-speaking adults accepted the reading only 31% of the time. On the other hand, English- and Kannada-speaking children accepted this reading only 33% and 23% of the time respectively, in contrast with Mandarin-speaking children’s 63% acceptance.

Fig. 3 displays the acceptance rates of the negation wide-scope reading<sup>6</sup> from Mandarin-speaking children and adults in WfNt and WtNf conditions from Experiments 1 and 2. Unlike English- and Kannada-speaking adults, who showed no significant

<sup>6</sup> For ease of comparison, Fig. 3 illustrates the acceptance rates of the negation wide-scope reading for the three experiments. Therefore, for experiment 2, they are 69% for adults and 37% for children.

difference in the rate of acceptance in the two conditions, Mandarin-speaking adults accepted the narrow-scope reading of the numeral significantly more often than its wide-scope reading (72% vs. 31%,  $t(64)=4.34$ ,  $p<0.001$ ). As for children's results, English- and Kannada-speaking children accepted the narrow-scope reading of the numeral significantly more often than its wide-scope reading, whereas Mandarin-speaking children demonstrated a reverse pattern, i.e. they accepted the wide-scope reading of the numeral significantly more often than the narrow-scope reading of the numeral (63% vs. 35%,  $t(42)=2.54$ ,  $p<0.02$ ). The acceptance rates were entered into an analysis of variance (ANOVA) with two factors: age (adults vs. children) and condition (WtNf vs. WfNt). The analysis revealed a reliable interaction between age and condition ( $F(1,106)=22.32$ ,  $p<0.005$ ), but no significant effect of age ( $F(1,95)=0.358$ ) or condition ( $F(1,95)=0.017$ ). It is clear from the results of Experiments 1 and 2 that Mandarin-speaking adults and children have the opposite preferences for interpreting sentences with negation and an object QNP.



**Figure 3:** Proportion of YES responses to negation wide scope for children and adults in the conditions in Experiments 1, 2 and 3



## 4. Experiment 3

In the third experiment, we examine whether the availability of the two readings for sentences with an object QNP will be changed for Mandarin-speaking children and adults by manipulating the order of events happened and hence the expectation built during the story. More specifically, in this experiment, we make the actual outcome of the stories corresponding to the wide-scope reading of the numeral, but this event happens earlier in the story, rather than at the end as in Experiment 2.

Regarding the effect of contexts on the availability of sentence interpretations, in addition to Gualmini (2004), Musolino & Lidz (2006) demonstrated that English-speaking children's ability to access the non-isomorphic interpretation (i.e. not every horse jumped over the fence) of sentences like (9a) dramatically improves (from 15% to 60%) when the sentences are preceded by an affirmative statement, as shown in (9b).

- (9) a. Every horse did not jump over the fence.
- b. Every horse jumped over the log and/but every horse did not jump over the fence.

Moreover, Musolino & Lidz (2003) also showed that English-speaking adults' acceptance of the non-isomorphic interpretation (i.e. it is not the case that two frogs jumped over the rock) for sentences like (10a) can be increased from 27.5% to 92.5% when an affirmative statement precedes the test sentence as in (10b).

- (10) a. Two frogs did not jump over the rock.
- b. Two frogs jumped over the fence but two frogs did not jump over the rock.

Instead of placing the test sentences after another statement as in Musolino & Lidz (2003, 2006), in this experiment we rearrange the order of the events and make the event for the wide-scope reading of the numeral occur earlier in the story, and at the end of the story, the narrow-scope reading of the numeral was false. As indicated in Crain & Thornton (1998:223), the order in which the events are acted out is important, and the last-mentioned event is the most salient, so the interpretation associated with that aspect of the context will be favored. Since in Experiment 2, the wide-scope reading of the numeral is the last event in the story, in Experiment 3 we try to make it an earlier event (and hence less salient) but the narrow-scope reading of the numeral was the last event (and more salient).

## 4.1 Methods

### 4.1.1 Participants

For Experiment 3, we tested 25 Mandarin-speaking children (9 girls and 16 boys) between the ages of 4;2 to 5;6 (mean age 4;10) and 33 adults. All the adult participants were undergraduate students at National Taiwan Normal University in Taipei and the child subjects were recruited from the daycare center at the same university. None of the participants took part in either Experiment 1 or 2.

### 4.1.2 Procedure

The procedure used in this experiment was the same as in Experiment 1.

### 4.1.3 Materials

This experiment also contained eight trials administered in a pseudo-random order—two practice trials, three experimental trials, and three filler trials that were items from an unrelated experiment. Only those children who correctly rejected at least one of the two practice trials and could correctly justify their answers were included in the data analysis. As in Experiment 2, the contexts for the test sentences also made the wide-scope reading of the numeral true (i.e. Wt) and the narrow-scope reading false (i.e. Nf), and hence this wide-scope reading of the numeral corresponds to the non-isomorphic interpretation.

Although as in Experiment 2, the wide-scope reading of the numeral is true but the narrow-scope reading is false in this experiment, the orders of the events are different in the two experiments. In Experiment 2, the event in which the two objects on which the main character does not perform an action happens at the end of the story, whereas in this experiment it happens in the middle of the story (before the main character performs an action on any of the objects). In the scenario of the test story corresponding to the sentence in (7), repeated here as in (11), a girl is milking a cow when a woman asks her to feed the four hungry kittens. The girl thinks the milk she gets will not be enough for four kittens, and so only agrees to feed the two skinny ones. Since the first kitten drinks up the milk, the girl thinks she cannot help the second skinny kitten. As the woman keeps begging, the girl tries to get more milk and feed the second kitten.

- (11) xiao nūhai meiyou wei liang-zhi maomi  
little girl did not feed two-CL kitten  
'The little girl did not feed two kittens.'

The arrangement of the events was such that earlier in the story, the wide-scope reading of the numeral was true, followed by the possibility of the narrow-scope reading being true, and then it turned out that the narrow-scope reading was false. The detailed plots for each test story can be found in Appendix C.

