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STUDIES ON QUANTIFICATION IN CHINESE

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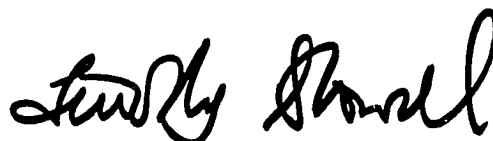
A dissertation submitted in partial satisfaction of the  
requirements for the degree Doctor of Philosophy  
in Linguistics

by

Thomas Hun-tak Lee

1986

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A handwritten signature in black ink, appearing to read "Timothy Stowell", written over a horizontal line.

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1986

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ABSTRACT OF THE DISSERTATION

Studies on Quantification in Chinese

by

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Doctor of Philosophy in Linguistics

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This study of quantification in Mandarin Chinese consists of two parts. The first part (Chapter One) presents a Government-Binding analysis of three issues in Chinese syntax: universal quantification, the distribution and referential properties of quantifier phrases and quantifier scope. The theory of quantification developed in May (1977, 1985) is adopted for the main body of this work. We propose that quantifier phrases in Chinese have the dual property of being able to function both as operators and as variables and that in Chinese the clausal node Quantifier Raising (QR) adjoins to *is S*" rather than *S*. These assumptions allow us to account for a range of distributional and referential

properties of quantifiers in the language. We also present evidence from Chinese showing that QR is essentially clause-bounded and that for Chinese the crucial determinants of scope order within the clausal domain is linear precedence rather than c-command.

The second part of the dissertation draws on the theoretical findings of Chapter One, and explores ontogenetic aspects of some of the quantificational properties of Chinese, specifically the isomorphic scope interpretation principle according to which the relative scope of two quantificational expressions can be mapped directly from Surface Structure. A principled account of how children may acquire quantificational competence is proposed, in which we argue that children initially view quantifiers as non-operators and that the relative scope property of quantifiers is learned on the basis of positive evidence. A parameter of scope order is also motivated. Experimental findings are reported on how Mandarin-speaking children and English-speaking children between three and eight years of age interpret sentences containing a universal quantifier and an existential quantifier. Our findings on acquisition of quantificational scope in Chinese support the hypothesis that the unmarked interpretation of quantifier phrases is a referential one, and that the divergences between the English and Chinese data may be due to cross-linguistic syntactic differences with respect to the quantifier phrases included in the experiment.

## Preface

This study of quantification in Mandarin Chinese consists of two parts. The first part (Chapter One) presents a Government-Binding analysis of three issues in Chinese syntax: universal quantification, the distribution and referential properties of quantifier phrases and quantifier scope. It will be argued that a number of core quantificational properties of the language can receive unified treatment if a level of Logical Form, a rule of Quantifier Raising and the notion of governing category are assumed. The theory of quantification developed in May (1977, 1985) is adopted for the main body of this work. In this part of the dissertation, we propose that quantifier phrases in Chinese have the chameleon property of being able to function both as operators and as variables and that in Chinese the clausal node Quantifier Raising (QR) adjoins to *is S* rather than *S*. These assumptions allow us to account for a range of distributional and referential properties of quantifiers in the language. We also argue following Hornstein (1984) that QR is essentially clause-bounded and that for Chinese the crucial determinants of scope order within the clausal domain is linear precedence rather than c-command, contrary to Huang (1981, 1982).

The second part of the dissertation draws on the theoretical findings of Chapter One, and explores ontogenetic aspects of some of the quantificational properties of Chinese, specifically the isomorphic scope interpretation principle according to which the relative scope of two quantificational expressions can be mapped



directly from Surface Structure. A principled account of how children may acquire quantificational competence is proposed. In this account, we argue that children initially view quantifiers as non-operators and that the relative scope property of quantifiers is learned on the basis of positive evidence. A parameter of scope order is also motivated. Experimental findings are then reported on how Mandarin-speaking children and English-speaking children between three and eight years of age interpret sentences containing a universal quantifier and an existential quantifier. It will be seen that the findings on acquisition of quantificational scope in Chinese support our hypothesis, and that the divergences between the English and Chinese data may be due to cross-linguistic syntactic differences with respect to the quantifier phrases included in the experiment. An attempt will be made to correlate the acquisition of relative scope of quantifiers with that of other salient properties of Chinese: the topic-prominent character of the language and the fact that the relative scope of modals and negation can also be predicted by linear order. Finally a number of suggestions are raised on the kind of experiments that will shed light on unresolved issues dealt with in the present study.

## Chapter One

### Three Aspects of Quantification in Chinese

#### 1.0 Introduction

This chapter investigates three areas of quantification in Mandarin Chinese: (a) the logical properties of the universal quantifier dou "all, each" and its interaction with wh-words and noun phrases without quantifier determiners; (b) the referentiality of numeral phrases; and (c) quantifier scope and the issue of clauseboundedness of Quantifier Raising.

The theoretical assumptions of our analyses are largely based on May (1977) and May (1985), the main assumption being that there is a level of Logical Form (LF) in syntax where generalizations about quantificational phenomena such as operator binding and scope relations can be captured. An important rule for deriving LF representations from Surface Structure (SS) is the rule of Quantifier Raising (QR), which adjoins quantifier phrases (Q-NP) to maximal projection nodes (NP, VP, PP, S). In May (1977, 1985), a large amount of evidence from English has been adduced showing that the rule of QR is subject to constraints akin to those governing syntactic movement. For example, just as noun phrases undergoing topicalization and wh-movement must move to positions c-commanding their traces, so a quantifier phrase undergoing QR must land in a position c-commanding the trace it leaves behind. Both need to obey a condition on proper binding which requires a binder to c-command its bindee. Another example showing the similarity between syntactic

movement and LF movement is that both are subject to certain island conditions such as the Complex Noun Phrase Constraint (CNPC), as (1-4) show.

- (1) We bought the film [that John saw]
- (2) \*John<sub>i</sub>, [we bought the film [that t<sub>i</sub> saw]]
- (3) We bought the film [that everybody saw]
- (4) \*Everybody<sub>i</sub> [we bought the film [that t<sub>i</sub> saw]]

Just as John cannot be topicalized out of a relative clause, so the Q-NP everybody cannot move out of the relative clause to have wide scope over the matrix clause at LF. Thus (3) cannot mean "for every person x, we bought the film that x saw."

The theoretical significance of LF as a level of syntactic representation is further demonstrated by Huang (1982), who shows that insights into Universal Grammar can be gained if we assume one difference between English and Chinese to be that while wh-movement in English occurs in the mapping from Deep Structure (DS) to SS, wh-movement in Chinese takes place in the mapping between SS and LF. Like wh-movement in syntax, wh-movement at LF must not violate the subcategorization properties of the verb.

- (5) COMP [Paul asked me [who<sub>i</sub> [John saw t<sub>i</sub>]]]
- (6) \*Who<sub>i</sub> [did Paul ask me [ t<sub>i</sub> [John saw t<sub>i</sub>]]]
- (7) COMP [Zhangsan wen wo [COMP [Lisi kanjian shei]]]  
ask me see who
- (8) COMP [Zhangsan wen wo [shei<sub>i</sub> [Lisi kanjian t<sub>i</sub>]]]  
ask me who see
- (9) \*Shei<sub>i</sub> [Zhangsan wen wo [t<sub>i</sub> [Lisi kanjian t<sub>i</sub>]]]  
who ask me see



In the event that the verb can subcategorize for both [+wh] and [-wh] complements, as with a verb like know, one would expect the sentence to be interpretable either as an indirect question or as a direct question. In terms of wh-movement in syntax, this would mean the wh-word can move into both the lower COMP and the matrix COMP, as seen in (14) and (15).

- In the Chinese sentences, corresponding to the SS (16), both (17) and (18) will be well-formed LF representations, (17) representing an indirect question reading "Zhangsan knows who Lisi saw," while (18) represents a direct question "Who does Zhangsan know Lisi saw."

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they lend further support to the value of postulating LF as a level of grammar and to these theoretical primitives.

## 1.1 Dou as a Universal Quantifier

### 1.1.0 Significance of dou

The adverb dou, which occurs in preverbal position following the subject, has been described as an adverb of scope and quantity by Chinese linguists (Ding 1961, Chao 1968, Li and Thompson 1981). It can mean either "all, each" or "even", as illustrated in (19), which can either be understood as "They all have graduated" or as "even they have graduated."

- (19) Tamen dou biye le  
They all graduate part./asp. (asp.=aspect marker  
part.=sentence-final particle)

Our analyses here are only concerned with dou as a universal quantifier.

An understanding of the logical properties of dou is crucial to any study of quantification in Chinese for a number of reasons. First of all, noun phrases denoting universal quantification typically require the presence of dou if they occur in subject position. In Chinese universal quantification can be signalled by reduplicating the classifier of a noun phrase or by means of the determiners mei 'every', renhe 'any', suoyou 'all', quan 'all/entire'.

- (20) a. Gege xuesheng \*(dou) hui kai che  
CL-CL student all know drive car  
"Every student knows (how to) drive a car"
- b. Meige xuesheng \*(dou) hui kai che  
every-CL student all know drive car  
"Every student knows (how to) drive a car"
- c. Renhe xuesheng \*(dou) hui kai che  
any student all know drive car  
"Any student knows (how to) drive a car"

d. Suoyou xuesheng \*(dou) hui kai che  
 all student all know drive car  
 "All students know (how to) drive a car"

e. Quanbu xuesheng \*(dou) hui kai che  
 all-CL student all know drive car  
 "All students know (how to) drive a car"

These four determiners have somewhat different distributional properties: renhe 'any' and suoyou 'all' differ from mei 'every' and quan 'all/entire' in that the former can never precede classifiers in a noun phrase while the latter two can.<sup>1</sup>

(21) mei ban xuesheng  
 every class student "Every class of students"

(22) quan ban xuesheng

(23) renhe (\*ban) xuesheng

(24) suoyou (\*ban) xuesheng

Mei can be further differentiated from quan: while mei can cooccur freely with any classifier capable of being understood as denoting an individual, quan is generally used with classifiers denoting a set or collective, or a classifier denoting an individual interpretable as having extent.

(25) \*quan ci biaoyan / mei ci biaoyan  
 time performance/ every time performance

(26) \*quan chi bu / mei chi bu  
 foot cloth foot cloth

(27) quan zhi bi / mei zhi bi  
 rod pen rod pen

(28) quan zhang zhi / mei zhang zhi  
 sheet paper sheet paper

(29) quan bao mi / mei bao mi  
 sack rice sack rice

(30) \*quan ge xuesheng / mei ge xuesheng  
 CL student CL student



(31) \*quan zhong gongzuo / mei zhong gongzuo  
           kind work                   kind work

(32) quan renlei / \*mei (CL) renlei  
           mankind                   mankind

(33) quan Zhongguo / \*mei (CL) Zhongguo  
           China                   China

(25-26) and (30-31) show that since the classifiers ci 'time' and chi 'foot' indicating units of measurement, as well as the general classifier ge 'individual',<sup>2</sup> and the classifier zhong 'type, kind' are normally not understood as having extent, quan cannot be used with these classifiers. In (27-29), where zhi 'rod', zhang 'sheet' and bao 'sack' can be interpreted as encompassing length or size, quan can be used. A related characteristic of quan is that it can modify nouns referring to a unique set of individuals while mei cannot, as (32-33) illustrates. Renlei 'mankind' and Zhongguo 'China' refer to unique entities, and these can only be modified by quan and not by mei.<sup>3</sup>

In spite of these distributional differences, noun phrases containing these determiners or the reduplicated classifiers need the support of dou if they occur in subject position, as shown in (20). The essential role of dou can also be seen from the fact that it alone can function as a universal quantifier without the above mentioned determiners. (34-35) show that dou is the obligatory element in universal quantification.

(34) Tushuguan dou guan men le  
       library all close door asp./part.  
       "(the)libraries have all closed"

(35) Zhe jige xiaohai dou hen congming  
       this several child all very intelligent

"These several children are all very intelligent"

Thus, not only is dou required to support universal quantifiers such as meige N, suoyou N occurring in subject position, but it can also function independently as a universal quantifier. A third property of dou underscoring its importance is that it can quantify wh-words in subject/topic position to denote 'every/any'. When combined with shei 'who' the pair means 'everyone/anyone'; when cooccurring with shenme 'what' the resultant meaning is 'everything/anything'; dou can also be used with nei 'which', zhenme 'how', nali 'where' to yield the meanings 'every/any', 'by whatever/any means' and 'everywhere/anywhere'. (36-40) illustrate these uses.<sup>4</sup>

- (36) shei dou hui youyong  
who all know swim  
"Everyone/anyone knows (how to) swim"
- (37) shenme ren wo dou bu pa  
what person I all not fear  
"I am not afraid of anyone"
- (38) nei jia dianyingyuan dou you lengqi  
which CL cinema all have air-conditioning  
"Every/any cinema is air-conditioned"
- (39) nali dou zhao bu dao Zhangsan  
where all find not compl. (compl.=complement)  
"Zhangsan cannot be found anywhere"
- (40) ni zhenme yang tiao dou keyi  
you how CL select all may  
"You may select in whatever/any way (you want)"

The fact that dou can function independently as a universal quantifier and that it can interact with a range of wh-words shows that a detailed analysis of this adverb may be a prerequisite to

understanding universal quantification in Chinese. This section 1.1 presents an analysis of dou under the following headings: constraints on dou-quantification, distribution, binding of wh-words, distributivity and quantifier marking. We will formalize the quantificational effects of dou by means of a rule of coindexing which applies at SS. It will be shown that such a formulation will contribute toward a unified analysis of seemingly disparate phenomena.

#### 1.1.1 Constraints on dou-quantification

It is a well-known fact from previous studies (Ding, Chao, Li and Thompson) that dou must quantify constituents to its left, and that there is a plurality requirement on the constituents it quantifies.

- (41) [Zhangsan de xiaohai] dou biye le  
           nom child all graduate asp./part. (nom=nominalizer)  
       "Zhangsan's children have all graduated"
- (42) [Zhangsan he Lisi] dou qu guo Beijing  
           and all go asp.  
       "Zhangsan and Lisi have both been to Beijing before"
- (43) [mei ge ren] dou you che<sup>5</sup>  
       every CL person all have car  
       "Everybody has a car"
- (44) [niunai] dou he wan le  
           milk all drink compl. asp./part.  
       "(the)milk has all been drunk"
- (45) \*Zhangsan dou shui le<sup>6</sup>  
           all sleep asp./part.
- (46) Zhe zhang zhi dou hua le mao  
       this sheet paper all draw asp. cat  
       "All of this sheet has been drawn with cats"

(41-42) illustrate instances of count nouns being quantified by dou.

(42) quantifies a set of two individuals and the sentence asserts

that each of them has been to Beijing before. In (43), dou appears to be playing a seemingly redundant role in supporting the subject quantifier meige ren. (44) provides an example of a mass noun receiving a partitive interpretation, while (45-46) reflect the nature of the plurality requirement. The predicate of (45) sleep can only hold of a complete individual and not parts of an individual, but dou requires a plural antecedent, hence the ungrammaticality of the sentence. In (46), on the other hand, the predicate can hold of different parts of the sheet of paper, and thus the sentence can be grammatical under a partitive reading.

The leftward direction of quantification is shown in the following examples.

(47) \*ta dou kanjian [nei xie xiaohai]  
s/he all see those child

(48) [neixie xiaohai]<sub>i</sub> [ta dou kanjian t<sub>i</sub> le]  
those child s/he all see asp.  
"s/he has seen all those children"

(49) \*Zhangsan dou renshi [meige ren]  
all know every-CL person

(50) [meige ren]<sub>i</sub> [Zhangsan dou renshi t<sub>i</sub>]  
every-CL person all know  
"Zhangsan knows everyone"

These sentences reveal that the direction of dou-quantification must be leftward, as the sentences where the potential antecedents are found in object position (47, 49) are ill-formed, while the counterparts of this pair of sentences (48, 50) with the object NPs topicalized to a position left of dou are grammatical.

In the context of the Extended Standard Theory framework assumed here, the question as to at what level of representation

dou-quantification takes place naturally arises. There is strong evidence that dou-quantification must take effect at SS, and not at DS or LF. (51-52) suggest that dou-quantification does not take place at DS.

(51) [e dou xi le yifu]  
all wash asp. clothes  
"(some people) have all washed (their) clothes"

(52) yifu<sub>i</sub> [e dou xi le t<sub>i</sub>]  
clothes all wash asp.  
"(the) clothes have all been washed"

(51) represents the sentence corresponding to the DS of (52) in which the NP yifu 'clothes' has been topicalized. If dou-quantification only applies at DS, then one would expect first of all that (51) and (52) are synonymous and secondly, they should have the same grammatical status. However, (51) is grammatical only under the reading where the null subject refers to some set of individuals understood from the discourse context. The sentence cannot mean "the clothes have all been washed". However, (52) encompasses both readings. Thus the evidence rules out the possibility that dou-quantification takes place only at DS, but is consistent with the position that it applies at both DS and SS, as well as the position that it only applies at SS. Consider subject inversion cases such as (53) below where the object position is occupied by a postposed DS subject.

(53) [e dou lai le keren]  
all come asp. guest  
"Guests have arrived (at certain times/ places)"

(54) [keren dou lai le]  
guest all come asp.  
"(the) guests have all arrived"

Here again, (53) is a sentence whose DS corresponds to the DS of (54). If the effect of dou is realized at DS and SS, one would expect (53) and (54) to share the reading represented by the latter, which is an interpretation where keren 'guest' is quantified. (53), however, only has a reading where implicit spatial-temporal locations are quantified and lacks the interpretation of (54).<sup>7</sup> The evidence therefore suggests that dou-quantification applies at SS. Given the preceding discussion, we assume that for Chinese, a rule of dou-coindexing applies at SS, as follows.

