CHAPTER I

INTRODUCTION

The purpose of this study is to investigate the acquisition of quantifier scope interaction, that is, sentences containing a universal quantifier *every* (or *mei-ge* in Chinese) and an existential quantifier *a* (or *yi-ge* in Chinese) in English and Chinese. It is well documented in the linguistic literature that English and Chinese demonstrate some contrasts in terms of quantifier scope interpretation (e.g. Huang 1982, Lee 1986, Aoun and Li 1993). For example, in English, active and passive sentences containing a universal quantifier and an existential quantifier are ambiguous, regardless of the position of the two quantifiers.

(1) a. Every bear is eating a cake. ('every>a'; 'a>every')
b. A bear is eating every cake. ('a>every'; 'every>a')

(2) a. Every cake was eaten by a bear. ('every>a'; 'a>every')
b. A cake was eaten by every bear. ('a>every'; 'every>a')

In (1a), the sentence is true in a situation in which for every bear, there is a cake such that the bear is eating the cake, or in a situation in which there exists a cake such that all the bears are eating the same cake[1]. In (1b), the sentence can be true in a situation in which for each cake, there is a bear eating the cake, or in a situation in which there exists a

[1] In traditional linguistic literature, an active sentence like (1a) is considered ambiguous, allowing both the universal wide scope reading and the existential wide scope reading. However, as pointed out in Hornstein and Pietroski (1999), 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 serveral 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 that sentence true in English are not applicable to the corresponding Chinese sentence (3a), in this study we will 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.'

specific bear such that the bear is eating all the cakes. In both (1a) and (1b), the first reading has the universal quantifier taking scope over the existential quantifier (thus the universal wide scope reading 'every > a'), and the second interpretation has the existential quantifier taking scope over the universal quantifier (thus the existential wide scope reading 'a > every'). The same ambiguity applies to the passive sentences in (2).

In contrast with the relatively free assignment of scope in English, the interpretations allowed in the corresponding Chinese sentences are more restricted.

(3) a. mei-zhi xiong dou zai chi yi-kuai dangao
every-CL bear all ASP eat a-CL cake
"Every bear is eating a cake." (‘every>a’; ‘a>every’)

b. yi-zhi xiong zai chi mei-kuai dangao
a-CL bear ASP eat every-CL cake
"A bear is eating every cake." ('a > every')

(4) a. mei-kuai dangao dou bei yi-zhi xiong chi-le
every-CL cake all by a-CL bear eat-ASP
"Every cake was eaten by a bear." (‘every>a’; ‘a>every’)

b. yi-kuai dangao bei mei-zhi xiong chi-le
a-CL cake by every-CL bear eat-ASP
"A cake was eaten by every bear." ('a > every')

As shown above, in Chinese active and passive sentences, when the universal quantifier is in the subject position and the existential quantifier in the object position (as in (3a) and (4a)), the sentence can have both interpretations, as in English. However, when the existential quantifier is in the subject position and the universal quantifier in the object position (as in (3b) and (4b)), there is only one interpretation allowed, namely, the

existential wide scope reading.[2] For (3b), the sentence is true only in a situation in which there exists a bear such that the bear is eating all the cakes, and for (4b), the sentence can be true only when there is a specific cake such that the cake was eaten by all the bears.

Although there are differences between the two languages in terms of scope interaction in active and passive constructions, the interpretations for double object and *to*-dative constructions display the same pattern in both languages.

(5) Double Object Construction

a. laoshi jiegei yi-ge nuhai mei-ge qio
teacher lend a-CL girl every-CL ball
"The teacher lent a girl every ball." ('a > every')

b. laoshi jiegei mei-ge nuhai yi-ge qio
teacher lend every-CL girl a-CL ball
"The teacher lent every girl a ball." (‘every>a’; ‘a>every’)

(6) *To*-Dative Construction

a. laoshi jie-le yi-ge qio gei mei-ge nuhai
teacher lend-ASP a-CL ball to every-CL girl
"The teacher lent a ball to every girl." (‘a>every’; ‘every>a’)

b. laoshi jie-le mei-ge qio gei yi-ge nuhai
teacher lend-ASP every-CL ball to a-CL girl
"The teacher lent every ball to a girl." (‘every>a’; ‘a>every’)

As shown in the above sentences, for double object and *to*-dative constructions, the sentences tend to allow both readings in English and Chinese except when the existential

[2] In earlier literature (e.g. Huang 1982, Lee 1986), active sentences like (3a) were considered as having only the universal wide scope reading. With respect to passive sentences, Aoun and Li (1993) considered them ambiguous in Chinese. A recent study on Chinese adult judgement (Lee 1998) showed that for active sentences like (3a), Chinese-speaking adults did allow the existential wide scope reading, and the results from our adult controls showed that passive sentences like (4b) can only have the existential wide scope reading. In Liu (1997), it was argued that for a sentence like (3a), the interpretation in which every bear is eating the same cake is actually a scope-independent reading.

QNP is the indirect object (the Goal) of the double object construction (as in (5a))[3]. For (5a), the only situation to make the sentence true is when there exists a specific girl such that the girl gets all the balls. For (5b) and (6a), the sentences are true either in a situation in which for every girl, there is a ball lent to her, or in a situation in which there exists a specific ball such that the ball is lent to all the girls. For (6b), the sentence is true either in a situation in which for each ball, there is a girl who gets the ball, or in a situation in which there exists a specific girl such that all the balls are lent to her.

Given the similarities and differences of quantifier scope interaction in these two languages, we will investigate the following issues. The first issue is how these contrasts and similarities affect the interpretations of quantifier scope interaction for children acquiring these two languages. The questions to be asked are: What is the initial reading children have for the sentences? Is the initial interpretation the same or different for English-speaking and Chinese-speaking children? It was shown in previous studies (e.g. Brown and Hanlon 1970; Marcus 1993) that negative evidence[4] is neither consistently nor reliably available for all children to unlearn a grammatical error. Therefore, one possibility is that young children may start with assigning quantifier scope according to the linear order of the QNPs, given the fact that the reading is either the only

[3] In Fox and Sauerland (1996) it was shown that in the environment of generic tense, a universal quantifier can take a scope which is wider than actually realized at LF, as shown in the double object sentence in (i).

(i) In general, I give [a tourist]$_{\exists}$ [every leaflet]$_{\forall}$. ($\exists > \forall$; $\forall > \exists$)

It was argued that the seemingly wide scope for the universal quantifier in the above and other cases is only an illusion due to the fact that the generic operator allows the existential quantifier to pick out a different individual in each relevant portion of the world. An example to show that the universal wide scope is only an illusion is to replace '*every*' with another quantifier such as '*many*'. Since '*many*' can not be trivialized as '*every*' can, the illusive wide scope is thus not possible. The test sentences used in our study all have past tense rather than generic tense, and hence the double object sentences should still allow only the existential wide scope reading.

interpretation or one of the interpretations for the sentences discussed. The other possibility is that the initial reading children assign for the sentences is the existential wide scope reading, for that is the reading all the above sentences allow. By starting with only the subset of the full range of interpretations, positive evidence in the linguistic environment will suffice for children to acquire the additional reading later if the sentences are ambiguous.

The second issue we will examine is how the syntactic structures of various constructions and the lexical idiosyncrasies of each language may influence the acquisition of quantifier scope interpretation. Among the four sentence constructions discussed above (i.e. active, passive, double object, and *to*-dative), it may be likely that since the latter two involve one more noun phrase and have more complex structures than the former two, they will cause more difficulty for children. If children assign non-adult interpretations (or preferences) to certain sentences, what we want to inquire is whether the difficulty results from any non-adult-like structure children have for the construction, or some lexical properties of the languages (e.g. the lack of an indefinite article in Chinese). The possibility that non-adult structures for some constructions result in non-adult interpretations is consistent with the maturational theory of language development, and the hypothesis that lexical idiosyncrasies of the languages cause differences for children's interpretation follows the continuity view of language acquisition. According to a variant of the maturational theory of language development (e.g. Felix 1992), it is assumed that the principles of Universal Grammar emerge based on biological maturation, i.e. they appear in child grammars successively in a specific order determined

[4] "Negative evidence" refers to the form of adult feedback telling the child that his or her utterances do not conform with those of the adult grammar (Weissenborn et al. 1992, p. 9) .

by a maturational schedule. The implication of this view is that at each stage of development, child's grammar will be constrained only by those principles that have emerged, and it may violate those principles that have not yet matured. On the other hand, the continuity hypothesis (e.g. Clahsen 1992) postulates that the principles of Universal Grammar are available for children at the very beginning of language development, and the structures in child grammars will never violate those principles. According to this hypothesis, changes in development are driven by the linguistic data, either as the result of the child's changing perception of the input and/or of increasing lexical knowledge.

The arrangement of this thesis is as follows. In Chapter 1, we lay out the contrast with respect to quantifier scope interaction in English and Chinese, the structures for the double object and *to*-dative constructions proposed in linguistic literature, and the methodology used in this study. In Chapter 2 we outline the three hypotheses to be considered in the first series of experiments and review previous acquisition studies on quantifier scope for the two languages. Chapter 3 presents the details of the experiments on quantifier scope interaction in the double object and *to*-dative constructions. The results that support or do not support the three hypotheses will be discussed, and an account that considers English-speaking children's non-adult interpretation as an overgeneralization of dative alternation on sentences containing quantifiers is proposed. In Chapter 4, we report a series of experiments on the hypothesis that the non-adult interpretation obtained from English-speaking children in the double object construction results from a non-adult-like structure children have for the sentences. The results from the experiments do not support the hypothesis that children's non-adult reading comes

from a wrong syntactic structure or overgeneralization of dative alternation, as they show adult-like interpretations for all the sentence types tested. Chapter 5 is a series of experiments on the lexical idiosyncrasies between English '*a*' and Chinese '*yi-ge*'. The results from the experiments demonstrate that the lexical determinant is what causes the scope-taking differences between English-speaking and Chinese-speaking children. In Chapter 6 we try to characterize the difference between the initial interpretations children have for '*a*' and '*yi-ge*' both as non-quantificational, and propose an account for how children will converge on adult grammar.

In the following section, we will discuss the structures proposed in the literature for the double object and the *to*-dative constructions in English and Chinese, and show that in both languages the first object NP is in a higher position than the second object NP on the structure tree. In section 2, we will describe some basic components for the methodology (the truth-value judgement task) used in this study.

1 The Structures of Double Object and *To*-Dative Constructions

1.1 Larson's (1988) Analysis for English

Based on Barss and Lasnik's (1986) observations of certain asymmetries in the English double object construction (as shown in the (a) sentences below), Larson (1988) extended the findings to the oblique dative construction (shown in the (b) sentences below).

(7) Anaphor binding
   a. I showed John himself (in the mirror).
      *I showed himself John (in the mirror).
   b. I showed Mary to herself.
      *I showed herself to Mary.

(8) Quantifier binding
   a. I showed every friend$_i$ of mine his$_i$ photograph.
      *I showed its$_i$ trainer every lion$_i$.
   b. I sent every check$_i$ to its$_i$ owner.
      ??I sent his$_i$ paycheck to every worker$_i$.

(9) Weak crossover
   a. Who$_i$ did you show his$_i$ reflection in the mirror?
      *Which lion$_i$ did you show its$_i$ trainer?
   b. Which check$_i$ did you send to its$_i$ owner?
      *Which worker$_i$ did you send his$_i$ check to?

(10) Superiority
   a. Who did you give which book?
      *Which book did you give who?
   b. Which check did you send to who?
      *Whom did you send which check to?

(11) Each… the other
   a. I gave each man the other's watch.
      *I gave the other's trainer each lion.
   b. I sent each boy to the other's parents.
      *I sent the other's check to each boy.

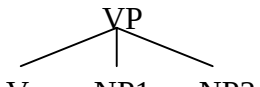
(12) Negative polarity items
   a. I gave no one anything.
      *I gave anyone nothing.
   b. I sent no presents to any of the children.
      *I sent any of the packages to none of the children.

Based on these asymmetries, Larson argued that given the assumption that the phenomena involve c-command[5], the above contrasts show that the first object NP must

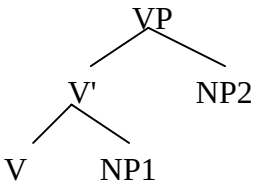
[5] Based on Reinhart (1979), it is assumed that a node A c-commands a node B if A and B do not dominate each other, and the first branching node dominating A also dominates B. For anaphor binding, reflexives and reciprocals (anaphors) must be c-commanded by their antecedents. For quantifier-pronoun binding, a quantifier must c-command a pronoun at S-structure if it is to bind it. For weak crossover, a *wh*-phrase c-commanded by an NP containing a pronoun at D-structure cannot be moved over that NP if *wh*- and the pronoun are co-referential. For superiority effects, a *wh*-phrase cannot be moved over another *wh*-phrase

c-command the second, but not vice versa. Therefore, this should cast doubt on the validity of the following structures frequently assumed for the double object construction[6].

(13) a.

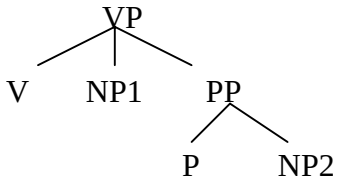


b.



Under a definition of c-command based on first branching nodes (Reinhart 1979), NP1 and NP2 mutually c-command each other in (13a), whereas in (13b) NP2 asymmetrically c-commands NP1. On the other hand, under a definition of c-command based on containment in maximal projections (Aoun and Sportiche 1983), since both NP1 and NP2 are contained in the maximal projection VP, they will mutually c-command each other in both (13a) and (13b), predicting no asymmetries. However, in the case of oblique datives, the above contrasts in the (b) sentences do not seem to raise any problems for c-command by appealing to the structure introduced by PP, as shown in the structures below.

(14) a.



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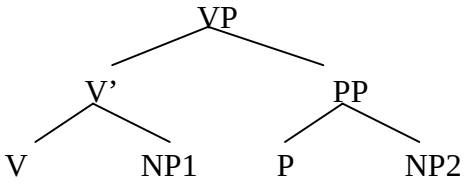

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that c-commands it in underlying representation. For the *each… the other* construction, it may have a reciprocal reading only when the *each*-phrase c-commands the *other*-phrase. For negative polarity items, they must occur in the c-command domain of negation or a negative quantifier.

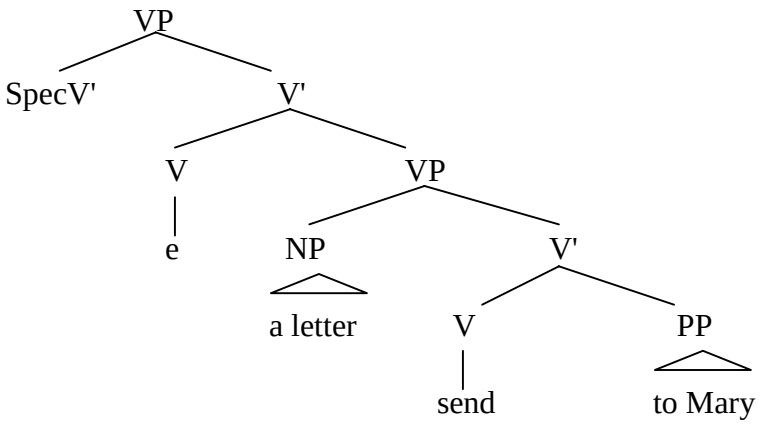
[6] For Barss and Lasnik (1986) and Jackendoff (1990), the asymmetries found in the double object construction do not motivate an asymmetrically c-commanding structure like Larson's. Instead, their accounts take linear order as well as c-command into the consideration of the definition of binding domains.

In (14a) NP1 asymmetrically c-commands NP2 under the definition of c-command proposed by Reinhart (1979), as NP2 is dominated by a branching node (PP) that does not dominate NP1. For (14b), NP1 asymmetrically c-commands NP2 under the definition of c-command given by Aoun and Sportiche (1983), for NP2 is contained in a maximal projection (PP) that does not contain NP1. The difference between the complement asymmetry in (14) for datives and the lack of asymmetry in (13) for the double object construction lies in the structure introduced by PP. For this reason, Larson proposed an account which assumes two VP shells and movement into the upper VP shell results in NP1's asymmetrically c-commanding NP2 in both double object and dative constructions.

In Larson's account, both the double object construction and the *to*-dative construction have the same D-structure like the following.

(15) a. John sent a letter to Mary.
b. John sent Mary a letter.

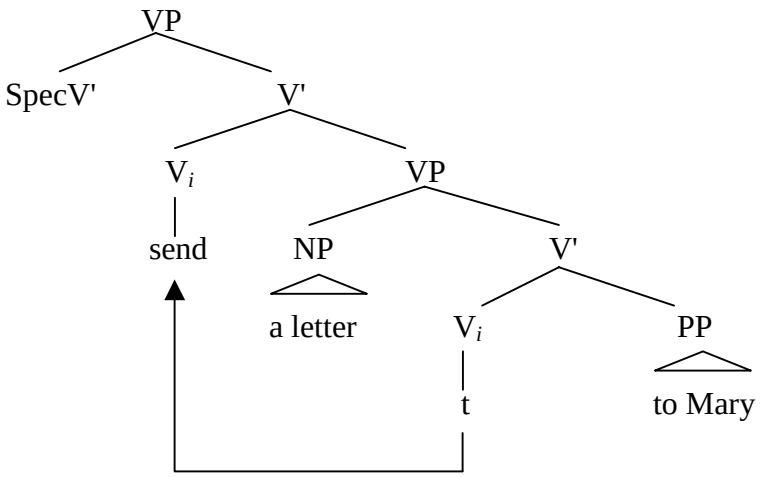
c.



In this structure, "…*send* takes the complement *to Mary*, forming a small predicate send-to-Mary… The latter is predicated of an 'inner subject' *a letter,* forming a VP with

clauselike structure: *a letter send to Mary*." (Larson 1988, p. 342) The surface form of a dative sentence is derived by raising the lower V into the empty upper V position to assign Case to the inner subject NP, as shown below.

(16)

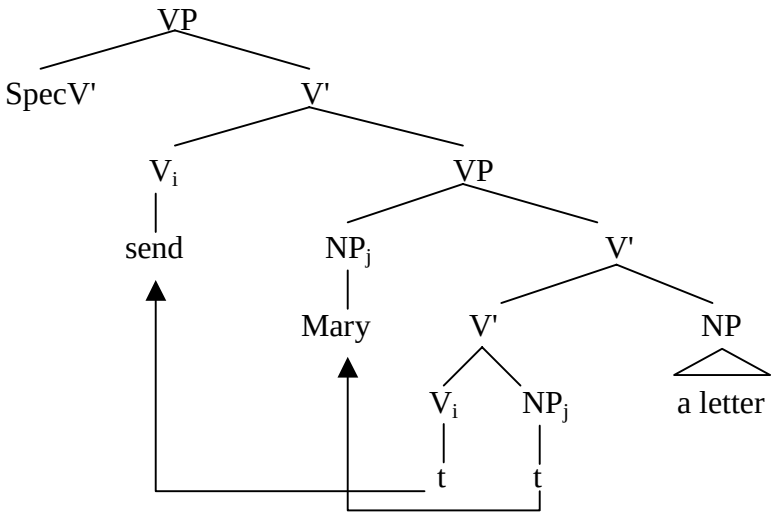


As for the double object construction, Larson argued that it is transformationally derived from the D-structure (15c) in a similar way as the derivation of passives. First, the preposition *to* governed by the verb *send* is absorbed, and thus no Case can be assigned to the indirect object. Second, the theta role assigned to the subject of VP (the direct object role) undergoes demotion, making this position nonthematic and hence empty. Since the direct object receives its theta role from V', under Argument Demotion[7] this theta role must be assigned to a V' adjunct, and hence the direct object is realized as a V' adjunct. The indirect object then undergoes NP Movement to the VP subject position, and the verb *send* raises into V-head position, assigning Case rightward to the VP subject (the original indirect object). The derivation is shown as follows.

[7] Argument Demotion

If α is a theta role assigned by X^i, then α may be assigned (up to optionality) to an adjunct of X^i.

(17)



The structural relations arising from Dative Shift as depicted above thus directly account for the asymmetries observed in the double object and the dative constructions.

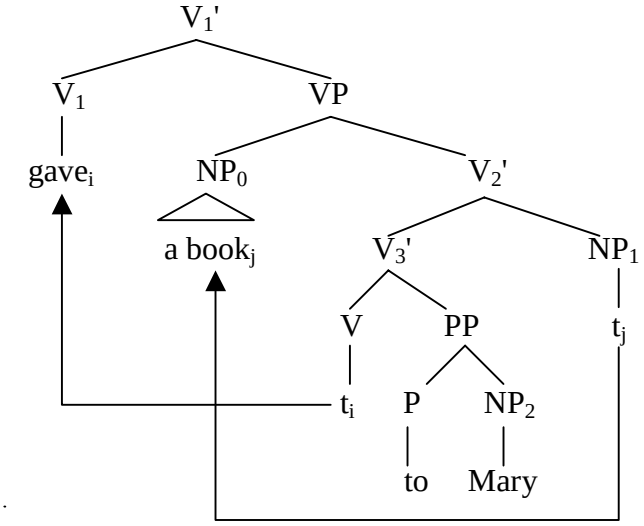
1.2 Aoun and Li's (1993) Analysis for English and Chinese

Aoun and Li (1993) proposed a variant of Larson's analysis of the double object construction. Since the quantifier scope interactions in the double object and the *to*-dative constructions have the same pattern in both English and Chinese, the structures proposed are assumed to hold in the two languages.

Unlike Larson's analysis, in Aoun and Li's analysis, they assumed that both objects are internal arguments in the double object and the *to*-dative constructions. They further assumed that assignment of internal theta roles obeys a directionality requirement (as argued by Koopman 1984, Travis 1984), and thus all internal arguments of a verb will be base-generated on the same side. The structure of a *to*-dative sentence is illustrated below.

(18) a. He gave a book to Mary

b.

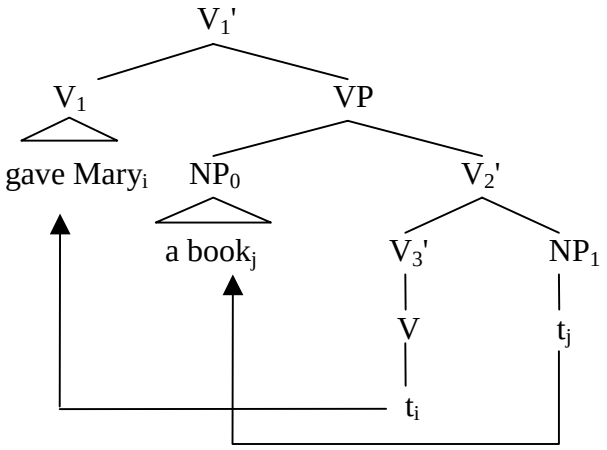


In the structure above, since both NP_1 *a book* and the dative PP are the internal arguments of V, they are base-generated on the same side (i.e. right) of the verb. Furthermore, since NP_1 cannot receive Case from V', it raises to the Spec of VP (i.e. NP_0) position to be assigned Case by the V which is raised to V_1 position. For the scope ambiguity of a *to*-dative sentence like "*John assigned one problem to every student*", one of the readings derives from *one problem*'s c-commanding *every student*. The other reading of the sentence comes from *every student*'s raising to an A'-position that c-commands the trace of *one problem* in NP_1.

In the case of a double object sentence, the preposition *to* is not generated, and NP_2 will have to be incorporated into the verb to receive the possessor theta role and so that the Case Filter will not be violated. When the verb moves to the higher V position, the incorporated NP_2 will be moved along, deriving the following structure for the double object construction.

(19) a. He gave Mary a book.

b.



For the non-ambiguity of a double object sentence like "*John assigned one student every problem*", Aoun and Li argued that since *one student* will adjoin to V_1' or higher but not V_1[8], and *every problem* can adjoin to VP but not higher, MBR[9] will render the sentence unambiguous. However, given that in their account an operator A may have scope over an operator B iff A c-commands B or an A'-element in the chain headed by the operator, it is not clear why the raised *every problem* cannot have scope over the trace of *one student* under V_3'.

As indicated in Kuno et al. (1999, p.74-77), the analysis proposed by Aoun and Li (1993) for the double object construction faces a theoretical problem. In Larson's analysis, the notion of c-command does not allow a V* to V* projection of the c-command domain of a given node[10]. Therefore, in the double object structure (17) the

[8] This is based on the assumption that X^0 categories are not possible hosts for the adjunction of QPs.

[9] Minimal Binding Requirement (Aoun and Li 1993, p. 8): Variables must be bound by the most local potential A'-binder.

[10] Aoun and Li adopted the definition of c-command from Reinhart (1983, 23) as shown below.

first NP c-commands the second NP, but not vice versa, given Larson's definition of c-command. In contrast, given Aoun and Li's notion of c-command, which allows a one-step X* to X* projection of the c-command domain of a given node, an S-structure like (19) will result in the second NP's c-commanding of the first NP. The mutual c-commanding of the two NPs will fail to capture the asymmetries observed by Barss and Lasnik (1986) for the double object construction.

1.3 Soh's (1998) Analysis for Chinese

Following Yang (1991) and Kung (1993)[11], Soh (1998) distinguished three types of double complement constructions: the double object construction, the shift construction, and the dative construction. The difference between the double object construction and the shift construction resides in the incorporation of the preposition *gei* 'to' into the head verb, as shown in (20a) and (20b).

(20) a. wo jie-le Zhangsan yi-ben shu (Double Object Construction)
I lend-ASP Zhangsan a-CL book
"I lent Zhangsan a book."

b. wo jie-gei-le Zhangsan yi-ben shu (Shift Construction)
I lend-to-ASP Zhangsan a-CL book
"I lent Zhangsan a book."

c. wo jie-le yi-ben shu gei Zhangsan (Dative Construction)

Node A c-commands node B iff the branching node α_1 most immediately dominating A either dominates B or is immediately dominated by a node α_2 that dominates B, and α_2 is of the same category type as α_1.

[11] As cited in Soh (1998), the analysis proposed by Yang (1991) considered the double object construction and the shift construction as involving almost the same structure, and the only difference is that the preposition is overt in the shift construction but covert in the double object construction. In contrast, Kung (1993) argued on the basis of evidence from extraction that the shift construction and the double object construction must not have the same structure. In Soh (1998, p. 176), it was argued that the ban against preposition stranding used by Kung (1993) can not really differentiate between the two constructions.

I lend-ASP a-CL book to Zhangsan
"I lent a book to Zhangsan."

Based on the distribution of duration and frequency phrases (DFPs) and the distribution of the dyadic quantifier GE 'each', Soh (1998) considered the shift construction as involving the same structure as the double object construction[12]. As shown below, for the double object and the shift constructions, the DFP may appear between the two objects or following both objects, but it may not precede both objects. However, for the dative construction, the DFP may not appear between the two objects but it may appear before or after both objects.

(21) Double Object Construction

a. wo jie-guo Zhangsan **liang** **ci** na-ben shu
I lend-ASP Zhangsan two times that-CL book
"I have lent Zhangsan that book twice."

b. ?wo jie-guo Zhangsan na-ben shu **liang** **ci**
I lend-ASP Zhangsan that-CL book two times
"I have lent Zhangsan that book twice."

c. *wo jie-guo **liang** **ci** Zhangsan na-ben shu[13]
I lend-ASP two times Zhangsan that-CL book
"I have lent Zhangsan that book twice."

(22) Shift Construction

a. ?wo jie-gei-le Zhangsan **liang** **ci** na-ben shu
I lend-gei-ASP Zhangsan two times that-CL book
"I have lent Zhangsan that book twice."

b. ?wo jie-gei-le Zhangsan na-ben shu **liang** **ci**
I lend-gei-ASP Zhangsan that-CL book two times
"I have lent Zhangsan that book twice."

[12] In addition to the evidence from the distribution of DFPs and GE 'each', the fact that the aspect marker *le* comes after the *V-gei* sequence but not between V and *gei* (as in (20b)) further suggests that the preposition is incorporated into the verb in the shift construction.

[13] For this sentence to be grammatical, it can only mean "I have borrowed that book of Zhangsan's twice" but not "I have lent Zhangsan that book twice."

c. *wo jie-gei-le **liang** **ci** Zhangsan na-ben shu
I lend-gei-ASP two times Zhangsan that-CL book
"I have lent Zhangsan that book twice."

(23) Dative Construction

a. *wo jie-guo na-ben shu **liang** **ci** gei Zhangsan
I lend-ASP that-CL book two times to Zhangsan
"I have lent that book to Zhangsan twice."

b. wo jie-guo na-ben shu gei Zhangsan **liang** **ci**
I lend-ASP that-CL book to Zhangsan two times
"I have lent that book to Zhangsan twice."

c. ?wo jie-guo **liang** **ci** na-ben shu gei Zhangsan
I lend-ASP two times that-CL book to Zhangsan
"I have lent that book to Zhangsan twice."

As for the distribution of GE 'each', it can appear between the two complements in the double object and the shift constructions, but it cannot appear in between the two complements in the dative construction, as illustrated below.

(24) a. tamen **ge** jie-le Zhangsan liang-ben shu
they GE lend-ASP Zhangsan two-CL book
"They each lent Zhangsan two books."

b. ta jie-le na san-ge ren **ge** liang-ben shu
he lend-ASP that three-CL person GE two-CL book
"He lent those three persons each two books."

c. ta jie-gei-le na san-ge ren **ge** liang-ben shu
he lend-gei-ASP that three-CL person GE two-CL book
"He lent those three persons each two books."

d. *ta jie-le na liang-ben shu **ge** gei san-ge ren
he lend-ASP that two-CL book GE to three-CL person
"He lent those two books each to three persons."

As demonstrated in Soh (1998, p.157-165), there is evidence from serial verb constructions in Chinese that the DFP may adjoin only to the lowest VP, as illustrated in the following examples.

(25) a. ta jiao Zhangsan qu-le Meiguo **liang ci**
he ask Zhangsan go-ASP US two times
"He asked Zhangsan to go to the US twice."

b. ta jiao Zhangsan qu-le **liang ci** Meiguo
he ask Zhangsan go-ASP two times US
"He asked Zhangsan to go to the US twice."

c. *ta jiao Zhangsan **liang ci** qu Meiguo
he ask Zhangsan two times go US
"He asked Zhangsan to go to the US twice."

d. *ta jiao **liang ci** Zhangsan qu Meiguo
he ask two times Zhangsan go US
"He asked Zhangsan to go to the US twice."

In addition, in the serial verb construction, GE can appear before either the first verb or the second verb[14], as shown below.

(26) a. laoshi **ge** pai liang-ge xuesheng jie san-dao ti
teacher GE assign two-CL student solve three-CL puzzle
"The teachers each assigned two students to solve three puzzles."

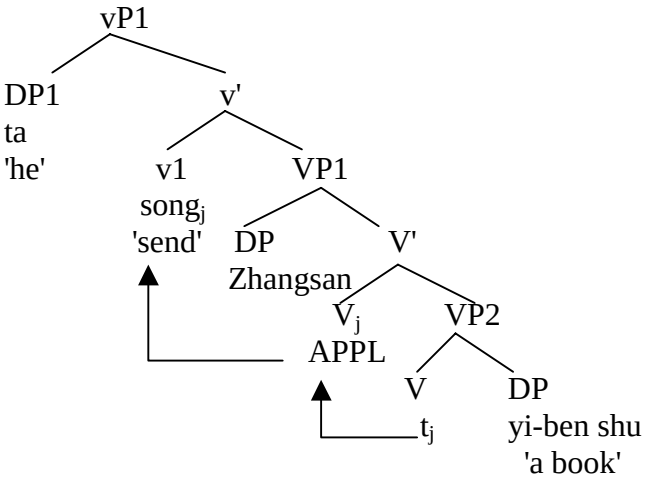
b. laoshi pai liang-ge xuesheng **ge** jie san-dao ti
teacher assign two-CL student GE solve three-CL puzzle
"The teachers assigned two students each to solve three puzzles."

Based on the distribution of DFPs and GE in the serial verb construction and the contrast found above between the double object / shift constructions and the dative construction,

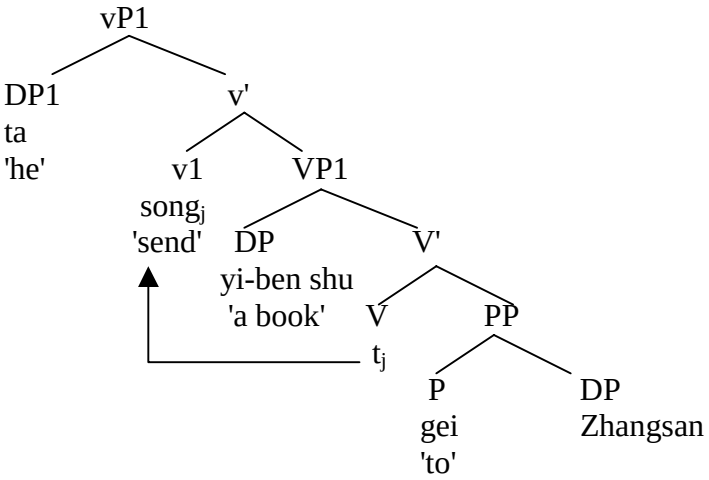
[14] In Chinese, *gei* can correspond to either English verb *give* or the preposition *to* in the dative construction. The fact that GE can appear before the second verb in the serial verb construction but not before *gei* in the dative construction suggests that *gei* in the dative construction functions not as a verb, but as a preposition like English *to*.