## 4.2 Results and discussion

Mandarin-speaking adults in this experiment accepted the puppet's statement (i.e. the wide-scope reading of the numeral) only 9% of the time, and children accepted it 15% of the time. The difference between children and adults was not significant,  $t(56)=1.33$ ,  $p>0.05$ . The reasons children and adults provided to justify their rejection were all because the little girl did feed two kittens. This demonstrated that Mandarin-speaking children and adults rejected the puppet's statement based on the narrow-scope reading of the numeral. That is to say, the results in this experiment showed that Mandarin-speaking adults and children had access to the narrow-scope reading of the numeral 91% and 85% of the time, respectively.

Fig. 3 also displays the acceptance rates of Mandarin-speaking children and adults for the test trials in the two different contexts of WtNf condition from Experiments 2 and 3. Children's YES responses decreased significantly from Experiment 2 (63%) to Experiment 3 (15%),  $t(42)=5.02$ ,  $p<0.001$ , and adults' acceptance rates of the wide-scope reading of the numeral also differed significantly between Experiment 2 (31%) and Experiment 3 (9%),  $t(57)=3.175$ ,  $p<0.01$ . The acceptance rates were entered into an analysis of variance (ANOVA) with two factors: age (adults vs. children) and condition (wide-scope-as-the-last-event vs. wide-scope-as-an-early-event). The analysis revealed a main effect of age ( $F(1,99)=11.136$ ,  $p<0.005$ ), a main effect of condition ( $F(1,99)=36.09$ ,  $p<0.005$ ), and a reliable interaction between age and condition ( $F(1,99)=4.23$ ,  $p<0.05$ ).

The results from this experiment clearly demonstrated that both Mandarin-speaking children and adults were sensitive to the contexts in which the order of the events happened, with children's ability to access the originally non-preferred interpretation increased more dramatically. However, a puzzle remains as to why the arrangement of events in Experiment 3 successfully leads subjects to the narrow-scope reading of the numeral, whereas the contexts in Experiment 1 does not. Note that in Experiment 1, the wide-scope reading of the numeral was also true earlier in the story, but it turned out to be false and the narrow-scope reading was true at the end. A plausible explanation has some bearing on the change of the subject's expectations caused by the manipulation of the orders of events in the two experiments. For the scenario in Experiment 3, in the middle of the story the wide-scope reading of the numeral is true when the main character

reveals the impossibility of performing the action upon two of the four objects (i.e. the wide-scope reading of the numeral is true). At this moment, the subject's expectation is that the main character will perform the action on the other two objects. After the action is performed on one of the two objects, due to some factors, the main character does not think he/she can do the action on the other object, and hence the expectation built up to this moment is that it is not the case that the main character will perform the action on two objects (i.e. the narrow-scope reading of the numeral is true). However, at the end of the story, the problem is solved and the main character does act upon two of the four objects, and thus the expectation of the narrow-scope reading of the numeral does not turn out to be what happens. Therefore, according to the subject's expectation, the test sentence does not truthfully describe the final outcome of the story. As for the scenario in Experiment 1, at the beginning the main character does not have the intension to perform the action on the two objects, and hence the wide-scope reading of the numeral is expected to be true. After the main character does something else, he/she decides to perform the action on only one of the two objects, and thus the expectation of the wide-scope reading of the numeral does not turn out to be true at the end of the story. Although the narrow-scope reading of the numeral truthfully describes the final outcome of the story, since the expectation built according to the scenario is the wide-scope reading of the numeral (i.e. the main character will not act upon the two objects), the test sentence fails to describe what happens in the story for he/she does act upon one of the two objects. Based on this account, for the narrow-scope reading of the numeral to be felicitous, the main character will have to originally intend to act upon the two objects, and then fails to do so on one of them.<sup>7</sup> The results from the current study therefore further demonstrate the effect of contexts on the resolution of scope ambiguity from children and adults, in line with Gualmini (2004) and Musolino & Lidz (2003, 2006). Specifically, the orders

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<sup>7</sup> A follow-up experiment testing this possibility showed that 4-year-old Mandarin-speaking children accepted the negation wide-scope reading 73% of the time (44 out of 60 trials), and 5-year-old children 60% of the time (36 out of 60 trials), compared with 35% acceptance in Experiment 1 of the present study. In the stories of the follow-up experiment, the main character originally intends to perform the action on the two objects (e.g., to feed the two kittens), but at the end for some reason only acts upon one of them. One of the reviewers pointed out that since in Experiment 1 of the present study, the two objects had different physical attributes (e.g., a big cow and a small cow), and this might appear to lean toward a reading of two specific cows. Note that in the follow-up experiment, the two objects also had different physical attributes (e.g., a black kitten and a white kitten) in three of the four stories, but subjects in this experiment did not show similar patterns as those in Experiment 1. Therefore, what is more important, at least regarding the test sentences in this study, is the context as manipulated in the sequence of events and the expectation derived from it.

of events can influence a listener's presumed expectation regarding the felicity condition and the interpretation of an ambiguous negative sentence.<sup>8</sup>

## 5. General discussion

To recapitulate the findings in the current study, the results from Experiments 1 and 2 demonstrated that unlike English and Kannada, in which adults accepted the two readings over 85% of the time, Mandarin-speaking adults preferred the narrow-scope reading of the numeral (72% acceptance) to the wide-scope reading (only 31% acceptance). Besides, unlike English- and Kannada-speaking children, Mandarin-speaking children did not seem to have problems raising the c-commanded QNP at LF to have scope over negation. They accepted the narrow-scope reading of the numeral only 35% of the time in Experiment 1, but the wide-scope reading about 63% of the time. In the contexts for the narrow-scope reading of the numeral in Experiment 1, when children rejected the statement after the story, the reasons they gave were “because the girl ate one cookie”, “because the boy rode one cow”, and “because Snow White bought one vase of flowers”. The reasons children gave for rejecting the statements showed that they interpreted the sentences as “The boy did not ride the two cows”, “The girl did not eat the two cookies”, and “Snow White did not buy the two vases of flowers”, i.e. they consider the QNP as specific (or definite), and hence assign a wide scope to it.