(55) dou-coindexing

Coindex dou with any constituent to the left of it

Since the binding relationship here represented by the coindexing is not a relationship of coreference, we symbolize the coindexing with superscripts to distinguish it from binding relationships such as those between topics and wh-phrases and their respective traces. The fact that dou-coindexing cannot apply at LF is supported by (49) and (56).

- (56) \*Zhangsan dou kanjian shei<sup>8</sup>  
                   all     see       who  
                   "Zhangsan saw everybody"

In Standard Mandarin, (49) and (56) are ill-formed, which would not have been the case if dou-coindexing can also take place at LF, because in the LF representation of (49) and (56), given as (57) and (58) respectively, the NP meige ren 'everybody' and the wh-phrase are both situated to the left of dou and satisfy the directionality requirement. If dou-coindexing took place at LF, we would expect dou

to be able to quantify meige ren 'everybody' in (57) and shei 'who' in (58), yielding in both cases the reading "Zhangsan knows everybody". As this reading is unavailable in both (49) and (56), which are both ungrammatical, dou-coindexing clearly does not apply at LF.

(57) [meige ren<sub>i</sub> [Zhangsan dou renshi t<sub>i</sub>]]  
 every-CL person all know  
 "Zhangsan knows everybody"

(58) [shei<sub>i</sub> [Zhangsan dou renshi t<sub>i</sub>]]  
 who all know  
 "Zhangsan knows everybody"

Another constraint on dou-coindexing is concerned with its locus of quantification. We have seen that dou must quantify some constituent to its left, but among the constituents to its left, which one can it quantify? Can it quantify more than one constituent? It has been suggested by Ding, Chao, Li and Thompson that either the subject or the topic or both can come under the influence of dou, as (59-62) demonstrate.

(59) Shanghai, [women]<sup>k</sup> dou<sup>k</sup> qu guo  
 we all go asp.  
 "We have all been to Shanghai before"

(60) [zhexie gushi]<sup>k</sup> ni dou<sup>k</sup> zhidao  
 these story you all know  
 "you know all these stories"

(61) [Qingdao, Hangzhou, Beidaihe]<sup>i</sup> women<sup>j</sup> dou<sup>k</sup> qu guo  
 we all go asp.  
 "All of us have been to Qingdao, Hangzhou and Beidaihe"  
 "We have been to each (of the three places): Qingdao, Hangzhou and Beidaihe"  
 "Each of us has been to each (of the three places): Qingdao, Hangzhou and Beidaihe"

(62) [neixie shu]<sup>i</sup> women<sup>j</sup> dou<sup>k</sup> xihuan  
 those book we all like  
 "We like all those books"  
 "All of us like those books"

"All of us like all those books"

In (59) it is the subject women that is quantified; in (60) it is the topic zhexie gushi 'these stories' that is coindexed with dou. It is the suggestion of the above-mentioned studies that in (61-62), either i or j, or both i and j can be the same as k. Thus the two sentences can be three-ways ambiguous.<sup>9</sup>

The picture, however, looks different if one of the preceding NPs is found within a prepositional phrase. As observed in Li and Thompson (337), dou does not seem to be able to quantify across a BA-phrase.<sup>10</sup> In (63-64) below, k must be coindexed with j and not i.

(63) women<sup>i</sup> [BA zhexie shu<sup>j</sup>] dou<sup>k</sup> song gei Lisi  
we these book all give to  
"We have given all these books to Lisi"

(64) Tamen<sup>i</sup> [BA zhe jige ren<sup>j</sup>] dou<sup>k</sup> tui dao le  
they this several person all topple asp.  
"They have toppled all these several persons"

In both these sentences, dou can only quantify the prepositional object. (63) lacks the reading "All of us have given (the) books to Lisi". Similarly, (64) does not have the interpretation "All of them have toppled these several persons." This observation of Li and Thompson's can be seen more clearly in sentences where dou can quantify only one of the competing NPs.

(65) wo<sup>i</sup> [BA zhexie shu<sup>j</sup>] dou<sup>k</sup> song gei Lisi  
I these book all give to  
"I have given all these books to Lisi"

(66) \*women<sup>i</sup> [BA zheben shu<sup>j</sup>] dou<sup>k</sup> song gei Lisi  
we this-CL book all give to

(67) ta<sup>i</sup> [BA zhe jige ren<sup>j</sup>] dou<sup>k</sup> tui dao le  
s/he this several person all topple asp.  
"S/he has toppled all these several persons"

(68) \*tamen<sup>i</sup> [BA zhe ge ren<sup>j</sup>] dou<sup>k</sup> tui dao le



they        this CL person all    topple asp.

In (65), *k* cannot be equal to *i* due to the plurality constraint, and therefore  $k=j$ . By the same token, in (66) *k* must not be the same as *j*, again because of the plurality requirement, but the ungrammaticality of the sentence shows that *k* is not identical with *i*, or else the sentence should have been well-formed, meaning "all of us have given the book to Lisi". The same observations hold for (67-68). In (67), it is permissible for  $k=j$ , and the result is grammatical; (68) indicates that *k* must be distinct from *i* and coindex with *j*, violating the plurality condition. The sentence cannot mean "every one of them has toppled this person," and on the reading "they have toppled all of this person," it is ungrammatical. Clearly a plausible formal statement is to attribute the ungrammaticality of (66-68) to the coindexing of dou with the object of the BA phrase.

With respect to the relevant constraints on dou-coindexing, any principle that appeals to minimal distance should be rejected, as sentences like (61) and (62) show that it is not the case that dou coindexes with the nearest quantifiable NP to its left. Two other hypotheses may be considered. One hypothesis links the impossibility of coindexing dou with the subject NP in sentences such as (63) or (66) to the characteristics of the BA-construction, which requires the prepositional object to be specific. According to this semantic/pragmatic account, if dou coindexes with women in (63) or (66), it would mean that each of us gave the same book or the same set of books to Lisi. This is pragmatically odd, since the event of

offering the same book or the same set of books to a person cannot normally be distributed among different agents. (66) is thus ungrammatical because of this pragmatic deviance. This analysis, however, runs into problems in cases where the event represented by the predicate can hold of different individuals denoted by the subject NP, as in (64) and (67). In the situation described by the sentences, the action of toppling specific individuals is clearly repeatable and distributable among different agents; there is nothing pragmatically odd about different people each toppling the same individual or the set of individuals. As demonstrated in (69-70) where dou precedes the BA-phrase and immediately follows the subject NP, indeed the reading of (63) and (66) where dou coindexes with the subject NP is odd. However, the corresponding readings of (64) and (68) are nevertheless perfectly natural, as shown in (71-72).

(69) ?women<sup>k</sup> dou<sup>k</sup> [BA zhexie shu] song gei Lisi  
           we       all           these book give to  
           "All of us gave these books to Lisi"

(70) ?women<sup>k</sup> dou<sup>k</sup> [BA zhe ben shu] song gei Lisi  
           we       all           this CL book give to  
           "All of us gave this book to Lisi"

(71) women<sup>k</sup> dou<sup>k</sup> [BA zhe jige ren] tui dao le  
           we       all           this several person topple asp./part.  
           "All of us toppled these several persons"

(72) women<sup>k</sup> dou<sup>k</sup> [BA Zhangsan] tui dao le  
           we       all           topple asp./part.  
           "All of us toppled Zhangsan"

If this semantic/pragmatic account is correct, we would expect (66) to be ill-formed (as is indeed the case), but at the same time we would also expect (68) to be well-formed, since the reading where

k=i is pragmatically natural. This prediction, however, is contrary to fact.

An alternative hypothesis is to propose that dou can only be coindexed with a leftward constituent only if the first maximal projection dominating dou also dominates that constituent. We have so far reviewed two types of situations: (a) given a choice of topic or subject NP, dou can coindex with either or both, and (b) given a subject NP and a NP within a BA-phrase, dou must quantify the latter. The difference between the two situations can be stated in terms of the two phrase structures below.<sup>11</sup> Here I assume the following phrase structure rules for Chinese:

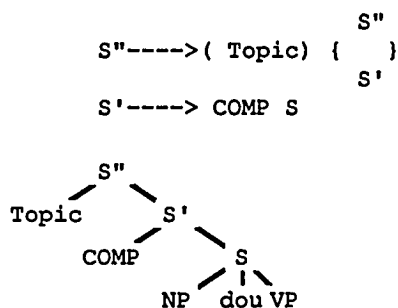


Fig.1

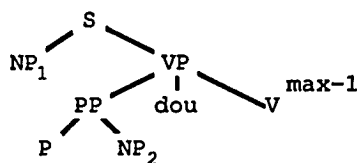


Fig.2

There is good evidence for including the BA-phrase within the VP maximal projection, as verbs need to subcategorize for it. In general only action verbs can take the BA-phrase whereas stative verbs such as 'love', 'like' cannot. One difference that emerges from comparing the two trees is that if we assume S, S' and S'' to be parts of the same projection, then clearly dou can quantify both the topic and the subject NP in Fig.1, as they are dominated by S'', the

first maximal projection node dominating dou. In Fig.2, however, the first XP dominating dou is VP, which dominates only the NP within the BA-phrase but not the subject NP. Hence the only coindexing possibility in Fig. 2 takes place within the VP.

Our analysis receives support from the fact that dou can quantify across certain types of PPs which are not part of the VP. Consider the following sentences.

- (73) Tamen<sup>k</sup> [zai zhe ge wuding] dou<sup>k</sup> zhong le lanhua  
 they at this CL rooftop all plant asp. orchid  
 "They have all planted orchids on the rooftop"
- (74) Zhe jige laoshi<sup>k</sup> [dui Zhangsan] dou<sup>k</sup> you pianjian  
 this several teachers toward all have prejudice  
 "These several teachers are all prejudiced toward Zhangsan"
- (75) Zhe sanjia gongshi<sup>k</sup> [gen Meiguo yinhang] dou<sup>k</sup> qian le hetong  
 this three-CL company with America bank all sign asp.contract  
 "These three companies have all signed contract(s) with the Bank of America"
- (76) Women<sup>k</sup> [gei Lisi] dou<sup>k</sup> xie le xin  
 we to all write asp. letter  
 "We all have written (a) letter to Lisi"

In (73-76) the NP within the PP denotes an individual and if dou must coindex with this NP, these sentences would be ungrammatical. However, all these sentences can be understood with the subject NP quantified by dou. This, as well as the fact that these PPs are not part of the verb phrase, can be seen in the light of the preposability of the PPs for stylistic variation. The examples below correspond to (73-76) with the PPs preposed to sentence initial position.

- (77) [zai zhe ge wuding] tamen dou zhong le lanhua  
 at this CL rooftop they all plant asp. orchid
- (78) [dui Zhangsan] zhe jige laoshi dou you pianjian  
 toward this several teacher all have prejudice

(79) [gen Meiguo yinhang]zhe jijia gongshi dou qian le hetong  
 with America bank this several company all sign asp contract

(80) [gei Lisi] women dou xie le xin  
 to we all write asp. letter

(81) \*[BA Zhangsan] tamen dou tui dao le  
 they all topple asp./part.

The fact that the BA-phrase in (81) cannot be preposed in the same way as the PPs in (77-80) shows that the former is more integrated with the verb than the latter. Thus it seems reasonable to assign the following phrase structure to sentences exemplified by (73-76).

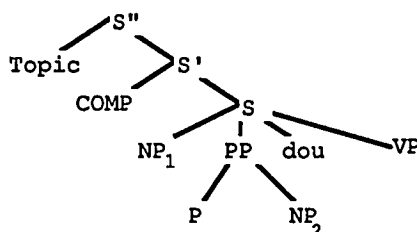


Fig.3

In this configuration, dou can quantify the topic, NP<sub>1</sub>, NP<sub>2</sub> or any combination of these three constituents, wherever the NPs satisfy the plurality requirement. Thus if we restrict NP<sub>2</sub> to a singular definite NP and fill in the topic and NP<sub>1</sub>, dou can quantify both constituents across the PP, as in (82).

(82) [zhe ji tian [COMP[tamen[zai zhege wuding]dou zhong le lanhua]]]  
 this few day they at this rooftop all plant asp.orchid  
 "(in) each of these few days, they planted orchids on this rooftop"  
 "(in) these few days, they all planted orchids on this rooftop"  
 "(in) each of these few days, they all planted orchids on this rooftop."

If a plural NP occupies the position of NP<sub>2</sub> so that it also becomes a candidate for dou-quantification, the resulting sentence (83) can receive up to 3+3+1=7 distinct interpretations, depending on whether

dou quantifies only one of the NPs or two of the three NPs or all three NPs.<sup>12</sup>

(83) [zhe ji tian[COMP[tamen[zai zhe jige huayuan]dou zhong le  
this few day they at this few garden all plant asp.  
lanhua]]]  
orchid

Our discussion thus far suggests that the loci of dou-quantification is governed by a-c-command constraint, so that our SS coindexing rule given in (55) can be reformulated as (84).

(84) Dou-coindexing

Coindex with dou any leftward constituent it c-commands.

(A c-commands B iff neither dominates the other and the first maximal projection dominating A also dominates B)

If one pursues this line of reasoning further, one would arrive at another constraint on dou-quantification, namely, that it is clausebounded. If our reformulated dou-coindexing rule (84) is correct, it follows immediately that the effect of dou cannot extend beyond the minimal clause containing it, so that candidate NPs in a higher clause will not be affected by it.<sup>13</sup>

(85) Ta shuo [ zhe ji ge laoshi dou likai le]  
s/he say this several teacher all leave asp.  
"s/he said that these few teachers have all left"

(86) \*Tamen shuo [zhe ge laoshi dou likai le]  
they say this CL teacher all leave asp.

(87) Ta mai le [[women dou xihuan] de shu]  
s/he buy asp. we all like nom book  
"S/he bought the books that we all liked"

(88) \*Tamen mai le [[wo dou xihuan] de shu]  
they buy asp I all like nom book

(85) and (87) are well-formed because dou can coindex with the plural NP within the embedded clause. In (86) and (88) the only available plural NPs preceding dou are found in the matrix clause, and the ungrammaticality of the sentences point to the clauseboundedness of dou.<sup>14</sup>

Aside from constraints vis-a-vis direction and loci of quantification, one last issue we would like to raise is the types of constituents that can be quantified by dou. In the examples we have given so far, the constituents that are quantified by dou are all noun phrases, be they topics, subjects or prepositional objects. It appears that dou can also quantify time adverbials and adverbials denoting events.

(89) Ta zuotian dou zai jia  
s/he yesterday all at home  
"S/he was home (all the time) yesterday"

(90) Lisi meitian dou kan dianying  
everyday all see movie  
"Lisi goes to movies every day"

(91) Zhangsan zai xiatian dou bu zuo shi  
at summer all not work  
"Zhangsan never works during the summer"

(92) Lisi chi fan dou yong dao cha  
eat rice all use knife-fork  
"Lisi uses forks and knives whenever he eats"

(93) wo du qian dou qu Las Vegas  
I gamble all go  
"I go to Vegas whenever I gamble"

(94) Lao Wang qing ke dou zai Hilton  
invite guest all at  
"Lao Wang (goes to) Hilton whenever (he) treats guests"

All these sentences can be assigned the structure (95) or (96). If assigned the structure of (95), the underlined phrase is treated as

an adverbial; if assigned the structure of (96) it is regarded as an adverbial functioning as a topic. All the adverbials in (89-94) can be moved into first topic position without changing the meaning of the sentence, assuming the structure (97).

(95) [ NP Adverbial dou VP]<sub>S</sub>

(96) [NP<sub>i</sub> [Adverbial [e<sub>i</sub> dou VP]<sub>S</sub>]<sub>S</sub>"]<sub>S</sub>"

(97) [Adverbial [NP dou VP]<sub>S</sub>]<sub>S</sub>"

When a time adverbial denotes a stretch of time, such as zuotian 'yesterday', dou quantifies that stretch of time. When an adverbial denotes an event, as in (91-94), dou seems to be quantifying the implicit time coordinate of the event, so that it means 'whenever the event occurs.' The adverbial quantified by dou can basically assume any of the maximal categories NP, PP, VP, S". An example of a clausal adverbial in topic position quantified by dou is given in (98).

(98) [Zhangsan qing ke] wo dou tao qian  
 invite guest I all pay  
 "(every time) Zhangsan treats a guest, I pay"

While quantification of event adverbials and time adverbs denoting stretches of time is generally permitted, this does not carry over to all sentential adverbial elements. It appears that among time adverbials, dou cannot quantify punctual adverbs such as mashang/like 'immediately/instantly', although it can quantify frequency adverbs such as tongchang 'usually', as demonstrated in the following examples.

(99) \*Ta mashang/like dou diao le xialai  
 s/he immediately all fall asp. down

(100) Ta tongchang dou da lanqiu



s/he usually all play basketball

dou quantifies the set of occasions on which the event occurs, and since adverbs like mashang violate the plurality requirement, (99) is ungrammatical. (100), on the other hand, can be interpreted as a set of more than one instance, and dou-quantification results in a well-formed sentence.

Other types of sentence adverbs such as domain adverbs and modal adverbs do not seem to be affected by dou; they can immediately precede the constituent quantified by dou or intervene between dou and the constituent it quantifies without changing the meaning or grammaticality of the sentence. Domain adverbs such as basically, generally speaking, morally, logically restrict the domain of universe where the proposition holds true. As observed in Bellert (1977), they have the semantic function analogous to that of a restricted quantifier.<sup>15</sup>

(101) (a) [Zhangsan he Lisi] jibenshang dou shi hao laoshi  
and basically all be good teacher  
"Basically, Zhangsan and Lisi are good teachers"

(b) Jibenshang [Zhangsan he Lisi] dou shi hao laoshi

(102) (a) Zhe jiju hua [zai lojishang shuo] dou bu tong  
this few utterance at logic say all not right  
"Logically speaking, these few sentences are not right"

(b) [zai lojishang shuo] zhe jiju hua dou bu tong

(103) (a) Women [zai daoyi shang] dou dui ta you zheren  
we at obligation on all to him/her have responsibility  
"Morally, we have a responsibility toward him/her"

(b) [zai daoyi shang] women dou dui ta you zheren

Since these adverbs are not objects of quantification but rather serve to restrict the domain of quantification, they are

exempted from the quantificational effects of dou. The absence of an impact on modal adverbs can also be seen from (104-106).