Soh (1998) assumed that there is one more VP-layer involved in the double object / shift constructions than in the dative construction (as originally proposed in Marantz 1993). The structures proposed by Soh (1998) for the double object / shift constructions and the dative construction are illustrated below.

(27) Double Object Construction



(28) Dative Construction



As shown in (27), there are two VP shells in the double object construction. The verb originates at the head position of the lower VP, and moves twice untill reaching its end

position. For the dative construction, there is only one VP shell, and the verb moves only once from the head of that VP to its end position.

1.4 Final Remarks

As demonstrated in the above review, it is generally assumed in the literature on Chinese syntax that the double object and the dative constructions in Chinese also show the asymmetrically c-commanding relations between the two arguments. Although most of the tests used by Barss and Lasnik (1986) and Larson (1988) to argue for the asymmetries are not applicable to Chinese, the following contrasts with respect to quantifier binding suggest that the asymmetries can also hold in Chinese.

(29) Double Object Construction

a. wo ji-gei mei-ge gongren$_i$ ta$_i$ zhe-ge yue de xinshue
I send-to every-CL worker he this-CL month of salary
"I sent every worker$_i$ his$_i$ salary for this month."

b. *wo ji-gei ta$_i$-de shoujienren mei-fen baoguo$_i$
I send-to it-of receiver every-CL package
"I sent its$_i$ receiver every package$_i$."

(30) Dative Construction

a. wo ji-le mei-fen baoguo$_i$ gei ta$_i$-de shoujienren
I send-ASP every-CL package to it-of receiver
"I sent every package$_i$ to its$_i$ receiver."

b. *wo ji-le ta$_i$-de xinshue gei mei-ge gongren$_i$
I send-ASP he-of salary to every-CL worker
"I sent his$_i$ salary to every worker$_i$."

Similar to the English examples in (8), the Chinese double object sentences in (29) and the dative sentences in (30) also display the same contrast with respect to the possibility for the possessive pronoun to be bound by the universal quantifier NP. When the

universal QNP precedes (or presumably c-commands) the NP containing the possessive pronoun, the bound variable reading is allowed (as in (29a) and (30a)). However, when the possessive pronoun is in a NP which precedes (or c-commands) the universal QNP, the bound variable reading is prohibited (as in (29b) and (30b)). The contrast is comparable with that in the active sentences in (31) and the passive sentences in (32). Based on the similarities, in this study, we consider English and Chinese as having the same basic structures for the double object and the dative constructions.

(31) Active Construction

a. mei-ge xiaohai$_i$ dou zunjing ta$_i$-de fumu
every-CL child all respect he-of parents
"Every child$_i$ respects his$_i$ parents."

b. *ta$_i$-de xiaohai zunjing mei-ge fumu$_i$
he-of child respect every-CL parent
"His$_i$ child respects every parents$_i$."

(32) Passive Construction

a. mei-ge xiaohai$_i$ dou bei ta$_i$-de fumu chongai
every-CL child all by he-of parent love
"Every child$_i$ is loved by his$_i$ parents."

b. *ta$_i$-de xiaohai bei mei-ge fumu$_i$ chongai
he-of child by every-CL parent love
"His$_i$ child is loved by every parents$_i$."

2 Methodology: The Truth Value Judgement Task

Throughout this study, the task used to probe children's interpretations of various sentences was the truth value judgement task developed in Crain and McKee 1985 and Crain and Thornton 1998. The truth value judgement task is a research technique designed to examine comprehension of sentences and discourse. Since both sentence and

meaning are under the experimenter's control, the task is especially useful for investigating whether or not sentences are ambiguous for children. In this section, we will provide a general description of the basic components in the truth value judgement task.

When using the truth value judgement task to test whether a certain constraint exists in children's mental grammar, the null hypothesis is that children lack the constraint under investigation, and will assign the interpretation the constraint prohibits. Therefore, the test sentences should be ambiguous for children, but not for adults. The experimental hypothesis is that children know the constraint. The truth value judgement task will make both alternative meanings available for each sentence on each trial by acting out a story in front of a child. Since subjects tend to say "Yes" when they do not really understand a test sentence, in order to reduce a type I error[15], the design of the story will be that the meaning prohibited by the constraint should be the actual outcome of the story. In order to make the event corresponding to the prohibited meaning salient to children, it is arranged to be the last-mentioned event in the story. The rationale is that if children know the constraint, they will say "No" when presented with the test sentences, i.e. the condition of falsification. Another advantage of the design is that the experimenter can then ask the child "What really happened?" to ensure that they reject the sentence for the right reason.

An important component in the truth value judgement task which is lacking in other commonly used tasks is the condition of plausible dissent. What the condition of

[15] A type I error is to conclude that the experimental hypothesis is correct when in fact the null hypothesis is correct. According to Crain and Thornton (1998, p. 213), since people have a tendency to say "Yes", if the correct answer corresponds to a "Yes" response, then children's responses may be counted as evidence for the experimental hypothesis when in fact they do not really understand the test sentences.

plausible dissent requires is that it is appropriate to ask children for a negative judgement of a sentence only if the corresponding positive judgement has been under consideration. It is a pragmatic "felicity condition" to make it clear to children why they are asked to confirm or deny a statement.

Compared with other commonly used tasks, the truth value judgement task is better in determining whether children have each of the alternative meanings for an ambiguous sentence. Since there is usually a preferred reading for an ambiguous sentence, other traditional tasks such as act-out or picture identification allow children to associate the sentence with only one interpretation of the sentence (most of the time the preferred one). What can not be inferred is whether children also allow the dispreferred reading or not. Since the meaning part can be manipulated in a truth value judgement task, the problem of preference can be solved by having the preferred interpretation corresponding to the false reading in the context and the dispreferred reading be the actual outcome of the story. By presenting a context corresponding to the dispreferred reading boosts its availability for the child to generate it. Therefore, the task will allow us to better probe whether both readings are available in children's grammar.

CHAPTER II

PREVIOUS ACQUISITION STUDIES ON QUANTIFIER SCOPE

In this chapter, we will review some previous acquisition studies on quantifier scope interpretations in Chinese and English. In Section 1, we layout three hypotheses proposed in the previous studies with respect to the acquisition of quantifier scope interaction to help compare different results from the studies and the predictions they will have for the double object and *to*-dative constructions. The studies on Chinese are in Section 2, and those on English are in Section 3. Section 4 outlines the goal of the first series of experiments on the double object construction and the *to*-dative construction.

1 Hypotheses to be examined

There are three primary hypotheses we will focus on for discussion here: the Isomorphic Hypothesis, the Hypothesis of Event Quantification for Universal Quantification, and the '*Yi-ge*' as Referential Hypothesis. The hypotheses and the prediction that follow from them are shown as follows.

I. The Isomorphic (Linearity) Hypothesis

This hypothesis states that children initially assign quantifier scope based mainly on the linear order of the quantifier QNPs. The prediction of this hypothesis is that for ambiguous sentences, children will give a lower acceptance of the interpretation on which the quantifiers are in an inverse. The acquisition of that interpretation will require positive evidence from the linguistic environment.

II. The Hypothesis of Event Quantification for Universal Quantification

This account is based on Philip's (1995) proposal. According to Philip (1995), children have a preference to assign the universal wide scope reading to sentences involving the interaction of a universal quantifier and an existential quantifier. That is to say, children tend to use the universal quantifier to bind an event variable rather than an individual variable. According to this hypothesis, for ambiguous sentences, children will assign the universal wide scope interpretation most of the time. However, if this hypothesis is true, for sentences which can only have the existential wide scope interpretation (e.g. Chinese active sentences with an existential quantifier in subject position, and double object sentences with an existential quantifier as the indirect object in English and Chinese), children will need negative evidence to expunge the universal wide scope reading from their grammar.

III. The '*Yi-ge*' as Referential Hypothesis

Both Lee (1986) and Chien (1994) found that Chinese-speaking children have a strong tendency to interpret the existential quantifier '*yi-ge*' as referential, which is the same as the existential wide scope reading. This implies that [-operator] is the unmarked value for the existential quantifier. With positive evidence, children will later acquire the [+operator] interpretation (i.e. the universal wide scope reading) of the existential quantifier.

2 Acquisition of Quantifier Scope in Chinese

2.1 Lee (1986)

Since S. F. Huang (1981), it has been observed that a strong isomorphism exists between S-structure and Logical Form (LF) in Chinese, as depicted by the unambiguous interpretation of the following sentence.

(1) yi-ge jingcha zhuazhu-le mei-ge xuesheng
one-CL cop arrest-ASP every-CL student
"A cop arrested every student."
a. There is an x, x = cop, such that for all y, y = student, x arrested y.
b. *For all y, y = student, there is a x, x = cop, such that x arrested y.

In (1), which has the existential quantifier noun phrase (QNP) in the subject position, only the existential wide scope interpretation is allowed for Chinese. However, the same sentence is ambiguous in English, with the possibility of both the existential wide scope and the universal wide scope readings. To capture the linearity of quantifier scope determination, J. Huang (1982) proposed the following condition for mapping from SS to LF.

(2) General Condition on Scope Interpretation (Huang 1982, p.220)
Suppose A and B are both QPs or both Q-NPs or Q-expressions, then if A c-commands B at SS, A also c-commands B at LF.

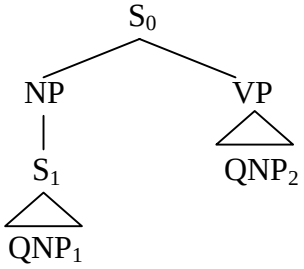
As pointed out by Lee (1986, 1991), the General Condition on Scope Interpretation cannot account for the following cases in which neither the matrix QNP nor the QNP in the embedded clause c-commands the other, but the matrix QNP has wide scope.

(3) a. [you wu-liu-ge ren xuan zhe-men ke] dui dajia dou hao
have five-six-CL person take this-CL class to everyone all good
"That there are five or six people taking this course is good for everyone."
(Lee 1986, p.138)

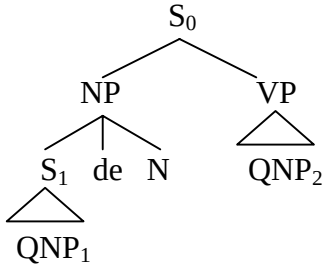
b. [shujia kan-le yibai-ben shu] de tongxue dedao mei-ge
summer read-ASP 100-CL book COMP student obtain every-CL
laoshi de chengzan
teacher POSS praise
"The students who read a hundred books in the summer obtained the praise from every teacher."
(Lee 1991, p.186)

In (3a), QNP1 occurs within a sentential subject; whereas in (3b), QNP1 is located within a relative clause modifying a subject NP. The tree structures below illustrate that QNP2 in the two sentences asymmetrically *commands* (but does not c-command) QNP1 (from Lee 1991, p.187).

(4) a.



b.



For this reason, Lee (1986) revised the condition for quantifier scope determination in Chinese as follows.

(5) General Condition on Scope Interpretation (Lee 1986, p.142)
Suppose A and B are both QPs or both Q-NPs or Q-expressions, then
(i) if A asymmetrically commands B at SS, A has scope over B at LF;
(ii) if A and B command each other and A precedes B at SS, A has scope over B at LF;
A commands B iff neither dominates the other and the first minimal clause dominating A also dominates B.

For the sentences in (3), since QNP2 asymmetrically commands QNP1 at SS, the former has scope over the latter at LF, despite the fact that it violates the linear order. For the

sentence in (1), the two QNPs are in the same clause and thus command each other, but since QNP1 precedes QNP2, the former has scope over the latter.

Using picture identification and/or act-out tasks, Lee (1986) investigated children's understanding of sentences with single quantifiers such as *yi-ge* 'a', *dou* 'all', *quan* 'all/entire' in Chinese, *every* and *all* in English, as well as the interaction of two quantifiers. The major findings of the study can be summarized as follows.

(i) In both Chinese and English, children understood single quantifiers at around age 4, long before they developed a firm grasp of the adult norms for quantifier scope interaction.

(ii) Children did not interpret sentences with a universal quantifier in the subject position and an existential quantifier in the object position (e.g. *Every child is eating a cake*) in the same way as adults until at least after six (in the case of English). In the case of Chinese-speaking children, the discrepancy from adults' interpretation was even larger. Children as old as 8 assigned the universal wide scope reading, in which each child is eating a different cake, only 62% of time in the act-out task, in contrast with adults' 95% acceptance. The late acquisition of the universal wide scope reading is not consistent with what is predicted by Philip's (1995) account.

(iii) For Chinese sentences which have an existential quantifier preceding a universal quantifier (e.g. *you yi-ge dangao mei-ge xiaopengyou dou zai chi* 'There is a cake (which) every child is eating.'), adults gave the universal narrow scope reading 90% of the time, and children gave this interpretation more than 80% of the time after age 5.

(iv) For sentences with the quantifier *quan* 'all' and *yi-ge* 'a' (e.g. *xiaomao quan fang zai yi-ge hezi li* "Put all the kittens in a box."), both English-speaking and Chinese-

speaking adults preferred the existential wide scope reading. That is, they interpreted the sentence to mean that all the kittens were put in a specific box. For Chinese-speaking children, the existential wide scope reading was also the preferred reading for all age groups; whereas for English-speaking children, the existential narrow scope interpretation was preferred. English-speaking children considered the sentence to mean each kitten was put in a separate box.

(v) For Chinese, the acquisition of the relative scope of QNPs did not parallel the acquisition of the relative scope of modals and negation; nor did it appear to be related to the acquisition of topic structures.

Based on the above findings, especially the results from *mei… yi* 'every…a' sentences, it was proposed that the existential quantifier *yi-ge* 'a' was initially interpreted referentially as a non-operator, thus leading to a scope-independent reading (i.e. the universal narrow scope reading) of the sentences. In a picture identification task, although Chinese-speaking adults consistently gave the universal wide scope reading 80% of the time, Chinese-speaking children gave this interpretation at most 35% of the time. In an act-out task, adults gave the universal wide scope reading 95% of the time, but children gave this reading 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 showed 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 gave this reading at least 68% of the time.

Based on the results from Chinese-speaking children and the youngest English-speaking children, it was argued that with regard to the unmarked option of the [+/-operator] parameter, instead of having [+operator] as the unmarked value (Hornstein 1984), the data suggested [-operator] as the unmarked value of the parameter. It was proposed that the results agree with the view that referentiality is the unmarked status of noun phrases (p. 354). In addition, Lee suggested that the fact that English-speaking children's acceptance of the universal wide scope reading increased more dramatically than their Chinese-speaking counterparts suggested that some kind of lexical idiosyncrasy may exist between English *a* and Chinese *yi-ge* (p. 359).

2.2 Lee (1991)

In Lee (1986), the sentences used for investigating children's interpretation of quantifier scope interaction contained two quantifiers in the same clause, one in the subject position and the other in the object position. Since the subject position of a sentence commands and also c-commands the object position, the test sentences in Lee (1986) could not be used to distinguish Huang's (1982) and Lee's (1986) conditions on scope interpretation. For this reason, in Lee (1991), sentences with one QNP commanding (but not c-commanding) and preceding the other QNP were used to tease these two conditions apart, as shown in the following examples.

(6) a. X zai yi-ge dengzi shang fang mei-gen shengzi
at a-CL stool on put every-CL string
"X puts every string on a stool."

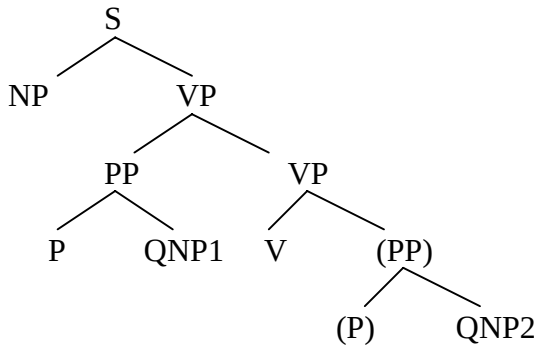
b. X zai mei-ge dengzi shang dou fang yi-gen shengzi
at every-CL stool on all put a-CL string
"X puts a string on every stool."

(7) a. X fang yi-gen shengzi zai mei-ge dengzi shang
put a-CL string at every-CL stool on
"X puts a string on every stool."

b. X fang mei-gen shengzi zai yi-ge dengzi shang
put every-CL string at a-CL stool on
"X puts every string on a stool."

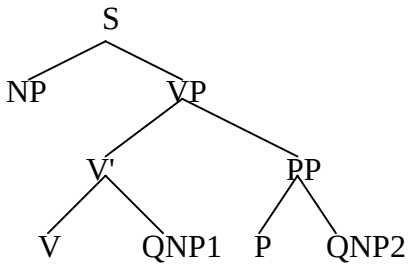
The structure for (6) is shown in (8) below. Here QNP1 is a preverbal prepositional object and QNP2 a postverbal object. Neither QNP c-commands the other, but they command each other. According to Lee's condition, since QNP1 precedes QNP2 at S-structure, QNP1 has scope over QNP2 at LF. The prediction is consistent with adults' judgements.

(8)



The structure for (7) is shown in (9). Here both QNPs occur postverbally. According to Huang's condition, since QNP1 c-commands QNP2, the former should take scope over the latter. On the other hand, based on Lee's condition, since both QNPs are in the same clause, and neither dominates the other (thus they command each other), QNP1 will take scope over QNP2 due to precedence. However, both Huang's and Lee's conditions only predict one of the two interpretations for this type of sentences, as they are ambiguous for Chinese-speaking adults.

(9)



Using an act out task, the prediction of this study was that if Lee's (1986) linearity principle is correct, then one should expect that for unambiguous sentences like (6), QNP1 should receive a predominantly wide scope interpretation, and for ambiguous sentences like (7), QNP1 should be the preferred interpretation for adults and older children. The results of this study showed that Chinese-speaking children older than 6 predominantly assigned a scope interpretation based on the linear order of the QNPs, regardless of the two different sentence types. As for children at age 3 and 4, they tended to assign wide scope for the universal quantifier, even when it was preceded by the existential quantifier (as in the cases of (6a) and (7a)). In this study, the results from older children seem to support the Linearity Hypothesis, whereas the results from younger children are consistent with Philip's (1995) Event Quantification account.

An interesting contrast was found between (6b) and (7b) where the universal quantifier precedes the existential quantifier, but (6b) is unambiguous while (7b) is ambiguous. For sentences like (6b), children's universal wide scope interpretation (also consistent with the linear order) starts from 63% at age 3 and steadily climbs to 95% by age 6. However, for sentences like (7b), since adults allow two interpretations for this type of sentences, children's universal wide scope interpretation also reflects the ambiguity. The acceptance of this reading starts from 40% at age 3, reaches 75% from age 4 to age 6, and then gradually declines to 60% at age 8 and 30% for adults.

To account for the ambiguity of (7b), Lee proposed that it is the joint effect of the linearity principle and a thematic hierarchy as follows.

(10) Thematic Hierarchy
(Group A): Agent, Location, Source, Goal
(Group B): Theme, Patient, Factitive (Narrow Scope Thematic Roles)

According to this account, "if a QNP bears a thematic role that is higher on the thematic hierarchy than another QNP within the same VP, then the former may have scope over the latter" (p. 204). For the sentences in (6), QNP1 precedes QNP2 and also has a location role which is higher than the theme role of QNP2; therefore, based on the linearity principle and the thematic hierarchy, it has wide scope. For the sentences in (7), QNP1 precedes QNP2, but the former has a theme role which is lower in the hierarchy than the location role of the latter, and thus the conflicting prediction of the two principles results in ambiguity.

2.3 Lee (1996)

A major issue in this study was whether a scope independent or a scope dependent interpretation is more basic for numeral phrases, i.e. whether or not children initially assume all QNPs to have operator status and assign scope dependency readings from the beginning. In addition, the role played by the adverb *dou* 'each/all' was also investigated. Five types of sentences were used, as shown below.

(11) a. Universal quantifier subject; numeral phrase object

suoyoude	shushu	dou	tiao-zhe	liang-tong	shui
all	uncle	each	carry-ASP	two-CL	water

"All the men are carrying two buckets of water."

b. Universal quantifier subject; bare NP object
suoyoude shushu dou tiao-zhe shuitong
all uncle each carry-ASP water-bucket
"All the men are carrying water-buckets."

c. Numeral phrase subject; numeral phrase object
you san-ge shushu tiao-zhe liang-tong shui
have three-CL uncle carry-ASP two-CL water
"Three men are carrying two buckets of water."

d. Conjoined NP subject; numeral phrase object; without adverb *dou*
Xiaoliang he Xiaoma na-zhe liang-ge qiqiu
Xiaoliang and Xiaoma hold-ASP two-CL balloon
"Xiaoliang and Xiaoma are holding two balloons."

e. Conjoined NP subject; numeral phrase object; with adverb *dou*
Xiaoliang he Xiaoma dou na-zhe liang-ge qiqiu
"Xiaoliang and Xiaoma are both holding two balloons."

The comparison of (11a) and (11b) was used to investigate whether young children interpret sentences with a subject universal quantifier and an object numeral phrase (i.e. (11a)) in the same way as they do to the corresponding sentences with a bare NP object (i.e. (11b)). Sentences like (11c) were used to show whether or not children assign scope-dependent readings as well as scope-independent readings. For sentences like (11d) and (11e), they were used to show whether young children are sensitive to the properties of the adverb *dou* 'each/all' when it is not preceded by a universal QNP. The task used was sentence-picture verification, and the subjects had to decide whether the interpretation depicted by the picture was true for the sentence or not. The first three types of sentences (11a, b, c) were paired with 6 interpretations: distributive, each-all, cumulative, extra theme, unrelated theme, non-exhausted agent[16]. The last two types of

[16] According to Lee (1996, p.176-177), the distributive situation corresponds to the subject wide scope reading, which is a scope-dependent reading. The cumulative reading, in which each member of either set is connected with at least one member of the other set, represents a scope-independent interpretation. The each-all situation, in which each member of one set is connected with all members of the other set, can be

sentences (11d, e) were paired with 3 interpretations: distributive, cumulative and each-all. The primary findings of this study are:

(i) In the absence of the adverb *dou*, adults mostly refused to give the distributive reading for the sentence type (11d), but 4 and 5 year-olds were not sensitive to the distributive property of the adverb *dou*. They accepted the cumulative reading for sentences with conjoined proper noun subjects, irrespective of whether the sentence contained the adverb *dou*, between 65 and 80% of the time.

(ii) The symmetrical reading found in Philip (1995) was not replicated here, as children did not behave differently on the distributive and extra-theme conditions for sentence types (11a, b, c).

(iii) About half of the 4 year-old and around 80% of the 5 year-old children allowed a cumulative reading only for the bare NP but not for a QNP. In addition, despite the fact that the distributive reading generally is not accepted by Chinese-speaking adults for sentences with a numeral phrase subject and a numeral phrase object (as in (11c)), children participated in this study overwhelmingly favored this reading. This showed that children preferred to give a distributive reading to sentences with numeral phrases in subject and object positions, and thus suggested that scope dependency (i.e. [+operator]) between quantity-denoting NPs is unmarked[17].

(iv) Since the results showed that children are not aware of the distributive property of the adverb *dou* until quite late, the assignment of subject wide scope by Chinese-

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taken as a scope-independent reading or a scope-dependent reading. The unrelated theme and the non-exhausted agent conditions are used to falsify the sentences. The extra-theme condition serves to test the proposal of Philip (1995).

[17] Note that the conclusion drawn from the results in this study is different from the conclusion in Lee (1986) with respect to the operator status of the QNPs.

speaking children can not be due to the distributivity of the adverb, but must be attributed to scope interaction between QNPs.

2.4 Chien (1994)

In this study (and also Chien and Wexler 1989), Chinese-speaking children's interpretations of sentences containing the universal quantifier and the existential quantifier were examined. Three proposals concerning scope facts of Chinese sentences were evaluated: Huang's (1982) Isomorphic Principle (as in (2)), Lee's (1986) Linearity Principle (as in (5)), and Aoun and Li's (1993) Minimal Binding Requirement and Scope Principle (as shown below).

(12) a. The Minimal Binding Requirement
Variables must be bound by the most local potential A'-binder. (An element is qualified as an A'-binder for a variable only if this element occupies an A'-position and c-commands the variable.)

b. The Scope Principle
A quantifier A has scope over a quantifier B in case A c-commands a member of the chain containing B.

The above principle was proposed to account for the ambiguity of the Chinese passive sentence below.

(13) a.

mei-ge	wanju	dou	bei	yi-ge	xiaohai	nazou	le
every-CL	toy	all	by	a-CL	child	take-away	ASP

"Every toy was taken by a child."

b. [mei-ge wanju dou [bei yi-ge xiaohai nazou *t* le]]. (*t* = trace)

Argument-chain

In (13), the surface subject *mei-ge wanju* 'every toy' and the postverbal NP-trace form an argument-chain through Move-α in mapping from D-structure to S-structure. After Quantifier Raising, the universal QNP takes scope over the existential QNP by c-commanding the latter. The existential QNP can also take scope over the universal QNP because the former c-commands the trace of the latter. The major difference among the three proposals is that in Huang's and Aoun and Li's analyses, the relevant hierarchical relation is *c-command*, while in Lee's analysis, it is *command*.

An act-out task was used in this study, and four sentence types were used, as shown below.

(14) Canonical Constructions

a. xie yi-ge shuzi zai mei-ge gezi li
mei-ge yi-ge
Write one-CL number in every-CL box.
every-CL one-CL
"Write a/every number in every/a box."

b. zai yi-ge gezi li (dou) xie mei-ge shuzi
mei-ge yi-ge
In one-CL box, (all) write every-CL number
every-CL one-CL
"In a/every box, write every/a number."

(15) Ba-Constructions (Object Fronting)

a. ba yi-ge shuzi (dou) xie zai mei-ge gezi li
mei-ge yi-ge
ba one-CL number (all) write in every-CL box
every-CL one-CL
"Write a/every number in every/a box."

b. ba yi-ge gezi (dou) xie mei-ge shuzi
mei-ge yi-ge
ba one-CL box (all) write every-CL number
every-CL one-CL
"Write every/a number in a/every box."

The primary findings of this study can be summarized as follows.

(i) There exists a high correspondence between the results from the canonical constructions and the results from the object fronting *ba*-constructions. This suggests that linear precedence is not a stable determining factor for scope interpretations in Chinese. For a canonical sentence like *xie mei-ge shuzi zai yi-ge gezi li* 'write every number in one box', and a *ba*-sentence like *ba mei-ge shuzi dou xie zai yi-ge gezi li* 'ba every number all write in one box', adults as well as children older than 5 predominantly assigned an existential wide scope reading, contrary to the prediction of the linearity principle.

(ii) Although the structure for sentences like (14a) is still controversial, Chien argued that the results suggested that Chinese-speaking children were sensitive to the notion of c-command, rather than command, in scope interpretation. However, the high correspondence between the results of the canonical and the *ba*-constructions casts doubts on this claim.

(iii) With respect to the Chinese existential QNP, it appears that the existential QNP has the properties of both [-operator] and [+operator], but the reading of *a certain* (which is [-operator]) seems stronger.

(iv) Most of the children from every age group had difficulty dealing with the *every-every* sentences. They consistently gave non-adult responses, i.e. instead of writing all the numbers in each of the boxes in the above examples, they wrote one number in each box.

3 Acquisition of Quantifier Scope in English

3.1 Philip (1995)

Using a sentence-picture verification task, i.e. the subjects have to answer a yes/no question about whether a sentence is true or not given the picture presented to them, Philip (1995) investigated the acquisition of quantifier scope interaction in various verb types in English. Previous studies found that young children gave non-adult *No* answers to sentences like *"Is every boy riding a pony?"* when the picture presented to them has an extra pony which is riderless. This was called the Symmetry Child response by Philip (1995). In addition, there were also some children who not only gave non-adult *No* answers to the above context, but also non-adult *No* answers to the same sentence paired with a picture in which each boy is riding a pony, but a girl is standing beside them, or a picture in which each boy and girl is riding a pony. This was referred to as the Perfectionist (or the exhaustive) response. Based on these findings, Philip (1995) proposed an Event Quantificational Account to explain the nonadult-like performance.

The basic claim of the account is that children differ from adults in that they generally *prefer* to treat all universal quantifiers as quantification over individual events. Therefore, they assign non-adult readings to determiner quantifiers like *every*, which should quantify over individual object in adult grammar. According to Philip (1995), "whereas under object quantification individual objects are the discrete units being counted, under event quantification it is rather individual collections of intentionally related objects that are the discrete units being counted" (p. 43).

Among the 216 children who participated in the study (excluding those who had attention problems), 85% of the children exhibited exhaustive or symmetrical responses

to some extent, and only 15% exhibited perfect adult-like performance. No significant difference was found between floated *all* and *every* in the incidence of symmetrical responses. As predicted by the account, some conditions showed a significant inhibitory effect for symmetrical responses to occur, as shown below.

(16) a. INTRANS Condition
Is every boy waving?
(Context: Three boys each is riding a pony and is waving. An extra pony is riderless, and a girl is standing beside.)

b. BARE Condition
Are boys riding ponies?
(Context: Same as (a))

c. TRANSX Condition
Is every boy riding?
(Context: Three boys each is riding a pony. An extra pony is riderless, and a girl is standing beside.)

d. SYM Condition
Is every boy riding a dinosaur?
(Context: Three boys each is riding a dinosaur. A pony is riderless, and a girl is standing beside.)

e. LIKE Condition
Does every boy like a pony/ponies?
(Context: Same as in (c))

f. LIKE-ING Condition
Does every boy like riding a pony?
(Context: Same as in (c))

g. NOMPRED Condition[18]
Is every boy a pony-rider?
(Context: Same as in (c))

The reasons why these conditions showed an inhibitory effect for the symmetrical responses are as follows.

[18] In this condition, the inhibition effect only occurred with *every* but not with *all*.

(i) Under the BARE condition, the sentences contain no universal quantification.

(ii) Under the INTRANS, TRANSX and SYM conditions, the restricted domain of quantification contains no falsifying element.

(iii) Under the LIKE, LIKE-ING and NOMPRED conditions, the adult-like affirmative response was predicted because when the children are treating these predicates as individual-level predicates, they would be encouraged to abandon the preference for event quantification and switch to adult-like object quantification.

For the other conditions tested, the prediction of the account was borne out, i.e. the children showed the symmetrical responses under these conditions. It was argued that since some agrammatic aphasics showed similar symmetrical responses for the tests, what was found from the symmetrical children could not be due to any effect of nonlinguistic cognitive processes. What forces the child to abandon the preference for the symmetrical interpretation is a growing awareness that this reading often leads to false information about the world.

3.2 Crain, Thornton, Boster, Conway, Lillo-Martin, and Woodams (1996)

Using different experimental methodology than Philip (1995), Crain et al. (1996) presented a series of experiments to argue against the position that children lack knowledge of any aspect of universal quantification. The Truth Value Judgement task was employed to test the hypothesis that the lack of plausible dissent was what led children to the non-adult responses found in Philip (1995).

Seven experiments were conducted in this study, as described below.

(i) In the first experiment, the same sentence-picture verification task was used to replicate the finding that some children assign a symmetrical reading to sentences with universal quantification. Although children gave symmetrical responses 35% of the time, in the noun-incorporation condition, only about half of the symmetrical children demonstrated significant improvement, providing little support to the symmetrical account.

(ii) Experiments 2 and 3 examined children's comprehension and production of the universal quantifier in distributive contexts. In all the test stories, there were objects left unused or uneaten by the toy characters, thus the correspondence of agents and objects was not symmetrical. However, 88% of the time children accepted the test sentences in the comprehension test, and 12 of the 14 children consistently produced sentences with *all* or *every* in the production test.

(iii) In experiment 4, the wide-scope reading for the indefinite NPs was investigated, and children correctly said Yes to the test sentences 92% of the time when the indefinite NPs were in object position, and 69% of the time when they were in subject position.

(iv) Experiment 5 tested deaf children's comprehension of distributive and nondistributive interpretations in American Sign Language. The results showed that children correctly responded to sentences with the universal wide scope reading 88% of the time, and the existential wide scope interpretation 87% of the time.