The results from Experiment 3 showed that although Mandarin-speaking children did not prefer the narrow-scope reading of the numeral given the contexts in Experiment 1, children as well as adults had easier access to this interpretation when the order of events was manipulated. Specifically, when the event to make the wide-scope reading true happened earlier in the story, but the event to make the narrow-scope reading false happened at the end of the story, Mandarin-speaking children and adults rejected the test sentences over 85% of the time. The finding demonstrated that both children and adults were sensitive to the salience of the events depicted in the order of occurrence, with the effect on children so dramatic that it could even override their preference for the wide-scope reading of the numeral. This is in accord with the emerging view (see Gualmini 2004, Musolino & Lidz 2003, 2006) that children's and adults' sentence processing abilities may differ quantitatively but not qualitatively, and the differences between children and adults regarding scope ambiguity resolution seem to reflect differences in

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<sup>8</sup> One of the anonymous reviewers believes that it is not so much the sequence of events, but the overall discourse context, that influences scope preferences. This is what I try to illustrate here. Since the order of events can influence the information flow, it plays an important role in fine-tuning a listener's expectations as the scenario is unfolded in the story.

the operation of the parser from the two groups rather than differences between children's emerging grammatical systems and those of mature speakers. Notwithstanding, the facts that the two alternative interpretations are not equally available for Mandarin-speaking adults, and that Mandarin-speaking children tend to have the non-isomorphic interpretation more easily than English- and Kannada-speaking children do still need an explanation. In the rest of this paper, we shall try to provide possible accounts in light of the differences on the structure of QNP's and on the structure of negative sentences between English and Mandarin.

### 5.1 The structure of quantified noun phrases

The results in the current study showed that Mandarin-speaking children had easier access to the wide-scope reading of the numeral for sentences with negation and an object noun phrase with a quantifier *liang* 'two' than English- and Kannada-speaking children as reported in Lidz & Musolino (2002). The different preferences in how English-speaking and Mandarin-speaking children interpret sentences with two quantified noun phrases reported in Lee (1986, 1996), Chien (1994), Phillip (1995), Su (2001), and sentences with negation and an object QNP in Lidz & Musolino (2002) and the current study hence demonstrate that the difference between children acquiring English and Mandarin cannot be attributed to simply the lexical idiosyncrasy between English 'a' and Mandarin 'yi'. It seems that Mandarin-speaking children consider the QNP in general to be [+specific] or referential, and hence always take a wide scope in an early stage of development, but English-speaking children treat them as [-specific] or non-referential. As suggested in Su (2001), what looks like a [+specific] interpretation by Mandarin-speaking children may be actually the result of a quantity-denoting number expression (i.e. a Number Phrase (NumP)) that Li (1996, 1997, 1998) proposed.

Drawing on data from the distribution and interpretation possibilities of Mandarin nominal expressions of the form [Number + Classifier + Noun], Li (1996, 1997, 1998) argues for the existence of a Determiner Phrase (DP)<sup>9</sup> projection in Mandarin as well as the existence of a category other than DP (i.e. Number Phrase (NumP)) in argument position. It has been observed by various linguists (e.g., Chao 1968, Li & Thompson 1981, Lee 1986, among many others) that in Mandarin Chinese, a preverbal subject or topic NP tends to be definite (as represented by a bare NP, an NP with a demonstrative 'this' or 'that', or a proper name as in (12)), whereas a postverbal NP tends to be indefinite

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<sup>9</sup> A Determiner Phrase is a functional category headed by a Determiner (e.g., the definite article 'the', the indefinite article 'a/an' in English) representing a nominal expression (Abney 1987), and it has been generally accepted that a nominal expression as an argument should be expressed by a DP and a nominal predicate by a Noun Phrase (NP).

(as represented by a bare NP or a number expression [Number + Classifier + Noun] as in (13)).

- (12) a. maomi pao jin le fangjian  
cat run into ASP room  
'The cat ran into the/a room.'
- b. zhe-zhi maomi pao jin le fangjian  
this-CL cat run into ASP room  
'This cat ran into the/a room.'
- c. jiafeimao pao jin le fangjian  
Garfield run into ASP room  
'Garfield ran into the/a room.'
- (13) a. jiali lai le jingcha  
home come ASP policeman  
'There came (some) policemen at home.'
- b. jiali lai le liang-ge jingcha  
home come ASP two-CL policeman  
'There came two policemen at home.'

However, a demonstrative with a noun, indicating definiteness, is not acceptable in a postverbal position (as in (14a)), whereas a number expression, indicating indefiniteness, generally is not allowed in a preverbal subject or topic position<sup>10</sup> (as in (14b, c)).

- (14) a. \*jiali lai le na-ge jingcha le  
home come ASP that-CL policeman ASP  
'There came that policeman at home.'

<sup>10</sup> Note that as clearly demonstrated in Chen (2004), position in sentences does not function as an unambiguous encoding device for marking (non)identifiability/(in)definiteness of reference for nominal expressions in Mandarin. In his preliminary corpus investigation, among the 15 utterances in which a QNP appears as the postverbal object in transitive sentences, 4 are identifiable (i.e. definite), and among the 34 utterances a QNP is the subject or the BA object of the sentences, 8 are nonidentifiable (i.e. indefinite). Therefore, indefinite expressions serving as the subject with a dynamic predicate as in (i) are in fact not uncommon in Mandarin.

(i) yi-zhi xiao qi'e yaoyaobaibai zou le shanglai  
one-CL little penguin swaying walk ASP up  
'A little penguin was waddling up.' (Chen 2004:1170)

- b. ?? liang-zhi maomi pao jin le fangjian<sup>11</sup>  
 two-CL cat run into ASP room  
 ‘Two cats ran into the/a room.’
- c. \*liang-zhi maomi, wo zhidao pao jin le fangjian  
 two-CL cat I know run into ASP room  
 ‘There are two cats, I know (they) ran into the/a room.’

To make (14b, c) acceptable, an existential marker *you* ‘have, exist’ is needed before the number expression (as in (15a, b)).

- (15) a. you liang-zhi maomi pao jin le fangjian  
 have two-CL cat run into ASP room  
 ‘Two cats ran into the/a room.’
- b. you liang-zhi maomi, wo zhidao pao jin le fangjian  
 have two-CL cat I know run into ASP room  
 ‘There are two cats, I know (they) ran into the/a room.’