- (104) (a) Zhaxie xuesheng keneng dou hui youyong  
these student probably all know swim  
"These students probably know (how to) swim"
- (b) Keneng zhaxie xuesheng dou hui youyong
- (105) (a) Zhangsan he Lisi hen mingxian dou shou guo suxue xunlian  
and evidently all receive asp.math training  
"Evidently, Zhangsan and Lisi have both had mathematics training"
- (b) Hen mingxian Zhangsan he Lisi dou shou guo suxue xunlian
- (106) (a) Zhiminzhe kending dou hui bei da bai  
colonialist definitely all will passive defeat  
"Colonialists will definitely be defeated"
- (b) Kending Zhiminzhe dou hui bei da bai

The behavior of modal adverbs with respect to dou can be understood in a similar light. Modal adverbs do not refer to entities or events but express the possibility of the truth of a proposition. Just like domain adverbs, they restrict the domain of quantification of a proposition: they specify the possible worlds where the proposition they modify hold true. Semantically, therefore, modal adverbs are not quantifiable by dou.

While dou can quantify past domain and modal adverbs, it cannot do so with manner adverbs such as slowly, loudly, severely, forcefully- adverbs that cannot be paraphrased as adjectives describing the psychological state of the individual(s) referred to by the subject. The examples below suggest that dou cannot follow manner adverbials.

- (107) a. ??Tamen hen man de dou pao guo lai  
they very slowly all run across come  
"They all ran over here slowly"
- b. Tamen dou hen man de pao guo lai

they all very slowly run across come

- (108) a. ??Zhe jige xuesheng dasheng de dou jianghua  
this several student loudly all speak  
"These few students all spoke loudly"

- b. Zhe jige xuesheng dou dasheng de jianghua  
this several student all loudly speak

- (109) a. ??Zhangsan he Lisi hen yanli de dou piping le wo  
and very severely all criticise asp. me  
"Zhangsan and Lisi both criticised me severely"

- b. Zhangsan he Lisi dou hen yanli de piping le wo  
and all very severely criticise asp. me

- (110) a. ??Yundongyuanmen hen yongli de dou ba qiu ti jin longmen  
sportsmen very forcefully all ball kick into goal  
"The sportsmen all kicked the ball forcefully into the goal"

- b. Yundongyuanmen dou hen yongli de ba qiu ti jin longmen

If we assume that these manner adverbs are predicate modifiers rather than sentential adverbs,<sup>16</sup> the ill-formedness of the (a) sentences in (107-110) receives a ready explanation. Consider the following structures, which represent the SS of the (a) and (b) sentences respectively.

- (111) [NP [Adv dou  $v^{\max-1}$ ]<sub>VP</sub>]<sub>S</sub>

- (112) [NP dou [Adv  $v^{\max-1}$ ]<sub>VP</sub>]<sub>S</sub>

According to our c-command requirement on dou-quantification, dou in the configuration (111) cannot quantify the subject NP, which lies outside its c-command scope, and the only constituent it can quantify is the manner adverbial. Since the manner adverbial denotes neither an entity nor an event, it cannot be an object of quantification; vacuous quantification results in the ungrammaticality of the (a) sentences. The (b) examples, however, have the configuration given in (112), where dou is located in the larger domain of S". Thus dou can be coindexed with the subject

NP.<sup>17</sup>

To summarize, our observations of the general constraints on dou can be stated as follows: dou must quantify a semantically non-singular constituent; it can only quantify NPs in topic or argument position, time adverbials capable of being interpreted as having a range of instants, and event adverbials; it must c-command and be to the right of its antecedent. Since NPs in argument and topic position and adverbials (PP, S", NP, Adverb) encompass all possible types of constituents that can precede dou, it appears that dou can quantify constituents unselectively, regardless of their syntactic category, subject to the constraints mentioned above. In this regard, it differs significantly from universal quantifier determiners such as mei 'every' and suoyou 'all' in that the latter determiners can only bind nominals. In contrast, dou seems to be a genuine natural language equivalent of an unselective quantifier in the sense of Lewis (1973).<sup>18</sup>

The essential property of an unselective quantifier, according to Lewis, is that it can quantify any free variable of a function within its scope. Lewis treats a case or event as a tuple of its participants with an underlying time coordinate, and represents a universally quantified sentence in the following form.

(113) 'A f(t, x<sub>1</sub>, x<sub>2</sub>,...x<sub>n</sub>)'

where t=time, and x<sub>i</sub>=participants.

(114) below gives an example where the variables bound by the unselective quantifier represent participants.

(114) A man always weighs less than a donkey but more than a dog

This sentence can be interpreted as "always, if x is a man, if y is a donkey, and if z is a dog, x weighs less than y but more than z," and can be analyzed as (114a).

(114a) 'A f(x,y,z)'

where A=always, x=man, y=donkey, z=dog.

Since the unselective quantifier can bind whatever variables that are left free in f, and in this sentence all x, y, z are free, so the formula is equivalent to 'A x=<sub>man</sub>, A y=<sub>donkey</sub>, A z=<sub>dog</sub>, f(x, y, z)' with the domain of quantification of variables restricted by the respective common nouns. (115) provides an example where a time variable is bound by the unselective quantifier.

(115) Always if it is raining, my roof leaks

In this sentence, no free variables are available in "if it is raining, my roof leaks", so the unselective quantifier can only bind the free variable in the time coordinate. (115) can be rendered as (115a) 'A t f(t)'.

Using the notion of an unselective quantifier, Lewis' analysis brings out the basic similarity between (114) and (115) in terms of logical structure. The two sentences are both instances of quantification over cases or events, representable as tuples of time and participants. The two differ in that (114) contains free variables in the participant coordinates, whereas (115) only has an open variable in the time coordinate.

Viewed in this theoretical context, don clearly exhibits the

properties of an unselective universal quantifier. For dou the free variables of the function are the wh-phrases, quantifier phrases and plural NPs within its c-command domain, as well as the time coordinate underlying the time and event adverbials; dou is free to bind any of these variables if they remain to be bound, and must bind at least one of them, lest vacuous quantification result.

### 1.1.2 Distribution

It has been observed in our preceding discussion that dou always occurs in preverbal position following a subject or topic. In the examples provided, we have seen that dou can occur between the subject NP and the VP, following a sentence adverbial such as keneng 'probably', mingxian 'evidently', or meitian 'everyday', zuotian 'yesterday'. Within the verb phrase, it can follow a PP such as the BA-phrase, which may be preceded by a manner adverb.<sup>19</sup>

(116) Lisi [manman de [BA zhe ji feng xin] dou shao diao ]<sub>VP</sub>  
           slowly               this several letter all burn  
       "Lisi slowly burned all these several letters"

(117) Lisi [ [BA zhe ji feng xin] dou manmande shao diao ]<sub>VP</sub>  
                                   this several letter all slowly burn

(118) Zhangsan [[BA zhe ji ge ren] dou henhende ma le yi dun]<sub>VP</sub>  
                                   this several person all severely scold asp.one CL  
       "Zhangsan gave all these several people a severe scolding"

As we have observed, because of the semantic properties of dou, a manner adverb alone preceding dou will result in anomaly (cf. 107-110), though a manner adverb following dou is acceptable. In terms of the schematic representation given as (119), dou can occupy slots 2 and 3, which can also be occupied by other adverbial elements.

(119) [Topic <sup>1</sup>[COMP[ NP <sup>2</sup> [.<sup>3</sup>.v...]<sub>VP</sub>]<sub>S</sub>]<sub>S</sub>]<sub>S</sub>"

The well-formedness of combinations of dou with different adverbial elements has to do largely with the properties of quantifier scope in Chinese, which we will examine in section 1.3. Given the above facts, the view we are leading to here is that dou should be considered both as a sentence adverb and as a predicate adverb.

The residue question concerning distribution is whether dou can fill slot 1 in (119). Previous studies have stated that dou follows the subject, but one might ask why dou cannot be inserted between a topic and a subject. At first glance, this indeed seems to be a possibility.

(120) [zhe ji tou feizhou daxiang dou [bizi hen chang]s]s"  
 this several Africa elephant all nose very long  
 "As for all these African elephants, (their)noses are long"

(121) [Zhangsan he Lisi dou [nianji hen da le]]  
 and all age very big asp  
 "As for both Zhangsan and Lisi, (their) age is advanced"

(122) [Tamen dou [shengti hen hao]]  
 they all body very good  
 "As for all of them, (their) health is good"

(123) [Zhaxie nuhaizi dou [piqi hen huai]]  
 these girl all temper very bad  
 "As for all these girls, (they) are bad-tempered"

Following standard phrase structure analysis, it seems reasonable to say that in the above examples, both the topic and subject positions are filled. The unquestionable grammaticality of these sentences suggests that dou can intervene between a topic and a subject. The situation, however, turns out to be more complicated if we examine other sentences. Consider the following:

(124) a. \*[zhe jige jiaoshou dou [fangzi hen da]]  
 this several professor all house very big





alienable. It stands to reason to regard one's houses or one's students or apprentices as not as important or intimate as one's body parts or inherent characteristics and therefore separable from oneself.

Thus two approaches can be followed in explaining the difference in grammaticality of the above two sets of examples. One is to propose that dou may occur in slot 1, subject to a pragmatic constraint on the subject, which may be formulated as (127).

(127) Pragmatic Constraint on Dou

In the configuration  $[NP_i \text{ dou} [NP_j \text{ VP}]_S]_S$ ,  $NP_1$  must bear a relationship of inalienable possession with  $NP_2$

According to this view, the (a) sentences of (124-126) are ill-formed because they violate the constraint (127).

An alternative approach is to claim that dou cannot occur in positions external to the subject and analyze the  $[NP \text{ VP}]_S$  constituents of (120-123) as complex predicates corresponding to lexical items. It has been observed by Chinese linguists (Teng 1975:85) that sentences such as duzi teng 'stomach ache', piqi huai 'temper bad', jixing hao 'memory good' behave as if they are idiomatic predicates. Many of these predicates can be paraphrased by means of single verbs, adjectives or predicative nominals. For example in (120-122), the sentential predicates can be paraphrased as chang bizi<sub>N</sub> 'long-nose', lao 'old', and jiankang 'healthy'. respectively. In this view, the ungrammaticality of the (a) examples

in (124-126) is attributed to the fact that the [NP VP] core of these sentences are not complex predicates, as they cannot be easily paraphrased as single lexical items. These sentences will not be base-generated since dou can only follow a subject.

While both approaches are plausible, evidence favors the second position. The first thing to consider is that if the second approach is adopted, one will not base-generate dou in subject-external position, and will therefore not need constraints such as the Pragmatic Constraint (127). A second fact to consider is that what constitutes an inalienable relationship could be quite arbitrary and cannot be stated generally, as illustrated in the following examples.

- (128) a. \*[Zhangsan he Lisi dou [fuqin/qizi chaoguo wushi sui le]]  
                     and           all father/wife over fifty year asp.  
           "As for Zhangsan and Lisi, (their) fathers/wives are  
           over fifty years old"

- (129) a. [zhepi gongren dou [jishu hen hao]]  
           this-CL worker all skills very good  
           "As for these workers, (their) skills are very good"

- b. [zhepi gongren dou [gongzi hen gao]]  
           this-CL worker all wage very good  
           "As for these workers, (their) wages are very high"

(128) and (129) parallel (125) and (126) respectively except that the subject NPs have been replaced by noun phrases that signify a pragmatically more intimate relationship with the topic NP. As one's relationship with one's father or wife is an inalienable one, one would expect (128) to be grammatical, which is contrary to fact. On the other hand, (129) illustrates cases of alienable possession where dou can intervene between the topic and the subject. Since wages and skills are acquired and are not inherent characteristics

of individuals, one would expect our Pragmatic Constraint (127) to rule out (129). Again the prediction fails. The lack of generality of a constraint such as (127) reflects the idiosyncracies of the lexicalization of complex predicates.

Besides the need to add a constraint to the grammar and the lack of generality of such a constraint, the third type of reason for not base-generating dou under S" is that a large number of topic structures cannot have dou preceding a subject NP, as shown in (130-133).

(130) [wo de erzi<sub>i</sub> [wo dou xihuan t<sub>i</sub>]]  
 I NOM son I all like  
 "My sons I like"

(131) \*[Wo de erzi<sub>i</sub> dou [wo xihuan t<sub>i</sub>]]  
 I NOM son all I see

(132) [Tamen<sub>i</sub> [Zhangsan dou xihuan t<sub>i</sub>]]  
 they all like  
 "All of them, Zhangsan likes"

(133) \*[Tamen<sub>i</sub> dou [Zhangsan xihuan t<sub>i</sub>]]  
 they all like

The examples illustrate the fact that it is generally the case dou can never occur between a topic and a subject if the topic originates from an argument position in S, irrespective of the pragmatic relationship between the topic and the subject. Thus, while in (130-131) it can be argued that the Pragmatic constraint (127) is violated, as tamen does not bear any close relationship with Zhangsan, the same argument cannot apply to (132-133) as one's relationship with one's son is clearly inalienable. If (130-133) can be ruled out by some constraint, it will not be a pragmatic constraint such as (127). The argument here against base-generating

dou in an external position under S" is that if this is permitted, we will be obliged to explain the puzzling fact that a base-generated element can only occur in an extremely limited set of well-formed surface structures.

A more satisfactory analysis attributes the anomaly of these sentences to a syntactic source. In such a syntactic account, (124a-126a), (131) and (133) are ill-formed because they are not base-generated. (120-123) are well-formed because the sentential predicates are lexical in character. These sentences actually correspond to the SS [NP dou VP]<sub>S</sub>, where the VP is a complex predicate.

In this view, dou is a sentential adverb as well as a VP adverb, and in this way it differs from other sentential adverbs such as modal adverbs and domain adverbs, which may occur clause-externally, as shown in (134).

(134) [zhexie juzi<sub>i</sub> keneng/yibanlaishuo [Zhangsan bu dong t<sub>i</sub>]]  
 these sentence probably/generally speaking not understand  
 "These sentences, Zhangsan probably/generally does not understand"

### 1.1.3 Binding of Wh-words

As mentioned earlier, one interesting property of dou lies in its interaction with wh-words to signal universal quantification, as in the following examples.<sup>20</sup>

- (135) Shei dou hui kai che  
who all know drive car  
"Everyone/anyone knows (how to) drive a car"
- (136) Ta sheme dou qingchu/ Sheme ta dou qingchu  
S/he what all clear / what s/he all clear  
"S/he is clear about everything"
- (137) Zhangsan nali dou qu guo/ Nali Zhangsan dou qu guo  
where all go asp./ where all go asp.  
"Zhangsan has been everywhere ( to every place)"
- (138) Tamen dou qu guo nali?  
they all go asp. where  
"where have they all been to?"

What exactly is the function of dou in these sentences? A lexical view seems to have been implicit in traditional and structural accounts of Chinese syntax (cf. Ding 1961, Chao 1968) to the effect that dou combines with certain wh-words to form new lexical entries equivalent to everything/anything, everybody/anybody, everywhere/anywhere. This view is clearly unsatisfactory for two major reasons. The first objection is that if dou and the wh-word are treated as one lexical item, it will involve long-distance amalgamation, since dou and the wh-word do not have to be adjacent to each other; nor do they have to form a constituent (cf. 142-144). In fact, as will be seen in later sections, dou can interact in such a way with a wh-word in a different clause than dou. How long distance lexical amalgamation of this sort can be carried out poses a serious problem for the analysis. Secondly, a lexical analysis

does not address the issue why dou exhibits this property precisely when the wh-word precedes dou. As shown in (138), if the wh-word follows dou, the sentence remains a question. It is hard to see how these special lexical items can be generated by the grammar without a series of ad-hoc restrictions. We argue that any adequate analysis of this issue should be able to account for the following data:

- (139) \*Tamen<sub>i</sub> dou [shei xihuan t<sub>i</sub>]<sub>S</sub>  
           they all who like
- (140) \*Shei<sub>i</sub> dou [tamen xihuan t<sub>i</sub>]<sub>S</sub>  
           who all they like
- (141) \*Ta dou renshi shei?  
           s/he all know who
- (142) Tamen dou renshi shei?  
           they all know who  
           "Who do they all know?"
- (143) Tamen shei dou renshi t  
           they who all know  
           "Everyone knows them/ They know everyone"
- (144) Shei tamen dou renshi t  
           who they all know  
           "They know everyone."
- (145) Shei dou renshi tamen  
           who all know them  
           "Everyone knows them"
- (146) Shei renshi tamen?  
           who know them  
           "Who know(s) them?"

The ungrammaticality of the first two sentences can be accounted for by our earlier assumptions about the positioning of dou at DS. Since dou never intervenes between a topic and a subject, (139-140) are ungrammatical. (141) is ruled out because dou can only quantify leftward, and quantification of the singular NP ta is illicit.

Examples (142-146) are the key test cases of whether an analysis of dou is adequate. We will argue that an analysis that appeals to the LF structure of these sentences can account for this range of facts by means of general principles, and is thus a more revealing approach than a lexical account. If we assume the rule of dou-coindexing (84), the LF representations corresponding to (146) and (145) will be as in Fig. 4 and Fig. 5 respectively, with the wh-word moved into COMP in both cases.