(v) In Experiment 6, children's interpretations of sentences with *wh*-questions and the universal quantifier like the following examples were examined.

(17) a. What did every pig buy?

b. What didn't every pig buy?

Both questions are ambiguous, allowing the collective reading and the distributive reading, though the distributive reading is highly dispreferred by adults for the negative question. The symmetrical account would predict that children should provide only the distributive paired-list answers to the above questions. However, the results showed that children gave paired-list answers to the affirmative questions 46% of the time, and collective answers 54% of the time. As for the negative question, paired-list answers were given only 6% of the time, and the collective reading was given 89% of the time. These results failed to support the symmetrical account.

(vi) Experiment 7 investigated relative clause and conditional donkey sentences like the following.

(18) a. Every farmer who has a donkey feeds it.
b. If a farmer has a donkey, he always feeds it.

On the symmetrical account, the same analysis should apply to both relative clause and conditional donkey sentences, while the alternative dynamic binding account predicts that children should perform differently on the two sentence types. In this experiment, children accepted the relative clause donkey sentences significantly more often than the conditional donkey sentences (86% vs. 46%) in contexts which were not appropriate to the universal wide scope interpretation.

To sum up, the findings from the series of experiments demonstrate that once the felicity considerations are satisfied, children make few errors in interpreting sentences with universal quantification.

4 The Goal of the Current Study on Quantifier Scope Interaction

The goal of the first series of experiments is to investigate the acquisition of quantifier scope interaction in double object and *to*-dative constructions, as well as active and passive constructions, in English and Chinese. As shown in Chapter 1, English and Chinese display a contrast in terms of quantifier scope interaction in active and passive constructions, but for double object and *to*-dative constructions they display the same pattern. Although some studies have been done to examine the acquisition of quantifier scope in active and passive constructions, there has been no study up to now tackling double object and *to*-dative constructions. Besides, previous studies on Chinese-speaking children's acquisition of quantifier scope used either a picture identification (or sentence-picture verification) task or an act out task. The problem with a picture identification task is that the felicity condition is not satisfied, as no context is provided for children to make a judgement. As for an act out task, if the test sentence is ambiguous, since the subject has to choose an interpretation for acting out, what is obtained is actually the preference, not really the competence. For these reasons, in the current study, a Truth-Value Judgement task (Crain and McKee 1985) will be used to avoid the methodological problems.

CHAPTER III

EXPERIMENTS ON QUANTIFIER SCOPE INTERACTION

In this chapter, we present the results from first series of experiments, in which we investigated how Enlish-speaking and Chinese-speaking children interpreted the quantifier scope interaction in the double object and *to*-dative constructions. The layout of the chapter is as follows. Section 1 contains the details of the experimental design and the results from each condition. In section 2 we provide a general discussion on the results obtained here and propose some possible accounts.

1 Experiments

Four experimental conditions (Double Object, *To*-Dative, Active, Passive) were presented to the English-speaking and Chinese-speaking subjects. For English, 24 adults and 24 preschool children participated in the study. All the English-speaking adult controls were undergraduate students at the University of Maryland, College Park, and all the English-speaking children were from the daycare center of the same university[19]. For Chinese, 22 adults and 27 preschool children participated in the study. The Chinese-speaking adult controls were all undergraduate students at National Taiwan Normal University. The Chinese-speaking children were from four daycare centers in Taipei. The range of age for English-speaking children was from 4;2 to 6;4 (with a mean age of 5;3), and for Chinese-speaking children from 4;9 to 6;10 (with a mean age of 5;9).

[19] Among the twenty-four English-speaking children, four of them were bilingual (one Chinese, two Korean, and one Spanish), but with English as their dominant language. Their responses were similar in pattern to those English monolingual children.

The task used in this study was a Truth-Value Judgement task as described in Crain and McKee (1985) and Crain and Thornton (1998). Each child was tested individually in a quiet room. After one of the two experimenters acted out the story with toys and props, the puppet (Kermit the Frog, played by the other experimenter) would say something about what he thought happened in the story. If the child thought what the puppet said was true in the story, he/she could feed the puppet with something as a reward. If the child thought the puppet was wrong, he/she could ask the puppet to do some push-ups in order to remind the puppet to pay attention to the stories. When the child thought the puppet was wrong, he/she was further asked to explain why it was wrong. All the children's responses were coded on separate answer sheets and also tape-recorded for future checking.[20]

Some sample stories and the results for each experimental condition are presented in the following sections.

1.1 Double Object and *To*-Dative Constructions

1.1.1 Double Object Construction

As the contrast of quantifier scope between English and Chinese shows in Chapter 1, despite the differences in active and passive constructions in the two languages, they demonstrate the same quantifier scope determination for a double object sentence like (1).

[20] Instead of being tested individually, the adult controls were tested as a group of 10 to 15 people. After each story, the adults had to write down on the answer sheet whether he/she thought the puppet was right or wrong, and also the reason why the puppet was wrong. During the experiment, they were not allowed to discuss the stories with each other, and they also obtained some extra credits in the class by participating in the study.

(1) laoshi jiegei yi-ge nanhai mei-ben shu
teacher lend-to a-CL boy every-CL book
"The teacher lent a boy every book." ('a > every')

In both English and Chinese, for the above sentence, only the existential wide scope interpretation (i.e. one boy receives all the books) is acceptable for adult speakers. The experimental condition in this section was designed to investigate whether children in both languages have the adult (i.e. 'a > every') interpretation, but suppress the non-adult (i.e. 'every > a') reading. There were two types of scenarios for the double object construction: one with the first NP (the goal) as the assertion[21]; the other with the second NP (the theme) as the assertion.

A. The Goal as the Assertion

For the first type (i.e. the goal as the assertion), the experimental design is as follows:

(2) a. Background: Snow White gave a so-and-so every balloon.
Assertion: a lady
Possible Outcome: Snow White gave a boy every balloon.
Actual Outcome: Snow White gave a lady every balloon.

b. Background: Snow White gave a so-and-so every balloon.
Assertion: a lady
Possible Outcome: Snow White gave every balloon to a lady. (Distributive)
Actual Outcome: Snow White gave a lady every balloon

In this type of stories, subjects had to be able to identify the assertion, as in contrast with another entity (2a), and to determine the quantifier scope for the NPs (2b). The

[21] In the experiment design, "background" can be thought of as a function, and "assertion" as an argument to this function (Crain et al. 1996, p. 115). It is the assertion part of the test sentence that is varied for the possible outcome and the actual outcome.

protocols for this type of scenario involved five characters, one of them (e.g. Snow White) was giving or selling things away, two of them were of the same type (e.g. boys), and the other three were of the same type (e.g. ladies). At an earlier point of the story, the main character (e.g. Snow White) thought about giving a balloon to each lady (the Possible Outcome in (2b)), but two of the ladies didn't like balloons, so it turned out that each lady got a flower. Snow White then tried to persuade one of the boys to take all the balloons, and the boy was interested in that, too (the Possible Outcome in (2a)). But later the boy decided that he preferred to have something else (e.g. swords). At the end, one of the ladies thought it might be fine for her to have the balloons, and thus she got them all. Since the assertion corresponded to the actual outcome, and the possible outcome corresponded to the negative judgement, the condition of plausible dissent was thus satisfied. There were two such stories, interleaved with stories from other experimental conditions. The protocol of the story is the following.

(3) Characters and Crucial Props

Snow White, three ladies, and two boys

Three flowers, three balloons, three toy swords, and one toy gun

Protocol

Exp:	Snow White is having a Halloween party at her house, but some of her guests don't know how to dress up for the party.
Lady1:	Snow White, we don't know how to dress up for your party. Can you help us?
SW:	No problem. I have a lot of great stuff for a party. Let me check what I have. Here I have three beautiful flowers, three balloons, three swords, and a toy gun. I think each of you ladies can have a balloon. They look good.
Lady2:	No, I want a flower. The balloons look more like children's things.
Lady3:	Yes, I agree with you. I want a flower, too. The balloons should be for kids.
Lady1:	I want a flower, too. They are really beautiful.
SW:	OK. You can have this flower. You can have this one. And this one is yours. How about you boys?
Boy1:	I want the toy gun. I want to dress up like a cowboy.

SW: And you, little boy? Do you want the three balloons? You can dress up like a clown.

Boy2: The balloons look great. But, I like the three swords more than the balloons. I can dress up like a knight to fight with enemies.

Lady1: If no one wants the balloons, I can have them. I think it will be fun for me to dress up like a clown with the balloons.

SW: OK, now everybody has made a decision. This is your toy gun. The swords are yours. And the balloons are yours.

Kermit: This is a really long and complicated story. It's a story about some people going to a party, and Snow White was helping them to dress up. I know what happened. "Snow White gave a boy every balloon."

Child: No, she gave the balloons to this lady.

Kermit: Oh, it's too bad I was wrong. Let me try another one. "Snow White gave a boy every sword."

Child: Yes.

Or No, only this boy got all the swords. (Symmetrical interpretation)

Kermit: There is another thing I want to make sure. "Snow White gave a lady every flower."

Child: No, each of them only got one flower.

Or Yes. (Symmetrical interpretation)

B. The Theme as the Assertion

For the second type of stories (i.e. the theme as the assertion) in the double object construction, the experimental design is as shown below.

(4) Background: The Mermaid gave a woman <u>every so-and-so</u>.
Assertion: every diamond
Possible Outcome: The Mermaid gave a woman every crown.
Actual Outcome: The Mermaid gave a woman every diamond.

In this type of stories, the subjects had to determine whether the amount of the things given (or sold) included "every" item of the set. The protocols for this type of stories involved four characters. At some point in the story, the main character (e.g. the Mermaid) was thinking about giving each of something (e.g. the crowns) to one of the

other characters (e.g. a woman), but it turned out that the person was not interested in having all of the items. Therefore, the main character could only give away (or sell) some of the items, and had to keep one which was defective or useless. By doing so, the condition of plausible dissent was satisfied. On the other hand, another character in the story did accept (or buy) every item of something (e.g. the diamonds) from the main character. There were two such stories with this type of scenario. A sample protocol is shown below.

(5) Characters and Crucial Props

The Mermaid, and three women

Three crowns, three diamonds, and a big shell

Protocol

Exp: The Mermaid is going back to the sea, and she has some precious things she can't take with her, so she needs to give them away.

Woman1: Mermaid, we heard that you have some good things to give away. Is that true?

MM: Yes, I have some very precious and pretty things to give away. I am sure you will like them. Here they are: three beautiful diamonds, three gorgeous crowns, and one huge shell.

Woman2: I want the shell. It looks really special. I can put it in my living room.

MM: No problem. How about you two? Do you want the diamonds or the crowns?

Woman3: I want the three diamonds. I can give them to my daughter for Christmas.

MM: Sure you can do that. I think your daughter will like them. (Turns to woman1) Well, now I only have the three crowns left. If you want, you can have all of them for free. That's a good deal, isn't it?

Woman1: They look really gorgeous, but this one is really too big. I don't think I can find anyone who has such a big head for this crown. I only want the two smaller ones.

MM: OK, no problem. Here is your shell. These are the diamonds for you. And you can have these two crowns. I will try to find someone else for this crown.

Kermit: This is an interesting story. It's about a Mermaid giving away some of her stuff before she goes back to the sea. And I know what happened. "The Mermaid gave a woman every crown."

Child: No, only two crowns.

Kermit: Oh, that's too bad. I want to try something else. "The Mermaid gave a woman every diamond."
Child: Yes.
Or No, this woman got all the diamonds. (Symmetrical interpretation)

1.1.2 *To*-Dative Construction

A double object sentence like (1), with an indefinite NP as the goal and a universally quantified NP as the theme, is not ambiguous in both English and Chinese. However, the corresponding *to*-dative sentence like the one in (6) is ambiguous between the existential wide scope interpretation and the universal wide scope interpretation in both languages.[22]

(6) laoshi jie-le mei-ben shu gei yi-ge nanhai
teacher lend-ASP every-CL book to a-CL boy
"The teacher lent every book to a boy."

The scenario of the stories for the *to*-dative construction is similar to that in part A (i.e. the goal as the assertion) of the double object construction, as shown in (7). The only difference is that since this sentence is ambiguous, the universal wide scope interpretation should elicit a YES (instead of NO in the double object construction) response from an adult grammar.

(7) Background: The troll sold every hat to <u>a so-and-so</u>.
Assertion: a girl
Possible Outcome: The troll sold every hat to a man.
Actual Outcome: The troll sold every hat to a girl.

There are two trials in this condition. A sample protocol is shown as follows.

(8) <u>Characters and Crucial Props</u>

[22] As we will discuss later in the Results section, some Chinese-speaking adults can only have the existential wide scope interpretation for a sentence like (6).

A troll, two men, and three girls
Two vases, three rings, three cookie jars, and three hats

Protocol

Exp: It's about Mother's Day. Three girls and two men are going to buy gifts for their mothers.

Girl1: Good morning, troll. We need to buy gifts for our mothers. What do you have here?

Troll: I have plenty of good things for mothers. See, here I have some beautiful rings, some stylish hats, some lovely cookie jars, and two vases. Do you girls want to buy the hats? I think your mothers will like them. They were made by a famous designer.

Girl2: No, my mother doesn't like to wear hats. But I think she would like to have a ring.

Girl3: My mother doesn't like hats, either. I think a ring would be a better gift for her.

Girl1: I want to buy a ring for my mother, too.

Troll: OK. I am sure your mother will like the gift. This ring is for you. This ring is for you. And this one is for you. (Turn to the men.) Now, how about you guys?

Man1: I think my mother would like the vases. She always likes to pick flowers from the yard and put them in a vase.

Troll: No problem. How about you? Do you want to buy the hats for your mother?

Man2: These hats are really pretty. But, they look a little bit too modern. My mother is already seventy years old, and I don't think she would like these kinds of hats. The cookie jars look quite cute. My mother likes to bake cookies. I think she would like them.

Girl1: I still have some money left, and I really like those hats. I want to buy all of them for my mother.

Troll: Good, these are your cookie jars, and these are your hats. And your mother is going to have a very big Mother's day gift this year.

Kermit: This is a really nice story. It's about two men and three girls buying Mother's Day gifts. And I know what happened. "The troll sold every hat to a man."

Child: No, this girl got all the hats.

Kermit: Oops, I'm wrong. Let me try it again. "The troll sold every cookie jar to a man."

Child: Yes.

Or No, only this man got all the cookie jars.

Kermit: There is still something else that happened in the story. "The troll sold every ring to a girl."

Child: Yes.

1.1.3 Results

The results for the double object construction are shown in Table I.

Table I. Double Object Construction

Sentence: Snow White gave a lady every flower
baixuegongzhu gei yi-ge xiaojie mei-duo hua
Snow White give a-CL lady every-CL flower

Context	English		Chinese	
	Adult (N=24)	Child (N=24)	Adult (N=22)	Child (N=27)
Part A				
a > every	Yes (46/46, 100%)	Yes (22/46, 48%)	Yes (43/44, 98%)	Yes (54/54, 100%)
every > a	No (46/46, 100%)	No (13/46, 28%)	No (41/44, 93%)	No (42/54, 78%)
Part B				
a > every	Yes (48/48, 100%)	Yes (18/43, 42%)	Yes (42/44, 95%)	Yes (41/50, 82%)
Total				
a > every	Yes (94/94, 100%)	Yes (40/89, 45%)	Yes (85/88, 97%)	Yes (95/104, 91%)
every > a	No (46/46, 100%)	No (13/46, 28%)	No (41/44, 93%)	No (42/54, 78%)

In both Part A and Part B of the double object construction, since the first sentence was used as a control to ensure that subjects were paying attention and knew the concept of *every*, we will focus on the discussion of the answers they gave to the second and the third sentences. As shown in Table I, there was a contrast between English-speaking children and Chinese-speaking children. Recall that for the double object construction, the scope regarding the universal quantifier and the existential quantifier is the same for both English and Chinese. All the Chinese-speaking children correctly accepted the existential wide scope interpretation for the test sentences in Part A, and they correctly accepted that interpretation for the test sentences in Part B 82% of the time. As for the universal wide scope context in Part A, it was correctly rejected by Chinese-speaking children 78% of the time. In general, most (about 80%) of the Chinese-speaking children had adult-like interpretation for the double object construction.

Among the Chinese-speaking children, 18 of them consistently gave adult-like answers to both stories in Part A, and only 3 out of the 27 children consistently accepted both adult and non-adult interpretations. Six children gave inconsistent answers to the two stories. None of the Chinese-speaking children rejected the adult reading but accepted the non-adult interpretation for the two stories. In Part B, 17 children consistently gave adult-like answers to both stories, and 14 out of the 17 children also gave adult interpretations in Part A. Only 1 out of the 27 children consistently gave non-adult answers to both stories, and the other 9 children gave inconsistent answers to the two stories. There were 14 Chinese-speaking children who consistently gave adult interpretations in both Part A and Part B.

However, the English-speaking children showed a different picture. For the existential wide scope interpretation (the adult interpretation), English-speaking children accepted it only 48% of the time in Part A, and 42% of the time in Part B. As for the non-adult universal wide scope reading in Part A, they wrongly accepted it 72% of the time. This showed that more than half of the English-speaking children demonstrated a non-adult grammar with respect to quantifier scope interpretation for the double object construction.

Among the English-speaking children, in Part A, only 5 of them consistently gave the adult-like answers to the test sentences for both stories. Four out of the 24 children consistently accepted both the adult and the non-adult readings for both stories, and 10 out of the 24 consistently rejected the adult interpretation (i.e. the existential wide scope reading) but accepted the non-adult interpretation (i.e. the universal wide scope reading) for both stories. The other 5 children gave inconsistent answers to the two stories. In

Part B, 5 children consistently gave the adult-like answers to the sentences for both stories, and 2 out of the 5 children also gave adult-like answers in Part A. Nine out of the 24 children consistently rejected the adult interpretation (i.e. the existential wide scope reading) for both stories, and 8 out of the 9 children also consistently gave non-adult answers in Part A. The other 10 children gave inconsistent answers. There were, in sum, only 2 English-speaking children who consistently gave adult interpretations in both Part A and Part B.

The results showed that most of the preschool English-speaking children we tested did not have the adult interpretation regarding quantifier scope for the double object construction. For those children who gave consistent answers in both Part A and Part B, more than half of them rejected the adult interpretation (i.e. the existential wide scope reading), but accepted the non-adult interpretation (i.e. the universal wide scope reading). The results from English seem consistent with Philip's (1995) Event Quantification for Universal Quantification Hypothesis. However, this account fails to explain why in Chinese the majority of children we tested could assign the adult interpretation, and also rejected the non-adult reading for the same sentences. Since the double object sentences we used had the existential quantifier preceding the universal quantifier, the results from Chinese-speaking children here suggested that the Isomorphic Principle (Huang 1982, Lee 1986) played an important role in children's determining quantifier scope. Unless we want to postulate that the development of quantifier scope assignment is governed by different cognitive constraints (depending on which language the child is acquiring), we need to consider whether what we found from the double object construction is only a

special case, or true in general. For this reason, we also need to examine children's ability to interpret *to*-dative sentences as shown in the results in Table II.

Table II. *To*-Dative Construction

Sentence: The dwarf sold every ring to a girl.

xiao-airen	mai-le	mei-ge	jiezhi	gei	yi-ge	nuhai
dwarf	sell-ASP	every-CL	ring	to	a-CL	girl

	English		Chinese	
Contexts	Adult (N = 16)	Child (N = 24)	Adult (N = 22)	Child (N = 27)
a > every	Yes (31/32, 97%)	Yes (24/48, 50%)	Yes (37/39, 95%)	Yes (52/53, 98%)
every > a	Yes (23/32, 72%)	Yes (37/48, 77%)	Yes (8/39, 21%)	Yes (15/53, 28%)

As shown in Table II, although *to*-dative sentences are ambiguous between an existential wide scope reading (i.e. 'a > every') and a universal wide scope reading (i.e. 'every > a') in English, for adults the 'a > every' reading is preferred (97% acceptance, in contrast with 72% for the 'every > a' reading). However, English-speaking children showed an opposite preference from the adults. They accepted the 'every > a' interpretation 77% of the time, and the 'a > every' reading only 50% of the time. The percentage of acceptance for the 'a > every' and the 'every > a' interpretations was actually very close to that of Part A for the double object construction.

Among the English-speaking children, 19 of them gave consistent answers to the two stories in the *to*-dative construction. Four out of the 19 children gave adult-like answers consistently to both stories (i.e. accepting both the readings), and 2 of them gave the same pattern of answers consistently to the sentences in Part A of the double object construction, too. Four of the 19 children consistently accepted the 'a > every' reading but rejected the 'every > a' reading, and all 4 of them also responded this way to both stories in Part A of the double object construction. Eleven children consistently rejected

the 'a > every' reading but accepted the 'every > a' reading to the two stories, and 9 of them did so in Part A of the double object construction, too.

For Chinese, although in the linguistic literature a *to*-dative sentence is usually considered as ambiguous between an existential wide scope reading and a universal wide scope reading like in English, the Chinese-speaking adults we tested seem to have a very strong preference to the existential wide scope reading. Among the 22 adults, they accepted this reading 95% of the time, but the universal wide scope reading only 21% of the time. For Chinese-speaking children, the acceptance for the 'a > every' interpretation was 98%, and the acceptance for the 'every > a' reading was 28%. Again, the percentage was similar to the results in Part A of the double object construction, and most of the Chinese-speaking children gave the same answers to the sentences as the adult controls.

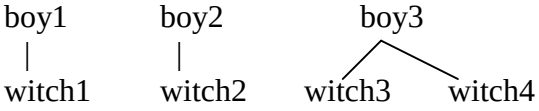
For Chinese, 17 out of the 27 children gave consistent answers to the two stories in the *to*-dative construction. Four out of the 17 accepted both the 'every > a' and the 'a > every' readings for both stories, and 2 of them also responded this way in Part A of the double object construction. Thirteen children consistently accepted the 'a > every' reading, but rejected the 'every > a' reading for both stories, and 12 of them did so in Part A of the double object construction, too.

The results from the *to*-dative construction showed that in both English and Chinese, instead of accepting both the existential wide scope and the universal wide scope interpretations, children tended to have only one reading for the sentences. For Chinese, most children, as well as adults, had only the existential wide scope reading for the test sentences. For English, despite the fact that adults preferred the existential wide scope interpretation for the test sentences in the *to*-dative construction, most English-speaking

children accepted only the universal wide scope reading, but rejected the existential wide scope reading. The results of the *to*-dative construction from English-speaking children were still consistent with the predictions of Philip's (1995) Event Quantification account. However, the results of the *to*-dative construction from Chinese-speaking children could no longer be accounted for by the Isomorphic Principle, as the universal quantifier precedes the existential quantifier in the test sentences.

In general, combining the results from both the double object construction and the *to*-dative construction, Chinese-speaking children assigned wide scope for the existential quantifier most of the time, but English-speaking children tended to assign wide scope for the universal quantifier. One possible explanation for this discrepancy is that Chinese *yi-ge* 'a; one' may have different lexical properties from those of the English existential quantifier. Perhaps Chinese *yi-ge* does not really correspond to the English existential quantifier *a* (∃), but to *exactly a* (∃!) (Norbert Hornstein, personal communication). Although in most cases the English *a* can be translated to Chinese *yi-ge*, there is indeed one situation in which the former can not correspond to the latter. Suppose we have a context like (9a), in which boy1 and boy2 each saw a different witch, but boy3 saw two witches. In this situation, the English sentence (9b) can be used to describe the context[23], but not the Chinese sentence (9c) with *yi-ge*.

(9) a.



b. Every boy saw a witch (before they entered the castle).

[23] Thanks to Paul Pietroski for pointing out this usage of English existential quantifier to me.

c. mei-ge nanhai dou kandao yi-ge wupuo
every-CL boy all saw a-CL witch
"Every boy saw a witch."

The results from the Chinese double object and the *to*-dative constructions may lead us to think that perhaps Chinese *yi-ge* should be treated, or was treated by Chinese-speaking children, as English '*a certain*', which always has wide scope, and thus falls into the Type I quantificational NP's according to Hornstein (1984). This possibility can be ruled out for two reasons. First, the Chinese indefinite NP *yi-ge* can indeed be quantificational when it occurs in the object position of an active sentence like (9c), meaning that each boy saw a different witch (the universal wide scope reading), or that all the boys saw the same witch (the existential wide scope reading).[24] Second, it cannot be true that Chinese-speaking children treated *yi-ge* as always having wide scope, because in Lee (1991) children predominantly assigned the universal wide scope reading to test sentences in which the universal quantifier preceded the existential quantifier, as the example in (10).

(10) X zai mei-ge xiaohai shenshang dou gai yi-tiao maojin
at every-CL child body-on all cover a-CL towel
"X covers on every child's body a towel."

As for English, although the symmetrical account holds for the results from the double object and the *to*-dative constructions, it may not be the end of the story. In Crain, Thornton, Boster, Conway, Lillo-Martin, and Woodams (1996), it was shown that even

[24] In both Huang (1982) and Aoun and Li (1993), a Chinese active sentence like (9c) was treated as unambiguous, allowing only the universal wide scope interpretation. However, as our results show in the next section about active and passive constructions, Chinese-speaking adults and children did allow the existential wide scope interpretation for such sentences. The results from Lee (1986), using a picture identification task, also showed that in fact the existential wide scope interpretation was chosen more often by children than the universal wide scope interpretation.

for those English-speaking children who gave symmetrical responses when pictures were used in the task, they could correctly assign the existential wide scope reading to active sentences when the Truth Value Judgement task was used. Due to these considerations, we also included active and passive constructions in this study, as shown in the next section.

1.2 Active and Passive Constructions

As mentioned in the previous section, the results from double object and to-dative constructions suggested that English-speaking children tended to assign only the universal wide scope reading, while Chinese-speaking children tended to have only the existential wide scope reading for the two constructions. Since previous research on these two languages demonstrated that English-speaking children did have access to the existential wide scope reading for active sentences (Crain et al. 1996), and Chinese-speaking children could assign the universal wide scope reading to some kind of active sentences (Lee 1991), the pattern found in the previous section may be restricted to double object and to-dative constructions only. Therefore, in our experiments we also included active and passive sentences as a comparison.

1.2.1 Active Construction

As mentioned Chapter 1, the main distinction between English and Chinese with respect to quantifier scope lies in the active construction. When the universal quantifier

is in subject position, and the indefinite NP in object position (as in (11)), the sentence is ambiguous in both English and Chinese.[25]

(11) a. Every boy likes a girl. (‘every>a’; ‘a>every’)

b. mei-ge nanhai dou xihuan yi-ge nuhai (‘every>a’; ‘a>every’)
every-CL boy all like a-CL girl
"Every boy likes a girl."

However, when the indefinite NP is in subject position, and the universal quantifier in object position, the sentence is still ambiguous in English (as in (12a)), but it is not ambiguous in Chinese (as in (12b)).

(12) a. A dog ate every cake. (‘a>every’; ‘every>a’)

b. yi-zhi xiaogou chidiao-le mei-kuai dangau ('a > every')
a-CL doggy eat-ASP every-CL cake
"A dog ate every cake."

In the present study we focused on whether or not children had the existential wide scope interpretation for the above active sentences. Since Philip (1995) found that English-speaking children tended to give a symmetrical reading to the test sentences, but Crain et al. (1996) found that English-speaking children did have the existential wide scope reading, it was worth examining whether the children who gave non-adult 'every > a' interpretation to the double object sentences in this study also have the 'a > every' reading for active sentences. As for Chinese, although Lee (1991), using act-out task, found that children predominantly gave the universal wide scope interpretation to the sentences in which the universal quantifier in locative PP preceded an indefinite NP

[25] As we have mentioned in the previous Results and Discussion section, although the sentences in (11) are ambiguous in both English and Chinese, there is still some difference. In Chinese, it can mean either that each boy likes a different girl (the universal wide scope reading), or that all the boys like the same girl (the existential wide scope reading). In English, in addition to the two interpretations, it can also be used in a context similar to (9a), in which each boy likes at least one girl, but this is not possible in Chinese.

object (as the example in (10)), in Lee (1986), using picture-identification and act-out tasks for active sentences like (11b), the results were mixed. For both tasks, children younger than 6 years old assigned existential wide scope reading about 60% of the time, and the universal wide scope reading about 35% of the time. The preference gradually changed with age towards adult's favoring the universal wide scope reading in both tasks. Due to this discrepancy between Chinese-speaking adults and children, it was also necessary to see whether by using a different experimental design, we could better probe their linguistic competence.

There were two types of stories used for the active construction: one with the indefinite NP in object position; the other with the indefinite NP in subject position. Sample stories are shown below.

A. The Indefinite NP in Object Position

For the first type of stories (i.e. the indefinite NP in object position) used in the active construction, the experimental design is as follows.

(13) Background: Every witch flew on <u>a so-and-so</u>
Assertion: a broom
Possible Outcome: Some witch flew on a carpet.
Actual Outcome: Every witch flew on the same broom.

At the beginning of the story, the three witches were thinking about each flying on a different small broom to get their magic water, but then decided that it would be too dangerous because they were too fat. Then, they thought maybe they could use the carpets to fly on, but the senior witch disagreed because witches were not supposed to fly

on carpets. At the end, one of the witches discovered a bigger broom under the carpet, and all three of them used the big broom.

There was one such trial[26]. Here is the protocol:

(14) Characters and Crucial Props
Three witches
Two small brooms, one big broom, and two carpets
Protocol

Exp: This story is about three witches who want to get some magic water from the top of a mountain.
Witch1: That mountain is so high. We won't be able to get there unless we can find something to fly on.
Witch2: Look! There are two brooms here we can use.
Witch3: But they are so small. I think we are too fat to fly on such small brooms. We will fall to the ground and die.
Witch1: How about the carpets? There are two carpets here.
Witch3: Well, some people can fly on carpets, but not us. We are witches, and our power to fly only allows us to use brooms, not carpets.
Witch2: There seems to be something under this carpet. (Removes the carpet.) It's a big broom. I think this one should be big enough for us to use.
Witch1: Yes, we can use this one to get the magic water. (Turns to witch3.) You are the oldest, you go first.
Witch3: OK. (Flies to the mountain and gets a bottle of magic water.) Great! I finally have the magic water.
Witch2: It's my turn now. (Flies to the mountain and gets a bottle of magic water.)
Witch1: I'm the youngest. Finally, it's my turn. (Flies to the mountain and gets a bottle of magic water.)

Kermit: I like this story about witches getting magic water. I know what happened in the story. "Every witch flew on a broom."
Child: Yes.
Or No, not these two brooms. (Symmetrical interpretation)

B. The Indefinite NP in Subject Position

[26] Since the active and passive sentences were not the focus of the present study, we used only one trial for each condition as a preliminary comparison with the results from the double object and *to*-dative constructions and also served as filler sentences.

For the second type of stories (i.e. the indefinite NP in subject position) used in the active construction, the experimental design is shown in (15), and the protocol is in (16). In this story, three boys were in a jumping contest. If any of them could jump over all the three fences, that person could go to the Olympic games. Two of the boys tried, but both failed. At the end, only one of the three boys jumped over all the three fences.

(15) Background: A so-and-so jumped over every fence.
Assertion: a boy
Possible Outcome: For every fence, there was a boy who jumped over it.
Actual Outcome: There exists a boy such that that boy jumped over every fence.

(16) Characters and Crucial Props
Three boys and three fences
Protocol

Exp:	There are three boys in a jumping contest. If any of them can jump over all three fences, that boy can go to the Olympic games.
Boy1:	I really want to go to the Olympic games. That has always been my dream. Let me start with the red fence first. (Runs, and falls.) It's too bad. I fell! Now I can't win.
Boy2:	I have been sick for a whole week. I hope I can still do this. Maybe it will be easier to try the one in the middle first. (Runs, and falls.) Oh, too bad. I have to practice more.
Boy3:	It's my turn. I have been working really hard on this for a long time. I know I can do this. (Jumps over all the fences.) Yahoo! Now I can go to the Olympic games!
Kermit:	This is a story about some boys in a jumping contest. I know what happened. "A boy jumped over every fence."
Child:	Yes.
Or	No, not these two boys. (Symmetrical interpretation)

1.2.2 Passive Construction

In English, a passive sentence is ambiguous no matter whether the indefinite NP is in subject position (as in (17a)), or in the *by* phrase (as in (17b)).

(17) a. A novel was read by every girl. (‘a>every’; ‘every>a’)
b. Every novel was read by a girl. (‘every>a’; ‘a>every’)

In Chinese, according to Aoun and Li (1993), the corresponding sentences are also ambiguous (as shown in (18)).