Nevertheless, in contrast to the aforementioned generalization for a subject not to be indefinite, an “indefinite” nominal can occur in the subject or topic position of the following sentence patterns.

- (16) a. yi-ge guantou gou chi liang-zhi maomi  
 one-CL can enough eat two-CL cat  
 ‘A can is enough for two cats to eat.’
- b. liang-zhi maomi chi-de-wan san-ge guantou  
 two-CL cat eat-can-finish three-CL can  
 ‘Two cats can finish three cans.’
- c. liang-tiao yu jiu keyi rang maomi chi-bao le  
 two-CL fish then can make cat eat-full ASP  
 ‘Two fish suffice to make the cat full.’

Li (1996, 1997, 1998) argued that the apparent counterexamples in (16) to the subject definiteness constraint share a common property—that is, the interpretation of such “indefinite” nominals in fact concerns quantity, rather than the existence of some individuals as in (14b, c)—and suggested that number expressions should be recognized

<sup>11</sup> As indicated in Li (1996, 1998), a number expression in the subject position becomes acceptable if they are answers to questions of ‘how many’, as expected if it is interpreted as a quantity expression, rather than an individual-denoting expression.



- According to Li (1996, 1998), an indefinite DP with a structure like (17a) denotes individuals because of the presence of the D projection (the position for an overt/null (in)definite article). Since D is generally taken to be the locus for expressing (in)definiteness, its distribution is confined by the prohibition against an indefinite nominal in subject or topic position in Mandarin as shown in (14b, c). Since the quantity-denoting number expression with a structure like (17b) does not have a D, the restriction is irrelevant, and hence it can appear in the topic or subject position as shown in (16).

(18) a. you    liang-ge    xuesheng<sub>i</sub>    hui    lai  
          have   two-CL   student   will   come  
          tamen<sub>i</sub>   hai   hui   dai   liwu   lai  
          they   till   will   bring   gift   come  
          ‘There will be two students coming and they will bring gifts.’  
      b. you    liang-zhi    maomi<sub>i</sub>    chi-bu-wan  
          have   two-CL   cat   eat-not-finish  
          ni    gei    tamen<sub>i</sub>    de    san-tiao    yu  
          you   give   them   DE   three-CL   fish  
          ‘There are two cats unable to finish the three fish you gave them.’

- c. Mali<sub>i</sub> zhidao you liang-ge ren<sub>j</sub> keyi ban-de-dong  
 Mali know have two-CL people can carry-can-move  
 ziji<sub>i/j</sub> de xingli  
 self DE luggage  
 ‘Mali knows that two people can carry self’s luggage.’

On the other hand, since a quantity-denoting expression (NumP) does not have a D projection, it is not expected to have a referential index with a following pronoun or reflexive as shown in (19).

- (19) a. ?? liang-zhi maomi<sub>i</sub> chi-bu-wan wu-tiao yu  
 two-CL cat eat-not-finish five-CL fish  
 tamen<sub>i</sub> hai tai xiao le  
 they still too little ASP  
 ‘Two cats cannot finish eating five fish. They are still too little.’  
 b. \*liang-zhi maomi<sub>i</sub> chi-bu-wan ni gei tamen<sub>i</sub> de wu-tiao yu  
 two-CL cat eat-not-finish you give them DE five-CL fish  
 ‘Two cats are unable to finish the five fish you gave them.’  
 c. Mali<sub>i</sub> zhidao liang-ge ren<sub>j</sub> keyi ban-de-dong  
 Mali know two-CL people can carry-can-move  
 ziji<sub>i/\*j</sub> de xingli  
 self DE luggage  
 ‘Mali knows that two people can carry self’s luggage.’

Li also argued that quantity-denoting number expressions are not quantificational expressions quantifying over individuals, and therefore they do not interact with other quantificational expressions with respect to scope as illustrated in (20a), in contrast with (20b).

- (20) a. wu-zhi maomi chi-de-wan shi-tiao yu  
 five-CL cat eat-can-finish ten-CL fish  
 ‘Five cats can finish eating ten fish.’  
 b. you wu-zhi maomi chi-de-wan shi-tiao yu  
 have five-CL cat eat-can-finish ten-CL fish  
 ‘Five cats can finish eating ten fish.’

The sentence in (20a) can only have the interpretation that five cats can finish, among them, ten fish. It cannot mean that there are 50 fish altogether (with the first nominal

taking wide scope) as allowed by the sentence in (20b).<sup>12</sup> Without having recourse to saying that Mandarin-speaking children acquire the specific or referential reading of the indefinites earlier than children acquiring other languages, it is likely that, as Su (2001) suggested, Mandarin-speaking children interpret QNP's as a quantity-denoting number expression (NumP), and thus assign it a scope-independent reading in an early stage of language acquisition.

Note that although for Mandarin-speaking adults, the quantity-denoting interpretation is usually seen when QNP's are in the scope of modal or belief-contexts, children do not seem to be confined by this restriction. Similar findings were reported in a longitudinal study of a Mandarin-acquiring child's spontaneous speech production (Hsieh 2008), in which the interpretation of a QNP did not comply with the distributional restriction of adult usage.

- (21) a. *liang ge bu yao* (2;10) (cf. *bu yao liang ge*)  
 two CL not want not want two CL  
 'I don't want two.'
- b. *liang zhi mei you shou* (3;1) (cf. *mei you liang zhi shou*)  
 two CL not have hand not have two CL hand  
 'No two hands.'
- c. *bu shi liang ge, liang ge mei you* (3;1) (cf. ... *mei you liang ge*)  
 not be two CL two CL not have not have two CL  
 'This is not two. I don't have two.'
- d. Mother: *laoshi shuo ye keyi dai liang ge a!*  
 teacher say also may bring two CL PART  
 'Teacher said you can bring two.'
- Child: *wo mei tingdao laoshi shuo liang ge keyi dai* (3;8)  
 I not hear teacher say two CL may bring  
 'I did not hear that Teacher said we can bring two.'