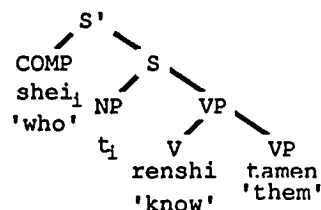


Fig. 4

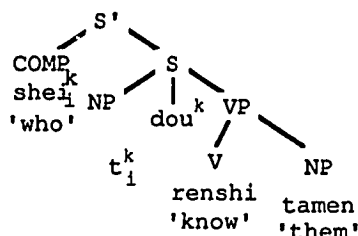


Fig. 5

Let us assume that the COMP is a [+wh] COMP for the moment. In Fig. 4, the wh-word shei 'who' fills the [+wh] COMP and the sentence can only be interpreted as a question. In Fig. 5, a somewhat different situation obtains. The wh-word has been coindexed with dou at SS and at LF has also moved into the [+wh] COMP, leaving a coindexed trace in subject position. However, this trace is also bound by the quantificational adverb dou. Here, we have an instance of a variable being bound by two different operators, which goes against the Bijection Principle (147).

(147) Bijection Principle(I)

A variable cannot be bound by two operators

Hence, the only configuration where (145) can be interpreted as a question is ruled out by the violation of a general restriction on binding.<sup>21</sup>

Note that the counterpart of (145) in English is also ill-formed, and an account along our analysis of dou can be extended to account for the ungrammaticality of (148), if we assume a rule of each-coindexing allowing each to bind its antecedent at ss.<sup>22</sup>

(148) \*Who each know(s) them?

While this cross-linguistic similarity is of interest and confirms the validity of the Bijection Principle as a condition of Universal Grammar (UG), it remains for us to address the further question why in English who-each cannot be interpreted as universal quantification in parallel fashion to Chinese. To answer this question of cross-linguistic difference, let us return to Fig. 5.

Consider the situation where the COMP in Fig. 5 is a [-wh] COMP. The situation is clearly ill-formed with the [+wh] word resting in a [-wh] COMP. However, an alternative structure is available, shown in Fig. 6.

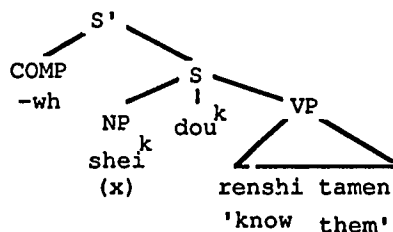


Fig. 6

Note that one option allowed in Chinese is for the wh-word not to



move into COMP at all at SS. This wh-word remaining in subject position under the effect of dou turns into an indefinite pronoun, which can be seen as an open variable bound by dou, yielding naturally the universal quantifier reading. This explanation is supported by the fact that wh-words in Chinese can function as indefinite pronouns in certain contexts (cf. Lu 1980:429)<sup>23</sup>, as (149) illustrates.

(149) Wo xiang chi dian shenme  
       I want eat CL what  
       "I want to eat something"

The reason why in English such an option does not exist is twofold: (i) unlike the case in Chinese, wh-movement in English takes place in syntax and not in LF. By the time each coindexing applies at SS, the wh-word will have already moved into COMP position, so that the sentence must be interpreted as a wh-question in order to be grammatical. However, as a result of each-coindexing, the trace of who becomes bound by each. This, however, conflicts with the Bijection Principle and the sentence as a result is ill-formed. (ii) A second reason why the Chinese option is not available in English may be that wh-words in general do not function as indefinite nouns in English, so that even if wh-movement can be delayed until LF, the wh-word residing in the subject position will not become an open variable to be bound by the universal quantifier each. Our analysis of the interaction of wh-words and dou thus carries with it the implicit claim that if in a language, wh-movement occurs at LF, and if the wh-words in the language can function as indefinites in some contexts, a sentence where the wh-word comes under the scope of the

equivalent of each could be interpreted as a declarative sentence.

Before we proceed to consider analyses of more complex examples involving dou and wh-words, a modification of the Bijection Principle is in order. Note that the Bijection Principle (147) as we have been employing it states that a variable cannot be bound by two operators. As stated, it seems to be contrary to fact, because we have seen that sentences such as (150) are grammatical. In the LF representation of (150), given as (151), meige ren 'everyone' undergoes QR, and the trace of it will clearly be bound by two operators, seemingly contradicting the Bijection Principle.

(150) [mei ge ren dou you che]  
every CL person all have car  
"Everyone has a car"

(151) [mei ge ren<sub>i</sub><sup>k</sup> [t<sub>i</sub><sup>k</sup> dou<sup>k</sup> you che]]  
everyCL person all have car

While this may appear to be a counterexample to the Bijection Principle, it in fact is not so upon further analysis. The difference between a structure like (151) and the one in Fig. 5 is that in addition to being bound by dou, the trace of meige ren is bound by the same type of operator, i.e. a universal quantifier, whereas the trace of shei 'who' in Fig. 5 is bound by a [+wh] operator. In other words, in the cases under discussion, the relevant issue is whether the variable is bound by two operators of different types. Based on this, the Bijection Principle may be reformulated as follows.<sup>23a</sup>

(152) Bijection Principle (I)

A variable may not be simultaneously bound by quantifiers

of different types.

With this modification, we can move on to elucidate sentences

(143-144), repeated as below:

(153) Tamen shei dou renshi t  
 they who all know  
 "They know everyone"/"Everyone knows them"

(154) Shei Tamen dou renshi/ Shenme ren tamen dou renshi  
 who they all know / what person they all know  
 "They know everybody"

These sentences are more complex because in each of them, two candidate NPs are available for dou-coindexing. As we will see, certain constraints operate on the coindexing process so that not all theoretically possible interpretations are permitted. First of all, the ambiguity of (153) should be noted. It can have two readings, depending on whether tamen 'they' functions as object or subject. It should be noted that consistent with the analysis just proposed, the sentence cannot be understood as a question on either reading. The SS representations for the two readings of (153) correspond to Fig. 7 and Fig. 8 respectively.

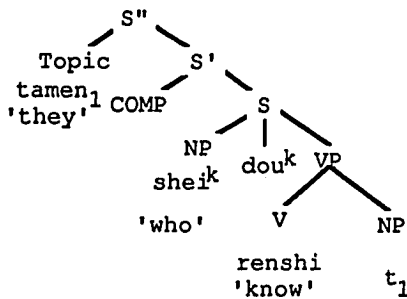


Fig. 7

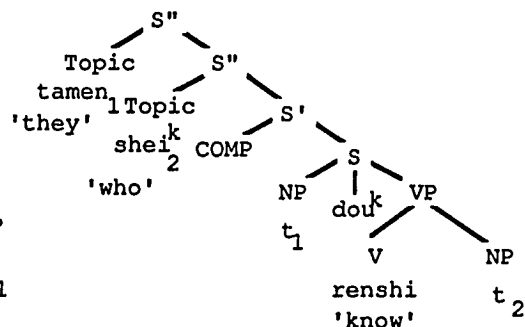


Fig. 8

Fig. 7 corresponds to the reading 'everybody knows them', where

tamen functions as a topicalized object. In a structure like this, if dou coindexes with shei, clearly the wh-word will not be able to move into COMP, lest the Bijection Principle (152) be violated. Rather, it will become an open variable bound by dou, resulting in the right interpretation. Fig. 8, on the other hand, represents the reading "they know everybody", where tamen functions as a topicalized subject, with the wh-word also appearing in topic position. Notice that since dou coindexes with shei, moving shei into the COMP will again be prohibited by the Bijection Principle. Consequently, whether the wh-word shei 'who' of (153) functions as DS subject or object, a question interpretation is excluded by general principles of Logical Form.

Observe that in (153), there are two quantifiable constituents preceding dou: tamen 'they' and the wh-word shei 'who'. We know from our earlier discussion (cf. examples 59-62) that when there is more than one NP that can be quantified by dou, dou can bind any of them. Applying this notion to the SS of the sentence (153), further LF representations can be derived in principle. Thus a third reading of (153) which is theoretically possible, assuming that the wh-word is the DS subject of the sentence, is given in Fig. 9, in which the wh-word is moved into COMP.

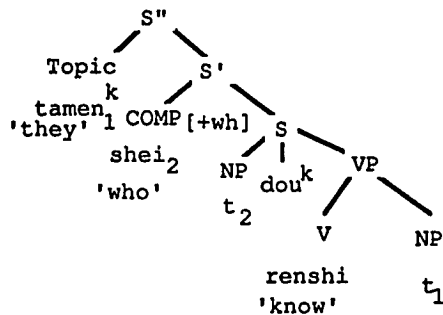


Fig. 9

This is made possible by having dou coindex with tamen instead of shei, so that wh-movement now no longer violates the Bijection Principle. In other words, the interpretation represented is a question equivalent to "\*Who knows all of them?", which is not an acceptable reading of (153). The ungrammaticality of such a LF representation is surprising because it is consistent with all known general principles of LF. For example, it is consistent with May (1977)'s Condition on Proper Binding, as the trace of the wh-word shei is properly bound from the COMP position. Further, it is also consistent with general principles governing antecedents and traces such as Pesetsky (1982)'s Path Containment Principle (PCC). Recall that in Pesetsky's terminology, a path is "a set of successively immediately dominating categorial nodes connecting a binder to a bindee," and the Path Containment Condition (PCC) states that "intersecting A-bar categorial paths must embed, not overlap." Applying these notions to the structure in Fig. 9, we see that the path relating the wh-word to its trace is {S', S}, whereas the path linking the topic tamen with dou is {S'', S', S}.<sup>24</sup> One path is embedded within another, so the PCC should predict the result to be

well-formed, which is contrary to fact. It appears, then, that other principles than the PCC are involved to constrain dou-coindexing.

Note that in a similar vein, corresponding to the phrase marker in Fig. 8 where the wh-word functions as the DS object of the sentence, we may in principle have a fourth LF representation of (153) as in Fig. 10. In this structure, dou again coindexes only with tamen 'they' and not with shei 'who'. Potentially, two interpretations are possible based on the configuration like the one below, depending on whether the wh-word is moved into COMP.

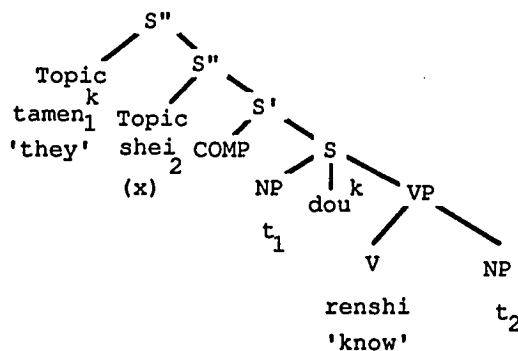


Fig.10

If the wh-word is interpreted as [-wh], i.e. as an open variable, the sentence has the meaning "\*someone knows every one of them", which is not an acceptable interpretation. The unavailability of this interpretation stems from the fact that the open variable will not be bound by any operator, since it is neither coindexed with dou nor bound by anything from COMP. If, however, the wh-word is [+wh] and therefore must move into COMP at LF, the sentences will receive the interpretation "\*who does everyone of them know?", again not an available reading of (153). This LF representation is given in Fig.

11.

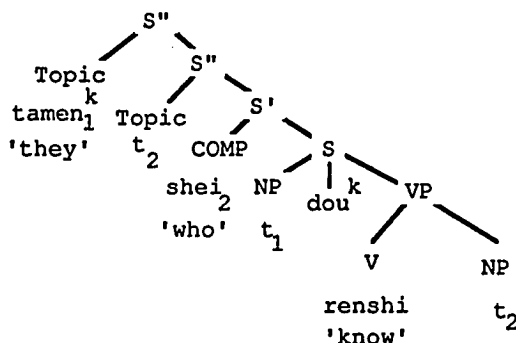


Fig.11

Here, the structure can be ruled out for a number of reasons. One is that if we assume that for proper binding, the node immediately dominating the antecedent of a trace must also dominate the trace (as in May 1977), then movement of the topicalized wh-word into COMP will fail to obey the Condition on Proper Binding, as the trace will not be bound.<sup>25</sup>

The ill-formedness of this structure can also be explained in terms of Pesetsky's Path Containment Condition. Note that the path linking dou to its antecedent tamen is {S'', S'', S', S}, and the path linking the wh-trace in topic position to the wh-word in COMP is {S'', S'}. One path is contained within the other. However, if we include the wh-trace in argument position as well, the path linking shei to its trace will be {S'', S', S, VP}; this path does overlap with the path binding dou to its antecedent, thus violating the PCC.

So far we have observed that while the PCC is able to explain the structural anomaly in Fig. 11, the same principle cannot account for the ungrammaticality of the LF representation in Fig. 9. One

might want to impose a more stringent version of the PCC so that two intersecting paths must not only show an embedding relationship but also a relationship of proper containment. By this more stringent requirement, the intersecting paths in Fig. 9 violate the PCC, since  $\{S', S\}$  is not properly contained by  $\{S'', S', S\}$ . This analysis, however, quickly runs into problems because it will at the same time exclude the interpretation "they know everybody" given in Fig. 8, which is one of the two possible readings of (153). In that LF representation, the path linking tamen to its topic trace is  $\{S'', S'', S', S\}$ , while the path connecting dou and the topicalized wh-word is  $\{S'', S', S\}$ . Since the latter path is not properly contained within the former, the interpretation should not have been well-formed.

It appears, then, that while all grammatical interpretations in the preceding examples are consistent with the PCC, the PCC is not restrictive enough to rule out certain ill-formed LF representations.<sup>26</sup> While a full analysis along this line of reasoning will be developed later, we should note here a basic similarity between the structures in the two figures which has not been captured by a PCC account: in both cases, dou-coindexing violates some kind of crossover constraint, in that a wh-word is 'crossed' by the binding path of dou. This crossover constraint will not only disallow readings such as (155) but will also rule out the

(155) \*tamen<sup>k</sup>    shei    dou<sup>k</sup>    renshi t  
          they    who    all    know

(156) \*tamen<sup>k</sup>    shei<sup>k</sup>    dou<sup>k</sup>    renshi t  
          they    who    all    know



possibility of dou coindexing simultaneously with the wh-word and tamen. In other words, the sentence cannot mean either "\*everyone of them knows everybody" nor "\*everybody knows everyone of them".

Recall that this type of coindexing is supposed to be possible if no wh-word precedes dou as in (157), which is ambiguous between "every

(157) Tamen<sup>k</sup> [zhe ji ge jiaoshou<sup>k</sup>] dou<sup>k</sup> renshi t  
 they this several professor all know

one of the professors knows everyone of them" and "every one of them knows every one of the professors". These facts can be accounted for by the following constraint on dou-coindexing.

(158) Crossover Constraint on Dou-coindexing

Dou must not cross a coindexable wh-word to bind  
 an antecedent

This constraint, together with the PCC, will also predict that a sentence like (154), repeated below as (159), will have two well-formed derivations, both formed by coindexing dou with the wh-word shenme ren 'what person'. First, let us note that the derivations arrived at by coindexing dou with tamen are all ill-formed.

(159) shenme ren tamen dou renshi t  
 what person they all know  
 "They know everyone"/"Everyone knows them"

(160) \*[shenme ren<sub>1</sub> [COMP [tamen<sup>k</sup> dou<sup>k</sup> [renshi t<sub>1</sub>]<sub>VP</sub>]<sub>S</sub>]<sub>S</sub>]<sub>S</sub>"  
 what person they all know

As can be seen from (160), the topicalized wh-word cannot move into COMP, since its trace will not be properly bound from COMP, and thus

a question reading "who does everyone of them know?" cannot be obtained.<sup>27</sup> At the same time, the wh-word cannot stay as a variable in topic position since there will be no operator to bind it. Hence (160) has no well-formed interpretation.

Notice, however, that dou in (159) can also coindex with the wh-word without violating crossover, yielding "they know everybody" as in (161).

(161) [shenme ren<sub>1</sub><sup>k</sup> [COMP[tamen dou<sup>k</sup> [renshi t<sub>1</sub>]]]]  
 what person they all know  
 "they know everybody"

A third possibility would be to coindex dou with both tamen and shenme ren, to produce (162), meaning "every one of them knows everybody".

(162) [shenme ren<sub>1</sub><sup>k</sup> [COMP[tamen<sup>k</sup> dou<sup>k</sup> renshi t<sub>1</sub>]]]  
 what person they all know  
 "every one of them knows everybody"

Both interpretations obey the Crossover Constraint as well as the PCC, as can be seen from Fig. 11a below.

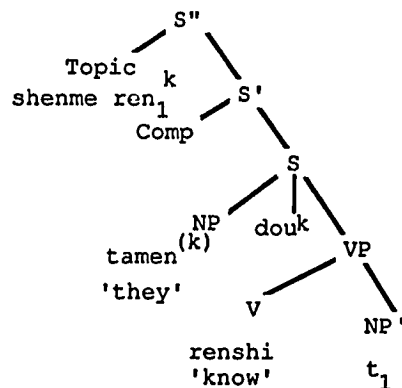


Fig. 11a

Here, since tamen 'they' stays in subject position and is not



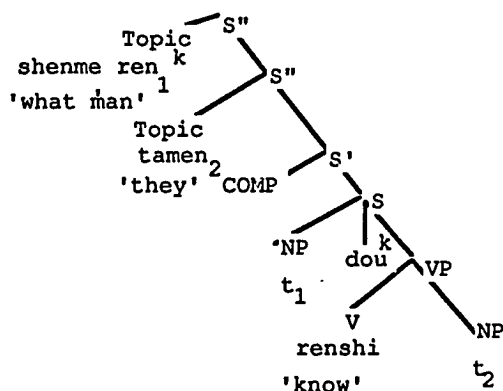


Fig. 11b

The path linking shenme ren to its trace  $t_1$  is {S'', S'', S', S}, whereas the path connecting tamen and its trace  $t_2$  is {S'', S', S, VP}. The two paths overlap and thus the PCC is violated. A similar analysis works for (164).