(18) a. yi-ben xiaoshuo bei mei-ge nuhai duguo-le (‘a>every’; ‘every>a’)[27]
a-CL novel by every-CL girl read-ASP
“A novel was read by every girl.”

b. mei-ben xiaoshuo dou bei yi-ge nuhai duguo-le (‘every>a’; ‘a>every’)
every-CL novel all by a-CL girl read-ASP
“Every novel was read by a girl.”

There were two types of stories used in the passive construction: one with the existential wide scope reading for the indefinite NP in object position, and the other with the existential wide scope reading for the indefinite NP in subject position. Sample protocols are presented below.

A. The Indefinite NP in Object Position

For this type of story (existential wide scope for the object indefinite NP), the experimental design is as follows.

(19) Background: Every dinosaur was caught by a so-and-so.
Assertion: a boy
Possible Outcome: Some dinosaur was caught by a girl.
Actual Outcome: Every dinosaur was caught by a boy.

[27] In Aoun and Li (1993), it was clearer that a sentence like (18b) was considered as ambiguous. As for a sentence like (18a), it was not clear whether it is ambiguous or not. Given their account of the passive in general, the ambiguity should also apply to (18a). However, since in Chinese an indefinite NP usually does not occur in subject position except in some restricted conditions such as following *you* "have, exist" (see Aoun and Li 1993, note 3 on p. 199, and note 5 on p. 200), the indefinite NP tends to always have a wide scope interpretation instead of a narrow scope reading.

There was one such trial in the study. In the story, some boys and girls were playing a game to see who could catch all three dinosaurs. Everybody was eager to do that but all failed except the last boy, who succeeded in catching all of the dinosaurs. The protocol is the following.

(20) Characters and Crucial Props

Three boys and two girls
Three dinosaurs

Protocol

Exp: There are three boys and two girls playing a game. If any of them can catch all three dinosaurs, that person will win a big prize.

Boy1: Let me try first. I really want to win the big prize. (Chases a dinosaur, but can't catch it.) Oh, I'm really tired now. This is much more difficult than I thought.

Boy2: Let me see if I can do it. I am so strong. I think I can do it. (Chases a dinosaur, but can't catch it.) Ouch! I sprained my leg. I have to stop now.

Girl1: These dinosaurs look really ugly. I'm so beautiful. I don't want to do this.

Girl2: I can play this game. I always run very fast. I am the fastest girl in the world. (Chases a dinosaur, but can't catch it.) Gee! This is really hard. I'm hungry now. I have to find something to eat.

Boy3: This looks really hard. But I need to find a gift for my sister's birthday. If I win the prize, I can give it to my sister as a gift. I must try my best to win the prize. (Catches the three dinosaurs.)

Kermit: I like this story about dinosaurs. I know what happened. "Every dinosaur was caught by a boy."

Child: Yes.

Or No, these two boys didn't catch any dinosaur. (Symmetrical interpretation)

B. The Indefinite NP in Subject Position

The second type of story with the passive construction had the indefinite NP in subject position, and the sentence was presented in a context with an existential wide scope interpretation. The experimental design is shown in (21), and the sample protocol in (22). In the story, there were three boys on a playground. At the beginning of the

story, two boys wanted to ride on a bicycle, but the two bicycles there were too small, so they were thinking about riding on a motorcycle. Although the bicycles were also too small for the third boy, instead of changing his mind, he looked for a big bike and found one. At the end, all the three boys rode on the big bicycle.

(21) Background: A so-and-so was ridden by every boy.
Assertion: a bicycle
Possible Outcome: A motorcycle was ridden by some boy.
Actual Outcome: A bicycle was ridden by every boy.

(22) Characters and Crucial Props
Three boys
Two small bicycles, one big bicycle, and two motorcycles
Protocol

Exp: This story is about some boys on a playground.

Boy1: Look! There are some cool things here. Bikes and motorcycles. They all look very new. I like riding bicycles. Oh no! These are bikes for little kids. I am a big boy now. They are too small for me. Maybe I should try riding a motorcycle.

Boy2: Let me see. The motorcycles look great, but I'm not good at riding motorcycles yet. It's safer to ride a bicycle. Oh, it's too bad these two bikes are so small. It will be too uncomfortable to ride on such a small bike. Maybe I should try a motorcycle.

Boy3: I really like this place. There are so many interesting things we can play. What are there? Motorcycles. Great! And bicycles? Wonderful! I enjoy riding bicycles. Oh, but these two bikes are too small. I remember my friend told me that there are bikes for big kids here. Let me look around. Ah ha! It's here, right behind the trees. Hey, look what I found! A big bicycle! (Pulls the big bike from behind the trees.) Do you guys want to try it?

Boy1: Sure, I want to try it. I'm not going to ride the motorcycles.

Boy2: Of course I want to ride the big bike. I'm not used to riding motorcycles.

Boy3: Ok, we can take turns riding this bicycle. (The three boys take turns riding the big bicycle.)

Kermit: This is an interesting story about three boys on a playground. I know what happened. "A bicycle was ridden by every boy."

Child: Yes.

Or No, not these two bikes. (Symmetrical interpretation)

1.2.3 Results

The results for the active construction are shown in Table III, and for the passive construction in Table IV.

Table III. Active Construction

	English		Chinese	
Context	Adult (N=24)	Child (N=24)	Adult (N=22)	Child (N=27)
Indefinite object (a > every)	Yes (18/23, 78%)	Yes (16/24, 67%)	Yes (22/22, 100%)	Yes (25/27, 93%)
Indefinite subject (a > every)	Yes (24/24, 100%)	Yes (20/24, 83%)	Yes (22/22, 100%)	Yes (24/27, 89%)

Table IV. Passive Construction

	English		Chinese	
Context	Adult (N=24)	Child (N=24)	Adult (N=22)	Child (N=27)
Indefinite object (a > every)	Yes (22/24, 92%)	Yes (14/24, 58%)	Yes (22/22, 100%)	Yes (24/27, 89%)
Indefinite subject (a > every)	Yes (22/24, 92%)	Yes (18/24, 75%)	Yes (22/22, 100%)	Yes (27/27, 100%)

As in the double object and the *to*-dative constructions, there was a contrast between the results from English-speaking and Chinese-speaking children for the active and the passive constructions. Chinese-speaking children interpreted the two test sentences in the active construction in an adult-like fashion, with around 90% acceptance of the existential wide scope reading. However, the position of the indefinite NP seemed to affect the interpretation of English-speaking children. When the indefinite NP was in the object position, the acceptance of the existential wide scope reading was 67% (16/24), but when it was in the subject position, the level of acceptance rose to 83% (20/24).

In the passive construction, for the existential wide scope reading, there was also a discrepancy with respect to the position of the indefinite NP for English-speaking

children, with the acceptance being lower in the object position (58%, for 14/24) than in the subject position (75%, for 18/24). As for Chinese-speaking children, the acceptance was at least around 90%, regardless of the position of the indefinite NP.

As shown in the results from English-speaking children on both the active and the passive constructions, there was a subject/object asymmetry in the sense that when the indefinite NP was in the object position, it was more difficult to obtain the inverse scope order. Although the difference was not significant ($p < 0.25$ for the active, and $p < 0.15$ for the passive), this may suggest that linearity to some extent plays a role in terms of how easy the indefinite NP can be assigned a wide scope. However, the results are not conclusive. In Crain et al. (1996), the results of their experiment 4 showed a reverse pattern-- when the indefinite NP was in the object position, the existential wide scope reading was accepted 92% of the time, but when it was in the subject position, the interpretation was accepted only 69% of the time. Since in the current study, we used only one trial for each type in both the active and the passive constructions, whether the subject/object asymmetry found here is an artifact or a robust result remains an open question for future research.

2 General Discussion

The three major findings of this series of experiments can be summarized as follows:

(i) For the double object construction with the existential quantifier NP as the recipient (or the goal, the indirect object), English-speaking children gave non-adult universal wide scope interpretation most of the time, while Chinese-speaking children had no difficulty assigning the correct existential wide scope reading.

(ii) For the ambiguous *to*-dative construction with the existential QNP as the recipient, English-speaking adults showed a preference for the existential wide scope interpretation, but English-speaking children preferred the universal wide scope interpretation. Chinese-speaking children and adults both consistently preferred the existential wide scope interpretation.

(iii) For the active and the passive constructions, Chinese-speaking children again had no problem assigning the existential wide scope reading to the test sentences, irrespective of the position of the QNPs. As for English-speaking children, the position of the QNPs seems to affect their interpretation. When the existential quantifier was in subject position, it was easier for English-speaking children to have access to the existential wide scope reading than when it was in object position.

With respect to the three hypotheses for scope determination laid out in previous chapter, given the results obtained in the experiments, the prediction from the Isomorphic (or Linearity) Hypothesis was not borne out. Although for the English active and passive constructions, it was easier for children to assign the existential wide scope reading when the existential QNP was in subject position than when it was in object position, in Crain et al. (1996) the reverse pattern was found. Therefore, the subject/object asymmetry found here might not be robust enough to support this hypothesis. Besides, the fact that Chinese-speaking children had equal ease in giving the existential wide scope reading for both subject and object positions casts some doubt on the validity of this hypothesis. As for the double object construction with the existential QNP as the recipient, if the hierarchical relationship is assumed in terms of command (as in Lee 1986), the hypothesis predicts that children will assign the existential wide scope reading (due to the

precedence of the existential QNP), contrary to the results. However, if c-command is assumed for the structure-dependent relationship, different results will be predicted depending on which structural configuration is adopted. We will leave this for later discussion.

For Philip's Event Quantification for Universal Quantification Hypothesis, although many of the results from English-speaking children seem to be consistent with the prediction of this hypothesis, there are still some problems. First, the fact that English-speaking children assigned the existential wide scope reading with relative ease when the existential QNP was in subject position of the active and passive constructions did not support this hypothesis. Second, the results from Chinese-speaking children, i.e. there was no difficulty at all assigning the correct adult-like existential wide scope reading for all the constructions tested, were completely the opposite of the prediction of this hypothesis.

As for the Hypothesis of the Existential Quantifier as Referential, the prediction of this hypothesis holds for Chinese, but not for English, especially as shown in the results of the double object and the *to*-dative constructions in English. However, since in the present study, we mainly examined the assignment of the existential wide scope interpretation, it is not clear that, even in Chinese, the hypothesis will be supported if we also test young Chinese-speaking children's assignment of the universal wide scope interpretation. This will require future research for clarification.

In the following sections, we will consider other possibilities to account for the results from the double object and the *to*-dative constructions obtained here. In section 2.1, we will discuss the structural-dependent consideration of c-command in double

object and *to*-dative constructions and its implications for the results. Here we will focus on the theories proposed by Pesetsky (1995) and C. Phillips (1996). In section 2.2, an alternative account involving dative alternation will be considered.

2.1 Structural-Dependent Considerations of C-Command

2.1.1 Pesetsky's (1995) Dual System

In Pesetsky (1995), a dual system was proposed to account for the problem of contradictory constituency. In his theory, both the *Cascade* structure (corresponding to the right-branching VP-structure) and the *Layered* structure (corresponding to the left-branching structure) coexist in the grammar, and both are relevant throughout the syntactic derivation. In other words, "Layered and Cascade structures are parallel organizations of each step of the derivation" (p. 234). The argument for this dual system comes from the fact that some constituency tests provide evidence for the right-branching structure, while other tests support the left-branching one. As shown in the following examples (23-25), the tests of binding, negative polarity item licensing and coordination all point to an extremely right-branching structure, as shown in (26).

(23) Binding (from Pesetsky 1995, p. 172)
- a. Sue spoke to these people$_i$ about each other$_i$'s friends in Bill's house.
- b. John spoke to Mary about these people$_i$ in each other$_i$'s houses on Tuesday.
- c. Sue gave books to these people$_i$ on each other$_i$'s birthdays.

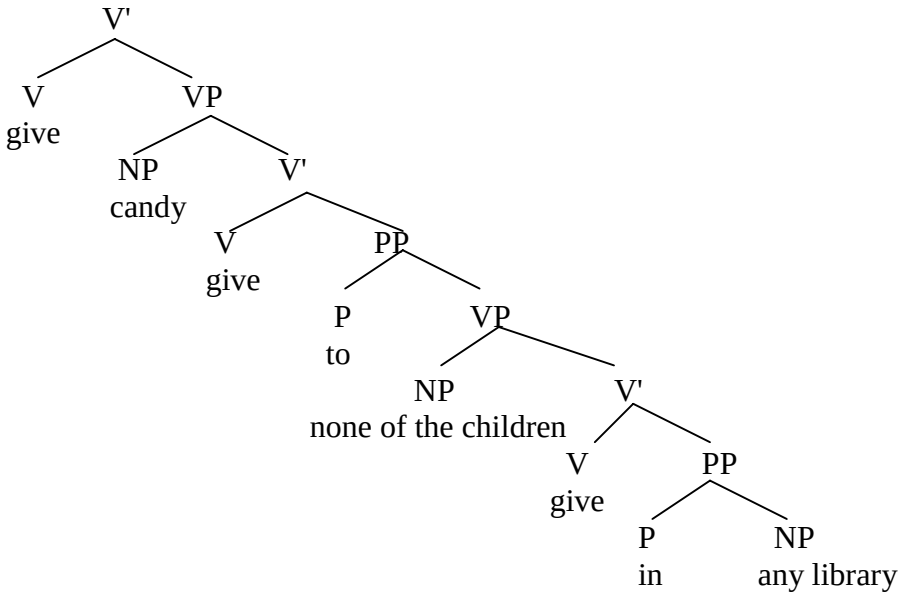
(24) Coordination (from Phillips 1996, p. 25)
- a. John gives [candy to children on weekends] and [money to homeless people on weekdays].
- b. John gives money [to children on weekends] and [to homeless people on weekdays].

c. John gives candy to [children on weekends] and [homeless people on weekdays].

(25) Negative Polarity Item Licensing (from Phillips 1996, p. 25)

a. John gave ***nothing*** to ***any*** of my children in the library on his birthday.
b. John gave candy to ***none*** of my children in ***any*** library on his birthday.
c. John gave candy to children in ***no*** library on ***any*** public holiday.
d. * John gave ***anything*** to ***none*** of my children in the library on his birthday.
e. * John gave candy to ***any*** of my children in ***no*** library on his birthday.

(26)



The above examples motivate the structure in (26) because in standard syntactic theories, it is assumed that binding and negative polarity item licensing require c-command, and that coordinator is an indicator of constituenthood.

In contrast with the above evidence for a right-branching structure, certain kinds of movement tests and ellipsis provide evidence for a left-branching structure for the same VP, as demonstrated in the following examples and tree structure.

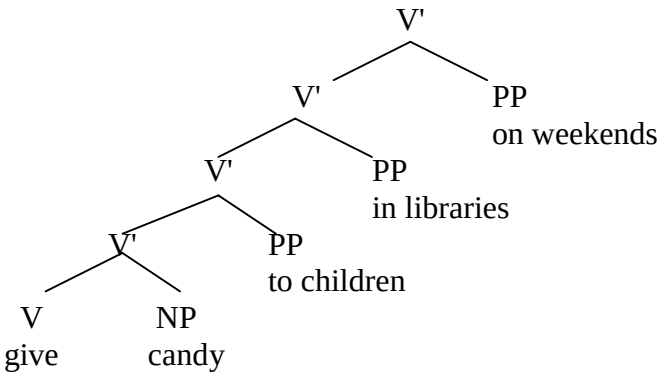
(27) Movement (from Phillips 1996, p. 26)

a. John intended to give candy to children in libraries on weekends,
… and [give candy to children in libraries on weekends] he did ___.

b. John intended to give candy to children in libraries,
… and [give candy to children in libraries] he did ___ on weekends.
c. John intended to give candy to children,
… and [give candy to children] he did ___ in libraries on weekends.
d. … and [give candy] he did ___ to children in libraries on weekends.[28]
e. *… and [to children in libraries] he did ___ give candy on weekends.
f. *… and [in libraries on weekends] he did ___ give candy to children.

(28) Ellipsis (from Pesetsky 1995, p. 247)
a. John [gave the book to them in the garden on Tuesday], and Mary did too.
b. John [gave the book to them in the garden] on Tuesday, and Mary did on Wednesday.
c. John [gave the book to them] in the garden on Tuesday, and Mary did in the concert hall on Wednesday.
d. *John [gave the book] to his friends in the garden on Tuesday, and Mary did to her colleagues in the concert hall on Wednesday.
e. *John [gave] the book to his friends in the garden on Tuesday, and Mary did the pamphlet to her colleagues in the concert hall on Wednesday.

(29)



It was argued by Pesetsky that both left- and right-branching structures can exist in a single sentence. Take the following sentences as examples (from Pesetsky 1995, p. 230). In both sentences, sequences of phrases starting at the left edge of the VP have been fronted, implying the Layered structure in (29), but the fronted portion of the VP contains

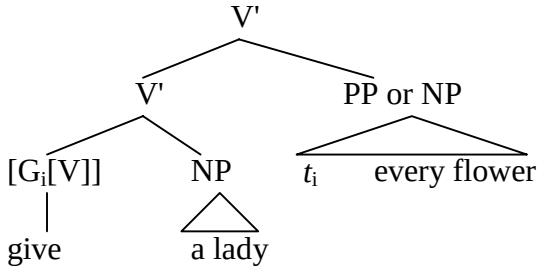
[28] There is a little difference regarding the Layered structure presented in Pesetsky (1995) and in Phillips (1996). For Pesetsky, the phrase "*give candy to children*" will have a ternary branching containing a V, a DP, and a PP, while for Phillips, the PP "*to children*" is adjoined to the V' "*give candy*", as shown in (29). Here we adopt Phillip's strictly binary structure for discussion.

an NP which binds a reciprocal in the stranded part of the VP, implying the Cascade structure in (26).

(30) a. … and [give the books to **them** in the garden] he did ___ on **each other's** birthdays.
b. … and [give the books to **them**] he did ___ in the garden on **each other's** birthdays.

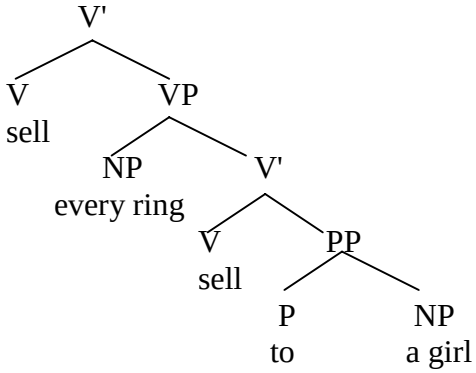
With respect to the implication of Pesetsky's Dual System theory on the present study, recall that our results on double object and *to*-dative constructions showed that English-speaking children tend to have the non-adult universal wide scope reading for double object sentences and also for the ambiguous *to*-dative sentences. Given the proposal of the Dual System theory, namely each sentence has two parallel structures, it may be possible that those English-speaking children who gave the non-adult pattern of responses had only one structure in their grammar at that point for interpreting the sentences. To illustrate this, consider the double object sentence in (31a) and the *to*-dative sentence in (32a). The diagrams in (31b) and (32b) show the possible structures used by those English-speaking children to interpret the sentences.

(31) a. Snow White gave a lady every flower.
b.



(32) a. The troll sold every ring to a girl.

b.



Although it is not clear whether in Pesetsky's theory, the double object construction also has two parallel structures like the *to*-dative construction[29], if it does, its corresponding Layered structure would be like the one in (31b). An analysis proposed in Pesetsky (1995) for the double object construction is that there is a zero morpheme (*G*) introducing the direct object (with the Theme role). The zero morpheme is an affix which, in the process of derivation, must move to the head V position and leave a trace in its original position. As shown in (31b), the non-adult interpretation given by English-speaking children for the double object construction can be accounted for by assuming that at this stage of development, children may use the Layered structure to interpret the sentences, resulting in the wrong answers. As for the *to*-dative construction, as shown in (32b), the results can be explained by stating that children use the Cascade structure for interpretation.

[29] Most of the examples of movement tests used to argue for the Layered structure are *to*-dative sentences. Given the ungrammaticality of (i), it seems that double object sentences are not eligible for this kind of movement.

(i) *… and [give the children] he did candy in libraries on weekends.

However, the backward binding examples in (ii) and (iii) suggest that there are also two structures for the double object construction (from Pesetsky 1995, p. 221).

(ii) Sue showed John and Mary each other's friends.

(iii) Sue showed each other's friends John and Mary.

Although the above illustration can account for the non-adult universal wide scope reading given by English-speaking children for the double object construction, there remain some problems. First, without any evidence for the unavailability of the alternative structure, it is not clear why children arbitrarily choose the Layered structure for the double object construction and the Cascade structure for the *to*-dative construction. Second, since Chinese-speaking children correctly assigned the existential wide scope reading for the double object and the *to*-dative constructions, if this account is on the right track, we will have to say that Chinese-speaking children used the Cascade structure for the double object and the Layered structure for the *to*-dative, which is the reverse of the English pattern. Due to these problems, mainly the arbitrariness of selecting one structure or another for each construction, the account relying on the Dual System cannot be what is really going on in children's language or cognitive development. In the next section we will turn to another structural possibility.

2.1.2 C. Phillips' (1996) Strictly Right-Branching Structure

In an attempt to resolve the problem of constituency contradiction without having parallel structures, C. Phillips (1996) proposed a strictly left-to-right right-branching syntactic structure. Based on the theory outlined in Chomsky (1995), Phillips (1996) assumed that syntactic structures are constructed incrementally from left to right, as required by the condition *Merge Right*, and that structure building is subject to the economy condition *Branch Right*.

(33) Merge Right
New items must be introduced at the right edge of a structure.

(34) Branch Right

Metric: select the attachment that uses the shortest path(s) from the last item in the input to the current input item.

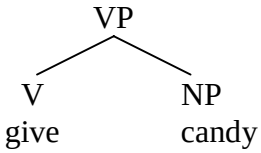
Reference set: all attachments of a new item that are compatible with a given interpretation.

In this theory, the strings that form constituents at intermediate stages in the derivation are different from the constituents of more orthodox bottom-to-top derivations. The constituency conflict is just the consequence of how the structure changes over the course of a left-to-right derivation of a single right-branching phrase marker. An example illustrating this is shown below (from Phillips 1996, p. 31).

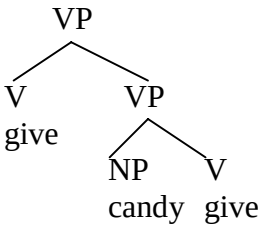
(35) a.

V(P)
give

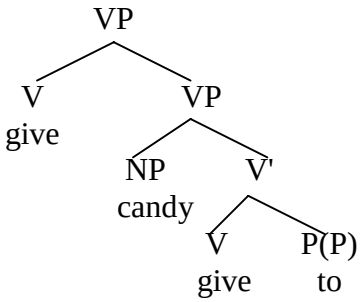
b.



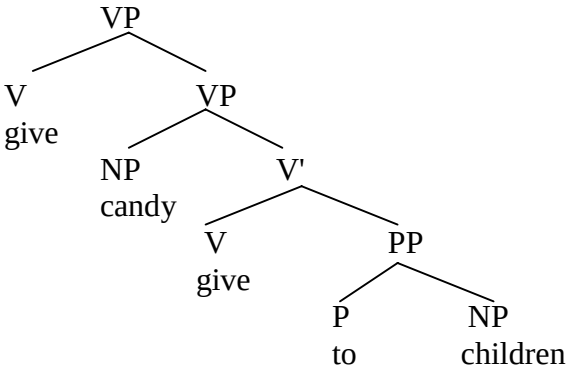
c.



d.



e.



In this theory, all the strings that are constituents in the Layered structure (e.g. *give candy*, *give candy to children*, etc.) are also constituents at some point (e.g. 35b and 35e) in the construction of the right-branching structure, although these strings are not always constituents in the final structure. The rightmost node is split when a new item is added into the structure (as in 35c), and thus a preceding constituent will also asymmetrically c-command a subsequent constituent. By doing so, only one right-branching, strictly binary structure is needed for sentences.

Given this theory, one may postulate that the reason why English-speaking children gave a non-adult universal wide scope interpretation for double object sentences was because in the derivation of syntactic structures, the rightmost node is not split when a new item is added, and thus a preceding constituent fails to asymmetrically c-command a following constituent. For this reason, a subsequent constituent (i.e.. the Theme QNP in the double object construction) and a preceding constituent (i.e. the Goal QNP) may c-command each other, and provide a chance for the former to have scope over the latter. If this possibility is true, we will expect to see that children should allow either QNP to have scope over the other QNP in double object and *to*-dative constructions, as they c-command each other in a non-split structure. The prediction will be either that children will allow both interpretations (i.e. treat the sentences as ambiguous), or that the acceptance of one reading should be about the same as the acceptance of the other reading (i.e. at chance level). However, the results of this study show that among the 24 English-speaking children, only 3 of them consistently accepted both readings for both double object and *to*-dative constructions. Ten children consistently accepted the universal wide scope reading and rejected the existential wide scope reading for both

constructions, and 5 consistently accepted the existential wide scope reading and rejected the universal wide scope reading. For Chinese, among the 27 children, only 2 of them consistently accepted both readings, and 12 of them consistently accepted the existential wide scope reading and rejected the universal wide scope reading. The results demonstrate that neither English-speaking nor Chinese-speaking children consistently treated the sentences as ambiguous, contrary to what is predicted. What is shown here is that the majority of English-speaking children consistently accepted only the universal wide scope reading (75% of the time, collapsing both constructions), and the majority of Chinese-speaking children consistently accepted only the existential wide scope reading (90% of the time) for both double object and *to*-dative constructions.

2.2 The Alternative Account: Overgeneralization of Dative Alternation

Another alternative account of the results for English double object and *to*-dative constructions is that English-speaking children may have difficulty processing two consecutive QNPs in the double object construction, and thus interpret these sentences through the corresponding *to*-dative construction. It was indicated in Pinker (1984, p. 398, note 5) that "Comprehension studies on older children show a much clearer asymmetry: double-object datives are far harder to comprehend than *to*- or *for*-datives".

A possible consequence of the difficulty in comprehending double object sentences involving two QNP's is that children may sometimes swap the two quantifiers, and a sentence such as "Snow White gave ***a*** lady ***every*** flower" will become "Snow White gave ***every*** lady ***a*** flower", and thus the non-adult interpretation. If this possibility is correct, we will expect the acceptance of the non-adult universal wide scope reading for the above

sentence to be at chance level, but in fact 72% of the time English-speaking children accepted this reading. The acceptance of this non-adult reading is significantly higher than chance level ($\chi^2 = 8.7$, $p < 0.01$). In addition, another problem with the swapping of quantifiers is that it fails to explain the consistency of the response patterns children gave to the double object and the *to*-dative constructions. For English-speaking children, 18 out of 24 consistently gave the same response patterns for both double object and *to*-dative constructions, and for Chinese-speaking children, 14 out of 27 gave consistent response patterns for the two constructions. It is not only the non-adult interpretation that English-speaking children assigned to the double object sentences, but also the consistent patterns they gave to both double object and *to*-dative constructions that we will need to account for.

In the acquisition literature, it has been documented that children acquiring English make overgeneralization errors of dative alternation (e.g. Bowerman 1988; Mazurkewich and White 1984; White 1987), contrary to the learnability paradox discussed in Baker (1979). Examples of such overgeneralization errors are as follows (from Bowerman 1988).

(36) a. I *said her* no. (Cf. I said no to her.)
b. Shall I *whisper you* something? (Cf. Shall I whisper something to you?)
c. *Button me* the rest. (Cf. Button the rest for me.)

In these examples, the utterances made by children do not exist in the adult grammar, hence it is not likely that children learn them from positive evidence. The only way children can come up with these sentences is through the correspondence of the *to*- or

for-dative and the double object constructions for some verbs, which occurs in the adult input, as illustrated in the following examples.

(37) a. I told her a story. (Cf. I told a story to her.)
b. Mary baked Jane a cake. (Cf. Mary baked a cake for Jane.)

In addition to the evidence of overgeneralization found in children's speech production, White (1987), using an act-out task and an imitation task for English-speaking children at the age of 3;8 to 5;8, found that there was no significant difference in terms of various error types for alternating and nonalternating verbs. Using a grammaticality judgement task for older children from 9 to 15 years old, Mazurkewich and White (1984) found that a number of ungrammatical sentences containing [NP NP] complements after Latinate verbs were accepted by the subjects, suggesting an overgeneralization made by these children. Another interesting finding from Mazurkewich and White (1984) in their imitation task was that in general children preferred the [NP PP] construction to the [NP NP] one, as demonstrated by their errors which converted the [NP NP] form to the [NP PP] structure, as in (38b) for (38a).

(38) a. The teddy is drawing the doll a house.
b. The teddy is drawing a house for the doll.

These studies all suggest that children are not conservative when acquiring a language, and that they overapply the dative alternation correspondence to generate double object forms which do not exist in adult grammar. Since the *to*-dative construction (i.e. the [NP PP] structure) is easier to process and hence preferred, it is likely that in the present study, children interpreted the double object sentences (i.e. the [NP NP] structure)

through the *to*-dative sentences (i.e. the [NP PP] structure), as the children did in the study of Mazurkewich and White (1984)[30]. The correspondence of the two sentence types is illustrated by the examples below.

(39) a. Snow White gave a lady every flower.
b. Snow White gave every flower to a lady.

In both English and Chinese, the *to*-dative sentences are ambiguous, allowing both the universal wide scope and the existential wide scope interpretations. For adults, the existential wide scope reading (i.e. the referential reading) is preferred in both languages. The preference may be due to discourse focus. Consider the following sentences.

(40) John gave every book to a girl, not a boy.

(41) a. Speaker A: John gave every book to a girl yesterday.
Speaker B: Oh yes, I know who it was.

b. Speaker A: John gave every book to a girl yesterday.
Speaker B: ??Oh yes, I know who they were.

For the sentence in (40), when a contrast is added to the end of the sentence, according to the English native speakers consulted who did not know the purpose of this study, the 'every > a' reading is highly dispreferred. It tends to mean a specific girl versus a boy. In

[30] Another relevant study which shows that children gave non-adult interpretations which did not conform to the order of the input strings is Crain et al. (1994). In that study, 35 of the 38 three- to six-year-old English-speaking children consistently interpreted *only* in a sentence like "Only the cat is holding a flag" as if it meant "The cat is only holding a flag."

(41), it is further demonstrated by the oddity of the conversation in (b) when the indefinite NP in the *to*-dative sentence does not refer to a specific person[31].

It has been shown that young children can not use pragmatic information (such as focus) reliably (e.g. Cutler and Swinney 1987, Halbert et al. 1995), and this may be the reason why for the *to*-dative sentences, English-speaking children predominantly gave the universal wide scope reading, but rejected the adult-preferred existential wide scope interpretation. As a result, the assignment of the universal wide scope reading for *to*-dative sentences is reflected in English-speaking children's interpretation of double object sentences.

Although the above account can explain why English-speaking children wrongly assigned the universal wide scope reading to the double object sentences, we may still ask why this did not happen to Chinese-speaking children. There are two possibilities. The first possibility is that perhaps morphologically there are more cues provided in Chinese double object construction which may help children interpret the sentences. Unlike English, which uses the same verb form for both double object and *to*-dative constructions, in Chinese double object sentences, the Goal marker *gei* 'to' can be incorporated into the verb (i.e. the shift construction), as shown in the following examples[32].

[31] As pointed out to me by Paul Pietroski, in (41b), if what the speaker B says is "Oh yes, I know those girls who got the books", the dialogue will sound fine. I have no explanation why the change makes different judgements at this point, and will leave this for future research.

[32] Although the appearance of the Goal marker following the verb is sometimes optional, in our test sentences for the verb *mai* "sell", we always used the incorporation form *mai-gei*. As for the verb *gei* "give", there is never an incorporation form **gei-gei*, thus it is more like its English corresponding double object verb. However, there was no difference in terms of error rate for the different verbs used.

(42) a. *To*-Dative

Zhangsan	mai-le	san-ben	shu	gei	Lisi
Zhangsan	sell-ASP	three-CL	book	to	Lisi

"Zhangsan sold three books to Lisi."

b. Double Object / Shift

Zhangsan	mai-gei	Lisi	san-ben	shu
Zhangsan	sell-to	Lisi	three-CL	book

"Zhangsan sold Lisi three books."

It may be likely that the incorporated Goal marker gives Chinese-speaking children enough information to correctly interpret the sentences without converting them to the *to*-dative construction. However, the comparison of the errors made by Chinese-speaking children on the incorporated form *mai-gei* 'sell-to' and the non-incorporated form *gei* 'give' in the double object construction showed no difference. Ten errors were made on the verb *gei*, and nine errors on the verb *mai-gei*. The results here do not show any significant advantage for the incorporated verb form.