<sup>12</sup> One of the anonymous reviewers states that in examples (20a, b), the QNPs have the collective reading, and considers what is at issue here is why children tend to assign QNPs wide scope in a distributive (not collective) reading. As reviewed in Introduction, Lee (1986, 1996), Chien (1994), and Su (2001) found Mandarin-speaking children tended to assign the narrow-scope reading (i.e. the collective reading) to a QNP in the object position of a sentence with the universal quantifier in the subject position or a QNP in the Recipient object position of a double object sentence with the universal quantifier in the Theme object position. It is Mandarin-speaking children's tendency to assign the collective reading in those types of sentences and the wide-scope reading for an object QNP in a sentence with negation that, as argued in the current study, is similar to the scope-independent quantity-denoting number expressions in (16) as discussed in Li's studies.

- (cf. ... keyi dai *liang ge*)  
 may bring two CL
- e. Mother: ni yi ge zi ye bu rende o  
 you one CL word also not know PART  
 'You don't know a word, right?'
- Child: wo yi ge zi rende a! (4;3)  
 I one CL word know PART  
 'I do know a word.'
- (cf. wo rende yi ge zi a!)  
 I know one CL word PART
- Mother: ni rende sheme zi?  
 you know what word  
 'What word do you know?'
- Child: wo rende yi a!  
 I know one PART  
 'I know 'one'.'

The example in (21a) was used when the child returned to his mother one of the spatulas because his mother had given him two in total and all he wanted was just one. Given the same context, an adult would use a sentence with negation and the verb preceding the QNP. As for (21b), it was used when the child wanted his mother to help him take off his pants because both of his hands were occupied. What the negative marker *mei* negates is the noun head, and again adults would put the QNP after the negation and verb. The child used (21c) to tell his mother that there were not two cookies. He wanted to have two. Just like the example in (21a), what is involved in the QNP here is quantity. Similarly, *liang ge* in (21d) and *yi ge zi* in (21e) are also quantity-denoting. Since the interpretation that the QNP has is a quantity one, no scope is involved.

## 5.2 The structure of negative sentences

The scope-independent quantity-denoting number expression account can explain why Mandarin-speaking children initially treat the QNP's as not interacting with other quantificational expressions, but it is still not clear why they do not prefer to interpret the QNP's as under the scope of negation as English- or Kannada-speaking children do. In this section we shall try to account for Mandarin-speaking children's lack of the negation wide-scope reading in light of the structure of negative sentences in Mandarin proposed by Huang (1988) and the constraint on the availability of metalinguistic readings proposed by Wible & Chen (2000).

Huang (1988) proposed Principle P as in (22) for the structure of negation in Mandarin to account for the acceptability of the sentences in (23).

- (22) *Principle P*: The negative morpheme *bu* forms an immediate construction with the first  $V^0$  element following it.

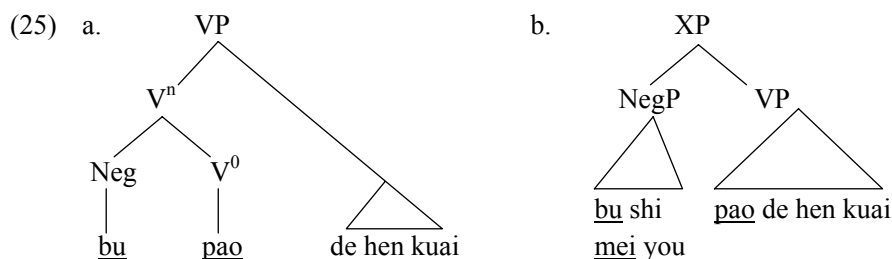
- (23) a. tamen pao de hen kuai  
           they run DE very fast  
           ‘They run very fast.’  
       b. \*tamen [bu pao] de hen kuai  
           they not run DE very fast  
           ‘They do not run very fast.’  
       c. ta pian le ni  
           he cheat ASP you  
           ‘He cheated you.’  
       d. \*ta [bu pian] le ni  
           he not cheat ASP you  
           ‘He did not cheat you.’

According to Huang (1988), the reason why (23b) is not acceptable is because when ‘*bu*’ forms a constituent with the following verbal head, the structure results in a nonsensical reading in which ‘non-running’ has the property of being ‘fast’. Similarly, (23d) is ruled out because Principle P assigns a structure which yields an incongruous reading that gives ‘*le*’ scope over ‘*bu pian*’, resulting in a perfective reading to a non-event. The nonsensical or incongruous readings of (23b) and (23d) can be prevented by having an auxiliary verb ‘*you*’ or the verb ‘*shi*’ intervening as a focus marker between the negative operator and the main verb, as shown in (24).

- (24) a. tamen [mei you] pao de hen kuai  
           they NEG have run DE very fast  
           ‘They did not run very fast.’  
       b. tamen [bu shi] pao de hen kuai  
           they NEG be run DE very fast  
           ‘It is not the case that they run very fast.’  
       c. ta [mei you] pian ni  
           he NEG have cheat you  
           ‘He did not cheat you.’

- d. ta [bu shi] pian le ni  
 he NEG be cheat ASP you  
 ‘It is not the case that he cheated you.’

The structures for the nonsensical (23b) and the acceptable (24a, b) can be schematically represented as (25a) and (25b) respectively. The crucial difference between the two structures resides in that in (25a) the negative morpheme *bu* forms a constituent with the verbal head that follows it, whereas in (25b) the negative morphemes *bu* or *mei* and the following verb do not form a constituent.



To better understand the availability of the negation wide-scope interpretation for sentences with negation and an object QNP in English and Mandarin, i.e. the reading that ‘it is not the case that NP1 V two NP2s’, we shall draw upon Horn’s (1985, 1989) works on negation. Horn (1985, 1989) pointed out that negation can serve not only as a truth-functional operator to reverse the truth value of a proposition, but also as a metalinguistic device, registering the speaker’s rejection to a previous utterance as infelicitous with respect to the designated situation. Take (26) and (27) as examples.

- (26) A: John is meeting a woman this evening.  
 B: No, he’s not (meeting a woman this evening)—he’s meeting his wife.  
 (27) Bill doesn’t have three children. He has four.