Part of our crossover constraint (158) stipulates that it constrains only those cases where the wh-word is coindexable with dou. This implies that if the wh-word is such that dou cannot affect it, it can be crossed by dou. This is supported by sentences involving the wh-word weishenme 'why', which does not interact with dou (cf. Note 4).

- (165)  $tamen^k$  weishenme  $dou^k$  chuan hong yifu?  
 they why all wear red clothes  
 "Why are they wearing red clothes?"

The above sentence can only be interpreted as a question, because weishenme 'why' cannot be coindexed with dou. Since the latter needs to bind something in order to be well-formed, tamen 'they' must coindex with dou. The wh-word then moves into COMP leading to a why-question.<sup>28</sup>

Another piece of evidence pointing to a crossover constraint has to do with the quantification of a singular prepositional object by dou, as in (166).

(166) \*women [zai yi ge difang<sup>k</sup>] dou<sup>k</sup> xi le zao  
we at one CL place all take asp.bath

Here, as we have seen from (73-76), dou can coindex with the NP in the PP or with the subject. In (166), coindexing the PP object with dou will violate the plurality requirement. In principle, dou can coindex with the plural women. However, this sentence is ungrammatical showing that the second coindexing option is ruled out by the Crossover Constraint. Thus the constraint appears to be more general than that stated: it prohibits dou from coindexing across a logical operator (wh-word or Q-NP).

Our treatment of dou-quantification not only provides a unified perspective on some synchronic data hitherto assumed to be disparate, it also offers a way of viewing the possible parameters of diachronic change. Recall that sentence (56), repeated below as (167), is considered ungrammatical.

(167) (\*)Zhangsan<sup>k</sup> dou<sup>k</sup> kanjian le shei?  
all see asp. who

The anomaly of the sentence is ascribed to the directionality constraint and the failure to satisfy the plurality requirement on dou-coindexing; by the former constraint, dou must coindex with Zhangsan, which is semantically singular. The interesting thing about this type of sentence is that in Beijing Mandarin (Lu 1980:153), it is in fact grammatical, having the meaning "who all

did Zhangsan see?", and that this apparent violation of the directionality constraint seems to be restricted to wh-words in object position. The following sentences show that the directionality constraint cannot be relaxed for [-wh] NPs, whether they are quantifiers or not.

- (168) \*Zhangsan dou renshi [meige ren]  
                   all know every-CL person  
       \*Zhangsan dou renshi [zhe ji ge laoshi]  
                   all know this several teacher

(168) is ungrammatical and cannot have the reading "Zhangsan knows everybody/ Zhangsan knows every one of these several teachers," where the object NPs are quantified by dou. What is even more interesting about (167) is that in the Beijing dialect, the sentence cannot have a declarative interpretation meaning "\*Zhangsan saw everybody" with dou quantifying the wh-word, on a par with (169).

- (169) Zhangsan shei<sub>i</sub> dou kanjian le t<sub>i</sub>  
                   who all see asp.  
       "Zhangsan saw everybody/ everybody saw Zhangsan"

It appears we have run into a paradoxical situation: if the sentence (167) can be grammatical, dou must be coindexed with the wh-word. At the same time, if dou is indeed coindexed with the wh-word, it does not affect the wh-word the way it does if the wh-word were in preverbal position. It would mean a great loss of generality to suggest that perhaps the directionality constraint or the plurality constraint can be made optional just in case wh-words occur in the object position of the sentence. A better analysis rests on the assumptions of the level of LF. At SS, (170) will become (171), its LF representation.

(170) [COMP[Zhangsan dou kanjian le shei]  
all see asp. who

(171) [shei<sub>1</sub><sup>k</sup> [Zhangsan dou<sup>k</sup> kanjian le t<sub>1</sub>]]  
who all see

If we assume that in these dialects, dou-coindexing applies at LF rather than at SS, then dou can be coindexed with shei, satisfying both the directionality constraint and the plurality requirement, as shei can be interpreted as referring to more than one individual.<sup>29</sup> The reason why we do not have a declarative reading is that the wh-word at LF has already moved into COMP and the trace t<sub>1</sub> is only bound by the wh-operator and not by dou, and the Bijection Principle is thus adhered to. In our framework, then, what appears to be a paradoxical fact about dialectal variation receives a plausible unified explanation.

A further theoretical implication of the analysis being presented is that a type of argument against transformational analyses of topic structures (cf. e.g. Lee 1983) is based precisely on the difference in meaning between (172a) and (172b).

(172)a. ?Zhangsan dou kanjian le shei  
all see asp. who  
"Who did Zhangsan see?"

b. Zhangsan shei<sub>1</sub> dou kanjian le t<sub>1</sub>  
who all see asp.  
"Zhangsan saw everyone"  
"Everyone saw Zhangsan"

If we treat the wh-word as topicalized from object position, how do we account for the vast semantic difference as well as the difference in grammaticality between the two sentences? Now that we have a more unified analysis of how dou interacts with wh-words, the

difference between the two sentences can be explained systematically by means of general principles, and the purported argument against transformational analyses of topics is no longer valid.

#### 1.14 Distributivity

We have been regarding du as an unselective universal quantifier, but as we well know, words having the logical function of universal quantifiers may have very different properties (cf. Vendler 1967). In English for instance, as Dougherty (1972) has observed, both, all and each share the property of requiring semantically non-singular antecedents.

- (173) \*The man will each have been hit by the girl  
      \*John will both have been hit by the girl  
      \*The man will all have been hit by the girl

However, they differ with respect to their behavior in symmetric predicates (cf. Carden 1976). While all can occur with symmetric predicates, each and both cannot. If a quantificational adverb shares with all the property of being able to cooccur with symmetric predicates, it is here defined as a non-distributive quantifier; if it cannot occur in symmetric predicates, it is called a distributive quantifier. Thus each and both are distributive by our definition.

- (174) The men all met at noon  
      \*each  
      \*both

Two other factors differentiating these quantifiers are also noted by Carden. One is that all and each seem to allow the verb to relate a member of the quantified set to its complement, while both cannot, as shown in (175).

- (175) All the men hate the others (of the men)



- Each of the men hates the others (of the men)  
 \* Both the men hate the other (of the men)

The other difference lies in the ability of both to modify predicates, a function not carried by the other two quantifiers, as demonstrated by the examples below.

- (176) John both danced and sang a lot  
       \*each danced and sang a lot  
       \*all danced and sang a lot

Coming back to dou, we observe that like all and both, it quantifies preceding elements, and like both and each, it cannot occur in symmetric predicates. Consider the following sentences.

- (177) a. Zhangsan he Mali mingtian jiehun  
           and Mary tomorrow marry  
           "Zhangsan and Mary will marry tomorrow"  
       b. Zhangsan he Mali dou mingtian jiehun  
           "Zhangsan and Mary will both marry (with someone else)tomorrow"  
       (178) a. Women heyong yi ge chufang  
               we share one-CL kitchen  
               "We share a kitchen"  
           b. Women dou heyong yi ge chufang  
               we all share one-CL kitchen  
               "We each share a kitchen (with someone else)"  
       (179) a. Zhe ji ge ren fenxiang yi bi caichang  
               this several person share one CL property  
               "These several persons share a property"  
           b. Zhe ji ge ren dou fenxiang yi bi caichang  
               this several person all share one CL property  
               "These several persons each share a property(with someone else)"

(177a) is vague; it could mean either "Zhangsan and Mary are going to marry each other tomorrow" or "Each of them is marrying someone else". But in (177b), only the second reading is possible. In (178a), because the verb heyong requires collectivity, the sentence



is allowed just in case the set of entities denoted by the quantified NP exceeds two in cardinality. Observe the contrast between the two sentences below.

(183) Wanggang he Lisi (\*dou) shi tongxiang  
          and           all are same-place of origin  
      "Wanggang and lisi are both from the same home village"

(184) Wanggang, Lisi he Zhaoqiang (dou) shi tongxiang  
          and                   all  
      "Wanggang, Lisi and Zhaoqiang are all from the same village"

In (183), two individuals are involved, and it seems dou, like both, prohibits connecting the two individuals by the symmetric predicate tongxiang 'same-place-of-origin'. However, as shown in (184), if the set comprises three individuals, the sentence is acceptable with dou inserted, precisely because the distributive effect of dou and the demand of a symmetric predicate can both be accommodated if the cardinality exceeds two. Su observes that (184) is equivalent to a conjunct of three clauses, each having the form of (183) without dou, as in (185).

(185) Wanggang he Lisi shi tongxiang, Lisi he Zhaoqiang shi  
          and           be same-village   and           be  
          tongxiang, Wanggang he Zhaoqiang shi tongxiang  
          same-village           and           be same village  
      "Wanggang and Lisi are from the same hometown, Lisi and  
          Zhaoqiang are from the same hometown, Wanggang and  
          Zhaoqiang are from the same hometown."

The theoretical implication one could draw from such an analysis is that once a set of individuals exceeds two in cardinality, one could have dou distributing subsets of the set, while the symmetric predicate holds of members of each subset.

To see how this works, suppose we have a set X of three members {a,b,c}. One way of satisfying the distributive requirement of dou

and the relational requirement of a symmetric predicate such as jiehun 'marry' is by having a subset Y of the power set of X, as  $\{\{a,b\}, \{b,c\}, \{a,c\}\}$ . Here the distributive requirement is met because X has been distributed in the form of Y so that none of the members of Y will enter into relations with each other. At the same time, however, the relational requirement of the symmetric predicate is satisfied, because the symmetric relation can hold of each member of Y (the distributed entities), each a set consisting of two members of X. Notice that if we only have a set of two members  $\{a,b\}$ , the conflict between dou and the predicate cannot be resolved. Consider the power set P of this two-member collection:  $\{\{a\}, \{b\}, \{a,b\}\}$ . Here, by the distributive requirement,  $\{a\}$  and  $\{b\}$  must be kept apart, but then this means there is no way the symmetric relation can be satisfied since the symmetric relation cannot hold of any of these distributed entities, which are singular in membership. Thus a conflict will arise between dou and a plural NP unless the noun phrase can be interpreted as having more than two members. This seems to be borne out by the fact that if we replace (180b, 181b) with BA objects denoting more than two individuals, the sentences become acceptable.

(186) Lisi BA Maozedong, Chiangkai-shek, Dengxiaoping dou xiang bijiao  
all recip. compare  
 "Lisi compared Maozedong, Chiangkai-shek and Dengxiaoping"

(187) Ta BA zhe ji ge gainian dou hunxiao le  
 s/he this several concept all confuse asp.  
 "S/he confused these several concepts"

Similarly, replacing the conjoined NP with a plural pronoun in

(177b) allows for a reading where marriage can take place among the

set of individuals referred to.

(188) Tamen dou mingtian jiehun  
they all tomorrow marry

Viewed in this light, the characteristics of the both construction in English stems from a general tension between a distributive quantifier and a symmetric predicate, which is a conflict also found in Chinese, the only difference being that the English word both requires not only semantic non-singularity but also duality on the part of the quantified NP. This means that one can never resolve the conflict at issue using both in English. With distributive quantifiers such as each, which, like the Chinese dou, imposes only a non-singularity requirement without specifying cardinality, one would predict that the conflict between the quantifiers and the predicates can be resolved.

Let us see how this notion based on examples such as (184) involving symmetric predicates can be extended to cases where the predicate holds between a member of the set and its complement. Taking a set of three members {a, b, c} again, one could hypothesize that in a sentence such as (189)

(189) Tamen dou yuanyi huxiang bangzhu  
they all willing each-other help  
"they are all willing to help each other"

a subset N of the power set is instantiated:

{ {a}, {b}, {c}, {a,b}, {b,c}, {a,c} }. Dou quantification is satisfied because the set of three individuals has been distributed, so that none of the three members of N - {a}, {b}, {c} can relate to each other. However, each of them can relate to the remaining members of





antecedents are available in this case, dou does not necessarily need to coindex the subject NP; it may also coindex with the PP object, so that  $j=k$ . If dou must bind all possible antecedents, we would expect the sentence to be acceptable only on the reading where Zhangsan and Mali do not marry each other but marry someone else. If, on the other hand, dou-coindexing is not obligatory on all candidate constituents, then the reading where Zhangsan and Mali marry each other should be possible, i.e. under the coindexing arrangement  $j=k$  and  $i$  not equal to  $k$ . Intuitions are not sharp in this area, but it appears the latter reading is possible, showing that dou-coindexing does not apply across the board obligatorily.<sup>30</sup>

#### 1.1.5 Quantifier Marking

The last property of dou we observe is its role in marking NPs without quantifier determiners as quantificational phrases. This group of NPs includes proper names, pronouns, NPs with demonstrative determiners, as well as common nouns with zero determiners. For the sake of convenience these NPs will hereafter be referred to as quantifier-bare NPs. It appears that these NPs behave differently in relation to other quantificational phrases depending on whether they are marked by dou. Consider the following.

- (196) a. zuotian tamen kan le yi chang dianying  
 yesterday they see asp. one CL movie  
 "yesterday they saw a movie"
- b. zuotian tamen dou kan le yi chang dianying  
 yesterday they all see asp. one CL movie  
 "yesterday they each saw a movie"
- (197) a. jintian wo de tongxue pengjian le yi ge xiaotou



today I nom classmate run-into asp one CL thief  
 "My classmates ran into a thief today"

- b. jintian wo de tongxue dou pengjian le yi ge xiaotou  
 today I nom classmate all run-into asp. one CL thief  
 "Today my classmates each ran into a thief"

- (198) a. Zhangsan he Lisi chi le san wan fan  
           and eat asp. three bowl rice  
 "Zhangsan and Lisi ate three bowls of rice"

- b. Zhangsan he Lisi dou chi le san wan fan  
           and all eat asp. three bowl rice  
 "Zhangsan and Lisi both ate three bowls of rice"

The (a) sentences all contain only one Q-NP, so that the Q-NP will obligatorily have wide scope, since it will adjoin to VP or the clausal projection taking scope over the entire sentence. Following May (1985), the scope of a Q-NP  $\alpha$  is defined as "the set of nodes which  $\alpha$  c-commands at LF." Thus the LF structures of the (a) sentences can be illustrated by (199), the LF representation of (198a).

- (199) [san wan fan<sub>i</sub> [Zhangsan he Lisi chi le t<sub>i</sub>]]  
           three bowl rice and eat asp.

This means there are three bowls of rice which Zhangsan and Lisi ate; the predominant reading is that altogether there are three bowls of rice consumed by the two individuals. Similarly (196a) means "there is a film they saw yesterday", i.e. they saw the same film. For (197a), again it must be the same thief who was encountered by my classmates. These readings can be accounted for by the fact that there is only one Q-NP binding a trace at LF. However, the (b) sentences show quite a different interpretation. (196b) means "Each of them saw a film yesterday", the films seen by them possibly different. Similarly, in (197b) the thieves encountered by

my classmates could be different thieves. Likewise, in (198b) "the three bowls of rice" must be a non-referential reading, allowing the possibility that Zhangsan and Lisi ate two different sets of three bowls of rice. The facts suggest that in the (b) sentences, the NPs without quantifier determiners, which are marked by dou, function as if they are Q-NPs at LF and take wide scope over the object NP.<sup>31</sup> As we will see from section 1.3 of this chapter, quantifier scope in Chinese is generally based on c-command relations at SS, governed by the following isomorphic principle:

- (200) if a Q-NP  $\alpha$  c-commands another Q-NP  $\beta$  at SS,  
 $\alpha$  also c-commands  $\beta$  at LF (i.e.  $\alpha$  has scope  
over  $\beta$ )

The quantifier scope relations reflected in the (b) sentences conform to this c-command scope interpretation principle and support our proposal that the NPs concerned behave as if they are Q-NPs at SS.

The NPs without quantifier determiners in the above examples all occur in DS subject position. Consider cases where they act as indirect objects of the verb phrase.

- (201) a. zhe ji ge laoshi [wo song le yi zhang hua t]  
this several teacher I give asp. one CL picture  
"I gave a picture to these several teachers"
- b. zhe ji ge laoshi<sup>k</sup> [wo dou<sup>k</sup> song le yi zhang hua t]  
this several teacher I all give asp. one CL picture  
"I gave a picture to each of these several teachers"
- (202) a. zhe ji chang dianying, [wo t fu le wu kuai qian]  
this several movie I pay asp. five CL money  
"I paid five dollars for these several movies"
- b. zhe ji chang dianying, [wo dou fu le wu kuai qian]

(203) a. Zhangsan he Mali, [wo gei le san fen liwu t]  
and I give asp. three CL present  
"I gave three presents to Zhangsan and Mary"

In the (a) sentences the Q-NPs in direct object position must have clausal scope, being the only Q-NPs within the sentence. Thus in (201a), the teachers received the same picture. Similarly in (202a), the predominant reading is one where a total of five dollars is paid for the entire set of movies. In (203a), it is the same three gifts that are given to Zhangsan and Mary. The LF representation of the sentences (201a) and (203a) can be illustrated by (204).<sup>32</sup>

NP<sub>3</sub> is the topicalized indirect object NP, which falls within the scope of the sole Q-NP in the sentence adjoined to S".

(205)  $[NP_3^k \ [NP_1 \ \underline{dou}^k \ [Q-NP_2 \ [ [V \ t_2] \ t_3]_{VP}]_{VP}]_S]_S''$

When we turn to sentences where these quantifier-bare Q-NPs occur as direct objects, the situation seems a little more complicated. It appears that unlike the cases we have considered, the dou-quantified NP actually shows narrow scope with respect to the indirect object Q-NP, despite the former's location in a hierarchically more prominent position.