Another possibility is that the indefinite *a* is not analyzed by English-speaking children in the same way as *yi-ge* is by Chinese-speaking children. When English-speaking children rejected the existential wide scope interpretation for a *to*-dative sentence like "The troll sold every cookie jar to ***a*** man", some children further explained that it would be correct if the puppet said "The troll sold every cookie jar to ***one*** man." It is likely that due to the mechanism of the Unique Entry Principle[33] discussed in Pinker (1984), English-speaking children distinguish ***a*** from ***one***, with the latter preserved for contexts requiring a specific entity. As for Chinese, although *yi-ge* can be translated to either English 'a' or 'one', it may correspond more closely to 'one' than to 'a', as it is the cardinal number for 'one'. This may explain why in Chinese, children tend to interpret

sentences with *yige* to be referential (e.g. the studies done by Lee 1986 and Chien 1994 as reviewed in Chapter 2). Lee's (1986) study also showed the discrepancy between English-speaking and Chinese-speaking children in interpreting sentences like "*Every bear is eating a cake*" and "*Put all the kittens in a box*." For the former sentence, the universal wide scope reading was assigned by English-speaking children older than five more than 60% of the time, but by Chinese-speaking children as old as seven only 40% of the time. For the latter sentence, the existential wide scope reading was preferred by English- and Chinese-speaking adults as well as Chinese-speaking children, but the universal wide scope reading was preferred by English-speaking children.

Another piece of evidence with respect to the scope taking properties of numeral phrases in Chinese comes from Kuno et al. (1999). In Kuno et al. (1999), based on the contrast in the following Chinese sentences (from Kuno et al. 1999, p. 100), it was argued that a numeral phrase in Chinese (e.g. *liang-ge nuren* 'two women') tends to have wider scope than a nonnumeral phrase (e.g. *henduo daoyan* 'many directors').

(43) Lisi jieshao liang-ge nuren gei henduo daoyan (unambiguous)
introduce two-CL woman to many director
"Lisi introduced two women to many directors."
'two > many': 'There were two women each of whom Lisi introduced to many directors.'

(44) Lisi jieshao henduo nuren gei liang-ge daoyan (ambiguous)
introduce many woman to two-CL director
"Lisi introduced many women to two directors."
(a) 'many > two': 'There were many women each of whom Lisi introduced to two directors.'
(b) 'two > many': 'There were two directors each of whom Lisi introduced many women to."

[33] The Unique Entry Principle refers to a constraint that "no complete set of grammatical feature values

The wide scope-taking property of Chinese numeral phrases may be the reason why the numeral phrase *yi-ge* tends to be referential for Chinese-speaking children

2.3 Conclusion

In this section, we considered several possibilities to account for the results found in the present study, especially the non-adult interpretation of double object sentences found from English-speaking children, in contrast to the adult-like performance found from Chinese-speaking children. In 2.1 we have shown that the structure-dependent considerations of c-command, either in terms of Pesetsky"s (1995) Dual System or C. Phillips' (1996) strictly right-branching structure, cannot satisfactorily account for the results without calling for some stipulations for each language. In 2.2, based on the consistency of the response pattern found in the double object and the *to*-dative constructions, an alternative account was proposed, which considers the non-adult interpretation from English-speaking children as an overgeneralization of dative alternation on quantifier scope. As for the reason why Chinese-speaking children did not make the same errors, it was argued that the lexical idiosyncrasy of the indefinite *a* in English and *yi-ge* in Chinese may play a role here.

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may be encoded by two or more distinct morphemes" (Pinker 1984, p. 177).

CHAPTER IV

EXPERIMENTS ON THE STRUCTURAL FACTORS

1 Introduction

The two purposes of this part of experiments are first to investigate whether or not English-speaking children have the correct hierarchical structure for the double object construction, and second to test whether they analyze the double object sentences as the corresponding *to*-dative sentences. As shown in the results of the experiments on scope assignment in double object and *to*-dative constructions, English-speaking children have a non-adult interpretation which assigns wide scope to the universal quantifier for unambiguous double object sentences like (1).

(1) Snow White gave a lady every flower. (a > every; *every > a)

One possibility this non-adult reading exists in English-speaking children's mental grammar is that at this early stage of development children do not have the correct hierarchical structure for the two object NPs, and hence wrongly assign the scope for the quantifiers. This hypothesis can be formulated as follows.

(2) Structural Factor Hypothesis
Children's non-adult interpretation on quantifier scope assignment results from a nonadultlike hierarchical structure for the two object NPs in the double object construction.

Previous studies on the acquisition of the double object construction have found that preschool children have more difficulty comprehending and imitating double object sentences than *to*-dative sentences (e.g. Mazurkewich and White 1984; White 1987). On

the other hand, Snyder and Stromswold's (1997) study on transcript analyses showed that double object sentences were acquired before *to*-dative sentences. A problem arises as to why there exists a modality difference between production and comprehension. It may be that young children have not acquired the correct structure for the double object construction when they string the two objects together in production, and that they analyze the double object sentences via the corresponding *to*-dative sentences in comprehension.

As discussed in the previous chapter, there are proposals for the hierarchical structure of the two object NPs in the double object construction advocating a strictly right-branching structure (e.g. Phillips 1996) and the co-existence of both a right-branching and a left-branching structures (e.g. Pesetsky 1995). A plausible conjecture for English-speaking children's non-adult scope assignment will be that they adopt the left-branching structure which has the second object NP (the theme) c-commanding the first object NP (the recipient). A left-branching structure for a double object sentence like (1) will result in the universal quantifier in the theme NP taking scope over the existential qunatifer in the recipient NP. However, such a structural account for the results found in the double object construction will face the problem of a discrepancy between English and Chinese. Recall that Chinese-speaking children assigned the adult interpretation but English-speaking children did not. A structural account will have to stipulate that Chinese-speaking children have a right-branching VP structure to get the adult existential wide scope reading, but English-speaking children have a left-branching VP so that they assign wide scope for the universal quantifier. Without any further supporting evidence, it is not clear why this should be so. Therefore, in the experiments here, we will try to

find out whether English-speaking children have the adultlike hierarchical structure for the double object construction or not.

The sentences we used for the double object construction contain a possessive pronoun in either the first object noun phrase or the second object noun phrase, as shown in (3)[34].

(3) a. The man brought the smurf$_i$ his$_i$ bike.
b. *The smurf brought his$_i$ brother Mickey Mouse$_i$.
c. The Mermaid brought every girl$_i$ her$_i$ brush.
d. *The smurf brought his$_i$ girlfriend every Mickey$_i$.

When the possessive pronoun follows the other object noun phrase (as in (3a) and (3c)), co-reference is allowed. However, if the pronoun precedes the other object noun phrase (as in (3b) and (3d)), co-reference is prohibited. The contrast is comparable with the active sentences in (4).

(4) a. Tigger$_i$ hugged his$_i$ brother.
b. ?His$_i$ mother washed the smurf$_i$[35].
c. Every troll$_i$ rode his$_i$ horse.
d. *His$_i$ dog licked every dwarf$_i$.

The asymmetry of co-reference between the pronoun and the other object noun phrase in (3) is presumably due to the fact that the first object noun phrase c-commands the second

[34] In the experiment, we used sentences like (3a) and (3b), instead of the quantifier binding sentences (3c) and (3d), for testing. The consideration was that in our pilot study, since stories for quantifier binding sentences involved more characters and, therefore, took longer to act out, children tended to be confused. Thanks to Amy Weinberg for suggesting using the contrast between (3a) and (3b) for testing.

[35] Although co-reference between *his* and *the smurf* in a sentence like (4b) is considered acceptable because they do not c-command each other (e.g. Higginbotham 1983, p. 399; Huang 1995, p. 138), in Koopman and Sportiche (1982) it is considered unacceptable when the focal stress is on the object NP. However, the adults who participated in our experiment rejected the co-reference 97% of the time. There may be some dialectal differences, as indicated in note 25 in Koopman and Sportiche (1982).

noun phrase in the structural tree[36]. If the structure used by the English-speaking children is such that the second object NP c-commands the first object NP, or if they do not c-command each other at all, co-reference between the pronoun and the second object noun phrase should be possible in (3b) and (3d). That is, if English-speaking children do not have the adult hierarchical structure with respect to the two object NPs for the double object construction, they will have difficulty getting the adult interpretations for the contrasting sentences in (3).

Another aspect that can also be tested using the above sentences is whether the non-adult interpretation results from English-speaking children's analyzing the double object sentences as the corresponding *to*-dative sentences. If children analyze the sentences this way, they will have interpretations that are the inverse of the adult readings[37], as shown below.

(5) a. ?The man brought his$_i$ bike to the smurf$_i$.
b. The smurf brought Mickey Mouse$_i$ to his$_i$ brother.
c. *The Mermaid brought her$_i$ brush to every girl$_i$.
d. The smurf brought every Mickey$_i$ to his$_i$ girlfriend.

[36] A comprehensive account on all the co-reference possibilities for a pronoun is beyond the scope of this study (for more discussion on this topic, see e.g. Koopman and Sportiche 1982; Higginbotham 1983). However, it seems plausible to say that the pronoun's being in a NP which c-commands the other object NP makes co-reference of the two unacceptable, as in (3b) and (4b). The following examples from Koopman and Sportiche (1982) further support the reasoning, as the quantified noun is in a NP c-commanding the pronoun.

(i) *Whose$_i$ mother likes him$_i$
(ii) *Everyone$_i$'s mother likes him$_i$
(iii) *A picture of every child$_i$ pleased him$_i$

[37] Some English-speaking adults I consulted found the co-reference in (5a) not as bad as the unacceptability in (3b). In this situation, the prediction will be that if children convert the double object sentences into *to*-dative sentences, they will allow co-reference in both (5a) and (5b), and hence the contrast between the double object (3a) and (3b) will be lost.

The sentences in (5) show the interpretations children will have if they analyze the double object sentences as the corresponding *to*-dative construction. Since the order of the two object noun phrases are reversed, and thus are at different hierarchical positions, the allowed readings are the opposite of the adult readings.

In section 2, we will take a look at previous studies relevant to the consideration of the hierarchical structure in language development. In section 3, we present the details of experimental design and the results obtained.

2 Previous Studies on Structural Constraint

All the studies we consider here investigated Principle C of the Binding Theory (Chomsky 1981; 1986), which is a structural constraint prohibiting coreference[38]. Principle C can be defined as follows.

(6) Principle C
A NP (or a referring expression) cannot be co-referential with a pronoun P that c-commands it.

Principle C is employed to explain why co-reference between the pronoun and the NP is allowed in (7b) and (7d), but prohibited in (7a) and (7c)[39]. The principle does not rule out co-reference in (7b) and (7d) because in (7b) the NP c-commands the pronoun, while in (7d) they do not c-command each other. The principle has an effect on (7a) and (7c) in consequence of the pronoun's c-commanding the NP. Note that the prohibition cannot be

[38] There are more studies on Principle C than the four we include here. However, due to the problems with the tasks used, the results from those studies showed more of the subjects' preference than competence. For a discussion on this, see Crain and Thornton (1998) chapter 26.

[39] In all the three sentences, a deictic reading which co-refers the pronoun with someone not mentioned in the sentence is always allowed.

attributed to the linear order of the pronoun and the NP, as the pronoun precedes the NP in (7a), (7c) and (7d).

(7) a. *He$_i$ thinks the Troll$_i$ is the best jumper.
b. The Troll$_i$ thinks he$_i$ is the best jumper.
c. *He$_i$ was reading the paper, while the Troll$_i$ was eating a bagel.
d. While he$_i$ was reading the paper, the Troll$_i$ ate a bagel.

Since Principle C is a negative statement that excludes one of the possible meanings for the relevant sentences due to the structural constraint, it is plausible to consider it as a part of innately specified linguistics knowledge. Therefore, it should be expected to appear early in the course of language development.

Using the truth value judgement task, Crain and McKee (1985) investigated the acquisition of Principle C by young English-speaking children (mean age 4;2) using the sentences in (7). The results showd that for ambiguous sentences like (7d), children accepted the backward anaphora reading (i.e. the co-reference reading) 73% of the time, and the deictic reading 81% of the time. For unambiguous sentences like (7a) and (7c) where Principle C is effective, children rejected the co-reference reading 84% of the time for (7a) and 88% of the time for (7c). The findings suggest that the structural constraint prohibiting co-reference appear at an early age and thus ought to be innately specified.

Kazanina and Phillips (2000) used the corresponding Russian sentences in (7) to test Russian-speaking children's knowledge of Principle C. With respect to adult interpretations, Russian differs from English in that co-reference between the pronoun and the NP for a sentence like (7d) is unacceptable in Russian, but acceptable in English. It was argued that co-reference for (7d) in Russian is ruled out by a non-syntactic constraint which is effective when the first subject (i.e. the pronoun) is an agent. The

results from Russian-speaking children were very similar to the findings from English-speaking children in Crain and McKee (1985). For control sentences like (7b) where co-reference is possible, children accepted the co-reference reading around 85% of the time. For the Russian sentences that correspond to (7a), children rejected the co-reference reading 83% of the time. For (7d), although adults do not allow the co-reference reading, Russian-speaking children rejected the co-reference reading only 42% of the time. There was a correlation between the percentage of rejection and children's age for (7d), ranging from 10% for the 3-year-olds, to around 50% for the 3-5 year-old kids, and 80% for the 5-year-olds. It was concluded that syntactic constraints like Principle C appear at an early age, while non-syntactic constraints are acquired later.

Thornton (1990) tested children's knowledge of Principle C in strong crossover questions such as those in (8).

(8) a. *I know who$_i$ he$_i$ scratched t$_i$.
b. *I know who$_i$ he$_i$ said t$_i$ has the best smile.

For both sentences in (8), the pronoun and the wh-phrase '*who*' cannot co-refer, i.e. the bound variable interpretation is not allowed. The prohibition can be explained by assuming the trace theory of movement and Principle C. Since the trace left by the wh-phrase after movement is c-commanded by the pronoun, co-reference is ruled out according to Principle C, with one further assumption that the trace of wh-movement is an r-expression. The results from this study showed that English-speaking children (mean age 4;2) rejected the bound variable reading 97% of the time for the one-clause crossover question in (8a), and 92% of the time for the two-clause crossover question in (8b). Children's knowledge of the structural constraint on strong crossover was validated

by their 100% acceptance rate of the deictic reading for the crossover control, and 95% rejection rate for the non-movement control sentences. In comparison with the crossover questions, it was also tested whether children allow the bound variable interpretation for sentences like (9).

(9) I know who$_i$ t$_i$ said he$_i$ has the best food.

In (9), since the trace left by the wh-phrase is in a position c-commanding the pronoun, Principle C does not apply, and hence the bound variable reading is possible. For these sentences, children accepted the bound variable interpretation 87% of the time. The findings from this study also demonstrate the early emergence of the structural constraint on the interpretation of sentences for children.

Guasti and Chierchia (2000) tested Italian-speaking children's knowledge of Principle C in standard sentences as in (7) and cases of "reconstruction" as in (10).

(10) a. *Nel barile di ciascun pirata$_i$ con cura ha$_i$ messo una pistola
In the barrel of each pirate$_i$ with care (he$_i$) put a toy gun

b. Le scimmie hanno nascosto il tesoro di ciascun bambino$_i$, mentre
The monkeys have hidden the treasure of each child$_i$, while
dormiva
(he$_i$) was sleeping

c. Il tesoro di ciascun bambino$_i$, le scimmie lo hanno nascosto, mentre
The treasire of each child$_i$, the monkeys it have hidden, while
dormiva
(he$_i$) was sleeping

In (10a), the pronoun cannot be anaphorically dependent (i.e. bound by) '*each pirate*', but in (10b) and (10c) both the bound variable reading and the deictic reading are allowed. The reconstruction effects occur when a phrase is displaced from its canonical

base position but still retains certain properties associated with the base position, rather than with its surface position. In (10a), the quantifier NP '*each pirate*' is contained in a PP which is preposed from its base position within the VP headed by the verb '*put*'. Since the subject pronoun c-commands the PP in its base position, Principle C prohibits the pronoun's being bound by the quantifier NP. In (10c), although the quantifier NP is contained in an object NP which is fronted, since the null subject pronoun of the *while*-clause does not c-command the quantifier NP in its base position, Principle C does not apply.

Three experiments were conducted in this study. In Experiment 1, an elicited imitation task was used to assess whether children could distinguish sentences that allow the co-reference reading (as in (7d)) from sentences that preclude the reading (as in (7c)) in backward anaphora contexts. The results showed that the twelve Italian-speaking children (mean age 4;7) tested changed the ungrammatical sentences 84% of the time, and the grammatical sentences 54% of the time. The difference was statistically significant. In Experiment 2, the truth-value judgement task was used to test whether children allow the backward anaphora reading of pronouns for sentences similar to (7c) and (7d) in Italian. The results of this experiment showed that Italian-speaking children rejected the anaphoric reading for sentences like (7c) 89% of the time, and accepted the anaphoric reading as well as the deictic reading for sentences like (7d) 92% of the time. Experiment 3 tested whether children who responded to Principle C in standard cases are also sensitive to it in reconstruction contexts like (10). Children rejected sentences like (10a), where the bound variable reading is prohibited, 90% of the time. For ambiguous sentences like (10b) and (10c), they accepted the bound variable reading 86% of the time

and the deictic reading 89% of the time. It was concluded that Principle C is part of the initial state of language development, and that there is no rule of reconstruction that needs to be separately learned by children.

To summarize, these previous studies demonstrate the early emergence of children's knowledge of the relevant structural (or syntactic) constraints in several different languages and different constructions. Since constraints are negative statements, and negative evidence is not available in the linguistic input for children to learn constraints, by logic the structural constraints must be innately specified.

3 Experiments

The Truth-Value Judgement task was used in the following experiments. Seventeen English-speaking preschool children, with ages ranging from 4;4 to 6;6 (with a mean of 5;6), and 21 adults participated in the Set I experiment. For the Set II experiment, we tested 19 children, with ages ranging from 4;3 to 6;7 (with a mean 5;6), and 23 adults. Among the 19 children from Set II, 13 of them also participated in the Set I experiment. All the preschool children were from the daycare center of the University of Maryland, College Park, and all the adults were undergraduate students of the same university.

Five sentence types were used in the experiemnts. We divided the test sentences into two sets. Set I included the double object sentences "*The Mermaid brought the smurf his bike*" and the active quantifier binding sentences "*Her brother carried every troll girl*". Set II contained the double object sentences "*The smurf brought his brother Mickey Mouse*", the active sentences "*Her dog licked the lady smurf*", and the active

quantifier binding sentences "*Every dwarf lifted their suitcase*"[40]. The sample stories for each sentence type are presented in the following sections.

3.1 Sample Stories

3.1.1 The Double Object Sentences

For the double object sentences, the possessive pronoun is either in the theme noun phrase (as in A), or in the recipient noun phrase (as in B). The sentences were presented after a story in which the possessive pronoun co-refers with the other object noun phrase as the last event. The condition of plausible dissent was satisfied by providing the possible outcome of coreference with another character used earlier in the story.

A. Possessive Pronoun in the Theme Noun Phrase

Three sentences[41] similar to "*The Mermaid brought the smurf his bike*" were used to see if children allow co-reference between the possessive pronoun in the theme noun phrase and the preceding recipient noun phrase. The experimental design is as follows.

(11) Test Sentence: The Mermaid brought the smurf his bike.
Possible outcome: The Mermaid brought the smurf Donald Duck's bike. (deictic reading)
Actual outcome: The Mermaid brought the smurf the smurf's bike. (co-referential reading)

At the beginning of the story two characters (e.g. smurf and Donald Duck) want to do something (e.g. watch a movie), but they cannot bring the objects (e.g. bikes) with

[40] We used the plural pronoun in the experiment instead of the singular pronoun as in (4c) because in our pilot study it was found that the deictic reading for the singular pronoun was strongly preferred by children and some adults. A similar finding was found in Savarese (1999).

them, so they ask another character (e.g. the Mermaid) to watch the bikes for them. After they watch the movie, they ask the Mermaid for their bikes. The Mermaid then makes the suggestion that the smurf takes Donald Duck's bike. This provides a possible outcome satisfying the condition of plausible dissent. The suggestion is not accepted, so the Mermaid brings the smurf's bike to the smurf. The protocol of the story is as follows.

(12) Characters and Crucial Props

A Mermaid, a smurf, Donald Duck, and 2 bikes (one green, one colorful)

Protocol

Story: Donald Duck and this smurf are going to a movie, but they can't bring their bikes into the theater.

Smurf: Hey, there's a mermaid sitting outside the theater. Maybe she can watch our bikes for a while.

DD: Good idea! Good morning, mermaid! We need someone to watch our bikes when we watch the movie in the theater. Can you do that for us?

Mermaid: Oh, yes. I'm going to stay here for a while to enjoy the sunshine. Give me your bikes.

(After watching the movie,…)

Smurf: Thank you for watching the bikes, mermaid! Now can I have my bike back?

Mermaid: Smurf, I think Donald Duck's green bike looks better with you, and your colorful bike matches better with the color of his outfit. You two should exchange your bikes.

Smurf: Oh, no. I don't want that green bike. I got that colorful bike from my grand mom as a gift several years ago, and I really love it. I don't want to exchange.

DD: I don't want to exchange either.

Mermaid: OK, never mind. It's just a suggestion. Here's your colorful bike, smurf.

Kermit: This is a story about Mermaid, Donald Duck, and a smurf. I know what happened, " The Mermaid brought the smurf his bike."

Child: Yes (if allow the co-referential reading).
Or No (if only allow the deictic reading).

B. Possessive Pronoun in the Recipient Noun Phrase

[41] The verbs used in the three sentences were '*bring*', '*give*', and '*throw*'.

Two sentences[42] similar to "*The smurf brought his brother Mickey Mouse*" were used to test whether children reject the co-reference between the possessive pronoun in the recipient noun phrase and the following theme noun phrase. The experimental design is shown below.

(13) Test Sentence: The smurf brought his brother Mickey Mouse[43].
Possible outcome: The smurf brought the smurf's brother Mickey Mouse. (deictic reading)
Actual outcome: *The smurf brought Mickey Mouse's brother Mickey Mouse. (co-referential reading)

The scenario involves two characters (e.g. a smurf and Mickey Mouse) and their brothers. At the beginning of the story the smurf wants to bring Mickey Mouse to the smurf's brother. On the way to the smurf's home, because something unexpected happens (e.g. the motorcycle breaks down), it will be too late for Mickey Mouse's appointment with his own brother if they go to the smurf's home first. Therefore, at the end the smurf brings Mickey Mouse to Mickey Mouse's brother. Notice that the condition of plausible dissent is built into the story by having the smurf originally considering bringing Mickey Mouse to the smurf's brother. The protocol is shown below.

[42] In the experiment we used three test sentences containing the same verbs as in the previous section. But since 8 out of the 10 non-adult acceptance came from the verb '*throw*', there might be some property of that verb which was irrelevant to our concern here. Therefore, in our analysis, we excluded the verb '*throw*'.

[43] There is a difference between the experimental design used in this section and the previous section. In the previous section (with sentences like "*The Mermaid brought the smurf his bike*"), since the possessive pronoun is in the second object position (as a theme), it can co-refer with either the subject noun phrase, the first object noun phrase (the recipient), or have a deictic reading. Judgements from adult speakers show that the co-referrence with the subject is much more preferred than the co-referrence with the recipient noun phrase. Therefore, we made the possible outcome as the deictic reading referring to someone outside the sentence (e.g. Donald Duck), and the gender of the subject noun phrase different from the pronoun. However, the same design will cause problems for this section. Some adult native speakers told us that a sentence like "*The Mermaid brought his brother Mickey Mouse*" sounded very bad, even in a context in which the pronoun referred to someone else. Since our concern is more with the co-referential possibility between the two object noun phrases, we made the possible outcome in this section as having the pronoun referring to the subject.

(14) Characters and Crucial Props

A smurf and his brother, Mickey Mouse and his brother

Protocol

Story: This smurf and this Mickey Mouse are good friends. Now they just finished today's work at school.

Smurf: Mickey, do you have any plans after school?

MM: Yes, I'm going to swim with my brother at 4 o'clock. How about you?

Smurf: I'm going home. My brother has some problems with his homework, and that's hard for me, too. I know you are very smart. Could you help my brother before you go swimming?

MM: I guess that will be fine. It's only 2 o'clock now.

Smurf: Thank you, Mickey. Let's get onto my motorcycle. (Both get onto the motorcycle and leave.)

(After a while,…)

Smurf: There may be something wrong with my motorcycle. Let me take a look. (Tries to fix the motorcycle.)
I'm sorry, Mickey. I didn't know it would take me so much time to fix my motorcycle.

MM: Well, now it's getting late. I don't think I'll be able to help your brother today. My brother is waiting for me at the swimming pool, and I don't want him to worry about me.

Smurf: You are right. It's quite late now. Maybe next time you can still help my brother. Now I'll just drop you off at the swimming pool. (Both get onto the motorcycle.)
Here's your brother.

MM: Bye, smurf.

Smurf: Bye. (Goes home.) Hi, brother, Mickey cannot come today. Maybe tomorrow he will come here to help you.

Sbrother: OK.

Kermit: This is a story about a smurf, his brother, and the Mickey Mouse brothers. I know what happened, "The smurf brought his brother Mickey Mouse."

Child: No, Mickey Mouse didn't go to the smurf's house (adult reading).
Or Yes (non-adult reading).

3.1.2 The Active Sentences

For the active sentences, the possessive pronoun is either in the subject position (as in A), or in the object position (as in B). The sentences are presented after a story in which the pronoun is bound by a universally quantifier NP, or co-refers with the other NP

in the sentence. The condition of plausible dissent is satisfied by having the pronoun refer to someone mentioned in the story, but not in the sentence. The sample stories are shown below.

A. Possessive Pronoun in the Subject Position

Two types of active sentences with the possessive pronoun in the subject position were used in the experiment: one with the universal quantifier noun phrase as the object, the other with a regular noun phrase as the object. For each type, there were two trials. The sentences with the universal quantifier noun phrase as the object were sentences like "*His dog licked every dwarf*", and those with a regular noun phrase as the object were sentences like "*Her dog licked the lady smurf*". These sentences were employed as a comparison with the double object sentences. Since the subject position in the active sentences is at a higher position, c-commanding the object, there is a contrast between the prnoun's interpretation in subject position and object position. By analogy, any findings of the asymmetry of the pronoun interpretation in the two object positions presumably should also be attributed to the asymmetrically c-commanding hierarchical structure of the two object positions.

The experimental design for the sentences with the universal quantifier noun phrase as the object is shown below.

(15) Test Sentence: His dog licked every dwarf.
Possible outcome: His (the boy's) dog licked every dwarf. (deictic reading)
Actual outcome: *His (every dwarf's) dog licked every dwarf. (quantifier binding)

The scenario of the story starts with one character (e.g. a boy) with the other 3 characters (e.g. dwarfs) and each of them has something related to them (e.g. dogs). At some point in the story, the boy's dog is going to lick all the dwarfs. Therefore the plausible outcome is considered, and hence satisfies the condition of plausible dissent. However, it turns out that for some reason (e.g. the dwarfs' hair hurts the dog), the dog does not want to lick the dwarfs. Instead, each dwarf's own dog licks them so that their master won't feel too sad. The protocol is as follows.

(16) Characters and Crucial Props

A boy and his dog, 3 dwarfs and their dogs

Protocol

Story: There's a pet contest. This boy brings his dog to the contest. Here we also see 3 dwarfs and each of them has a dog in the contest, too.

Boy: Hi, dwarfs. Nice to see you here. This is my lovely dog. He's a really smart dog. He can do whatever I ask him to do. Let me show you. (Talk to the dog.) Hi, doggie, go lick all the dwarfs over there.

Dog: OK. I'll do whatever you ask me to do. (Walk towards the dwarfs.) Oh, oh, these dwarfs are old guys. I don't like to lick old people. I only like to lick kids' faces. No, I don't want to do that. (Walk back to the boy.)
Sorry, I can't do it. I don't like to lick old people.

Boy: I'm sorry, dwarfs. This never happened before.

Dwarfs: We are really hurt. We feel so sad.

Dwdog1: Don't worry, master. I love you very much. I'll lick you.

Dwdog2: I'll lick my master, too.

Dwdog3: Me, too.

Kermit: This is an interesting story about a boy in a pet contest. I know one thing that happened, "His dog licked every dwarf."

Child: No, their dogs licked them (adult reading).
Or Yes (non-adult reading).

The experimental design for the sentences with a regular noun phrase as the object is shown below.

(17) Test Sentence: Her dog licked the lady smurf.
Possible outcome: Mulan's dog licked the lady smurf. (deictic)
Actual outcome: ?The lady smurf's dog licked the lady smurf. (co-referential)

For this type of stories, at the beginning a character (e.g. Mulan) and someone related to him/her (e.g. a dog) are doing something together (e.g. playing). After a while, another character (e.g. a lady smurf) comes into the scene. At some point of the story, Mulan asks her dog to do something (e.g. licking) to the lady smurf, and this possible outcome makes the condition of plausible dissent true at this point of the story. However, for some reason (e.g. the lady smurf is afraid of big dogs) it is not done. Instead, in the end the lady smurf's own dog licks her. The protocol is shown below.

(18) Characters and Crucial Props
Mulan and her dog, a lady smurf and her dog
Protocol
Story: Mulan is training her dog to catch things for her in a park.
Mulan: Listen to me, doggie. Now I'm going to throw this brush away, and you have to catch it and bring it back to me. OK? Go! (Throws the brush away, and her dog runs away to get the brush.)
(Then a lady smurf comes to the park with her dog.)
Smurf: Good morning, Mulan. What are you doing so early in the park?
Mulan: I got a dog from my friend. He's very smart. I'm training him to catch things. Guess what? He is so lovely that every time he sees me, he licks my face. When he comes back, I'll ask him to lick your face. That's really nice.
Smurf: Sounds interesting. I'd like to be licked by your dog.
(Mulan's dog comes back.)
Mulan: Good, doggie. Good job. Now go to lick the lady smurf's face.
Mdog: OK. (Goes toward the lady smurf.)
Smurf: Stop, stop. Don't come any further. I'm afraid of big dogs, Mulan. No, no. I don't want your dog to lick me. He really scares me.
Mulan: OK, come back, doggie. I'm sorry. I didn't know you are afraid of big dogs.
Smurf: Oh, my goodness. I think I'll just ask my dog to lick me, not yours. (Smurf's dog licks her.) Good, my dear.

Kermit: This story is about Mulan training her dog in a park. I know what happened, "Her dog licked the lady smurf."

Child: No, the smurf's dog licked her (adult reading).
Or Yes (non-adult reading).

B. Possessive Pronoun in the Object Position

Sentences like "*Every dwarf lifted their suitcase*" in which a possessive pronoun is in the object position were used in the experiment. There were two trials for this type of sentences. They were employed as a comparison with the sentences with the possessive pronoun in the subject position to show that the rejection of the latter sentences (if any) is not due to the hypothesis that young children only allow deictic interpretation. If children do allow co-reference for the sentences used in this section, the rejection as well as the acceptance must be a result of the hierarchical structure they have in their mental grammar.

The experimental design for the sentences is shown as follows.

(19) Test Sentence: Every dwarf lifted their suitcase.
Possible outcome: Every dwarf lifted the knights' suitcase. (deictic)
Actual outcome: Every dwarf lifted every dwarf's suitcase. (coreferential)

In the story, at the beginning three characters (e.g. dwarfs) are going to do something in a place, and they meet another two characters (e.g. knights) in the scene. At some point of the story, the three dwarfs want to compete with the knights to see who is stronger. They decide that if any of them can lift the knights' heavy suitcase, he wins. Therefore, the three dwarfs try to lift the knights' suitcase one by one, but none of them succeed. The story thus has the condition of plausible dissent built in as the possible outcome (the deictic reading) is considered at this point of the story. To show that they

are also strong, each of the dwarfs lifts their own suitcase individually. The protocol runs as follows.

(20) Characters and Crucial Props
Three dwarfs and two knights
Protocol

Story: These 3 dwarfs are going to travel, and each of them brings a suitcase to put their stuff in. On the train station, they see these 2 knights going to travel, too.

Dwarf1: Hey, knights. Nice to see you here. Going to travel?

Knight1: Yes, we are leaving for vacation. See, this is our big suitcase. We put everything we need in it. It's really heavy.

Knight2: Do you guys remember last time we were talking about whether dwarfs are stronger than knights? Maybe we can use this suitcase. If each of you can lift it, then you are strong. See how easy it is for us knights to lift it. (Each knight lifts the big suitcase.)

Dwarf1: Let me try. I think I'm strong. (Tries but fails.) This is heavy! Well, you put too much stuff in it. See, I can lift my suitcase. (Lifts his suitcase.)

Dwarf2: Now it's my turn. I think I can do that. (Tries but fails.) Oh, this is much harder than I thought. But, I can lift my suitcase. See. (Lifts his suitcase.)