The negation in (26) and (27) does not negate the truth of the proposition (that ‘John is meeting a woman this evening’ or ‘Bill has three children’). Rather, the negation is a metalinguistic one due to the fact that ‘woman’ and ‘wife’ form a lexical entailment pair (i.e. if A is a wife, that entails A is a woman) and that *three* is a scalar operator that is lower-bounded by their truth-conditional semantics (i.e. if A has four children, it is necessarily true that A has three). The scalar operators like *some* or *three* may be upper-bounded by conversational implicature, triggered by Grice’s maxim of Quantity (Grice 1975). Normally speakers in a conversation have to be as informative as possible, and

the assertion of the scalarly weaker statement then conversationally implicates the falsity of the stronger statement. Hence if someone says “*Bill has three children*”, it implicates that “*Bill doesn’t have four children*”. If someone knows Bill has four children, and this fact is relevant in the conversation, it will be misleading for someone to inform you that Bill has three (although it is true). Therefore, in Horn’s (1985, 1989) account, the negation in (26) and (27) does not negate the proposition, but operates on a metalinguistic level to reject the implicature that may be associated with the assertion of that proposition. Although as pointed out in Horn (1985:144, 1989:363), metalinguistic negation can be used to object to virtually any aspect of a previous statement, from its phonetic form to its morphological or syntactic form, in the current study what is relevant is the negation of the sentence’s presupposition as the affirmative statement asserts that the main character will perform the action on two objects.<sup>13</sup>

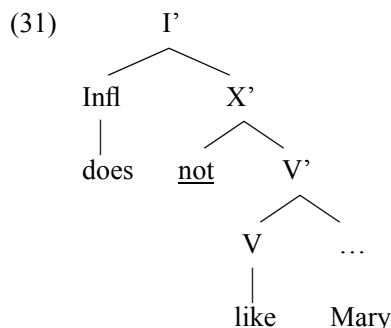
Regarding the contrast of the availability of metalinguistic readings, Wible & Chen (2000) noticed the free availability of metalinguistic readings in English sentences as in (28) and the unavailability of such readings in Mandarin sentences as in (29), and proposed a Constraint M in (30) to account for the difference between the two languages.

- (28) a. John doesn’t like Mary. (He loves her.)  
       b. They didn’t let me go. (They made me go.)  
       c. He isn’t tall. (He’s towering.)
- (29) a. Zhangsan bu xihuan Mali. (# ta ai Mali.)<sup>14</sup>  
       Zhangsan NEG like Mali ( he love Mali)  
       ‘John dislikes Mary. (# He loves her.)’  
       b. tamen bu rang wo qu. (# tamen bi wo qu.)  
       they NEG let I go ( they force I go)  
       ‘They didn’t let me go. (# They forced me to go.)’  
       c. ta bu gao. (# ta gao de budeliao.)  
       he NEG tall ( he tall DE extremely)  
       ‘He isn’t tall. (# He is extremely tall.)’
- (30) *Constraint M:* A metalinguistic reading of negation is prohibited where the negative morpheme forms an immediate constituent with the predicator head  $X^0$  (typically  $V^0$ ).

<sup>13</sup> Note that I am not trying to equate metalinguistic negation with the negation wide-scope reading, but it is only this aspect of metalinguistic negation (i.e. the negation of the presupposition) that is relevant to our discussion of the negation wide-scope reading in a sentence with negation and an object QNP.

<sup>14</sup> Following Wible & Chen (2000), the # marks sentences which are grammatically acceptable, but pragmatically infelicitous in the given context.

Based on Constraint M, metalinguistic readings are available in the English sentences in (28) because as shared by a number of analyses (e.g., Aoun & Li 1993, Baker 1991, Chomsky 1991, Pollock 1989, Radford 1997, among others), the negative morpheme *not* does not form a constituent with the main verb which follows it but is the sister of some higher projection of that verb, as depicted in (31).



However, in Mandarin, according to Principle P in (22), the negative morpheme forms an immediate construction with the first verbal head ( $V^0$ ) element following it, and hence metalinguistic readings are prohibited. This constraint can explain the contrast of (29) in which the negative morpheme forms a constituent with the following verb (with a structural representation as in (25a)) and (32) in which a focus marker *shi* intervenes between the negative morpheme and the verb (with a structural representation as in (25b)) with respect to the availability of metalinguistic readings in Mandarin.

- (32) a. Zhangsan bu shi xihuan Mali. (ta shi ai Mali.)  
           Zhangsan NEG be like Mali (he be love Mali)  
       b. tamen bu shi rang wo qu. (tamen shi bi wo qu.)  
           they NEG be let I go (they be force I go)  
       c. ta bu shi gao. (ta shi gao de budeliao.)  
           he NEG be tall (he be tall DE extremely)

Constraint M also accounts for the contrast between negated sentences in which the verb *you* is a main verb, as in (33), and negated sentences in which *you* is an auxiliary verb, as in (34).

- (33) Zhangsan mei you san-ge xiaohai. (# ta you si-ge xiaohai.)  
       Zhangsan NEG have three-CL child ( he have four-CL child)  
       ‘Zhangsan doesn’t have three children. (He has four children.)’



- (34) Zhangsan mei you yang san-ge xiaohai.  
 Zhangsan NEG have raise three-CL child  
 (ta yang le si-ge xiaohai.)  
 (he raise ASP four-CL child)  
 ‘Zhangsan didn’t raise three children. (He raised four children.)’

Although all the sentences in (29), (32), (33) and (34) contain the structure of [*bu/mei* + verbal head  $V^0$ ], only the  $V^0$ s with which the negative morpheme combined in (29) and (33) are the heads of the main predicate, and hence according to Constraint M, metalinguistic readings of the negation will not be available. In (32) and (34), the presence of auxiliary verbs *shi* and *you* intervening between the negative morpheme and the main verb frees the sentences from Constraint M and renders metalinguistic readings of the negation available. The sentences in (33) and (34) are crucial to the current study, as they are sentences with negation and an object QNP. The sentences in (33) and (34) illustrate that the metalinguistic reading is allowed in (34), but not in (33).