- (206) qizi<sub>i</sub><sup>k</sup> [e dou<sup>k</sup> [fang t<sub>i</sub> [zai yi ge hezi li]]]  
 chesspiece all put at one-CL box inside  
 "Put all the chesspieces in one box"  
 "All the chesspieces are placed in one box"
- (207) Da xigua<sub>i</sub><sup>k</sup> [wo dou<sup>k</sup> [fang t<sub>i</sub> [zai yi ge suoja dai li]]]  
 big watermelon I all put at one CL plastic bag inside  
 "I put all the big watermelons in one plastic bag"
- (208) Hao xuesheng<sub>i</sub><sup>k</sup> [wo dou<sup>k</sup> [song t<sub>i</sub> [qu yi ge yanjiusuo]]]  
 good student I all send to one CL research-institute  
 "I sent all the good students to one research-institute"
- (209) Zhengzhi fan<sub>i</sub><sup>k</sup> [e dou<sup>k</sup> guan t<sub>i</sub> [zai yi ge xiao fangjian li]]]  
 political prisoner all lockup at one CL small room inside  
 "Lock all the political prisoners in one small room"  
 "All the political prisoners are locked up in one small room"

In all these sentences where the topicalized NP is marked by dou, the Q-NP in indirect object position tends to take wide scope over the subject NP. The strongly preferred reading is for the chesspieces to be placed in the same box (206), for the watermelons to be all placed in the same plastic bag (207), for all the good students to be sent to same research institute (208), and for all the political prisoners to be locked up in the same room (209).

The evidence thus far shows that with regard to quantifier-bare Q-NPs coindexed with dou, such a NP in subject position will always have scope over a Q-NP in direct object position; if it is a

topicalized indirect object, it will invariably have scope over a Q-NP in direct object position, showing an isomorphism between SS c-command relations and LF scope relations. However, a quantifier-bare Q-NP direct object in topicalized position tends to take narrow scope with respect to another Q-NP in indirect object position. We will argue that all these cases are consistent with general principles such as the PCC and that the last exception represents a case of marked scope order.

Let us illustrate the difference at SS between a sentence such as (201b) and a sentence such as (207) in Fig. 12 and Fig. 13 respectively. Recall that the topicalized NPs in (201-203) originate from a prepositional object position and the preposition is deleted after topicalization, since preposition stranding is prohibited at SS in Chinese.<sup>33</sup> Therefore in Fig. 12, the trace of the topicalized NP is an immediate daughter of VP.

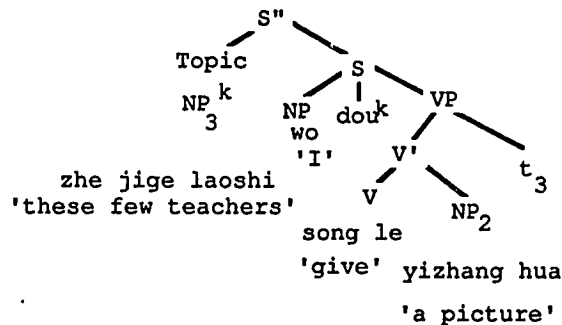


Fig. 12

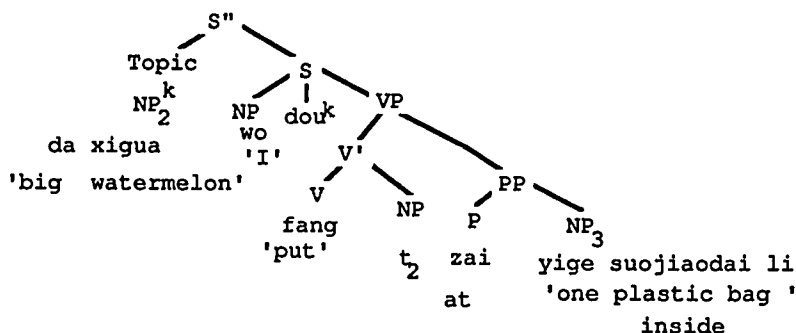


Fig. 13

Compare Fig. 12 to Fig. 13, where the trace of the topicalized NP is part of V'. The issue we would like to resolve is why in Fig. 12, NP<sub>2</sub> has narrow scope, whereas in Fig. 13, NP<sub>3</sub> has wide scope, with respect to the topic NP marked by dou.

Note first that all the LF representations derivable from the SS in Fig. 12 are consistent with the PCC, assuming that V's do not count as nodes in a path. At LF, the topicalized NP<sub>3</sub> marked by dou will function as a Q-NP; it does not need to undergo QR, as it is already bound by an operator (i.e. dou). The path connecting NP<sub>3</sub> and its trace will be {S'', S, VP}. Now, NP<sub>2</sub>, being a Q-NP in argument position, needs to undergo QR at LF. If NP<sub>2</sub> adjoins to S'', the path it forms will be {S'', S'', S, VP}, which embeds the path formed by NP<sub>3</sub> and its trace. If, on the other hand, NP<sub>2</sub> adjoins to VP, the resulting path will be {VP, VP}, which is embedded in the binding path of NP<sub>3</sub>. Thus, in either case, a LF representation consistent with the PCC will result. However, of these derivations, only the structure formed by adjunction to the lower S'' and that formed by VP adjunction conforms to the requirement that if a Q-NP c-commands another Q-NP at SS, it also c-commands it at LF. Thus, constrained

by both the PCC and the requirement for isomorphic mapping between SS and LF, NP<sub>3</sub> must have scope over NP<sub>2</sub>.

Figure 13 represents the SS of (207). Here, two well-formed LF structures are possible. As the topicalized NP<sub>2</sub> is already bound by dou, it need not undergo QR at LF. The path between NP<sub>2</sub> and its trace will be {S", S, VP}. NP<sub>3</sub> has three possible adjunction sites: S", VP or PP. If NP<sub>3</sub> adjoins to VP, the path it forms {VP, VP, PP} will include PP, a node lying outside the path of topicalization. This means overlapping paths will be produced, violating the PCC. There are two ways to circumvent this violation. One is to adjoin NP<sub>3</sub> to PP. If this option is taken, the paths of NP<sub>3</sub> and NP<sub>2</sub> will not intersect at all, and the PCC does not apply. The other option is for NP<sub>3</sub> to adjoin to S" to have wide scope over NP<sub>2</sub>. Such a manouever will produce a path that embeds the path of topicalization, in accordance with the PCC. Thus while two LF representations are permitted by the PCC, only one of the two LF structures (with NP<sub>3</sub> adjoined to PP) is consistent with the isomorphic scope principle. The fact that the reading of (207) is one where NP<sub>3</sub> has wide scope over NP<sub>2</sub>, in violation of the isomorphic principle, suggests that it is a case of marked scope order.

That the scope interpretation of (207) is marked is supported by the fact that in Fig. 13, if NP<sub>2</sub> is replaced by a Q-NP like meige da xigua 'every big watermelon', then NP<sub>2</sub> can have wide scope over NP<sub>3</sub>. If a Q-NP favoring a collective interpretation like suoyou da xigua 'all big watermelons' substitutes for NP<sub>2</sub>, then as before the

predominant interpretation is for NP<sub>2</sub> to have narrow scope. Further investigation into the area may lead to better understanding of the marked scope interpretations, which are consistent with the PCC but which violate language-specific scope interpretation principles such as the isomorphic principle.

#### Summary of 1.1

In the preceding subsections, we have examined the logical properties of dou as a universal quantifier. We have seen that dou must coindex with a semantically non-singular antecedent which it c-commands.<sup>34</sup> It functions like an unselective quantifier binding [+wh] and [-wh] nominals functioning as topics, subjects or prepositional objects and its quantificational effect is clausebounded. Semantically, it distributes the entities denoted by the NP it quantifies and it also earmarks noun phrases without quantifier determiners as Q-NPs at the level of Logical Form.



## 1.2 Referentiality of Numeral Phrases

This section studies the distribution of noun phrases of the form [numeral +classifier+(modifier)+ head noun], and explores the contexts in which these NPs can be referential. In our discussion we will propose a general constraint on quantification in Chinese which is intimately related to the topic-prominent character of the language. The interaction of singular numeral phrases with negation as well as with the universal quantifier dou is studied. In addition the behavior of the singular noun phrase in relation to other numeral phrases is examined. It will be argued in the spirit of Heim (1982) that in general numeral phrases in Chinese can function as operators or as variables, in the same way that wh-words can, as we have seen in the preceding section.

Referentiality of a noun phrase is here equated with specificity: a noun phrase is said to be specific or referential if the existence of the referent in the speaker's universe of discourse is presupposed and that identifiability of the referent on the part of the speaker is assumed (cf. Kuno 1970, Jackendoff 1972: 286).

Thus in a sentence such as

(210) I bought a book

the noun phrase is by necessity specific or referential. For this sentence to be true, there must be a particular book such that the speaker bought it, and since the event has taken place with the speaker being a participant, he must have sufficient knowledge to be able to identify the referent of a book. In contrast, in well-known intensional contexts such as want-contexts, the same NP may not be

referential.

(211) I want to buy a book

In (211) a book may refer to a particular book identifiable by the speaker, in which case the NP is specific or referential, or it may refer to any member of the class of books, in which case the entity is not identifiable and its existence not assumed by the speaker. In this latter use, the NP is said to be non-specific or non-referential. Thus the notion of referentiality adopted here is a notion of logical referentiality.<sup>35</sup>

#### 1.2.1 Constraints on Distribution of Numeral Phrases

A very striking fact about the distribution of numeral phrases in Chinese is that with a number of exceptions which we will examine in this section, numeral phrases are generally prohibited from matrix subject position if no logical operators occur elsewhere in the sentence. Since the first NP can always be analyzed as the topic of the sentence, this implies that numeral phrases also cannot occur in topic position of the sentence.

(212)a. ??[yi ge xiaohai] tou (le) wo de chezi  
          one CL kid steal asp I nom. car  
          "A kid stole my car"

b. ??[yige laoshi] mai (le) fangzi  
          one CL teacher buy asp. house  
          "A teacher bought a house/houses"

c. ??[san ge ren] si (le)  
          three CL person die asp.  
          "Three people died"

d. ??[yi ge suxuejia] hen congming  
          one CL mathematician very intelligent  
          "A mathematician is very intelligent"

This prohibition is surprising because not only are numeral phrases

prevented from becoming referential in such a position, they seem to be banned from that position altogether, referential or not.

The normal way of rendering the intended meanings is to place the numeral phrases in postverbal position following the existential verb you 'have/exist'. (213a-d) illustrate these facts:

- (213)a. you [yi ge xiaohai] tou (le) wo de chezi  
have one CL kid steal asp I nom. car  
"A kid stole my car"
- b. you [yige laoshi] mai (le) fangzi  
have one CL teacher buy asp. house  
"A teacher bought a house/houses"
- c. you [san ge ren] si (le)  
have three CL person die asp.  
"Three people died"
- d. you [yi ge suxuejia] hen congming  
have one CL mathematician very intelligent  
"A (certain) mathematician is very intelligent"

These facts contrast sharply with the situation in English, where the counterparts of sentences (212a-c) are grammatical. As observed in Kuroda (1979:40), an English sentence equivalent to (212d) is also not acceptable, as the predicate attributes a constant and inherent property to the subject, and it seems that we cannot attribute a property to something referred to in an indefinite way. The English counterpart of the sentence can only be understood as a generic sentence in which the property is attributed not to a single individual but to a whole class of individuals. In the Chinese sentences above, we cannot claim that the source of ambiguity lies in the perfective aspect marker le, since deleting the aspect morpheme does not make the sentences more acceptable. Without the aspect marker, the sentences sound semantically incomplete, as if

further assertion remains to be made. It should be observed that this is the only syntactic position where a numeral phrase is disallowed; in all other positions numerals can occur referentially or non-referentially.

The object position can of course be a referential slot for numeral NPs. In the sentences below, the NPs concerned are generally logically referential.<sup>36</sup>

(214) wo kanjian le [wu ge ren]  
I see asp. five CL person  
"I saw five persons"

(215) Zhangsan kan le [liang chang dianying]  
see asp. two CL movie  
"Zhangsan saw two movies"

(216) Zhege jiaoshou zhengming le [yi ge dingli]  
this professor prove asp. one CL theorem  
"This professor proved a theorem"

The numeral NPs in this position can be non-referential in the contexts of irrealis verbs such as want or will, in questions and also in imperatives.

(217) wo xiang mai [yi ben wuxia xiaoshuo]  
I want buy one CL martial-art novel  
"I want to buy a martial-arts novel"

(218) ta hui ji [yi feng xin] hui jia  
s/he will mail one CL letter to home  
"S/he will mail a letter home"

(219) ni mai le [wu ben shu] ma?  
you buy asp five CL book question part.  
"Did you buy five books?"

(220) shei mai le [wu ben shu]?  
who buy asp five CL book  
"Who bought five books?"

(221) na [san ge pingguo] lai  
fetch three CL apple come  
"Fetch three apples (here)"

In (217) the NP 'a martial arts novel' can be specific or non-specific, and 'a letter' in (218) has a similar status. In (219-221), the object NPs are normally understood as being non-referential and have only a numerical reading. The presence of another quantifier can also induce non-referentiality in the object position, as in

- (222) zhexie xiaohai meitian chi [yige pingguo]  
 these kid everyday eat one-CL apple  
 "These kids eat an apple every day"

Here, under the influence of the adverbial quantifier meitian 'everyday', the object NP can refer to a specific NP (an unlikely reading given the pragmatics of the situation described by the sentence) but may also refer to a non-specific member of the class of apples. Singular numeral phrases can function non-referentially as predicate nominals.

- (223) wo yao dang (yige) jiating laoshi  
 I want serve-as one-CL family teacher  
 "I want to be a home tutor"

- (224) Yuefei shi (yige) minzu yingxiong  
 be one-CL national hero  
 "Yuefei is a national hero"

- (225) ta yao zuo (yige) meiguo ren  
 s/he want be one-CL America person  
 "S/he wants to be an American"

- (226) Zhangsan shi (yige) youming de yisheng  
 be one-CL famous nom. doctor  
 "Zhangsan is a famous doctor"

In the above sentences, the quantifier phrase [numeral + classifier] can be omitted. Note that while either the QP or the zero determiner can be used in predicate nominal use, the zero form is more common. In fact, in situations where the potential referent of the NP is

unique the numeral phrase cannot be used in place of the zero form.

- (227) \*Lisi xiang dang yi ge banzhang/ zhuxi/ zhongtong  
want serve-as one-CL class-monitor/chairman/President  
"Lisi wants to be a class-monitor/chairman/President"

- (228) Lisi xiang dang yi ge zhuzhang/fenhui huizhang  
want serve-as one-CL team-leader/chapter president  
"Lisi wants to be a team leader/ president of the chapter  
(of an association)"

Since the positions of class monitor, chairman, and president are normally unique, and the use of the numeral 'one' in non-referential use implies 'one out of many', a conflict results. On the other hand, the positions designated by zhuzhang 'team leader' and fenhui huizhang 'president of a chapter (of an association)' are non-unique and hence the use of the singular numeral phrase is permitted.<sup>37</sup> However, it should be mentioned that it is not always the case that the zero form is preferred over the numeral form in predicate nominal constructions. If the noun is preceded by a modifier, the inclusion of a numeral actually makes the sentence sound more natural; and the more detailed the modification, the more necessary it is to include the singular numeral. The sentence below illustrates such a use.

- (229) ta xiang zuo ?(yi ge) yonggan, zhengzhi, juyou yuanjian de  
s/he want serve-as one CL brave upright have foresight  
jidu tu  
Christian  
"S/he wants to be a brave, upright Christian with foresight"

Numerical phrases serving as direct objects in postverbal position or as prepositional objects in preverbal position are typically referential (in the absence of other logical operators),

as shown by the sentences below, where the bracketed NPs are normally understood referentially.

- (230) a. wo gei le Zhangsan [liang ben shu]  
 I give asp. two CL book  
 "I gave two books to Zhangsan"
- b. wo song gei Zhangsan [san fen liwu]  
 I offer to three CL present  
 "I offered three presents to Zhangsan"
- c. Ta mai gei wo [yi dong fangzi]  
 s/he sell to me one CL house  
 "S/he sold me a house"
- (231) a. Zhege chushi [ti si ge laoban] zuo guo shi  
 this-CL chef for four CL boss do asp. work  
 "This chef has worked for four bosses"
- b. Zhangsan [xiang wu ge pengyou] jie le qian  
 from five CL friend borrow asp. money  
 "Zhangsan borrowed money from five friends"
- c. Tamen [zai yige guangchang] juxing le wuhui  
 they at one-CL square hold asp. dance-party  
 "They held a dancing party at a square"

Again, when embedded in want-contexts, interrogative and imperative constructions, as well as quantifier contexts, these NPs can become non-referential. All the bracketed NPs below can have both referential and non-referential readings.

- (232) a. wo hui gei Zhangsan [liang ben shu]  
 I will give two CL book  
 "I will give Zhangsan two books"
- b. Shei song gei Lisi [san fen liwu]  
 who offer to three CL present  
 "Who offered Lisi three presents?"
- c. gei wo [yi dong fangzi]  
 give me one CL house  
 "Give me a house"
- (233) a. Mei ge chushi dou [ti wu ge laoban] zuo guo shi

every CL chef all for five CL boss work asp.  
"Every chef has worked for five bosses"

b. Zhangsan [xiang wu ge pengyou] jie le qian ma?  
from five CL friend borrow asp. money question  
part.  
"Did Zhangsan borrow money from five friends?"

c. Tamen xiang [zai yige guangchang] juxing wuhui  
they want at one-CL square hold dance-party  
"They want to hold a dance party at a square"

We find numeral phrases in adjunct positions as well, in  
non-referential or referential use. Below are examples of duration  
and frequency adverbs.

(234) a. Ta deng le [san ge xiaoshi] le  
s/he wait asp. three CL hour part.  
"S/he has waited for three hours"

b. Lisi qu guo nar [liang ci]  
go asp. there two time  
"Lisi has been there twice"

c. nei ge bingren hunmi le [san tian]  
that CL patient unconscious asp three day  
"That patient has been unconscious for three days"

d. Wo xiang zai zher zuo liangge xiaoshi  
I want at here sit two-CL hour  
"I want to sit here for two hours"

e. Shei qu guo Meiguo liangci?  
who go asp. America twice  
"Who has been to America twice?"