Dwarf3: Well, let me try it. (Tries but fails.) It's too heavy. But I'm still a strong dwarf. See, I can lift my suitcase. (Lifts his suitcase.)

Kermit: This is a story about 3 dwarfs meeting 2 knights in a train station. I know what happened, "Every dwarf lifted their suitcase."

Child: Yes (if allow the co-referential reading).
Or No, they didn't lift the knights' suitcase (if only allow the deictic reading).

3.2 Results and Discussion

The results for the double object sentences are shown in Table I, and the results for the active sentences are shown in Table II.

Table I. Double Object Sentences

Sentence types	Adult	Child
1. The Mermaid brought the smurf his bike. (his = the smurf) (3 trials)	Yes (61/63; 0.97)	Yes (51/51; 1)
2. The smurf brought his brother Mickey Mouse. (his = Mickey Mouse) (2 trials)	No (38/38; 1)	No (36/38; 0.95)

Table II. Active Sentences

	Adult	Child
1. Every dwarf lifted their suitcase. (their = every dwarf) (2 trials)	Yes (32/38; 0.84)	Yes (33/38; 0.87)
2. Her brother carried every troll girl. (her = every troll girl) (2 trials)	No (41/41; 1)	No (32/34; 0.94)
3. Her dog licked the lady smurf. (her = the lady smurf) (2 trials)	No (37/38; 0.97)	No (35/38; 0.92)

As demonstrated in the results above, the English-speaking children gave interpretations of the test sentences similar to the adults. None of the differences between children and adults on the acceptance and rejection of the sentences are statistically significant.

As shown in Table I, the results from the double object sentences show that children as well as adults accept co-reference between the possessive pronoun and the other object noun phrase when the former follows (and thus is c-commanded by) the latter. The co-reference is rejected when the possessive pronoun precedes (or c-commands) the other object noun phrase. All of the 17 children who participated in the Set I experiment consistently accepted the co-reference reading for the three test sentences, as did adult speakers. Among the 19 children in the Set II experiment, 17 of them consistently rejected the co-reference reading for the two test sentences, and 2 of them rejected the reading for one of the two sentences. Of the 13 children who participated in both Set I

and Set II, 11 consistently accepted the co-reference reading for the sentences in Set I, and rejected that reading for the sentences in Set II.

The asymmetry of acceptance and rejection of the double object sentences is parallel to the pattern found in the active sentences. As demonstrated in Table II, when the possessive pronoun is in the subject position, co-reference with the object NP which contains either the universal quantifier noun phrase or a regular noun phrase is prohibited. However, when the possessive pronoun is in the object position, both adults and children allowed the pronoun to be bound by the universal quantifier noun phrase in subject position. Of the 17 children who participated in the Set I experiment, 15 consistently rejected the bound variable reading for the two test sentences which had the possessive pronoun in the subject NP and the universal quantifier in the object NP. Two of them rejected the reading once. Among the 19 children who did the Set II experiment, which had the sentences with the universal quantifier in the subject NP and the possessive pronoun in the object NP, 15 of them consistently accepted the bound variable reading for the two trials, 3 accepted once, and 1 consistently rejected it. As for the sentences which had the possessive pronoun in the subject NP and a regular noun in the object NP, 17 out of the 19 children consistently rejected the co-reference reading for both trials, 1 rejected once, and 1 consistently accepted it. Of the 13 children who participated in both Set I and Set II, 11 consistently rejected the bound variable reading when the possessive pronoun is in the subject NP, and accepted the reading when the pronoun is in the object NP.

The asymmetry found in the double object sentences and the active sentences presumably results from the fact that one position (e.g. the subject position or the first

object position) is higher on the tree structure than the other (e.g. the object position or the second object position). The fact that English-speaking children allow the same interpretations for the test sentences as the adult counterparts indicates that young children have the correct hierarchical structure for the double object construction as they do for the active construction.

Another conclusion which can be drawn from these results is that since children do have the adult-like interpretations for the possessive pronoun in the double object construction, the possibility that they analyze the double object sentences the same as the corresponding *to*-dative sentences is not supported. If they did analyze the double object sentences the same as the *to*-dative sentences, their interpretations would have been either the opposite of the adult interpretations or show no contrast, since the order of the two object noun phrases is reverse for the two constructions.

To summarize, we conclude that: first, children have the correct hierarchical structure for the double object construction; and second, they analyze the double object sentences as they are, not as the corresponding *to*-dative sentences.

CHAPTER V

EXPERIMENTS ON THE LEXICAL FACTORS

1 Introduction

The first series of experiments showed that for unambiguous double object sentences like "*Snow White gave a lady every flower*", English-speaking children tend to assign a non-adult universal wide scope reading, but Chinese-speaking children correctly give the adult existential wide scope interpretation. However, the non-adult interpretation could not be attributed to any problems English-speaking children may have with respect to the hierarchical structure of the two object noun phrases, since, as shown in the second series of experiments, they have adult-like interpretations for the co-reference possibilities of a pronoun in the various sentence types. In this chapter, we will explore the possibility that the discrepancy seen in the scope interpretations of English-speaking and Chinese-speaking children may be attributed to the lexical idiosyncrasies of English '*a*' and Chinese '*yi-ge*'. The hypothesis can be formulated as follows.

(1) Lexical Factor Hypothesis
Children's non-adult interpretation on quantifier scope assignment results from a lexical idiosyncracy between English '*a*' and Chinese '*yi-ge*'. At an early stage of development, English-speaking children analyze the indefinite '*a*' as meaning "any" (i.e. non-specific), whereas Chinese-speaking children consider '*yi-ge*' to mean "exactly one" (i.e. specific).

Although Chinese does not have overt definite or indefinite articles corresponding to English '*the*' and '*a*', definiteness can be indicated by the use of bare noun phrases[44] (for definite) and numeral noun phrases (for indefinite) as shown in the following examples.

(2) wo jintian mai-le yi-ge huaping, keshi houlai meimei ba
I today buy-ASP a-CL vase but later sister BA
huaping dapuo-le
vase break-CL
"I bought a vase today, but later (my) sister broke the vase."

(3) (you) yi-zhi gou paojin yuanzi, houlai gou you pao chuqu le
have a-CL dog run-into yard later dog again run out ASP
"There was a dog running into the yard, and later the dog ran out again."

In the above examples, regardless of whether the numeral noun phrases appear in the object position (as in the first clause in (2)) or in the subject position (as in the first clause in (3)), they introduce new information. The bare noun phrases refer to given information already established in the discourse context. Although in both examples, '*yi-ge*' refers to a single entity, in some contexts, it can also have an existential interpretation (i.e. meaning "at least one", as in (4)) as well as a free choice reading (as in (5)).

(4) he yi-bei niunai zai qu xuexiao
drink a-cup milk then go school

[44] Bare noun phrases can also be indefinte (as in (i)) or generic (as in (ii)). For a detailed discussion, see Cheng and Sybesma (1996).

(i) meimei mai shu qu le
sister buy book go ASP
"(My) sister went to buy a book/books."

(ii) meimei xihuan mao
sister like cat
"(My) sister likes cats."

As can be seen from the above examples, when bare noun phrases are used as indefinite or generic, it can always be translated as plural noun phrases in English, but when it is used as definite, whether it is plural or singular depends on the discourse referent.

"Drink a cup of milk before going to school."

(5) yi-ge hao xuesheng hui zhunshi jiao zuoye
a-CL good student will on-time turn-in homework
"A good student will turn in homework on time."

In (4), '*yi-ge*' does not have to mean "exactly one". So long as the listener drinks "at least one" cup of milk, he/she has done the right thing. For (5), a natural interpretation is that "any" good student will turn in homework on time, not just a specific one.

Although English '*a*' and Chinese '*yi-ge*' share these similarities, they differ from each other in that '*yi*' is also the number for '*one*' in Chinese, but in English the indefinite article '*a*' and the number '*one*' are separate lexical items. Given the similarities and differences between '*a*' and '*yi-ge*', it is worth investigating how young children interpret them at an early stage of development.

The organization of this chapter is as follows: In section 2, we will review relevant acquisition studies on the interpretation of the indefinites. In section 3, we present the experimental design and results, and a discussion of the results will be presented in section 4.

2 Review of Relevant Acquisition Studies

2.1 Schaeffer (1997)

Schaeffer examined the acquisition of object scrambling in Dutch and object clitic placement in Italian. The theoretical framework is based on Sportiche (1992), in which it is proposed that in the adult grammar scrambling and clitic placement are related to each other and can be reduced to one single syntactic process, driven by specificity. The

following sentence structure is assumed for both Dutch and Italian (DiscP = 'Discourse Phrase' and SpP = 'Specificity Phrase').

(6) [CP [AgrSP [DiscP (adverbs) [TP [SpP [NegP *(Dutch)* [AgrOP [VP]]]]]]]]

Specific objects and clitics need to be licensed under spec-head agreement in a functional phrase (SpP or DiscP). Two types of specificity are proposed. Discourse-related specific object DPs (e.g. *the tree*) have an antecedent in the discourse and move to spec DiscP, while non-discourse-related specific object DPs (e.g. *the sun*) move to spec SpP. They are assumed to be licensed by a null clitic in the head of DiscP/SpP. Object clitics are base-generated in the head of SpP and licensed by a *pro* object that has moved from the VP-internal position to spec SpP.

Schaeffer formed a prediction for language development based on this theoretical framework. She predicted that at an early stage children may fail to grammatically mark 'specificity' due to the lack of a distinction between discourse-related and non-discourse-related specificity. Her study investigated the possible positions of five different types of objects (including definite DP, proper name, specific indefinite, non-specific indefinite[45], and personal pronoun) and three kinds of elements over which an object can move in adult Dutch (i.e. low adverb, negation, and high adverbs). Schaeffer also devised Italian experiments that examined the phonetic realization and the position of the direct object clitic. There were three conditions in the experimental design. First, three types of constructions were used: simple present tense construction, restructuring verb

[45] Although efforts were made to create scenarios to distinguish specific indefinites from non-specific indefinites, as indicated by the author (p. 51), even the adult subjects were not very sensitive to the subtle differences in the set-ups of the scenarios. Therefore, in the results, all the indefinites were analyzed as one group without making a distinction between specific and non-specific.

construction, and *passato prossimo* construction. Second, she tested sentences with a single direct object clitic and sentences with a double clitic. Third, the *passato prossimo* construction with and without agreement was also manipulated. The study tested 49 Dutch-speaking children between the ages of 2;4 and 6;10, and 35 Italian-speaking children between the ages of 2;1 and 5;11. The task used was a combination of a Truth-Value Judgement Task and an Elicited Production Task.

For sentences with negation, the Dutch 2-year-old children placed definite DPs and proper name objects in a position following negation about 70% of the time, which is not allowed in adult Dutch. The Dutch-speaking 2-year olds also showed a significantly lower percentage of pre-negation indefinite objects than Dutch-speaking adults did. For both definite and indefinite DPs, there was a big jump towards adultlike structures around age 3. As for the direct object clitic placement, the Italian 2-year olds produced overt object clitics only 22% of the time, as opposed to the 100% adult rate. The 2-year-old Dutch-speaking children used clitics in the clitic scenarios only 16% of the time. For both Dutch and Italian, the percentage of clitic-pronouns drastically increased to around 60% at age 3, and close to adultlike at age 4 and older.

With respect to object scrambling over low and high adverbs, the Dutch 2-year olds produced few adverbs, but children older than 3 allowed scrambling over low and high adverbs in an adultlike manner. Based on the results that scrambling of direct objects and object clitic placement in obligatory contexts were optional for Dutch and Italian 2-year olds, Schaeffer argued that the marking of specificity, the feature that drives direct object scrambling, was optional. In addition, she argued that the optional marking of specificity is no longer allowed by age 3, when an adultlike performance takes over.

Although in this study, Dutch-speaking and Italian-speaking children reached adultlike performance with respect to object scrambling and clitic placement after age 3 or 4, it is still not clear whether the specificity of the indefinite is also acquired around that age. Since the study showed that even the adult subjects could not distinguish the subtle differences in the manipulations for specific versus non-specific indefinites, in the result analysis no distinction was made between the two. Therefore, what was found in this study may simply be the development of (in)definiteness, not really specificity. In addition, if children do acquire the distinction of specificity around age 3 or 4, a problem arises in our first experiment for the double object construction as to why English-speaking children as old as 5 or 6 failed to correctly interpret the indefinite '*a*' as specific in contexts where only one specific character was crucial.

2.2 Musolino (1998)

Using a truth-value judgement task, Musolino (1998) investigated English-speaking children's interpretations of sentences containing negation and quantified noun phrases as shown below.

(7)	a.	Every horse didn't jump over the fence.	(every>neg; neg>every)
	b.	Some horses won't jump over the fence.	(some>neg)
	c.	Cookie Monster didn't eat two slices of pizza.	(two>neg; neg>two)
	d.	The smurf didn't buy every orange.	(neg>every)
	e.	The detective didn't find some guys.	(some>neg)

The adult interpretations are shown in parentheses. What Musolino found was that children's responses could be categorized into three classes: (i) those which correspond to the adult interpretations (as in sentences (7b) and (7d)); (ii) those which represent one of

the possible adult readings (as in (7a) and (7c)); (iii) those which are different from any possible adult interpretations (as in (7e)). To account for English-speaking children's interpretations of sentences containing negation and quantified noun phrases, Musolino observed that children's interpretations differ from those of adults in the cases where syntactic scope and semantic scope do not coincide. When syntactic scope and semantic scope do not coincide, children's interpretations correlate with the interpretations determined by overt syntactic scope. That is to say, in the domain of QNP-Neg interaction, children map overt syntactic scope (defined in terms of asymmetric c-command or linear precedence[46]) and semantic scope isomorphically. Based on this scope mapping strategy, children correctly interpret unambiguous sentences like (7b) and (7d) in which the only reading is to map the scopes of QNP and Neg isomorphically. For ambiguous sentences like (7a) and (7c), the isomorphic scope mapping leads children to allow only one of the two possible interpretations. As for sentences like (7e), which adults only allow an interpretation with the reverse of the syntactic scope, the isomorphic scope mapping results in children's non-adult interpretation.

Musolino argued that the observation of isomorphism is not a primitive learning principle, but an observation derived from more fundamental properties arising from the interplay between properties of QNPs and learnability considerations. Following Hornstein (1984), Musolino proposed that QNPs can be partitioned into two groups: (a) type II QNPs whose interpretation is determined grammatically (i.e. via movement options) and whose interpretation is fixed by overt position with respect to negation; (b)

[46] Although the English sentences used in this study could not determine whether children compute scope on the basis of (asymmetric) c-command relations between Neg and QNP or linear precedence, a subsequent study by Lidz and Musolino (2000), which examined Kannada-speaking children's interpretation of Neg- QNP interaction, showed that what matters is the c-command relations.

type I QNPs which, in addition to functioning like type II quantifiers, are also subject to an extragrammatical (i.e. non-movement based) wide scope interpretive mechanism[47]. In light of this distinction, isomorphism can be considered as a property of type II quantifiers. That is to say, since type I quantifiers have more interpretive options than type II quantifiers, children initially treat QNPs as being type II (i.e. the more restrictive option). With positive evidence, children will later acquire the other interpretation which tells them the QNPs can take wide scope with respect to negation in the object position as type I QNPs. The option is driven by learnability considerations. The rationale is that suppose children initially assume the QNPs as type I, which allow two possible interpretive options, they would be at the risk of overgenerating for the QNPs which are in fact type II, and thus need negative evidence to expunge the non-adult reading from their grammar.

Although the account can explain children's lack of one of the interpretations when the sentences are ambiguous for adults (as sentences (7a) and (7c)), a problem remains for the sentences in (7e). For those sentences where '*some*' is in the object position, children assign a reading which is not available in the adult grammar (i.e. '*some*' in the scope of negation). A question to ask is how will children abandon the non-adult interpretation in the absence of negative evidence? A possibility pursued by Musolino is to consider *some* and *any* as allomorphs. He argued that once children acquire this piece of morphological information, the Uniqueness Principle or Mutual Exclusivity given by

[47] There is a slight difference between Hornstein (1984) and Musolino (1998) on the characterization of type I quantifiers. For Hornstein (1984), QNPs like *some N* or *a certain N*, which always take wide scope, are the true type I QNPs. However, Musolino (1998) distinguished two subtypes of type I QNPs: those which always take wide scope are type Ia QNPs, and those which are ambiguous between a type II reading and a reading given by Wide Scope Interpretive Mechanism (e.g. *two N*) are type Ib QNPs.

UG will prevent them from assuming that both forms have the same meaning in the scope of clausemate negation.

In Musolino's account, what guides children's scope-taking for Neg-QNP interaction is mainly the syntactic scope. However, as discussed in our first experiment on QNP-QNP interaction, isomorphism cannot account for English-speaking children's non-adult interpretation for the double object sentences and Chinese-speaking children and adults' preferred reading for the *to*-dative sentences. It remains a puzzle why this strategy is observed only in Neg-QNP interaction, but not QNP-QNP interaction in English. In addition, it is not clear whether isomorphism will also be observed in Chinese Neg-QNP interaction.

2.3 Abu-Akel and Bailey (2000)

Drawing on naturalistic data from English-speaking children's speech, the study by Abu-Akel and Bailey examined the developmental course of children's use of determiners '*a*' and '*the*'. As pointed out by Abu-Akel and Bailey, previous studies on the acquisition of articles had the drawbacks of investigating the language of children 3 years and older, and using the gross categorization of definite (given information) and indefinite (new information). To avoid the shortcomings, they used a more fine-grained coding for DPs to analyze the transcripts of 17 children between 18 months to 58 months interviewed at three-month intervals. When coding specificity for a DP containing either the indefinite '*a*' or the definite '*the*', it was judged *specific* if the reference was to a specific member of a class (as in examples (8a, b)), and *non-specific* if the reference was to any member of a class (as in examples (9a, b)).

(8) a. That's ***the red one***.
b. There is ***a hammer*** in that drawer.

(9) a. I need ***a handkerchief***.
b. Going in ***the air***.

Referentiality is context dependent. Examples in (10) and (11) show exophoric and endophoric references, respectively. "Exophoric reference" is defined as identifiable within the specific situation, but not by prior discourse (as in (10a, c)), or identifiable on extralinguistic grounds, no matter what the situation (as in (10b)). "Endophoric reference" is defined as identifiable from the discourse.

(10) a. Mind ***the step***.
b. As ***the child*** grows, he learns to be independent.
c. I've got ***a brick*** on there.

(11) He saw a man on the street. ***The man*** was wearing a strange hat.

The results of the study on the production of definite and indefinite DPs show that between 18 and 24 months, indefinite DPs are predominant. At around 27 months there is a sharp drop in the omission of determiners '*a*' and '*the*' (from 60% to 33%), a sharp increase in definite-specific DPs (from 8% to 28%), and, to a lesser degree, an increase in indefinite-specific DPs (from 15% to 24%). Specificity is roughly distributed across definite and indefinite DPs equally, but when non-specificity occurs, it is primarily with indefinite DPs. As for discourse referentiality, there is an increase in the mean proportions of definite-exophoric DPs (0%-28%), and a decrease of indefinite-endophoric DPs (48%-14%).

It is concluded in this study that other than omission errors, children as young as 18 to 24 months of age acquire and use the articles '*a*' and '*the*' correctly, contrary to what was found in previous studies. The omission errors from young children show that the use of determiners in the early stage is optional, but when present, they are used correctly. The authors argue that this is compatible with the notion of optionally marking finiteness in children's early grammar, and provides evidence that functional categories are present from the earliest stage in language acquisition.

Although the results in this study show that the specificity of the indefinite appears early in child English, it is not clear when English-speaking children will master its meaning in an adultlike manner in most of the obligatory contexts. A corpus-based study like this one cannot provide an answer to that question, especially when there is no morphological or syntactic realization of specificity for the indefinite in a language like English. The utterances can always be ambiguous between specific and non-specific. When a child uses a DP with the indefinite article, even though the context requires the DP to be specific, it is never clear whether the child interprets it as specific or non-specific. In addition, a closer look at the results shows that the percentage only tells us among all the utterances obtained at a certain age period, how many of them can be categorized as specific-indefinite for example. The analysis therefore does not tell us how often a child correctly uses the indefinite as specific in obligatory contexts for specificity.

2.4 Foley, Lust, Battin, Koehne, White (2000)

This study investigated the acquisition of the indefinite determiner in a context which allows both the referential and the quantificational interpretations. Here the term "referential-type interpretation" is defined as an interpretation where a NP denotes a unique individual or entity, and "quantificational/variable interpretation" as when the NP either behaves like a quantifier or is bound by a quantifier. The following example illustrates the two interpretations.

(12) The committee will adopt a plan.
   a. Referential: A particular plan, among a set under consideration, will be adopted.
   b. Quantificational: The committee will adopt some plan, but we don't know which one (and they may not have been expected to adopt one at all).

Foley et al. used VP ellipsis as the context of the study. As shown below, VP ellipsis sentences with pronouns are ambiguous between a two-object bound variable (i.e. sloppy) interpretation and a one-object referential (i.e. strict) interpretation.

(13) Bert touches <u>his</u> apple and Oscar does too.
   a. Two-object bound variable interpretation:
      B touches B's apple; O touches O's apple.
   b. One-object referential interpretation
      B touches someone's apple; O touches the same apple.

In the study, they contrasted children's interpretations of sentences such as in (13) with the same children's interpretations of indefinites in a VP ellipsis context as in the following example.

(14) Bert touches <u>an</u> apple and Oscar does too.

In addition to the two interpretations for the pronoun sentences, the indefinite sentences also allow a tow-object non-bound-variable interpretation. A two-object non-bound-variable interpretation for this sentence can be any one of the following possibilities: (1) B touches either B's or O's apple, and O touches someone else's apple. (2) B touches someone else's apple, and O touches either B's or O's apple. (3) B touches O's apple, and O touches B's apple. An act-out task and a truth value judgement task with pictures were used in this study.

In both tasks, the results from children between 3 to 7 years old showed that they accepted both one-object and two-object bound variable interpretations, with a preference to the latter, for both the indefinite sentences and the pronoun sentences. As for the two-object non-bound-variable interpretation, children accepted it for the indefinite sentences from around 15% to 30% in different age groups, but less than 5% for the pronoun sentences.

Based on the results, it was concluded that children, like adults, have access to both referential-type and quantificational/variable type interpretations for indefinites from the early stage of development. In addition, since the children did not treat indefinites in the same way as pronouns, it was argued that children must treat them like a free variable. This is compatible with a theory of unselective binding such as those proposed by Heim (1982) and others.

Although Foley et al. argue that children have access to a referential-type interpretation for indefinites early in their development, a closer look at the results from the indefinite sentences in the act-out task show a difference between adults and children. English-speaking adults highly preferred one-object type interpretation (70% vs. 20%)

for the indefinite sentences, but children in all age groups preferred two-object bound variable interpretation (around 50% vs. 10% for 4 to 7 year-old groups). This observation suggests that the referential-type interpretation may not be prominent for young children.

2.5 Schafer and de Villiers (2000)

Using acquisition data, this study compared the predictions of the Specificity Hypothesis to the Familiarity Hypothesis, and argues that the latter gives a better account than the former. According to the Specificity Hypothesis, specific indefinite and definite determiners project the same structure (i.e. they should appear in D and project DP), and the mastery of the two sorts of determiners should emerge at the same stage in acquisition. The Familiarity Hypothesis analyzes specific '*a*' as the head of a Number Phrase which projects above NP and below DP. It predicts that familiarity is what is required for the use of the article '*the*' and hence the projection of DP, and that children master the specific indefinite well before they master the appropriate use of '*the*'.

The study elicited noun phrases containing the articles '*a*' and '*the*' from children under the following eight conditions.

(15) Conditions for eliciting '*a*' and '*the*'

1 Part-the: inherent part of previously mentioned object
E.g. Adrienne got a pet hamster for her birthday and put it in a nice cage. It tried to excape so she quickly closed something. What did she close?

2, 7 Familiar-the: previously mentioned object
E.g. Emily has two pets, a frog and a horse. She wanted to ride one of them, and so she put a saddle on it. 2. Guess which. 7. What was it?

3 Specific-a: referent known to speaker only
E.g. I'll bet you have something hanging on the wall of your room at home. What is it?

4, 8 Multipac-a: one of a previously mentioned set

E.g. Three ducks and two dogs were walking across a bridge. One of the animals fell off the bridge and said "Quack". 4. Guess which. 8. What was it?

5 Non-referential-a: non-referential, but assumed in situation
E.g. Cindy is going to the pond. She wants to catch some fish. What will she need?

6 Predicational-a: nominal following '*have*'
E.g. Think of a baseball player. Can you imagine what one looks like? What does he have?

A total of 37 children (age ranging from 3;6 to 5;5) and 10 adults participated in the study. The results showed that children had adult-level mastery of using the non-specific indefinite '*a*' in conditions 5 and 6 as well as the specific indefinite '*a*' in condition 3. The adult response for conditions 4 and 8 was either '*one of the*' or '*a*' about 70% of the time. However, children used '*one of the*' or '*a*' less than 30% of the time, preferring '*the*' (about 55%). Although children performed like adults in condition 1 by using the definite '*the*', they did not master the uses of '*the*' in conditions 2 and 7 (around 63% in condition 2 and 54% in condition 7). Based on these results, Schafer and de Villier argued that the grammar of children ages three to five contains an adult-like NP and NumP category, but not the adult-like DP category, and that adults analyze specific '*a*' and '*the*' differently, with the former as the head of NumP, and a D[+hearer] to project the latter.

Although the children in this study performed at an adult level for most of the conditions expected to elicit '*a*', the results for conditions 4 and 8 showed that they had not acquired the specificity of the indefinite yet. The use of '*a*' in those two conditions was even lower than the use of '*the*' in conditions 2 and 7. The results found in conditions 4 and 8 may shed some light on the non-adult interpretation we had for the double object sentences. It seems that English-speaking children at an early stage of

development do not interpret the indefinite '*a*' as specific or partitive. Instead, they use the definite article '*the*' for specificity.

2.6 Krämer (2000)

In this study, Krämer assumes Van Greenhoven's (1998) analysis of indefinites. According to this analysis, a so-called "free variable indefinite" gives rise to the specific reading, whereas a "predicative indefinite" gives rise to the non-specific reading. Based on this, she proposes a hypothesis as to whether either of the interpretations would pose particular difficulty to children. The hypothesis is shown below.

(16) Non-Integration Hypothesis:
Children acquire the predicative interpretation of indefinites early.
The free variable interpretation is acquired later because it requires discourse integration.

In Dutch (as well as some other languages, e.g. German) an indefinite's syntactic position may help determine its interpretation. This property enables the investigation of whether children may ignore the syntactic position of the NP and can verify the predicted difficulty with the free variable interpretation of indefinites. For example, in the following expressions (from Krämer 2000, p. 4), when *een paard* 'a horse' appears to the left of the particle *even* 'involving little time or effort', it implies the speaker has a particular (i.e. "specific") horse in mind. In contrast, when it appears to the right of the particle, it indicates that the speaker will likely be satisfied with any horse.

(17) a. Ik wil een paard even vasthouden.
I want a horse PART hold
"I want to hold a (particular) horse for a minute."

b. Ik wil even een paard vasthouden.
I want PART a horse hold
"I want to hold a horse for a minute."

In addition, a distinction similar to that between high and low indefinite object NPs can be found between sentence initial indefinite subjects and postverbal subjects in existential constructions as shown below.

(18) a. Een oude vrouw liep op straat.
An old woman walked on street
"A (particular) old woman was walking in the street."

b. Er liep een oude vrouw op straat.
There walked an old woman on street
"A (just some) old woman was walking in the street."

In Dutch, (18a) conveys the interpretation that some particular woman is intended, but the less marked, non-specific interpretation must be used in the existential construction in (18b).

Five experiments were conducted to examine the predictions of the Non-integration Hypothesis. Using a picture completion task, the first experiment investigated whether children relate high indefinite subject NPs to elements in the discourse context. For sentences like (18a), adults cannot avoid a source-set interpretation, but according to the Non-integration Hypothesis, children may fail to properly relate the high indefinite NPs to the source set. Experiments 2 and 3 examined whether children interpret the indefinite object NP inside or outside the scope of the negation operator (Experiment 2) and the frequency adverb *twee keer* 'twice' (Experiment 3) (the examples are shown in (19)).

(19) a. De jongen heeft geen vis gevangen.
The boy has no fish caught
"The boy did not catch any fish."

b. De jongen heeft een vis niet gevangen.
The boy has a fish not caught
"The boy did not catch a (particular) fish."

c. Je mag twee keer een potje omdraaien.
You may two times a jar around-turn
"You may turn over a jar twice." (should involve two jars)

d. Je mag een potje twee keer omdraaien.
You may a jar two times around-turn
"You may turn over a jar twice." (may involve only one jar)

Experiments 4 and 5 investigated whether children interpret the sentence-initial indefinite subject NP inside or outside the scope of the frequency adverb *twee keer* 'twice' (Experiment 4) and negation (Experiment 5). The examples used are shown below in (20).

(20) a. Een knikker mag twee keer rollen.
A marble may two times roll
"A (particular) marble may roll twice."

b. Een meisje is niet aan het dansen.
A girl is not PROGR-dance
"A (particular) girl is not dancing."

Experiments 3 and 4 (with the frequency adverb) used an act-out task, and experiments 2 and 5 (with the negation operator) used a truth-value judgement task. The age range of the child subjects was from 4 year old to around 7 or 8.

The results in Experiment 1 showed that although the percentage of adultlike responses were well above chance, children did not always restrict their choice of a referent to a source set in a context in which adults had a source-set reading. For

Experiments 2 and 3, when the NP was in a lower position than negation and the frequency adverb, both children and adults interpreted the indefinite object NPs inside the scope of negation and *twee keer* 'twice'. However, when the NP was in a higher position, adults interpreted the indefinite NPs as outside the scope of negation and *twee keer*, whereas children considered them as outside the scope of negation only 16% of the time, and outside the scope of *twee keer* 49% of the time. In Experiments 4 and 5 where the indefinite NPs were in the sentence-initial subject position, children interpreted them as outside the scope of *twee keer* 61% of the time and outside the scope of negation 62% of the time. This contrasted to adults, who interpreted the NPs as outside the scope of negation and the frequency adverb 100% of the time. It was concluded that young children (under age 7) are able to interpret low indefinite NPs in an adultlike manner (i.e. as "predicative indefinites"), but they are often unable to interpret high indefinite NPs as adults do (i.e. as "free variable indefinites"). The deviation from adult interpretations is accounted for by the Non-integration Hypothesis as a failure to assign the high indefinite NPs a free variable interpretation because of insufficient discourse integration.

Although Dutch-speaking children seem to have more difficulty interpreting the indefinite as taking scope over a frequency adverb and negation, the experiments with negation still show a big difference between the indefinite in object position versus subject position. The wide scope interpretation for the indefinite rises from 16% in the high object condition in experiment 2 to 62% in the subject condition in experiment 5. In addition, our first series of experiments show that Chinese-speaking children seem to prefer wide scope for '*yi-ge*' at an early stage of development. Therefore, it is not clear whether the findings from Dutch-speaking children will hold cross-linguistically.

2.7 Summary of Previous Findings

In this section, we will summarize the findings of the studies presented in sections 2.1 to 2.6. It is helpful to consider the results from the speech production studies and the comprehension studies separately.

The three studies on children's speech production (Schaeffer 1997; Abu-Akel and Bailey 2000; Schafer and de Villiers 2000) basically show that children as young as age 3 have knowledge of the various usages of the definite and the indefinite with one exception. Schafer and de Villiers (2000) found that 5 year-old children still had problems in one of the conditions for eliciting the definite article as well as one of the conditions for eliciting the indefinite article.

For the comprehension studies, Musolino 1998 and Krämer 2000 found that that children as old as 4 to 6 still cannot manage the wide scope reading for the indefinite noun phrases. However, the reasons proposed to account for this late acquisition are different. Krämer proposed that the reading is acquired late because it requires discourse integration. Musolino attributed it to the collision of mapping between syntactic scope and semantic scope. Although Foley et al. 2000 concluded that children have access to both a referential-type and a quantificational/variable type interpretations for indefinites from the beginning of development, it is not clear in their study whether children are able to interpret the indefinite as specific consistently in obligatory contexts at an early stage.

This shows that production and comprehension studies differ with respect to whether and when young children have a full grasp of all the usages of the indefinites. Notwithstanding, it is generally found that the predicative (i.e. non-specific)

interpretation appears before the specific (or referential) interpretation (e.g. Schaeffer 1997; Musolino 1998; Schafer and de Villiers 2000; Krämer 2000). However, in these studies, the languages investigated (i.e. English and Dutch[48]) have separate lexical items for the indefinite article and the numeral '*one*', it remains an open question as whether the findings can hold in a language where the numeral '*one*' also functions as indefinite, as in Chinese. In the following section, we will try to tackle this question.