With respect to the results of Experiments 1 and 2 in the current study, the reason why Mandarin-speaking adults prefer the narrow-scope reading to the wide-scope reading of the numeral for the test sentences may be due to the complementary distribution of the *you-le* alternation first noted in Wang (1965),<sup>15</sup> as shown in (35).

- (35) a. nanhai qi le niu  
 boy ride ASP cow  
 ‘The boy rode the cow.’  
 b. nanhai mei you qi niu  
 boy NEG have ride cow  
 ‘The boy did not ride the cow.’

As shown in (35), when the event described in the statement is past, the negation morpheme *mei* and the auxiliary verb *you* are used instead of *bu*. By analogy, the affirmative counterpart of the test sentence “*The boy did not ride two cows*” (as in (36a)) will be “*The boy rode two cows*” (as in (36b)).

<sup>15</sup> Wang (1965) accounted for the alternation of the perfective aspect *le* as in (35a) and the auxiliary verb *you* in (35b) by postulating the latter as in a suppletive relation with the former. However, Teng (1973) pointed out that negative sentences with *meiyou* do not only correspond to affirmative sentences with the aspect *le*, but can also correspond to affirmative sentences with the experiential/perfective aspect *guo*, the progressive aspect *zhe*, or a stative verb. Nevertheless, it still holds that *meiyou* instead of *bu* should be used to negate an affirmative sentence with the aspect *le*.

- (36) a. nanhai meiyou qi liang-tou niu  
 boy did not ride two-CL cow  
 ‘The boy did not ride two cows.’  
 b. nanhai qi le liang-tou niu  
 boy ride ASP two-CL cow  
 ‘The boy rode two cows.’

Since in the context given by the story, the boy only rode one of the two cows, the statement in (36b) is false, and hence its negated form in (36a) is true.

As for why Mandarin-speaking children prefer the wide-scope reading of the numeral instead of the negation wide-scope reading for sentences like (36a), in addition to the possibility that Mandarin-speaking children consider the QNP’s as scope-independent quantity-denoting number expressions, another possible reason has some bearing on Principle P and Constraint M. It is likely that since for sentences like (35b) and (36a), the auxiliary *you* can be optionally deleted (as shown in (37)), children assign a structure to the sentences in which the negative morpheme forms a constituent with the head verb. Therefore, according to Constraint M, metalinguistic readings (i.e. the negation takes scope over the quantified noun phrases) will not be available for those children.

- (37) a. nanhai [mei qi] niu  
 boy NEG ride cow  
 ‘The boy did not ride the cow.’  
 b. nanhai [mei qi] liang-tou niu  
 boy NEG ride two-CL cow  
 ‘The boy did not ride two cows.’

Furthermore, this raises another relevant possibility that since negative sentences with focus marker *shi* unambiguously indicate sentence negation and permit metalinguistic readings (as in (38)), Mandarin-speaking children initially consider negative sentences with focus marker *shi* as the only way for metalinguistic negation, and treat negative sentences with ‘*meiyou* + V’ or ‘*mei* + V’ as constituent negation.<sup>16</sup>

<sup>16</sup> A follow-up experiment was conducted to see whether Mandarin-speaking children did distinguish *meiyou* from *bushi* in sentences with negation and an object QNP. In one of the contexts, there were four objects, and the main character performed the action on two of the objects (i.e. the wide-scope reading of the numeral was true). For the *bushi* condition, test sentences similar to (38) were used, and 4-year-old children accepted the sentences only 10% of the time (6 trials out of 60, N=15), which was not significantly different from adults’ 3% acceptance rate (2 trials out of 60, N=15). For the *meiyou* condition, sentences similar to (36a)

- (38) nanhai [bu shi] qi liang-tou niu  
 boy NEG be ride two-CL cow  
 ‘It is not the case that the boy rode two cows.’

As indicated in Teng (1973), sentence negation is generated through phrase structure rules, whereas constituent negation is specified in the lexicon (e.g., *bu xihuan* ‘dislike’, *bu daode* ‘immoral’, etc.). If indeed Mandarin-speaking children initially consider negative sentences with ‘*meiyou* + V’ or ‘*mei* + V’ as constituent negation indicating contrary relations, it naturally follows that the negation wide-scope reading will not be relevant, as shown in the example in (39).

- (39) laoshi bu xihuan liang-ge xuesheng  
 teacher dislike two-CL student  
 ‘The teacher dislikes two students.’

For the sentence in (39), the only interpretation is that there exist two students that the teacher dislikes.

## 6. Concluding remarks

The goal of this study is to provide cross-linguistic evidence from Mandarin to demonstrate the influence of structure and context on children’s scope ambiguity resolution. As shown in the results of Experiment 3, children as well as adults are

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were used. Adults accepted the sentences 50% of the time (30 trials out of 60,  $N=15$ ), and children at the 5-year-old group and 4-year-old group both had the acceptance rate of 60% (36 trials out of 60,  $N=15$ ). Sentences with *meiyou* similar to (36a) were also used in a context in which there were two objects, and the main character only performed the action on one of them (i.e. the wide-scope reading of negation was true). Adults accepted the sentences 80% of the time (48 out of 60 trials,  $N=15$ ), and 5-year-old and 4-year-old children had the acceptance rates of 60% (36 out of 60 trials,  $N=15$ ) and 73% (44 out of 60 trials,  $N=15$ ), respectively. For the two *meiyou* conditions, adults displayed significantly different acceptance rates for the two types of contexts ( $t(28)=2.32$ ,  $p<0.05$ ), but neither 5-year-old nor 4-year-old exhibited this contrast. Therefore, the results demonstrated that children correctly assigned the negation wide-scope reading as the only interpretation for the *bushi* sentences as adults did. However, although Mandarin-speaking adults preferred the negation wide-scope reading for the *meiyou* sentences, children in the two age groups failed to show the preference. Note that in this follow-up experiment, the acceptance rate for the wide-scope reading of the numeral from Mandarin-speaking children (i.e. 60%) was still higher than that of English-speaking children (35%) and Kannada-speaking children (20%) as reported in Lidz & Musolino (2002).

sensitive to the manipulation of the order of events in the context. Given an appropriate context, children are able to overcome their bias toward a preferred reading. On the other hand, the results from Experiments 1 and 2 display a different pattern of interpretation from English- and Kannada-speaking children and adults as reported in Lidz & Musolino (2002). As I have tried to show in the discussion, the cross-linguistic difference may arise due to the differences on the structure of quantified noun phrases and/or the structure of negative sentences among these languages. Future research from other languages will certainly be needed to tease the two possibilities apart, so that we can better understand the structural effects on scope ambiguity resolution from adults and children.