The duration and frequency adverbs in (234a-c) are referential  
because the events having occurred, they must refer to particular  
moments or durations of time which are known to the speaker. These  
adverbs can become non-referential under the influence of other  
operators, as (234d-e) demonstrate. In (d), as the event of sitting  
has not occurred, the stretch of time 'two hours' is clearly  
unspecified. In (e), the particular times at which the event 'going



to America' occurred depends upon the individual picked out by the question word shei 'who', and are therefore non-referential.

A restricted set of numeral NPs (basically numeral +CL+ ren 'person') occurring in preverbal position can function non-referentially as manner adverbials. In these sentences, clearly the numeral phrase cannot be coindexed with the subject NP. They function adverbially modifying the way an action is carried out.

- (235) Women changchang [yige ren] qu luying  
we often one-CL person go camping  
"We often go camping singly"

- (236) Shang ge xueqi, zhe jige tongxue dou [liang ge ren] xi wan  
last CL term this few classmate all two CL person wash dish  
"Last term, these several classmates washed dishes in groups  
of two"

Given the fact that in a simple clause (i) numeral phrases can occur in all positions except the subject position, and (ii) such NPs appearing in all argument positions besides the subject can be referential or non-referential, depending on the context, the exclusion of the numeral phrase from the subject position presents a puzzle. To address this issue, we would like to ask first of all whether in a simple clause, such an occurrence is permitted under the influence of other constituents. In this regard, two general facts should be noted. One is that numeral phrases can occur referentially if they are preceded by a topic (Fan 1986).<sup>38</sup> In the example below, the first NP represents the topic of the sentence and it can signify a time or location of a group of individuals.

- (237) a. Beijing [sanshi ge qingnian] fangwen le riben  
thirty CL youth visit asp. Japan  
"Thirty youths from Beijing visited Japan"

- b. Xili [liang ge jiaoshou] hen xihuan Zhangsan  
 department-in two CL professor very like  
 "Two professors in the department like Zhangsan very much"
- c. Ganggang [yi ge ren] lai zhao ni  
 just now one CL person come find you  
 "Just now a man came to look for you"
- d. Zuotian [yi ge gongren] cong chuankou diao le xialai  
 yesterday one CL worker from window fall asp. down  
 "Yesterday a worker fell down from the window "
- e. Tamen [liang ge ren] yijing shui le  
 they two CL person already sleep asp.  
 "The two of them have already fallen asleep"

Considering a sentence like (237a), one might question whether the above sentences have a structure where the numeral phrase is a subject preceded by a topic, i.e. a structure of the form (238a), or a structure of the form (238b) with a complex NP as the subject.

(238) a. [Topic [NP VP]<sub>S</sub>]<sub>S</sub>"

b. [[NP N']<sub>NP</sub> VP]<sub>S</sub>

The second view is not unreasonable since combinations such as xili liangge jiaoshou 'two professors in the department' and tamen liangge ren 'the two of them' can be found in object position (cf. b,e), where no topic can occur.

- (239) wo xihuan [xili liangge jiaoshou]/ [tamen liangge ren]  
 I like department-in two CL professor/they two-CL person  
 "I like two professors in the department/the two of them"

In other words, how do we know this sequence of constituents does not form a partitive construction? Our objections to a partitive analysis are based on three considerations. First, the topics may be time adverbials as in (237c-d), which refer to instants or stretches of time, and it is impossible to combine these time adverbials with a non-temporal numeral phrase to form a partitive construction. Thus

neither [\*zuotian yige gongren] 'yesterday one worker' nor [\*ganggang yige ren] 'just now a man' can occur in object position. Even if we regard the initial NP-NP sequences in (237 b,e) as a constituent, we are still left with the task of explaining why the subject numeral phrases are sanctioned by temporal topics such as those in (c) and (d). The second reason against a partitive analysis of the initial constituents is that pause particles such as ne, a, ma, generally considered to be phonological markers of topics, can be inserted immediately after the topic (cf. Chao 1968), as shown in the following sentences.

- (240) a. Beijing a, [sanshi ge qingnian] fangwen le riben  
           part. thirty CL youth visit asp. Japan  
           "Thirty youths from Beijing visited Japan"
- b. Xili ne, [liang ge jiaoshou] hen xihuan Zhangsan  
           department-in part. two CL professor very like  
           "Two professors in the department like Zhangsan very much"
- c. Tamen ma, [liang ge ren] yijing shui le  
           they part., two CL person already sleep asp.  
           "The two of them have already fallen asleep"

Thirdly, in all the above sentences, including (237 b,e), an adverbial or a parenthetical can be added between the topic and the subject, showing the latter two elements do not cohere as a partitive phrase.

- (241) a. Beijing qunian sanshe ge qingnian fangwen le riben  
           last-year thirty CL youth visit asp. Japan  
           "Last year, thirty youths from Beijing visited Japan"
- b. Xili, ju shuo, liangge jiaoshou hen xihuan Zhangsan  
           department-in, it is said, two-CL professor very like  
           "It is said that two professors in the department like Zhangsan"
- c. Tamen ganggang liangge ren yijing shui le  
           they just-now two-CL person already sleep asp.

"Just now the two of them had fallen asleep"

If we recognize the initial constituent as a topic, then these topics clearly license the occurrence of numeral phrases in subject position. A special case of this type of context is found in enumerative constructions, where the topic corresponds to a superset, while the individually enumerated subjects correspond to subsets of the superset, as in (242).

- (242) Zhe ji ge xuesheng, liangge ren xiwan, san ge ren  
this several student two CL person wash-dish, three-CL person  
sao di  
sweep floor  
"As for these several students, two of them wash the dishes,  
(and) three of them sweep the floor"

Another means by which a numeral phrase can be used referentially as a subject is by modifying the NP with a vivid description.

- (243) a. yige [gaogao shoushou] de jinfa guniang ganggang lai zhao ni  
one-CL tall thin nom blonde girl just-now come find you  
"A tall, thin blonde-haired girl came to look for you just  
now"
- b. yige [conglai mei nian guo daxue] de zuojia chuban le  
one-CL ever not study asp college nom writer publish asp.  
yibu hen hongdong de zhuzuo  
one-CL very sensational nom. work  
"A writer who has never attended college published a  
sensational work"
- c. liangge [chengjing dedao Nobel jiang] de jiaoshou  
two CL have-been obtain prize nom. professor  
jinnian tuixiu le  
this-year retire asp.  
"Two professors who had obtained the Nobel prize retired  
this year"
- d.? yige [gaogao shoushou] de jinfa guniang kanjian le shei?  
one-CL tall thin nom blonde girl see asp. who

"Who did a tall, thin blonde-haired girl see?"

It is well-known that in general an indefinite NP with a high degree of descriptive richness tends to be understood referentially and behaves more like a name rather than a quantifier, violating all scope islands in always requiring a wide scope reading (Fodor and Sag 1982).<sup>39</sup> In Chinese, it seems that a parallel situation obtains: with a rich descriptive phrase, the numeral NP ceases to behave like a quantifier phrase, and is exempted from the subject constraint, just as proper names and definite NPs can. It is worthy of note that even a descriptive phrase loses its referentiality once it is placed in an interrogative context as (d) shows.

We note here a third way by which numeral phrases can appear in subject position: by means of dou support. The universal quantifier dou, when quantifying a preceding non-singular numeral phrase, has the effect of supporting it and making it referential. Note that in the examples below, not only is the set of individuals quantified, but they must also refer.<sup>40</sup>

(244) san ge ren \*(dou) qu le  
three CL person all go asp.  
"(The) three persons all left"

The subject of the sentence can only be understood as referring to three specific individuals, and cannot be non-referential. This property of dou seems to be quite general; numeral phrases with dou-support can also appear in topic position, again able to function only referentially.

(245) san bu dianying [ta \*(dou) kan le]  
three CL movie s/he all see asp.  
"S/he saw (the) three movies"

We have seen that numeral phrases can appear referentially when they are topic-bound, rich in descriptive vividness, or when supported by *dou*. Are there contexts where they can occur in subject position, but only non-referentially? Here, we would like to observe three types of contexts where numeral phrases can only occur non-referentially in subject position. First of all, modal verbs and adverbs allow numeral phrases to occupy subject position.

- (246) [wu ge ren] zhunneng wancheng renwu  
 five CL person definitely complete task  
 "Five persons can definitely complete the task"
- (247) [liang ge ren] keneng liqi bu gou  
 two CL person perhaps energy not enough  
 "Two people may not have sufficient energy (for a task)"
- (248) [yi tou langgou] keyi pao changtu  
 one CL Alsatian can run long-distance  
 "an Alsatian can run long distance"
- (249) [yi ge nanren] yinggai yonggan  
 one CL man ought-to brave  
 "A man ought to be brave"
- (250) [yi ge guafu] hui gan dao jimo  
 one CL widow will feel lonely  
 "a widow will feel lonely"
- (251) [liang ge ren] \*(keyi) chi [shiwān fān]  
 two CL person can eat ten-bowl rice  
 "Two persons can eat ten bowls of rice"

All the numeral phrases in (246-251) can only have a non-referential reading. The above examples cover two types of cases: one is where we have a singular NP with a generic reading, as in (248-250). The sentence corresponds to the formula "for all x, if x has the property denoted by the noun, then it is necessarily the case that the predicate holds of x". Another type of case, illustrated by (246-247) and (251), denote a reading where the subject has only a

numerical reading. These sentences generally refer to the boundedness or capacity of the individuals implied by the numeral phrase. In (246), the boundedness is defined by the accomplishment of the task and (247) concerns the capacity of the strength required. As (251) shows, the extent of the capacity required can be made explicit by means of an overt Q-NP phrase in the predicate. Note that the Q-NP itself nonetheless cannot sanction the appearance of the numeral phrase subject; a modal element is obligatory for achieving this effect.

A second environment where numeral phrases occur non-referentially in preverbal position is found in sentential subjects. In general, in order for numeral phrases to appear at all in such embedded position, the sentence subject cannot take the perfective aspect le.

(252) [san ge pengyou chi (\*le) fan] duo hao  
 three CL friend eat asp. rice very good  
 "It would be nice for three friends to have a meal"

(253) [liangge xiaohai zou (\*le) gangsuo] hen weixian  
 two-CL child walk asp. steel-rope very dangerous  
 "It is dangerous for two children to walk the tightrope"

We know that the NPs in the embedded clause are subjects and not adverbial phrases because as we remarked earlier, numeral phrases as preverbal adverbs are restricted to only one set of NPs with ren 'person' as the head noun. This can be seen from the fact that such adverbial use is not possible following dou if another head noun is used instead.

(254) meinian xiatian, Zhangsan he Lisi dou [yige ren]/\*[yige tongxue]  
 every-year summer, and all one-CL person/one-classmate  
 qu luying

go camp

"every summer, Zhangsan and Lisi go camping alone (singly)"

- (255)a. \* zhe ji tou gou dou [yi ge ren/ yi ge gou] shuijiao  
this several dog all one CL man/one CL dog sleep  
"These several dogs all sleep singly"

- b. Tamen dou [yi ge ren] shuijiao  
they all one CL person sleep  
"They all sleep alone"

It appears that in (254) the noun tongxue 'classmate' is too descriptive to warrant adverbial use of the NP; in (255), the sentence cannot mean "these several dogs are sleeping singly" on a par with (255b) and replacing gou 'dog' with ren 'person' does not improve the sentence because the former entails the [+human] semantic feature, which is incompatible with the noun gou 'dog'. We know that yige ren 'one person' in the above examples is not in subject position, as it has been established in section 1.1.2 that dou must follow the subject of the sentence.

Thirdly, numeral phrases function non-referentially as subjects of hypothetical clauses.

- (256) a. [ruguo yige ren bu gou], jiu zhao wu ge ren qu  
if one-CL person not enough, then find five-CL person go  
"if one people is not enough, find five persons"
- b. [ruguo liangge jiaoshou quexi], hui jiu kai bu cheng  
if two-CL professor absent meeting then start not compl.  
"if two professors are absent, the meeting cannot be held"
- c. [chaoguo ershi ren lai] de hua, huichang yiding hui  
over twenty person come if venue certainly will  
hen luan  
very chaotic  
"if over twenty persons show up, the venue will be chaotic"
- d. [yi ge nuren jie le hun] keneng hui xiang sheng xiaohai  
one CL woman marry asp. perhaps will want bear child  
"(if) a woman gets married, (she) will perhaps want to  
bear children"



- e. [ruguo yi ge ren zhong le caipiao],ta hui biande hen fuyou  
if one CL person hit asp.lottery s/he will be very rich  
"If a man wins the lottery, he will become very rich"

The (a-c) sentences allow for only a numerical reading of the NPs in the if-clauses, which may or may not require an explicit conditional morpheme. If the numeral phrase is singular, then a generic reading may be obtained, sentences (d, e) illustrate the interpretation corresponding to the formula "it is possibly/necessarily the case that for all x, if x has a property y, then the predication holds of x." While numeral phrase subjects in hypothetical contexts must occur non-referentially, whether a generic reading is always derivable from a singular NP depends on whether a modal interpretation can be assigned to the sentence. In (256a), despite the presence of a singular NP, a generic reading is unavailable, because unlike the case of (d-f) sentences, the truth of the sentence seems to be contingent on a specific situation rather than being generally true in all or some possible worlds.

To summarize the facts presented so far, a numeral phrase is generally banned from subject position of a clause. While a numeral phrase can play a referential role in subject position when supported by a descriptive phrase, a topic or the universal quantifier dou, it can appear in that position non-referentially only in one context, viz. in the presence of a modal element. The other subject positions it can occupy are all contained within an embedded clause, and in all these slots it can only be non-referential if no other logical operators intervene.<sup>41</sup> We have also seen that no such constraint is imposed on other argument

positions. This asymmetry between the subject and object is further attested by the referential properties of numeral NPs within complex NPs. Observe the contrast between the (a) and (b) sentences below.

- (257) a. Wo {xihuan } [[san ge ren] de fangzi]  
           mai le  
           I { like } three-CL person nom. house  
           buy asp.  
           "I like/bought the houses of three persons"  
           "I like/bought houses (accomodating )three person"
- b. [[sange ren] de fangzi] hen kuanchang  
           three-CL person nom house very spacious  
           "House (accomodating )three persons are very spacious"
- (258) a. Wo {xihuan } [[yige xiaohai] de muqin]  
           pengjian le  
           I { like } one-CL child nom. mother  
           meet asp.  
           "I like/met the mother of a child"  
           "I like/met mothers who have one child"
- b. [[yige xiaohai]de muqin]jintian canjia baojian yantaohui  
           one-CL child nom mother today join health seminar  
           "Single-child mothers today took part in a health seminar"
- (259) a. Wo xihuan kan [[yige nuhaizi tiao]de wu]  
           ganggang xinshang guo  
           I like watch one-CL girl dance nom dance  
           just-now enjoy asp.  
           "I like to watch/just enjoyed the dances of a girl"  
           "I like to watch/just enjoyed dances performed by one girl"
- b. [[yige nuhaizi tiao ] de wu] tebie haokan  
           one-CL girl dance NOM dance especially nice  
           "Dances performed by one girl are especially nice"

Just as numeral phrases can be referential or non-referential in object position with irrealis verbs, so the complex NPs containing numeral in the (a) sentences also have two readings. In (257a), the complex NP can refer to houses of three specific individuals or houses with a capacity for accommodating three people. In (258a),

the object NP can mean 'single-child mothers' or the mother of a specific child. Likewise, the relevant NP in (259a) can refer to a dance performed by a particular girl or 'dances performed by only one girl'. The (a) sentences with verbs taking aspect also show that it is possible to have both an internal and an external reading of the quantifier phrase regardless of whether the verb is irrealis, though an irrealis verb will of course favor an external reading. Turning to the (b) sentences, we find a sharp contrast between these complex NPs in subject position and those in (a), which are found in object position of the matrix clause; we also find a parallel between subject numeral phrases in a sentential subject (cf. 252-253) and those in a complex NP occupying matrix subject position. Just as the subject numeral phrases in a sentential subject can only be non-referential, so the numeral phrases in (b) are restricted to a non-referential reading. Why is there this subject/object asymmetry with regard to numeral phrases within complex NPs?

We will consider here two possible approaches to such a range of quantification data in Chinese. The first approach, which we shall call a Definiteness approach, can be developed along the ideas suggested in Chao (1968). Chao observes that (1968:76) "since the subject sets the topic of the talk and the predicate gives the information by adding something new, the subject is likely to represent the known, while the predicate introduces something unknown...there is a very strong tendency for the subject to have a definite reference and the object to have an indefinite reference."

Therefore one could argue that a numeral phrase is banned from subject position because it fails to be inherently definite. If it occurs in initial position, it can always be reanalyzed as a topic, which must be definite- a requirement that it will not meet. If the numeral phrase occurs later in the sentence, as in postverbal position or prepositional object position, then it will not be reanalyzable as a topic and is therefore permitted. Thus an association is established between definiteness and appearance in the earlier part of the sentence on the one hand, as well as between indefiniteness and later occurrence in the sentence.

This account leaves much to be desired. First of all, it will fail to explain why, for example, *wh*-words can occur as subjects of a simple clause, as in (260), since it is hard to argue for the definiteness of *wh*-words.

(260) *shei lai le*  
       *who come asp.*  
       "who came?"

Further, such an intuitive account will also fail to explain why universal quantifiers like *mei+CL* 'every' and *renhe* 'any' can occur in subject positions only when supported by *dou*.