3 Experiments

The goal of the experiments reported in this chapter is to investigate the possibility that at an early stage of development, English-speaking children interpret '*a*' as meaning "any" (i.e. non-specific), while Chinese-speaking children consider '*yi-ge*' to mean "exactly one" (i.e. specific)[49]. To test this possibility, we used active sentences with the negation operator and an indefinite NP in the object position as test sentences. Since in the first series of experiments, we examined the QNP-QNP interaction, if the results found there are really the effect of lexical idiosyncracy, we should expect to also find some differences for Neg-QNP interaction between English and Chinese.

We divided the experiments into two parts. In Part I, the experiments were designed to examine how English-speaking and Chinese-speaking children interpret '*a*' and '*yi-ge*' respectively for sentences with negation, and whether it correlates with how they interpret the QNP-QNP interaction in the double object sentences. In Part II, we tested

[48] As indicated in Krämer 2000 (p. 13, note 5), "although the spelling of the indefinite article *een* is similar to that of the numeral *één* 'one', these words are pronounced differently" in Dutch.

[49] The characterization as specific vs. non-specific used here is preliminary. A more detailed discusssion of the distinction between English-speaking and Chinese-speaking children's interpretations for the indefinite can be found in Chapter 6, section 2 under the section title "Characterizing the Distinction between English and Chinese".

whether Chinese-speaking children allow '*yi-ge*' to be interpreted as non-specific in three sentence types (i.e. sentences with negation, and two types of passive sentences).

3.1 Part I (English and Chinese)

In this part of experiments, we investigated English-speaking and Chinese-speaking children's interpretation of sentences with negation like "*Mickey Mouse didn't ride a dog*" and double object sentences like "*The dwarf sold a rabbit every brush*." The prediction is that if at an earlier stage of development English-speaking children consider the indefinite '*a*' to be non-specific (i.e. to mean 'any'), there should be a correlation between the acceptance of the existential narrow scope reading in the double object sentences and the sentences with negation. That is to say, those children who assign narrow scope to '*a*' in the double object sentences should also interpret '*a*' to be within the scope of negation. We also predict that if Chinese-speaking children only allow '*yi-ge*' to be interpreted as specific (i.e. to mean 'exactly one'), they should assign wide scope to it in both sentence types.

We used a Truth-Value Judgement task in these experiments. For English, 30 adults and 18 preschool children participated. All of the English-speaking adults were undergraduate students at the University of Maryland, College Park, and all of the English-speaking children were from the daycare center of the same university. For Chinese, 28 adults and 16 children were tested. The Chinese-speaking adults were all undergraduate students at National Taiwan Normal University, and the Chinese-speaking children were from the daycare center of National Taiwan University. The range of age

for English-speaking children was from 3;10 to 6;2 (with a mean age of 5;0), and for Chinese-speaking children from 4;6 to 6;3 (with a mean age of 5;4).

3.1.1 Sentences with Negation

Sentences like *milaoshu meiyou qi yi-zhi gou* "Mickey Mouse didn't ride a dog" were used to examine whether English-speaking and Chinese-speaking children allow the indefinite noun phrase to take wide scope over negation (i.e. 'a > not'). In both English and Chinese, this sentence is ambiguous for adults. It can mean either Mickey Mouse didn't ride any dog (i.e. wide scope for the negation, 'not > a'), or there exists a dog which Mickey Mouse didn't ride (i.e. wide scope for the indefinite, 'a > not'). It was the second reading that was tested in this part of experiment.

The experimental design is as follows:

(21) Test Sentence: Mickey Mouse didn't ride a dog.
Possible Outcome: Mickey Mouse didn't ride any dog.
Actual Outcome: Mickey Mouse didn't ride one of the dogs.

What we want to know in this part of the experiment is whether children allow the wide scope reading for the indefinite. Therefore, the event that corresponds to that reading occurs at the end of the story. In order for children to plausibly deny the test sentence, the alternative reading (i.e. the wide scope for negation) will be the possible outcome that is considered earlier in the story. The scenario of the stories involved a main character (e.g. Mickey Mouse), who was thinking about doing something (e.g. riding animals). At first the main character doesn't want to do anything to the first type of objects (e.g. dogs) he/she encounters. The possible outcome was considered at this

point of the story, and the condition of plausible dissent was satisfied. Although the main character preferred the other type of objects (e.g. horses), for some reason (e.g. the horses were wild and kept jumping) the character couldn't do what he/she wanted to. Therefore, the character went back to the first type of objects and did the action on two of the three objects (because one of them was not qualified.) There were four trials in this part of experiment. The protocol of the story is as follows.

(22) Characters and Crucial Props
Mickey Mouse, 2 horses, and 3 dogs
Protocol

Story: Mickey Mouse (MM) comes to a circus where people can ride on any animals they like.

MM: Wow, there are some dogs here. But I guess it won't be much fun to ride a dog. Let me see whether they have other kinds of animals. (Walk toward the horses.)
Cool, there are horses here. I never rode a horse before. Let me try it. (The horses start jumping wildly.)
Oh my goodness, these horses are so wild. They are too dangerous to ride. I think it's better to ride a dog. (Turn to the dogs.)
Hey, this dog is cute. Let me try riding this one. (Ride on a dog.)
This one is also adorable. I want to try this one, too. (Ride on another dog.)
(Turn to the third dog, and this dog starts barking at MM.)
Oh, this one is not friendly. I'd better not ride this one.

Kermit: I like this story about Mickey Mouse at a circus to ride on animals, and I know what happened. "Mickey Mouse didn't ride a dog."

Child: Yes. (If subjects allow wide scope for the indefinite.)
Or No, he did ride two dogs. (If subjects only allow wide scope for the negation.)

3.1.2 The Double Object Sentences

In order to compare each subject's interpretation of the negation sentences with that of the double object sentences (a within-subject comparison), we included three trials of

the double object sentences intervened with the sentences with negation. An example of the stories is as follows[50].

(23) Sentence: The Mermaid gave a lady every vase.
Possible outcome: Every vase is given to a different lady.
Actual outcome: Every vase is given to the same lady.

(24) Characters and Crucial Props
A Mermaid, 3 ladies, 3 cookie jars, 3 vases, and 1 crown
Protocol

Story:	This Mermaid is going back to the sea to visit her family, and she needs to give away some things she cannot take with her.
Lady1:	Hey, Mermaid, do you still have anything you'd like to give away?
MM:	Yes, I still have 3 cookie jars, 3 vases and a crown I want to give away. I think each of you ladies should get a vase. They are made of blue crystal and very valuable.
Lady1:	I don't need a vase now. But I like that crown. I want it.
Lady2:	I don't need a vase either. I'd like to get some cookie jars. I think I'll have the two smaller ones. The other one is really too big.
Lady3:	Well, I like the vases. If they don't want them, I think I can take them.
MM:	Sure. This is the crown you want, you want these 2 cookie jars, and you can take these 3 vases with you.
Kermit:	This story is about the Mermaid giving away things before she goes back to the sea, and I know what happened. "The Mermaid gave a lady every cookie jar."
Child:	No.
Kermit:	Oops I was wrong. Give me one more chance to see if I'm right about this. "The Mermaid gave a lady every vase."
Child:	Yes.
Or	No, this lady got all the vases. (Symmetrical interpretation)

3.1.3 Results

[50] For detailed discussion of the scenario for the stories, please see the part about the double object construction under the subtitle of "The Theme as the Assertion" in the first series of experiments.

The results for the sentences with negation are displayed in Table I, and for the double object sentences in Table II.

Table I. Sentences with Negation

Sentence: Mickey Mouse didn't ride a dog. (a > not)
Milaoshu meiyou qi yi-zhi gou
Mickey Mouse didn't ride a-CL dog

	Adult	Child	Statistics
English	Yes (60/120; 0.5)	Yes (24/72; 0.33)	$p < .05$
Chinese	Yes (64/100; 0.64)	Yes (49/64; 0.77)	Not Significant

Table II. Double Object Sentences

Sentence: The dwarf sold a rabbit every brush. (a > every)
Xiaoairen mai-gei yi-zhi tuzi mei-ba shuzi
dwarf sell-to a-CL rabbit every-CL brush

	Adult	Child	Statistics
English	Yes (78/83; 0.94)	Yes (24/54; 0.44)	$p < .0001$
Chinese	Yes (45/46; 0.98)	Yes (42/42; 1.0)	Not Significant

As shown in Table I, 50% of the English-speaking adults accepted the sentences with negation when given the context with wide scope for the indefinite noun phrase[51], as opposed to only 33% of the English-speaking children. The difference between the English-speaking adults and children was significant ($z = 2.3$, $p < .05$). For Chinese, the corresponding sentences in the same context were accepted by adults 64% of the time, and by children 77% of the time. The difference between the Chinese-speaking adults and children was not significant ($z = 1.76$, $p > .05$). When the subjects rejected the sentences, the reason they gave was “because Mickey Mouse did ride two dogs”.

Among the eighteen English-speaking children, only one of them consistently accepted all the four sentences with negation, but eight of them consistently rejected all

the four sentences. Five children accepted three of the sentences, one child accepted two of the sentences, and three children accepted only one of the four sentences. For the sixteen Chinese-speaking children, nine of them consistently accepted all the four sentences with negation, and only two of them consistenly rejected all the four sentences. For the rest, three of them accepted three of the sentences, and two of them accepted two of the test sentences.

The pattern found in the first experiment was replicated here for the double object sentences. That is, given an existential wide scope context, English-speaking and Chinese-speaking adults accepted the sentences 94% and 98% of time, respectively (as that is the only interpretation). However, Chinese-speaking children accepted the sentences 100% of the time, while English-speaking children accepted them only 44% of the time. The difference between English-speaking adults and children was significant ($z = 6.56$, $p < .0001$). The reason English-speaking children gave for rejecting the double object sentences was “only this rabbit got all the brushes”, or “these two rabbits didn’t get any brush”.

Among the eighteen English-speaking children, seven of them consistently accepted all the three double object sentences, and eight of them consistently rejected all three sentences. Three of the children accepted only one of the three sentences. Out of the sixteen Chinese-speaking children, ten consistently accepted all the three double object sentences, and only two consistently rejected all three sentences. Two of the children accepted two of the three sentences, and the other two accepted only one of the three sentences.

[51] Note that although the test sentences here are ambiguous, the preferred reading for both English-speaking and Chinese-speaking adults is the one with negation taking wide scope (i.e. the 'not any' interpretation).

From the percentages of acceptance for the sentences with negation and the double object sentences, Chinese-speaking children performed like Chinese-speaking adults in accepting wide scope for '*yi-ge*'. On the other hand, English-speaking children differed from English-speaking adults in the resistance against wide scope for '*a*'. We further examined whether there was a correlation between the acceptance of wide scope for '*a*' in the sentences with negation and the double object sentences among English-speaking children. Table III shows the number of English-speaking children who said Yes or No to the two sentence types consistently[52].

Table III. Response Patterns among English-speaking Children

	Negation Sentences		
Double Object		Yes	No
	Yes	5	2
	No	1	9

As shown in Table III, five out of the eighteen English-speaking children consistently accepted the test sentences for the two constructions, i.e. they consistently assigned wide scope for the indefinite noun phrases. On the other hand, nine out of the eighteen children consistently rejected the test sentences for the two types of sentences, which means they consistently assigned narrow scope for the indefinite. Only three children did not have consistent response patterns for the two sentence types. This shows that there is a significant correlation for the response patterns between the two sentence types (χ^2 = 6.8, $p < .01$).

[52] Since there were four trials in the sentences with negation and three trials in the double object sentences, we categorized the response pattern based on whether the child gave consistent Yes/No answers at least three times for the sentences with negation and twice for the double object sentences. One of the children could not be categorized in any of the patterns because the child had said Yes twice and No twice for the sentences with negation.

To summarize, the results of this part of experiment support the hypothesis that at an early stage of language development, English-speaking children interpret '*a*' to be non-specific (i.e. to mean “any”), and thus assign it a narrow scope in both the sentences with negation and the double object sentences. However, Chinese-speaking children consider '*yi-ge*' to refer to something specific, and therefore assign a wide scope to it in both sentence types. In the second part of the experiment, we further investigated whether or not Chinese-speaking children also allow '*yi-ge*' to be non-specific at this stage of development.

3.2 Part II (Chinese only)

Given that Chinese-speaking children allow wide scope for '*yi-ge*' in both the sentences with negation and the double object sentences, it is not clear whether or not they also allow narrow scope for '*yi-ge*' in the sentences with negation. As mentioned earlier, the sentences with negation are ambiguous for adults in both Chinese and English, allowing either wide scope or narrow scope for the indefinite noun phrase. If Chinese-speaking children also allow narrow scope for '*yi-ge*' (i.e. for it to be non-specific or “any”), an explanation will be needed as to why they did not wrongly assign narrow scope for it in the double object sentences, as the English-speaking children did. The purpose of this part of the experiment is to examine whether Chinese-speaking children also allow the narrow scope interpretation for ‘yi-ge’.

Three sentence types were used in the experiment-- sentences with negation, passive sentences with the universal quantifier in the subject position, and passive sentences with the existential quantifier in the subject position. All the sentences were presented in a

context in which the indefinite noun phrase was within the scope of either negation or the universal quantifier. A Truth-Value Judgement task was used to elicit responses from thirteen Chinese-speaking children (age range from 4;6 to 6;3, with a mean of 5;6) and 31 adults. All the children also participated in the first part of the experiment.

3.2.1 Sentences with Negation

Sentences like *tiaotiaohu meiyou tiao guo yi-ge langan* "Tigger didn't jump over a fence" were used in this part of experiment. Although the sentence is ambiguous, allowing either wide scope or narrow scope for the indefinite noun phrase, it was presented in a context in which the indefinite took narrow scope. That is to say, the sentence was presented after a story in which Tigger didn't jump over any fences. If Chinese-speaking children also allow '*yi-ge*' to take narrow scope under negation, they should say Yes to the test sentences. If they only allow wide scope for '*yi-ge*', then they should reject the test sentences, as there are three fences that Tigger didn't jump over in the story.

The experimental design is as follows.

(25) Test Sentence: tiaotiaohu meiyou tiao guo yi-ge langan
Tigger didn't jump over a-CL fence
"Tigger didn't jump over a fence."
Possible Outcome: Tigger didn't jump over one of the fences.
Actual Outcome: Tigger didn't jump over any fences.

Since what we want to test here is whether Chinese-speaking children allow the negation to have scope over the indefinite, the event corresponding to that interpretation occurs at the end of the story. The alternative reading in which the indefinite takes wide

scope over negation, is the possible outcome considered at some point earlier in the story to satisfy the condition of plausible dissent. The scenario of the stories involved two characters engaging in some kind of competition or game (e.g. jumping or treasure hunt). At first the main character (e.g. Tigger) was so confident about jumping over the two lower fences that he chose to start with the most difficult one (e.g. the highest fence). He tried, but failed. The possible outcome was thus true at this point of the story, as Tigger was sure he could jump over the other two fenses. The other character (e.g. Ninja Turtle) then took his turn and chose to start from the lower fences. He succeeded in jumping over the two lower ones but also failed to jump over the highest one. The main character then took his second turn. He decided to try jumping over the two chairs as a practice and succeeded. But as he tried to jump over the two lower fences, he still failed. There were three trials for this sentence type. The protocol of the story is as follows.

(26) Characters and Crucial Props

Tigger, Ninja Turtle, 3 fences, and 2 chairs

Protocol

Story: Tigger and this Ninja Turtle are competing to see who jumps better.

Tigger: I know I'm a good jumper. I've won so many times in jumping competitions. Let me start with the highest fence. I know the other two lower fences are very easy for me. (Try, but fall.) Too bad, I fell. But I'm sure I can jump over the two lower fences. I've done that so many times. Let me take a rest first.

Ninja: Now look how good I am. (Jump over the two lower fences.) See. Now the hard one. (Try, but fall.) Well, this one is really too high.

Tigger: OK. Let me practice with these 2 chairs first. (Jump over the 2 chairs.) Now I'm ready for the 2 lower fences. (Try, but fall.) This is too bad. I fell again. I must have eaten too much during New Year.

Kermit: I like this story about Ninja and Tigger trying to jump over the fences. I know what happened. "Tigger didn't jump over a fence."

Child: Yes (if allowing narrow scope for the indefinite).

Or No, he didn't jump over 3 fences (if only allowing wide scope for the indefinite).

3.2.2 The Passive Sentences

A. Universal Quantifier in Subject Position

In addition to the sentences with negation, the passive sentences like *mei-zhi gou dou bei yi-ge lanjingling maizou le* "Every puppy was bought by a smurf" in which a universal quantifier was in the subject position were also included in the experiment. This sentence allows the indefinite noun phrase to take either a wide scope (i.e. the puppies were bought by the same smurf) or a narrow scope (i.e. the puppies were bought by different smurfs). These sentences were included in order to see if there is any difference between Neg-QNP interaction and QNP-QNP interaction. The sentences were presented in a context in which every puppy was bought by a different smurf in order to test whether Chinese-speaking children also allow narrow scope for '*yi-ge*'. We predicted that if the hypothesis that Chinese-speaking children only allow '*yi-ge*' to be specific (i.e. to take a wide scope) is true at this early stage of development, they should reject the sentences. But if they accept the test sentences, that will indicate that they allow both interpretations in their mental grammar.

The experimental design is shown below.

(27) Test Sentence: mei-zhi gou dou bei yi-ge lanjingling maizou-le
every-CL pupppy all by a-CL smurf buy-ASP
"Every puppy was bought by a smurf."
Possible Outcome: Every puppy was bought by the same smurf.
Actual Outcome: Every puppy was bought by a different smurf.

Since what we want to examine is whether Chinese-speaking children also allow narrow scope for '*yi-ge*', the event corresponding to that interpretation happens at the end

of the story. The alternative wide scope reading is a possible outcome considered some time in the story, and thus the condition of plausible dissent is satisfied. The stories involved three characters (e.g. smurfs). At the beginning of the story, one of the three characters wanted to get something (e.g. buying puppies or finding food), and intended to get all the three objects available. Therefore the possible outcome was considered at this point. Then another two characters showed up and they also wanted to have the objects. Although the first character disagreed and suggested they get something else, the last two characters insisted on having what they liked. Since they thought it was unfair for the first character to have all the objects, the three characters finally compromised and each of them got one. There were three trials for this sentence type. The protocol of the story is shown below.

(28) Characters and Crucial Props

Minnie, three smurfs, a horse and three puppies

Protocol

Story: These 3 smurfs come to this Minnie's pet store.

Smurf1: These puppies are so cute. I'm sure my son will love all the 3 puppies here. I want to buy all of them.

Smurf2: Wait, we want to buy a puppy for our kids, too.

Smurf1: You can buy that little horse. It's cute, too.

Smurf3: But I don't have enough space to have a horse at home, and my daughter really wants to have a puppy. She will be really disappointed if I don't buy one for her today.

Smurf1: I can understand that feeling. Ok, I guess I'll just get this gray puppy.

Smurf2: Thank you, and I'll buy this brown one.

Smurf3: Then I'll get this white one.

Kermit: This is a story about 3 smurfs in Minnie's store to buy pets. And I know what happened. "Every puppy was bought by a smurf."

Child: Yes (if allowing a narrow scope for the indefinite).

Or No, they were bought by three smurfs (if only allowing a wide scope for the indefinite).

B. Existential Quantifier in Subject Position

Sentences like *yi-ba shuzi bei mei-ge nuhai yongguo-le* "A brush was used by every girl" in which an existential quantifier was in the subject position were also included in this part of experiment. These sentences were used as a comparison with the passive sentences with a universal quantifier in the subject position to see if there is any subject/object position effect. Since the main purpose is to test whether Chinese-speaking children also allow a narrow scope for '*yi-ge*', the sentences were presented in a context in which each girl used a different brush. Although the sentences are ambiguous in English, the prediction of ambiguity is not clear in Chinese, depending on which theory is used. Based on Huang's (1982) Isomorphic Principle, they should be unambiguous in Chinese, as the existential quantifier c-commands the universal quantifier at S-structure. However, according to Aoun and Li's (1993) Minimal Binding Requirement and Scope Principle, they should be ambiguous, as in addition to the above reading, the universal quantifier can also take scope over the existential quantifier after Quantifier Raising[53]. If our hypothesis that Chinese-speaking children only allow '*yi-ge*' to have a wide scope at an early stage of development holds true, then we should expect to see that they reject the test sentences.

The experimental design is shown below.

(29) Test Sentence:

yi-ba	shuzi	bei	mei-ge	nuhai	yongguo-le
a-CL	brush	by	every-CL	girl	use-ASP

"A brush was used by every girl."

Possible Outcome: The same brush was used by every girl.
Actual Outcome: A different brush was used by every girl.

The scenario of the stories involves three characters (e.g. girls) going to someone's place (e.g. a Mermaid) to borrow or try something (e.g. brush). It was recommended to the three characters that since one of the objects was so good, they should all try it. At this point of the story the possible outcome was considered, satisfying the condition of plausible dissent. However, the suggestion was turned down because the three characters did not like the recommended object. Instead, each of them chose a different one to use. There were three trials for this sentence type. The protocol of the story is shown below.

(30) Characters and Crucial Props
Mermaid, three girls, one big brush, and three small brushes
Protocol

Story:	These 3 little girls are going to dance in a show, and they come to this Mermaid for help with their hair.
Girl 1:	Hey, Mermaid, we are going to be in the show in 5 minutes. Can you help us do our hair?
Mermaid:	Sure, since you all have very long hair, I think you should all use my big brush to do your hair.
Girl1:	I understand that, but I really don't like that one. It's too big. I like this small pink brush, because my hair is also pink, and it's not too big. (Use the small pink brush.)
Girl2:	I know my hair is long, and it may be easier to use that big brush, but I really like this yellow brush, because it matches with my yellow hair. (Use the yellow brush.)
Girl3:	I understand what you mean, Mermaid, but I really like this purple brush, because purple is my favorite color. I want to use this one. (Use the purple brush.)
Kermit:	This story is about 3 girls asking Mermaid for help with their hair. I know what happened. "A brush was used by every girl."
Child:	Yes (if allowing a narrow scope for the indefinite).
Or	No, three brushes were used (if only allowing a wide scope for the indefinite).

3.2.3 Results

[53] For the details of Huang's (1982) and Aoun and Li's (1993) theories, please see the section on the review

The results of testing the three sentence types on Chinese-speaking children and adults are shown in Table IV below.

Table IV. Results of the Three Sentence Types in Chinese

Sentence Types (3 trials for each type)	Adult	Child	Stat.
1. Tigger didn't jump over a fence. (not > a)	Yes (75/84; 0.89)	Yes (10/39; 0.26)	$p < .0001$
2. Every dog was bought by a smurf. (every > a)	Yes (42/92; 0.46)	Yes (8/39; 0.21)	$p < .01$
3. A brush was used by every girl. (every > a)	No (92/92; 1.0)	No (37/39; 0.95)	Not Sig.

For the sentences with negation, although Chinese-speaking adults' preference was the reading with the negation taking wide scope (89%, in comparison with the 64% of acceptance for the indefinite taking wide scope in Table I), Chinese-speaking children had a reverse preference. They accepted the negation wide scope reading only 26% of the time, but the indefinite wide scope reading 77% of the time (as in Table I). The difference between adults and children with respect to the acceptance of the negation wide scope reading was highly significant ($z = 7.02$, $p < .0001$). When children rejected the test sentences, the reason they gave was “because Tigger didn’t jump over three fences, not just one”. Among the thirteen children tested, seven of them consistently rejected all of the three test sentences, and only one of the children consistently accepted all three. For the rest, three of them rejected two of the three sentences, and two children rejected only one of the test sentences.

When the universal quantifier was in the subject position of passive sentences, Chinese-speaking adults accepted the universal wide scope reading 46% of the time, and children accepted them 21% of the time. The results from the adults showed that

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of Lee (1986) and Chien (1994).

although the sentences were ambiguous, allowing a wide scope for either the universal quantifier or the existential quantifier, the preferred reading for adults was the existential wide scope reading. For children the preference was even more dramatic. The difference on the acceptance of the universal wide scope reading between Chinese-speaking children and adults was significant ($z = 2.7$, $p < .01$). The reason subjects gave for rejecting the test sentences was “the dogs were bought by three smurfs, not one”. Among the thirteen children, nine of them consistently rejected all the three test sentences, and only one child consistently accepted all the test sentences. Of the other four, one child rejected two of the three test sentences, and two children rejected only one sentence.

For the passive sentences with an existential quantifier in the subject position, Chinese-speaking adults rejected the universal wide scope reading 100% of the time, and children rejected them 95% of the time. The reason subjects gave for rejecting the sentences was “three brushes were used, not just one”. The result from Chinese-speaking adults demonstrate that the sentences are not ambiguous, contrary to the prediction from Aoun and Li's (1993) Minimal Binding Requirement and Scope Principle and supporting Huang's (1982) Isomorphic Principle. Among the thirteen children, eleven of them consistently rejected all the three test sentences, and only two children accepted one of three sentences.

4 Discussion and Conclusion

In the experiments presented here, we investigated how English-speaking and Chinese-speaking children interpreted the indefinite '*a*' and '*yi-ge*' respectively under negation and in double object sentences. The results showed a contrast between children

acquiring the two languages. For the sentences with negation, even when given a context in which the indefinite takes a wide scope, although adults allow two interpretations in both languages, English-speaking children predominantly rejected the wide scope reading. But Chinese-speaking children had no problem accepting this reading (as in Table I). For the double object sentences, what we found in this experiment replicated the results found in the first experiment, i.e. Chinese-speaking children accepted the wide scope for the indefinite as adults did, but English-speaking children rejected it, resulting in a non-adult interpretation. Furthermore, a significant correlation exists between English between children allowing wide scope for the indefinite and accepting only narrow scope for the indefinite in the two sentence types. That is to say, English-speaking children who rejected the wide scope for the indefinite in the sentences with negation also rejected the indefinite wide scope reading in the double object sentences. In addition, those who accepted the reading in one sentence type tended to also accept it in the other sentence type. The results from the first part of the experiment suggest that at this early stage of language development, Chinese-speaking children interpret '*yi-ge*' as taking a wide scope, while English-speaking children consider '*a*' as only taking a narrow scope.

In the second part of the experiment, we tested whether Chinese-speaking children also allow a narrow scope for '*yi-ge*'. The results from the sentences with negation demonstrated that given a context in which the indefinite took a narrow scope under negation, although this was the preferred reading for Chinese-speaking adults, children predominantly rejected it. The rejection of the indefinite narrow scope reading indicates that, at an early stage, Chinese-speaking children allow only wide scope for '*yi-ge*'. This

hypothesis was further supported by the results from the passive sentences with the universal quantifier in the subject position. Again, although the sentences were ambiguous in Chinese, children predominantly rejected the sentences given a context for the universal wide scope reading, revealing the lack of a narrow scope interpretation for the indefinite '*yi-ge*'. As for the passive sentences with the existential quantifier in the subject position, both Chinese-speaking adults and children rejected them given a context with the universal wide scope reading, supporting Huang's (1982) Isomorphic Principle of scope in Chinese.

In comparison with the results found in previous acquisition studies, our results from English-speaking children are compatible with what Musolino (1998) and Krämer (2000) found in English and Dutch That is, children as old as 5 or 6 years-old still have difficulty getting the wide scope for the indefinites. We can say that according to Krämer's account, children at this age still predominantly allow only the predicative interpretation for the indefinites. Alternatively, we can use Musolino's observation of isomorphism to say that children assign the scopes to negation and the indefinite based on their syntactic scope. However, our results from Chinese-speaking children do not follow the same pattern. It is the free variable interpretation that they allow for '*yi-ge*' at this early stage of development. In addition, the semantic scope Chinese-speaking children assigned to negation and the indefinite does not conform to the syntactic scope, as the negation is c-commanding the object indefinite NP. Therefore, the findings from Chinese-speaking children cast doubt on the accounts propossed by both Musolino (1998) and Krämer (2000).

To sum up, the findings from the series of experiments here support our hypothesis that at an early stage of development, English-speaking children interpret '*a*' as meaning 'any' (i.e. non-specific), whereas Chinese-speaking children consider '*yi-ge*' to mean 'exactly one' (i.e. specific). The default value for the indefinite '*a*' and '*yi-ge*' given by English-speaking and Chinese-speaking children respectively can be observed not only in the double object sentences, but also in the sentences with negation and the passive sentences. This demonstrates that the different results found in previous studies on the acquisition of quantifier scope in English (e.g. Philip 1995, and the works cited there) and Chinese (e.g. Lee 1986, 1991; Chien 1994) are not really due to the different strategies or principles adopted by children acquiring the two languages. The differences of the results from the two languages can actually be reduced to the lexical idiosyncracies between English '*a*' and Chinese '*yi-ge*'.

CHAPTER VI

GENERAL DISCUSSION AND CONCLUSION

In this chapter, we will have a general discussion of the results obtained in this study. Section 1 summarizes the results found in the three series of experiments. In section 2, we will try to propose a unified characterization of English and Chinese. In section 3, we propose an account of how children will converge on an adult grammar. Section 4 provides further considerations on the learnability problem, and Section 5 is a discussion of scalar implicatures and suggestions for future research.

1 Summary of the Experimental Results

The major findings from the three series of experiments are summarized in the following three tables. The test sentences are shown in the left column, with the adult and child interpretations following them in each cell. The interpretations in the parenthesis are the dispreferred readings, and the shaded cells show the sentences for which children's interpretations differ from adults'.

Table I. The Double Object and *To*-Dative Sentences

	English Adult	English Child	Chinese Adult	Chinese Child
1. Snow White gave a lady every flower.	a > every	every > a	a > every	a > every
2. The troll sold every hat to a man.	a > every (every > a)	every > a (a > every)	a > every (every > a)	a > every (every > a)

Table II. The Structural Factor in English

	Adult	Child
1. The mermaid brought the smurf his bike.	smurf = his	smurf = his
2. The smurf brought his brother Mickey Mouse.	his ≠ Mickey Mouse	his ≠ Mickey Mouse
3. Every dwarf lifted their suitcase.	every dwarf = their	every dwarf = their
4. Her brother carried every troll girl.	her ≠ every troll girl	her ≠ every troll girl
5. Her dog licked the lady smurf.	her ≠ the lady smurf	her ≠ the lady smurf

Table III. The Lexical Factor of the Indefinites

	English Adult	English Child	Chinese Adult	Chinese Child
1. Mickey Mouse didn't ride a dog.	not > a (a > not)	not > a (a > not)[54]	not > a (a > not)	a > not (not > a)
2. Every dog was bought by a smurf.			a > every (every > a)	a > every (every > a)[55]
3. A brush was used by every girl.			a > every	a > every

As shown in Table I for the double object sentences, English-speaking adults and Chinese-speaking adults and children only allow one interpretation (i.e. the existential wide scope reading). However, English-speaking children accept this reading only about 50% of the time, but allow the non-adult universal wide scope reading about 70% of the time. For the ambiguous *to*-dative sentences, the preferred reading for English-speaking adults and Chinese-speaking adults and children is the existential wide scope reading. Again, English-speaking children show a non-adult preference for the universal wide scope reading.

[54] Although English-speaking children and adults have the same preference to the negation wide scope reading ("not > a"), the preference is even stronger for children, i.e. children's acceptance of the existential wide scope reading ("a > not") is significantly lower than adults'.

As displayed in Table II, English-speaking children perform at an adult-level in terms of the c-command relation between the two object noun phrases. Based on these results, we can at least draw the conclusion that the non-adult interpretations seen from English-speaking children on the double object construction can not be attributed to any non-adult structure for these sentences in their mental grammar.

A non-adult pattern was found in Chinese-speaking children in the experiments concerning the lexical determinant of the interpretation of the indefinite. For English-speaking adults and children as well as Chinese-speaking adults, the preferred reading for sentences with negation like "*Mickey Mouse didn't ride a dog*" is the one with wide scope for negation. However, Chinese-speaking children strongly prefer the reading that assigns wide scope to the indefinite. This preference is also demonstrated in the passive sentences with the universal quantifier in the subject position. Chinese-speaking children's preference to the existential wide scope reading for these ambiguous sentences is significantly stronger than adults'.

2 Characterizing the Distinction Between English and Chinese

As the results from the first and the third sets of experiments demonstrate, the scope discrepancy observed in English-speaking and Chinese-speaking children may well be attributed to the lexical idiosyncracies between English '*a*' and Chinese '*yi-ge*'. This can be seen clearly from the results of the third set of experiments. When '*a*' and '*yi-ge*' appear in the object noun phrase position in sentences with negation, English-speaking children interpret '*a*' as under the scope of negation, but Chinese-speaking children

[55] Although both Chinese-speaking children and adults prefer the existential wide scope reading ("a > every"), children's preference is stronger than adults as shown in the significantly lower acceptance of the

consider '*yi-ge*' as taking a wide scope over negation. In this section, we will discuss the characterization of the distinction between the ways English-speaking and Chinese-speaking children interpret the indefinite.