## Appendix A: Test stories for Experiment 1 (Wide false, Narrow true for the QNP)

### 1. Test Story 1

Plot: see §2.

Puppet's statement:    xiao nanhai    meiyou    qi    liang-tou    niu  
                                  little boy    did not    ride    two-CL    cow  
                                  'The little boy did not ride two cows.'

### 2. Test Story 2

Plot: In this story Snow White comes to Rabbit's moving sale. She first sees two vases of beautiful flowers, but thinks she has already had a lot of flowers at home, and so decides not to buy them. She then finds a nice dresser and so buys it. At the end, she thinks she can buy a vase of flowers to put it on the top of the dresser, and so buys the vase with red flowers but not the vase with white flowers for she does not like white.

Puppet's statement:    baixuegongzhu    meiyou    mai    liang-ping    hua  
                                  Snow White    did not    buy    two-CL    flower  
                                  'Snow Whit did not buy two vases of flowers.'

### 3. Test Story 3

Plot: In this story, a girl comes to a kitchen to look for something to eat after swimming. She first sees two cookies, but does not feel like eating anything sweet, and so decides not to eat them. She then finds a drumstick and eats it. At the end, she thinks now she can eat something sweet, and so eats the chocolate cookie but not the strawberry cookie for she does not like the latter.

Puppet's statement:    xiao nühai    meiyou    chi    liang-kuai    binggan  
                                  little girl    did not    eat    two-CL    cookie  
                                  'The little girl did not eat two cookies.'

## **Appendix B:**

### **Test stories for Experiment 2 (Wide true, Narrow false for the QNP)**

#### 1. Test Story 1

Plot: In this story a lady comes to Squirrel's store to buy hats. Originally the lady wants to buy all four of the hats, but later she finds out she only has enough money to buy two of them, and hence decides not to buy the other two hats.

Puppet's statement:    xiaojie    meiyou    mai    liang-ding    maozi  
                                 lady    did not    buy    two-CL    hat  
                                 'The lady did not buy two hats.'

#### 2. Test Story 2

Plot: In this story a dog is asked by its master to help to catch the four rabbits and put them in a cart. The dog promises to catch all four of them. After the dog catches the two little rabbits and put them in the cart, the two big ones run away and hide themselves in a carriage so that the dog cannot reach them.

Puppet's statement:    xiaogou    meiyou    zhuadao    liang-zhi    tuzi  
                                 dog    did not    catch    two-CL    rabbit  
                                 'The dog did not catch two rabbits.'

#### 3. Test Story 3

Plot: see §3.

Puppet's statement:    xiao nühai    meiyou    wei    liang-zhi    maomi  
                                 little girl    did not    feed    two-CL    kitten  
                                 'The little girl did not feed two kittens.'

## Appendix C:

### Test stories for Experiment 3 (Wide true, Narrow false for the QNP)

#### 1. Test Story 1

Plot: In this story a dog is asked by its master to help to catch the four rabbits and put them in a cart. The dog promises to catch only two of the four rabbits, because the other two run too fast and they have been hiding in a place where the dog cannot reach. The dog catches the first rabbit easily and puts it in a cart, but the second one runs away and hides itself under a carriage. The dog thinks it will not be able to catch the second rabbit. After a while, the second rabbit comes out, and the dog finally catches it.

Puppet's statement:    xiaogou   meiyou   zhuadao   liang-zhi   tuzi  
                                  dog        did not    catch       two-CL    rabbit  
                                  'The dog did not catch two rabbits.'

#### 2. Test Story 2

Plot: In this story a lady comes to Squirrel's store to buy things. Squirrel first shows the lady four hats, but the lady does not want two of them because of the color. When the lady is about to pay for the other two hats, she realizes the money she has is only enough for one hat and thinks she will just buy one. However, Squirrel thinks the two hats will look really nice with the lady and offers her a discount. At the end the lady buys the two hats.

Puppet's statement:    xiaojie   meiyou   mai   liang-ding   maozi  
                                  lady       did not    buy    two-CL    hat  
                                  'The lady did not buy two hats.'

#### 3. Test Story 3

Plot: see §4.

Puppet's statement:    xiao nūhai   meiyou   wei   liang-zhi   maomi  
                                  little girl    did not    feed   two-CL    kitten  
                                  'The little girl did not feed two kittens.'

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## 範域歧異性語意判斷的結構與情境效應

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本研究以三個實驗的結果探討以台灣的國語為母語的兒童和成人對於賓語名詞含有數量詞的否定句（如 *The boy did not ride two cows* 「男孩沒有騎兩頭牛」）影響其範域歧異性語意判斷的因素。實驗一和二的結果與 Lidz & Musolino (2002) 研究英語和 Kannada 語的結果有兩點不同。首先，說英語和 Kannada 語的成人對於此類句子所容許的兩種語意詮釋接受度都很高，但說國語的成人對數量詞窄域的接受度明顯比數量詞寬域高。其次，雖然說英語和 Kannada 語的兒童對數量詞窄域的接受度明顯較高，說國語的兒童卻對數量詞寬域的接受度較高。此外，實驗三的結果顯示兒童和成人的語意詮釋都會受到故事情境中事件發生次序先後的影響，兒童對數量詞窄域的接受度甚至會明顯提高。針對國語、英語和 Kannada 語兒童與成人在此類句子語意詮釋上的差別，本研究提出是由於個別語言含有數量詞的名詞組和否定句的結構不同的原因。

關鍵詞：語言習得，歧異性語意判斷，數量詞範域，否定句，國語（台灣）