One way to characterize the distinction is to say that Chinese-speaking children interpret '*yi-ge*' to mean "exactly one", but English-speaking children consider '*a*' to be an existential quantifier meaning "at least one". This would mean that Chinese-speaking children treat '*yi-ge*' as scope independent, but English-speaking children treat '*a*' as quantificational. A problem with this charaterization is that if English-speaking children do interpret '*a*' as meaning "at least one", then in the double object sentences where one of the three characters gets all the objects, the context should be consistent with the "at least one" reading and elicit a Yes answer from children[56]. Since English-speaking children rejected the sentences given in this context, this may not be the right way of characterizing the distinction.

Another way of characterizing the difference is to postulate that Chinese-speaking children consider '*yi-ge*' to refer to something "specific" (or "referential") by default, and English-speaking children take the indefinite '*a*' to be "non-specific". With respect to the definition of "specificity" or "referentiality", although various assumptions are made in the linguisitc literature, the most wide spread view is that an NP is considered specific if it has wide scope over an operator (e.g. Fodor and Sag 1982). Enς (1991) considers this view as just a descriptive term and further elaborates Heim's (1982) theory of definiteness to account for specificity.

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universal wide scope reading ("every > a").

[56] Thanks to Gennaro Chierchia for pointing out this to me.

According to Enç, all NPs carry a pair of indices. The first index represents the referent of the NP. The feature of the second index determines the definiteness and the specificity of the NP by constraining the relation of the referent of the NP to other discourse referents. Definiteness involves a strong link, i.e. the second index will be identical to the first one, whereas specificity involves a weak link, i.e. the second index will be a subset of the first one or stand in some recoverable relation to a familiar object. The discourse referent of a non-specific indefinite is required to be unrelated to previously established referents. Based on this, indefinite NPs such as *two boys* can be ambiguous in terms of specificity in certain contexts, having either a covert partitive reading (i.e. specific) or a non-partitive reading (i.e. non-specific) as shown in the following example (from Enç 1991, p. 8).

(1) a. Several children entered the museum.
b. I saw two boys at the movies.

In the above example, if the two boys who chose to go to the movies were not from the group of children who entered the museum, since there is no linking between them in discourse referent, the NP *two boys* is non-specific. But if the two boys who went to the movies were among the group of children who entered the museum, since the referent of *two boys* is included in the referent of *several children*, the NP *two boys* is specific.

Given Enç's formalization of specificity, a problem arises in characterizing the distinction between English '*a*' and Chinese '*yi-ge*' as *non-specific* versus *specific* in child language. The problem lies in the fact that in our experiments, all the characters are introduced in the story and then mentioned by the puppet before the test sentences with the indefinite NP are uttered. Therefore, according to Enç, the indefinite NP was always

specific, regardless of whether the objects in the story were given to only one or all of the characters.

An important fact about the difference between the children's interpretations of the indefinites '*a*' and '*yi-ge*' is that English-speaking children always consider all the entities introduced by the indefinite NP as a whole, but Chinese-speaking children only consider one of them. That is to say, for a sentence like "*Snow White gave a lady every flower*", English-speaking children require all the ladies in the discourse domain to be given some flower, and for "*Mickey Mouse didn't ride a dog*", all the dogs as a group must not have been riden by Mickey Mouse. To interpret the indefinte this way is like treating it as a bare plural[57] (in the sense of Carlson 1977) or a free choice '*any*' (Carlson 1981; Kadmon and Landman 1993) as demonstrated in the following examples.

(2) Bare Plural
   a. John didn't see spots on the floor.
   b. It is not the case that John saw spots on the floor.
   c. There were spots on the floor that John didn't see.

(3) Free Choice '*Any*'
   Any lawyer could tell you that.

As indicated in Krämer (2000, p. 30, which was adopted from Van Greenhoven 1998), (2a) only has the reading in (2b) because the bare plural *spots* is absorbed by the verb as a predicate of its internal argument's variable. The semantic incorporation of the bare plural makes it unable to escape from the scope of negation, as does the semantically incorporated indefinite. Therefore, predicative indefinites must take narrow scope with

[57] Thanks to Paul Pietroski for this suggestion.

respect to operators affecting the verb. The parallelism among indefinite noun phrases, bare plurals, and free choice '*any*' can be further illustrated in the following examples.

(4)	a.	(Even) a five-year-old child can do this.	(indefinite)
	b.	Five-year-old children can do this.	(bare plural)
	c.	Any five-year-old child can do this.	(free choice '*any*')

Note that the semantically incorporated predicative interpretation of indefinites is non-quantificational. As shown in the following example (from Krämer 2000, p. 63, which she cited from Van Greenhoven 1998), a verb such as "to have" which must take a predicative NP is not interpretable with a quantificational noun phrase.

(5) a. Mary has three sisters.
b. *Mary has every sister.

The reason why (5b) is not possible is because quantifiers cannot incorporate, hence the utterance is uninterpretable.

As argued above, the semantically incorporated predicative interpretation that English-speaking children initially assign for the indefinite is non-quantificational. Now let us take a look at the case in Chinese.

What we observe from the results obtained from Chinese-speaking children is that their initial value for the indefinite '*yi-ge*' is "exactly one". A question we should ask with respect to specificity is whether they allow for '*yi-ge*' the [+specific] value as default, and if so, why specifics are acquired later in development for children acquiring other languages (e.g. Schaeffer 1997; Krämer 2000). In the rest of this section, we will argue that what looks to be a [+specific] interpretation of '*yi-ge*' by Chinese-speaking

children is actually a result of the quantity-denoting number expression (NumP) that Li (1996, 1998) argues for.

Drawing on data from the distribution and interpretation possibilities of Chinese nominal expressions of the form [Number + Classifier + Noun], Li (1996, 1998) argues for the existence of a DP projection in Chinese as well as the existence of a category other than DP (i.e. NumP) in argument position. Since non-quantity indefinite individual-denoting expressions (DPs) are related to entities in the discourse/world but quantity number expressions (NumPs) are not, she proposes the following structural representations for the two categories.

(6) a. $[_{DP}$ D $[_{NumP}$ san-ge xuesheng]]
three-CL student
b. $[_{NumP}$ san-ge xuesheng]]
three-CL student

An indefinite DP with a structure like (6a) denotes individuals because of the presence of the D projection. 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 Chinese as shown in (7). Since the quantity-denoting number expression with a structure like (6b) does not have a D, the restriction is irrelevant, and hence it can appear in the topic or subject position as shown in (8).

(7) *san-ge xuesheng zai xuexiao shoushang le[58]
three-CL student at school hurt PAR
"Three students were hurt at school."

(8) wu-ge xiaohai chibuwan shiwan fan

[58] The sentence will be fine with the existential marker *you* 'have, exist' before the subject nominal expression.

five-CL child eat-not-finish ten-bowl rice
"Five children cannot finish ten bowls of rice."

Li argues that quantity-denoting number expressions are not quantificational expressions quantifying over individuals, and therefore they do not interact with other quantificational expressions with respect of scope as illustrated in the example in (8). This sentence can only have the interpretaion that five children cannot finish, among them, ten bowls of rice. It cannot mean that there are 50 bowls of rice altogether (with the first nominal taking wide scope). Without having recourse to saying that Chinese-speaking children acquire the specific or referential reading of the indefinites earlier than children acquiring other languages, we propose that Chinese-speaking children interpret '*yi-ge*' as a quantity-denoting number expression (NumP).

To recapitulate our discussion in this section, we have argued that English-speaking children initially interpret the indefinite '*a*' as the semantically incorporated predicative reading, whereas Chinese-speaking children consider '*yi-ge*' as a quantity-denoting number expression. Neither '*a*' nor '*yi-ge*' is analyzed by children as quantificational expressions. Given the multiple interpretations '*a*' and '*yi-ge*' can allow, children do not have a full grasp of all the adult readings from the beginning. Instead, children hypothesize a default value based on the lexical idiosyncracies in the language they are acquiring. In the next section, we will discuss the learnability problem posed by the non-adult interpretation assigned by English-speaking children for the double object sentences.

3 How Do Children Converge on the Adult Grammar?

Now that we have characterized the interpretations English-speaking children have for the indefinite '*a*' and Chinese-speaking children have for '*yi-ge*' as not quantificational expressions, a question remains as to how children converge on the adult grammar.

The interpretation Chinese-speaking children initially assign is one of the two meanings the ambiguous sentences have, such as sentences with negation "*Tigger didn't jump over a fence*", and passive sentences "*Every dog was bought by a smurf*". Since children's interpretation is a subset of the interpretations allowed by adult grammar, all they need is positive evidence provided in the linguistic environment to expand the possible interpretations.

A puzzle arises for the English case. Recall that the universal wide scope reading English-speaking children assign to the double object sentences like "*Snow White gave a lady every flower*" is not a possible interpretation for adults. Given the assumption that there is no reliable negative evidence in the linguistic environment (Brown and Hanlon 1970, Marcus 1993) to help children get rid of the non-adult meaning, a plausible question to ask is how can English-speaking children expunge the non-adult interpretation from their grammar. In the following, we will argue that since the initial interpretaion English-speaking children have for the indefinites is not quantificational, once they realize the quantificational usage later in their development, Quantifier Raising (i.e. QR, as in May 1977, 1985 and sebsequent works) will apply. The relevant constraints (e.g. locality constraints like Minimality and Shortest) applied to QR as argued in Bruening (to appear) will therefore expunge the non-adult reading for the double object construction from children's grammar.

Bruening (to appear) relates the phenomenon of "frozen scope" in double object and spray-load construction (as shown in the examples below) by proposing that the facts in both cases can be accounted for as the effect of economy principles that derive the Superiority Condition of Chomsky 1973.

(9) Double Object Construction

a.	The teacher gave a (different) book to every student.	(every>a OK)
b.	The teacher gave a (#different) student every book.	(*every>a)

(10) Spray-Load Construction

a.	Maud draped a (different) sheet over every armchair.	(every>a OK)
b.	Maud draped a (#different) armchair with every sheet.	(*every>a)

As shown above, when the Goal is the first noun phrase in the two constructions, the inverse scope is prohibited in English, which generally allows free scope interaction. In addition to the interaction of two quantifiers, scope freezing can also be found in quantifier-*wh* interactions and bound variable readings, as shown below.

(11) Quantifier-WH Interaction

a.	Which sheet did he drape *t* over every armchair?	(pair-list OK)
b.	Which book did you give *t* to every student?	(pair-list OK)
c.	Which armchair did he drape *t* with every sheet?	(*pair-list)
d.	Which student did you give *t* every book?	(*pair-list)

(12) Bound Variables

a.	Sally sent a student who'd taken her$_1$ course to every professor$_1$.	(every>a)
b.	Maud draped a sheet that matched its$_1$ color over every armchair$_1$.	(every>a)
c.	*Mona sent a professor who'd reviewed it$_1$ every book$_1$.	(*every>a)
d.	*Maud draped an armchair that matched its$_1$ color with every sheet$_1$.	(*every>a)

As illustrated above, pair-list readings and bound variable interpretations are allowed in the *to*-dative sentences (11b, 12a) and the locative variant of the spary-load construction

(11a, 12b), but prohibited in the scope freezing double object (11d, 12c) and the '*with*' variant of the spray-load constructions (11c, 12d).

Bruening argues that the frozen scope can not be due to the second object being unable to move (as proposed by Fox 1995), since ACD (antecedent-contained deletion) is permitted in the examples below, and QR is generally assumed to resolve ACD.

(13) a. Ozzy gave someone everything that Belinda did [$_{VP}$ Δ]. (*every>some)
b. Cleo wrapped a (#different) bedpost with every dress Chloe did [$_{VP}$ Δ]. (*every>a)

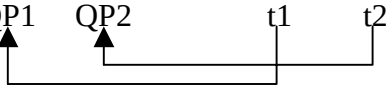
Bruening accounts for the frozen scope problem by proposing that both quantified objects are moved, but in such a manner as to leave their relative scope unchanged. He argues that the Minimality (adopted from Collins 1997) and Shortest (modified from Richards 1997) constraints not only account for cases of multiple wh-movement, but will also generalize to movement operations that are not obviously feature-driven such as QR.

(14) MINIMALITY
An operation OP may apply only if it obeys SHORTEST.

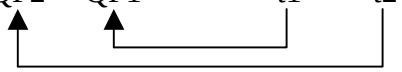
(15) SHORTEST
An operation OP relating a pair P of elements [α, β] obeys Shortest iff there is no operation OP' relating a well-formed pair P' which can be created by substituting γ for either α or β, and the set of nodes c-commanded by one element of P' and dominating the other is smaller than the set of nodes c-commanded by one element of P and dominating the other.

Based on these, the crossing-path kind of movement (as in (16a) below) which makes the relative scope unchanged will be allowed, but the nested-path kind of movement (as in (16b)) which results in the inverse scope will be ruled out by SHORTEST[59].

(16) a. QP1 QP2 t1 t2



b. * QP2 QP1 t1 t2



Given this account for QR in frozen scope constructions, once English-speaking children realize the quantificational usage of indefintes, the constraints restricting QR will be in force and drive the non-adult interpretation out of children's mental grammar.

4 Further Considerations on the Learnability Problem

In the account proposed above, we consider the fact that English-speaking and Chinese-speaking children start off with just one (but different) of the possible interpretations for '*a*' and '*yi-ge*' as the Unique Entry Principle (e.g. Pinker 1984) at work. As illustrated in section 1 of Chapter 5, both '*a*' and '*yi-ge*' can be interpreted as "exactly one" or non-specific (i.e. free choice "any") in appropriate contexts for adults. By contrast, the results of the experiments suggest that English-speaking children may

[59] Although frozen scope is observed in the constructions discussed (i.e. when both objects contain a quantifier NP), a question arises as to why ambiguity exists when the first object is not a quantifier (as in (i)), and in a transitive sentence like (ii) in English.

(i) A (different) teacher gave me every book.
(ii) A girl kissed every bride.

initially consider '*a*' as meaning non-specific (or free choice "any"), whereas Chinese-speaking children start off with the "exactly one" interpretation for '*yi-ge*'. This can be illustrated in Table IV below.

Table IV.
The Unique Entry Principle in Children's Interpretation of '*a*' and '*yi-ge*'

	Exactly One	Any (non-specific)
English	'*one*'	'*a*'
Chinese	'*yi-ge*'	bare noun

As shown in Table IV, English-speaking children may distinguish '*a*' from '*one*', with the former meaning non-specific (or free choice "any") and the latter meaning "exactly one". As for Chinese, children may initially consider '*yi-ge*' to mean "exactly one", and leave the non-specific interpretation for bare nouns. The reason why children make such a distinction is because of a constraint from the Unique Entry Principle telling children that "no complet set of grammatical feature values may be encoded by two or more distinct morphemes" (Pinker 1984, p. 177), and therefore children assume that different words mean different things.

I will describe two learning accounts to explain how children converge on the adult grammar. An assumption behind the first account is that the constraints for Quantifier Raising are not effective until the other interpretation of '*a*' and '*yi-ge*' is realized by children. The triggering data for children to expand the possible interpretations presumably would be the alternative reading of an ambiguous sentence (i.e. active or passive) containing another operator such as negation or the universal quantifier '*every*'.

Following Heim and Kratzer (1998), Bruening argued that since subjects do not need to move in order to be interpreted, subjects and objects do not compete for movement to the same position. Because there is no competition, MINIMALITY does not apply.

In the case of the double object construction in English, this account will take the assumption that the locality constraints will rule out the non-adult interpretation children have that analyzes the indefinite NP as a bare noun in its non-raised position.

The account proposed here also considers the different interpretations of sentences containing the indefinite '*a*' or '*yi-ge*' and the universal quantifier as resulting from distinct structures at a conceptual-intentional interface level (i.e. Logical Form). Chierchia and McConnell-Ginet (1990, pp. 114-120) provide some arguments against the view that there is no ambiguity in a sentence like (17), and that the more specific reading, where the loved one happens to be the same for everybody, is derived by contextual factors.

(17) Everyone loves someone.

One argument that poses problems for the proposal that quantifiers are interpreted in their linear order in terms of c-command at the surface structure comes from the following sentences.

(18) a. There was a name tag near every plate.
b. A flag was hanging in front of every window.
c. A student guide took every visitor to two museums.

For (18a, b), the preferred reading is the one where *every plate* (*every window*) has wide scope, which cannot be derived by appealing to contextual factors. For (18c), of the six possible quantifier construals, the most general one is the one where the second quantifier has scope over the other two. Therefore, a mechanism for assigning wide scope to the quantified NP that is not the leftmost one is needed.

Another argument for the scope ambiguity of (17) is that if the only reading for (19a) is (19b), since on such a proposal (19a) is unambiguous, the only possible reading for the negation of (19a), i.e. (19c), would be the one shown in (19d).

(19) a. Everyone loves someone I know.
b. $\forall x \exists y[\text{know}(\text{I}, y) \wedge \text{love}(x, y)]$
a. It is not the case that everyone loves someone I know.
b. $\neg\, \forall x \exists y[\text{know}(\text{I}, y) \wedge \text{love}(x, y)]$

In a scenario in which everyone loves a different person I know, it would be appropriate to report such a situation by means of (19c). However, (19d) would be false in such a scenario, because everyone does love one of my friends or another. We can also see the problem by looking at its logic. As shown in (20), the more general reading $\forall\exists$ in (20b) is the superset of the more restricted reading $\exists\forall$ (i.e. $\exists\forall$ entails $\forall\exists$).

(20) a. Everyone loves someone.
b. $\exists\forall \rightarrow \forall\exists$
c. $\neg\, \forall\exists \rightarrow \neg\, \exists\forall$

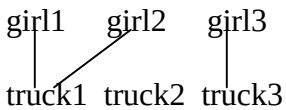
However, under negation the pattern is reversed, as shown in (20c) $\neg\, \exists\forall$ is the more general reading (the entailed one). Based on these, Chierchia and McConnell-Ginet argue that the strategy of assigning positive sentences like (20a) only the more general $\forall\exists$ reading is problematic and that scope ambiguities are real.

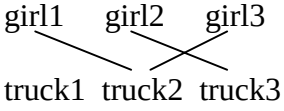
The view that (20a) has two distinct readings is not accepted by everyone in the linguistic literature. For example, Hornstein and Pietroski (1999) challenged the view that an expression like (21a) has two distinct readings, but granted that a sentence like (21b) does exhibit a scope ambiguity.

(21) a. Every girl likes some truck.
b. Some girl likes every truck.

The reason for arguing that (21a) does not exhibit scope ambiguity comes from the fact that in addition to the ∀∃ and the ∃∀ interpretations, the sentence is also true in various different situations as shown in (22).

(22) a.


b.


c.


However, it does not follow that (21a) is many ways ambiguous, as a quantified expression can be true in various situations on a single reading.

Hornstein and Pietroski proposed an account for the non-ambiguity of (21a) and the ambiguity of (21b). Following Chomsky's idea that "movement" is the result of two simple operations (i.e. copy and delete), after the two DPs are copied into the two Agr positions, there are four logical possibilities for deletion. It further follows Diesing's (1992) distinction of "strong/definite" (e.g. *every*) and "weak/indefinite" (e.g. *some*) expressions, and the proposal that propositions have a tripartite structure, with strong and weak DPs occupying different parts of propositional structures. It is then assumed that definite quantifiers like '*every*' have some property such that by the end of the derivation, expressions with that property cannot remain in VP (i.e. the original propositional shell). Based on these, the four logical possibilities for deletion (parentheses indicating the

deleted DP) and the ones that are ruled out are shown in (23) for the non-ambiguity of (21a), and in (24) for the ambiguity of (21b).

(23) a. [every girl [some truck [(every girl) [likes [(some truck)]]]]]
b. *[(every girl) [some truck [every girl [likes [(some truck)]]]]]
c. [every girl [(some truck) [(every girl) [likes [some truck]]]]]
d *[(every girl) [(some truck) [every girl [likes [some truck]]]]]

(24) a. [some girl [every truck [(some girl) [likes [(every truck)]]]]]
b. [(some girl) [every truck [some girl [likes [(every truck)]]]]]
c. *[some girl [(every truck) [(some girl) [likes [every truck]]]]]
d. *[(some girl) [(every truck) [some girl [likes [every truck]]]]]

Although the account can explain the ambiguity/non-ambiguity in English, it is not clear at this point how this can leave the double object sentences unambiguous in English.

Unlike the above accounts, which postulate scope ambiguity as resulting from syntactic structures, Fodor and Sag (1982) treated the different interpretations as the lexical ambiguity of the indefinite '*a*'. It was proposed that the indefinite '*a*' has both a quantifier interpretation and a referential interpretation, and an indefinite interpreted referentially is not a scoped element and does not exhibit any scope ambiguity. One piece of evidence for the lexical ambiguity of '*a*' comes from multi-clause constructions involving islands. It is shown that every other quantifier, including '*each*', has its scope constrained by island boundaries, but '*a*' does not. Therefore, (25) and (26) contrast with (27) and (28) in permitting the indefinite to be interpreted with scope over the highest clause.

(25) John overheard the rumor that a student of mine had been called before the dean.

(26) John thinks that for a student I know to be called before the dean would be preposterous.

(27) John overheard the rumor that each of my students had been called before the dean.

(28) John thinks that for each of my students to be called before the dean would be preposterous.

Based on this, it is argued that if '*a*' only has a quantificational interpretation, the ability for it to escape from scope islands will need to be recorded in the grammar as an exception to the general principles governing quantifier scope. However, if '*a*' also has a referential interpretation, there will be no need to attribute any exceptional characteristics for '*a*' as a quantifier.

It is beyond the scope of this thesis whether the various interpretations of '*a*' and '*yi-ge*' in sentences containing other quantifiers are the results of purely syntactic derivations, purely lexical ambiguities, or perhaps both. However, there is a second possible account worth considering here about how English-speaking children expunge the non-adult interpretaion for the double object sentences from their grammar which is worth considering here. As indicated in note 3 of Chapter 1, a double object sentence with generic tense as in (29) may have an illusion of allowing the universal quantifier to take wide scope over the existential quantifier.

(29) In general, I give [a tourist]$_{\exists}$ [every leaflet]$_{\forall}$. ($\exists > \forall$; $\forall > \exists$)

If the illusion is real, then children's universal wide socpe interpretaion for these sentences may not really be "non-adult". It may be likely that the interpretation is also part of the adult grammar, but some pragmatic factors (e.g. conversational implicature)

prohibit adults from assigning the reading to sentences in certain contexts (e.g. describing a past event). Since children may not have acquired the relevant pragmatic knowledge, they assign the interpretation in those circumstances where adults reject them. This possibility is plausible, as Crain et al. (2000) found that children accepted the inclusive reading of '*or*' in the contexts where adults only accepted the exclusive '*or*' interpretaion. In the next section, we will discuss the idea of "scalar implicatures" and the suggestion of some future research in more detail.

5 Scalar Implicatures and Future Research

The account discussed in section 2 and 3 concerned the way children interpret the indefinite noun phrases in English and Chinese, and how the locality constraints can expunge the non-adult interpretation from children's mental grammar once they acquire the quantificational interpretation of the indefinites. In this section we will take a look at some relevant issues regarding scalar implicatures (as discussed in Crain 2000, Olsen and Crain 2000, Crain et al. 2000, Chierchia et al. 2001). What we will argue for is that children at an early stage interpret '*a*' according to its logic meaning "at least one", and later after the acquisition of pragmatics, scalar implicatures will lead children to the meaning "exactly one".

In the standard view of scalar implicatures, it is assumed that the interpretation of logical words derives from an interaction between principles of semantics and principles of pragmatics. Principles of semantics provide the truth conditions for logical operators, which are assumed to be acquired as soon as language learners identify the words of the language that map onto the logical operators. However, language users are also affected

by pragmatic principles when using or interpreting sentences with logical words. It is generally assumed that conversational implicatures are governed by pragmatic principles such as Grice's principle of cooperation described in (30). The principle of cooperation is articulated into a number of more specific maxims, including the maxim of quantity as in (31).

(30) Principle of Cooperation (from Olsen and Crain 2000)
Make your conversational contribution such as required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged.

(31) Maxim of Quantity (from Olsen and Crain 2000)
a. Do not say what you believe to be false.
b. Do not say that for which you lack adequate evidence.

The maxims yield conversational implicatures to govern the use of linguistic expressions. Therefore, the basic meanings of logical words conform to standard logic, but in many conversational contexts, the use of these words implies but does not entail the most informative meaning. The reason for this is that some of the truth conditions corresponding to these words also correspond to other logical words (Crain et al. 2000, p. 50). For instance, the logical word '*and*' is associated with one of the truth conditions corresponding to '*or*', as shown in the example below.

(32) I bet John will order pizza or pasta.

The speaker of the sentence in (32) can win the bet in three situations, in which either John orders pizza only, or he orders pasta only, or he orders both pizza and pasta. In situations of uncertainty such as a prediction or a bet, scalar implicatures do not arise, as

a minimum requirement is established, and hence the full range of truth conditions corresponding to a logical word should be available to language users. Since the word '*and*' is true in a narrower set of circumstances than '*or*', the use of '*and*' is more informative than '*or*' in some contexts. The idea of scalar implicature is that "the assertation of an element on a scale implicates the negation of any more informative element on the same scale, on the assumption that speakers are being as informative as they can be" (Crain 2000). Therefore, in the contexts that give rise to conversational implicature (e.g. in describing events), the use of a weaker term '*or*' will imply it is *'not and*', as shown in the following example.

(33) John ordered pizza or pasta.

When hearing the sentence in (33), one will infer that the speaker does not mean John ordered both pizza and pasta, because if the speaker intends to mean that, a more effective way of expression (i.e. by using '*and*') will convey the information more directly.

Based on these, Olsen and Crain (2000) tested the hypothesis that early representation of the indefinite '*a*' is its classical logic meaning "at least one", and later acquisition of pragmatics, i.e. scalar implicature, derives its meaning as "exactly one". Two experiments were conducted, using the truth-value judgement task. In the first experiment, in which prediction contexts were used, the indefinite NP appeared in the antecedent of the conditional sentence as in (34a). After the puppet said the test sentence, some objects (e.g. two policemen) appeared on the stage, and subjects had to decide whether the puppet's prediction was right or wrong.

(34) a. If *a policeman* is on the stage, I get a coin!
b. If Merlin says shaZAM, *an animal* appears.

The results showed that English-speaking adults accepted '*a*' as "at least one" in the antecedent 77.5% of the time, and children accepted it 98.6% of the time. In the second experiment, in which description contexts were used, the indefinite NP was in the consequent of the conditional sentence as in (34b). Unlike the results in the first experiment, adults in the second experiment accepted the "at least one" reading for '*a*' only 18.4% of the time, and children accepted it only 55.3% of the time. However, there was an age effect for children. Children older than 5 accepted the reading only 22.2% of the time, but children under 5 accepted it 85% of the time. In both experiments, there was also an action task in which the puppet said, for instance, "*Please give me a troll*", and then there were six trolls put on the stage. Subjects had to decide whether what is put on the stage conforms to the command. In both experiments, adults and children interpreted '*a*' as "exactly one" at least 90% of the time for the action task.

Based on these results, it was concluded that there is a distinction between semantics, which is acquired early, and pragmatics, which is acquired later. The results also support the hypothesis that the early representation for the indefinite '*a*' is its classical logic meaning "at least one", and the "exactly one" meaning appears through later acquisition of pragmatics. The results also suggest that acquisition of pragmatics can vary in linguistic and discourse contexts, i.e. earliest acquisition in action contexts, and antecedent context earlier than consequent context.

For the findings obtained in our study, it seems reasonable to suppose that children at an early stage interpret '*a*' according to its logic meaning "at least one", and later after

the acquisition of pragmatics, scalar implicatures will lead children to the meaning "exactly one" in the contexts tested. There does not seem to be any clear evidence to tease these two possibilities apart at this moment. However, to consider English-speaking children's non-adult interpretation for the double object sentences as interpreting '*a*' to be "at least one" does not solve all the problems[60]. First, the double object sentences in our study are more similar to those used in Olsen and Crain's action task (e.g. "*Give me a troll*") than in their conditional sentences. Recall that in the context for the double object sentence "*Snow White gave a lady every flower*", one of the three ladies got all the flowers. It is not clear why children in our study rejected the "exactly one" reading, which is the only reading allowed by adults, but they accepted it over 90% of the time in the action task in Olsen and Crain (2000). The sentences used by Olsen and Crain (2000) did not involve other operators, but the sentences used in our study involved operators such as negation or a universal quantifier. It may be likely that children fail to assign the "exactly one" reading when the indefinite '*a*' has to interact with other operators. However, it is not clear why this can be the reason.

Second, Musolino (1998) found that there was a difference between the indefinite QNP containing '*some*' in the subject position and in the object position with respect to its interaction with negation. When the QNP containing '*some*' appears in the subject position, children had no problem interpreting it as taking wide scope over negation (100% acceptance), but when it is in the object position, children tended to interpret it as having narrow scope within negation (50% acceptance). A similar finding was also

[60] From the examples given in Olsen and Crain (2000), since the number of the objects appeared on stage was mostly two or more, it may still be likely that children distinguish '*a*' from '*one*', and interpret the former as "not exactly one".

observed in Krämar (2000) from Dutch-speaking children. When the indefinite was in subject position, the wide scope reading was accepted 62% of the time, but when it was in high object position, the acceptance was only 16% (and 27% in the follow-up experiment)[61]. It is not clear why there is a subject/object position effect if the late acquisition of scalar implicatures is what is responsible.

Since in our account an indefinite object NP is considered as semantically incorporated into the verb in child English, it will not predict children to have non-adult interpretation for the indefinite in subject position. As indicated in Krämar (2000, pp. 136-137), there may be two reasons why a subject indefinite NP can be different from an object indefinite NP. First, subject NPs have a free variable interpretation by default if they are indefinite. Second, the sentence-initial subject NPs are often discourse topics, and thus will lead to an interpretation in which prior discourse is taken into account.

Although in Musolino (1998), a quantified NP containing '*some*' in subject position was assigned wide scope over negation, the noun phrases he used were plural, as in "*Some horses won't jump over the fense*". One may argue that the results do not necessarily tell us whether children will interpret the indefinite '*a*' as having wide scope over negation in a sentence like "*A horse didn't jump over the fense*". A future study on this is needed to see if there is really a subject/object position difference in English-speaking children's interpretation of the indefinite. Another future research project worth

[61] In Krämar (2000), the discrepancy between subject and object positions was found for sentences with negation, but not for sentences with the adverb *twee keer* "twice". The acceptance for the indefinite subject NP to take wide scope was 61% (and only 38% in the follow-up experiment), and the acceptance of wide scope for the high object indefinite NP was 49%. Based on these results, Krämar (2000) argued that children acquire the predicative interpretation for indefinites early, regardless of the position in a sentence. However, as noted on p. 170, a study by Bergsma-Klein (1996) using a truth-value judgement task found that indefinite subject NPs take wide scope for Dutch-speaking children. Since Krämar (2000) used an act-out task for sentences with *twee keer* "twice", but a truth-value judgement task for sentences with negation,

conducting is to see whether English-speaking children accept the double object sentences like "*Snow White gave a lady every flower*" in a context in which the flowers are given to two of the three ladies. If the not-adult interpretation obtained in our experiments is really due to scalar implicature, and hence children interpret the indefinite '*a*' as "not exactly one", then they should accept the sentences in the new setting. But if children do analyze '*a*' as the free choice "any" or bare nouns as proposed in our account, then they should still reject the sentences for the reason that the third lady does not get any flower.

On this account, English-speaking and Chinese-speaking children interpret '*a*' and '*yi-ge*' differently in early development due to differences in the lexical system of the two languages. In Chinese, although '*yi-ge*' funcions in some sense like the indefinite, '*yi*' is also the numeral '*one*'. However, in English the indefinite and the numeral are represented by '*a*' and '*one*' respectively. The lexical idiosyncracy may result in children's taking only one of the possible meanings (although different in the two languages) as the default. Following this reasoning, we can predict that children acquiring each language should behave similarly in interpreting other quantifiers such as '*two*', '*three*', '*many*', and so on, as the lexical system in the two languages with respect to these quantifiers are alike. Another prediction of the account is that, cross-linguistically, children who acquire a language in which there is no separate indefinite article should pattern like Chinese-speaking children, and children acquiring a language with an indefinite article distinct from the numeral '*one*' should behave like English- or Dutch-speaking children.

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there might be a task effect that made the results incompatible with other studies using a truth-value judgement task.

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