(261) *meige ren \*(dou) hui youyong*  
       *every person all know swim* "everyone knows (how to) swim"  
  
       *renhe ren \*(dou) hui youyong*  
       *any person* "Anyone knows (how to) swim"  
  
       *Gege ren \*(dou) hui youyong*  
       *CLCL person* "everyone knows (how to) swim"

Of course one could defend the definiteness account in the manner of Chao (1968:77) by saying that reference to every member of the class

is considered definite reference, and therefore universal quantifiers can occur in subject position. However, the fact is they cannot occur in subject position unless supported by dou, so it appears that the semantics of mei+CL and renhe cannot account for their distribution.<sup>42</sup> In addition, as has been observed by Prior (1976), Evans (1980), quantifier phrases such as every do not actually refer.<sup>43</sup> It is difficult to define the 'definiteness' of a universal quantifier in terms of notions such as "identifiable to speaker and hearer"- which presupposes reference to objects.

The more serious inadequacy of the Definiteness account lies in its failure to account for sentences such as (262), where the topic

(262)??zhe ge xiaotou    sange jingcha    zhua le t  
           this CL thief    three policeman arrest asp.

"This thief has been arrested by three policemen"

position is occupied by a topicalized object. If the Definiteness account is correct, such a sentence should be grammatical as there is no need to reanalyze the subject numeral phrase as a topic, which is not borne out by the data.

A final objection to the definiteness account is that it does not address itself to the possibility of numeral phrases appearing as subjects in modal contexts and in sentential subjects. Since numeral phrases also occur initially in these contexts, why can't they be reanalyzed as topics in these contexts, and why is it that in contexts such as sentential subjects, only a non-referential reading is available. Clearly, the range of data we have been reporting must be accounted for in any adequate analysis, which the definiteness account does not seem to be.



difference between the two representations below. Fig. 14 corresponds to a LF representation of the sentence sange ren kanjian le wo 'Three persons saw me'. Fig. 15 corresponds to the LF representation of wo kanjian le sange ren 'I saw three persons.' In both structures, the topic has been left out in the expansion of S" and tree-pruning has already applied so that S" is no longer available.

We have noted the subject/object asymmetry between the two sentences. The unacceptability of the sentence in Fig. 14 can be accounted for as follows: if NP<sub>1</sub> is an operator, by our assumptions that QR adjoins to S" rather than S, the only adjunction site available to NP<sub>1</sub> is VP. But if it adjoins to VP, the trace of NP<sub>1</sub> will not be bound by its antecedent. Adjoining to the object NP will

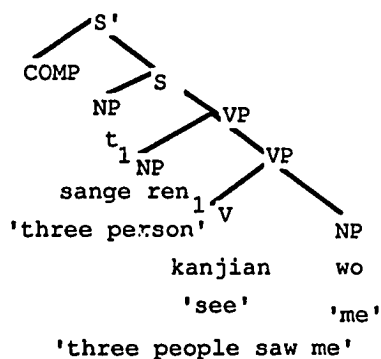


Fig. 14

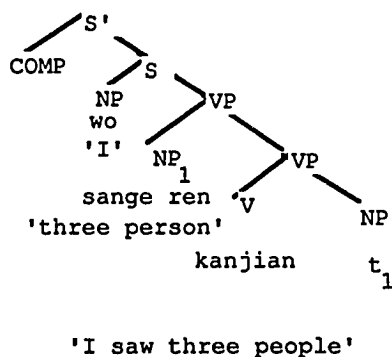


Fig. 15

also result in improper binding, and self-adjunction is prohibited by our assumption (e). Thus we cannot derive a LF structure where NP<sub>1</sub> can be represented as an operator-variable pair consistent with general principles. On the other hand, if NP<sub>1</sub> is regarded as a variable, and therefore does not need to adjoin, there is no

operator in the sentence to bind it, violating the Condition on Proper Binding. Hence the sentence is ungrammatical whether the numeral phrase is treated as an operator or a variable. In Fig. 15, if NP<sub>1</sub> is treated as a variable in situ, again there will be no operators to bind it; thus no grammatical reading will result on this option. However, if NP<sub>1</sub> is taken as an operator, it likewise has no adjunction site above VP, but nonetheless it can adjoin to VP, and by our Scope Domain Principle, since the adjoined Q-NP c-commands the predicate, it c-commands all the arguments of the predicate, including the subject, i.e. sange ren will have scope over the entire sentence.<sup>44</sup> In other words, the structure corresponds to the reading where the numeral phrase has a referential reading.<sup>45</sup> Our analysis implies that the well-formedness of the structure in Fig. 15 has nothing to do with the nature of the subject but is related to the presence of a c-commanding VP site for adjunction. This predicts that numeral phrases can also occur as objects of existential verbs which do not have thematic subjects, since a VP node will be available for adjunction. Thus the fact that (213) represents a typical way of introducing numeral phrases can be readily accounted for.

A second fact we can derive by our analysis is that wh-words should be able to occupy matrix subject position, since a COMP position is available for LF movement. Implicit in the preceding discussion is the view that the Topic position is not an obligatory part of the clause structure: not every base structure needs or can have this position. The COMP position, on the other hand, must be



part and parcel of every sentence to signal whether it is declarative or interrogative, as well as for subcategorization in the case of embedded clauses. As the constraints on QR adjunction sites do not apply to wh-phrases, the wh-phrase will simply move into the already available COMP, whether it is in subject or object position.

Our analysis also succeeds in deriving the readings of the sentences in Fig. 16 and Fig. 17 (cf. 257a,b). In the structures below, which contain a quantifier phrase embedded within a complex NP, if the Q-NP adjoins to a position external to the complex NP, the resulting structure represents a referential reading of the numeral phrase, as the adjoined Q-NP will have scope over the entire sentence; if the Q-NP adjoins to a node within the complex NP, the resulting structure represents a non-referential reading of the numeral phrase.

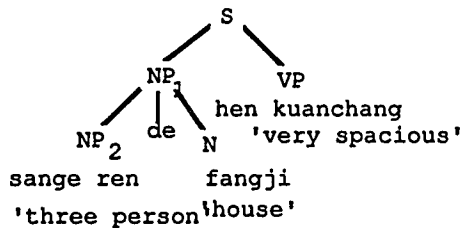


Fig. 16

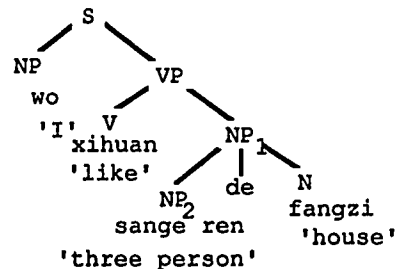


Fig. 17

First of all, it should be observed that in both structures, the numeral phrases cannot function simply as variables, since there will be no operators to bind them. Thus, in the well-formed LF representations of these sentences, the numeral phrases must function as operators and undergo QR. Turning now to Fig. 16, two

points should be noted about this structure where NP<sub>2</sub> is an operator; one is that unlike the sentence in Fig. 14, it is grammatical. Secondly, it has only the reading where sange ren 'three person' has scope within the subject NP. These two facts follow immediately from our assumptions: the sentence is grammatical because the numeral phrase NP<sub>2</sub> can land in a position leading to a well-formed LF structure, i.e. NP<sub>2</sub> can adjoin to NP<sub>1</sub>, its only legitimate adjunction site (as adjoining to VP will violate the Condition on Proper Binding). Being restricted to NP<sub>1</sub> as an adjunction site will mean, of course, that only the internal scope reading of NP<sub>2</sub> is possible. In Fig. 17, as we have noted (cf. 257a), the sentence is ambiguous between a NP-external scope and a NP-internal scope reading of NP<sub>2</sub>, and these two readings can be derived by adjoining to VP or to NP<sub>1</sub> respectively.<sup>46</sup> The difference and similarities between a numeral phrase in subject position and that contained within a complex NP in subject position can thus be analyzed using the same set of principles.

Our theory also leads us to the expectation that if a numeral phrase occurs as the subject of a verb complement, as in (263b), the sentence should be grammatical.<sup>47</sup>

(263)a. ??[yige ren] tou le ta de chezi  
 one-CL person steal asp s/he NOM car  
 "A person stole his/her car"

b. [ta [gaoshu wo [yi ge ren tou le ta de chezi]<sub>S</sub>]<sub>VP</sub>]<sub>S</sub>  
 s/he tell me one CL person steal asp.s/he nom car  
 "S/he told me that a man stole his/her car"

The embedded subject numeral phrase, if taken as a variable, will not have an operator to bind it; if taken as an operator, it may not

have any QR adjunction site within its clause. This is because the topic position being optional, a S" position might not appear in the clausal complement. However, it can adjoin to the matrix VP and yield a well-formed LF structure. Thus (263b) is grammatical whereas (263a) is not.

Next, we consider the case where the embedded clause is a sentential subject having the following structure. Adjunction becomes possible for NP<sub>1</sub> playing the role of an operator, as the following figure shows (cf. 252-253).

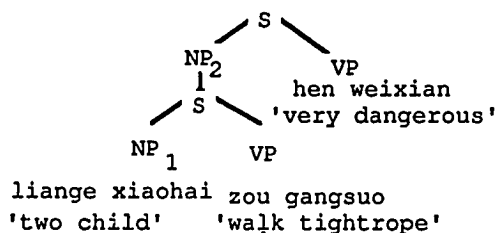


Fig. 18

Here, as the only legitimate landing site for NP<sub>1</sub> is NP<sub>2</sub>, and NP<sub>1</sub> in its adjoined position does not have VP within its scope, the interpretation of NP<sub>1</sub> must by necessity be a non-referential one, again consistent with the linguistic judgments reported above.<sup>48</sup>

The next set of facts we examine has to do with sentences having NPs topicalized from object position. Consider the following.

(264) ?? zhe ge xiaotou [sange jingcha zhua le t]  
           this CL thief     three-CL cop   arrest asp.  
           "this thief was arrested by three cops"

(265) \* sange fangjian [ wo xihuan t]  
           three-CL room     I   like

(266) sange ren de fangjian [ wo xihuan t]  
           three-CL person nom. room I   like

"I like three-person- rooms"

Fig. 19 and Fig. 20 represent the LF structures of (264) and (265) respectively. With topicalization comes the availability of a S" node for QR adjunction, so in Fig. 19, NP<sub>1</sub> can adjoin to S"; likewise in Fig. 20, NP<sub>2</sub> could adjoin to S". But in fact both sentences are ruled out.

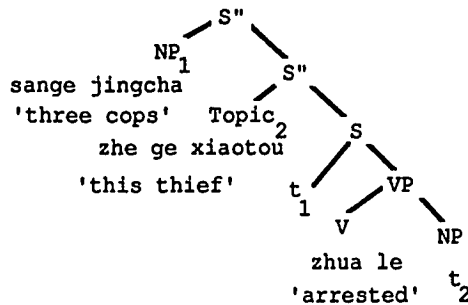


Fig. 19

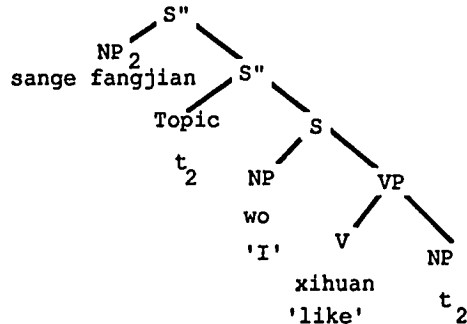


Fig. 20

We note first of all that the structure in Fig. 19 can be excluded by the PCC, since the path between NP<sub>1</sub> and its trace (from top to bottom) is {S'', S'', S}, while the path connecting the topicalized NP<sub>2</sub> and its trace is {S'', S, VP}. Clearly the two paths overlap, resulting in a PCC violation. Since S" is the only legitimate adjunction site for NP<sub>1</sub>, the sentence cannot have a well-formed LF derivation. If NP<sub>1</sub> remains in situ as a variable and does not adjoin, it will remain unbound, violating the Condition on Proper Binding. Turning now to Fig. 20, the reason why the topicalized NP cannot adjoin to S" can be seen as another instance of a Bijection violation. If NP<sub>2</sub> adjoins to S", there will be in essence two different types of binding involved, one between a topicalized NP and its trace, and another between a Q-NP and its trace. Here both

the intermediate trace of  $NP_2$  in topic position and the trace in DS object position are bound by  $NP_2$ , a violation of the Bijection principle (267), which prohibits an operator from binding two variables.

(267) Bijection Principle (II)

An operator cannot simultaneously bind two different variables

In Fig. 20,  $NP_2$  does not have the option of remaining in situ as a variable as no other operator is found within the sentence. Thus the sentence cannot have a grammatical reading.<sup>49</sup>

We are then left with the task of explaining why once we add dou in the sentence, a numeral phrase in subject as well as topic position is sanctioned, as the following figures indicate (cf. 244-245).

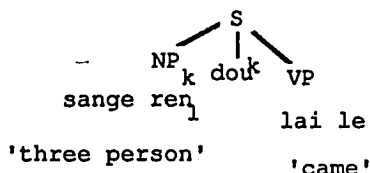


Fig. 21

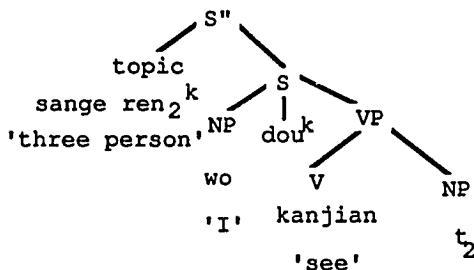


Fig. 21a

Recall that dou can coindex with any quantifiable constituent to its left within its c-command domain. First of all, let us observe that in both structures, the numeral phrase can coindex with dou and that in neither structure can the numeral phrase adjoin, for different reasons. In Fig. 21, sange ren 'three persons' cannot adjoin because

it has no adjunction site, S" being not available; in Fig. 21a, NP<sub>2</sub> in topic position cannot adjoin to S" because to do so will result in a violation of the Bijection principle (267). So in both structures, no well-formed LF representations can be produced if the numeral phrases are treated as operators. However, if the numeral phrases are regarded as variables, they can be bound by the universal operator dou, situated in an A' position in the sentence, and thus well-formed LF derivations can be produced. In such a kind of binding, since the operator dou c-commands the entire sentence, the numeral phrase bound by dou will have sentential scope and the reading represented is a referential one.

The fact that the presence of a base-generated topic will licence the appearance of a numeral phrase in subject position (cf. 237a-e) also receives a ready explanation because a base-generated topic will imply the accessibility of a S" node for QR, as illustrated in Fig.22, the LF representation of (237c).

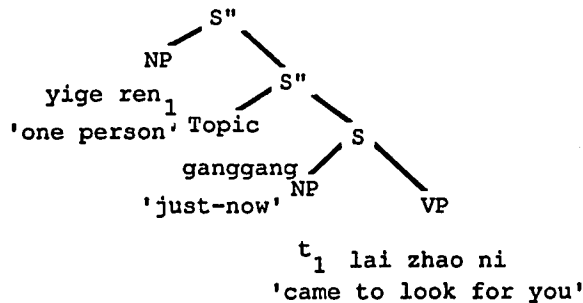


Fig. 22

NP<sub>1</sub> has adjoined to S" and since it c-commands the entire sentence, this would also mean the interpretation is one where the numeral phrase has a referential reading.

A more detailed examination of the extent to which a base-generated topic can license quantifiers in subject position reveals interesting differences between numeral phrases and universal quantifier NPs such as meige N 'every N', renhe N 'any N'. Recall that both numeral phrases and universal quantifier phrases cannot occur in subject position without the support of dou (cf. 261). If our theory is correct, we would expect that a base-generated topic, whether phonologically overt or null, should licence quantifier NPs in subject position, even if dou is absent, since S" will provide an adjunction site. As (268a,b) show, this is true of numeral phrases.

(268)a. [ganggang [liangge ren chuqu le]<sub>S</sub>]<sub>S</sub>"  
           just-now two-CL person leave asp.  
           "Just now, two persons left"

b. (A) Zhangsan gen Lisi zai naer?  
                                 and           at   where  
           "Where are Zhangsan and Lisi?"

(B) [ e [ liangge ren chuqu le]<sub>S</sub>]<sub>S</sub>"  
           topic two-CL person leave asp.  
           "(the) two (of them) have left"

In (268b), [e] is a null topic referring to Zhangsan and Lisi, whose reference is picked up from discourse, as in an exchange where a person A asks about the whereabouts of the individuals Zhangsan and Lisi. The response B is an appropriate reply to the question asked by A. The grammaticality of (268b) can be attributed to the presence of a S" node for adjunction. However, the same analysis cannot be extended to universal quantifier NPs, as demonstrated below.

(269) a. [ganggang [meige/suoyou ren \*(dou) chuqu le]<sub>S</sub>]<sub>S</sub>"  
           just now every-CL/all person all leave asp.  
           "Just now, everybody/all left"

b. (A) xiaohair zai nar?

child at where  
"Where are the children?"

(B) [e [ meige/suoyou ren \*(dou) chuqu le]s]s"  
topic every-CL/all person all leave asp  
"Everyone/all (of them) has left"

In (269a), where the topic is lexical, the universal quantifier NP cannot be licensed by the topic alone. In (269b), despite a given discourse context and a legitimate null topic referring to the group of children, the sentence is not well-formed without dou. This suggests that universal quantifier phrases such as meige ren 'everybody', suoyou ren 'all', renhe ren 'anyone' do not seem to be able to function as operators but are actually variables in these positions. Hence they need to be bound by operators such as dou before the sentence can be well-formed.

The view that universal quantifier phrases function primarily as variables and not as operators receives support from the fact that universal quantifiers are disfavored in object position. While universal quantifiers such as meige, 'every-CL' and suoyou 'all' can appear in object position, there seems to be a preference to prepose them.

- (270) a. wo mai le meiben shu  
I buy asp. every book  
  
wo mai le suoyou de shu  
I buy as all nom. book  
"I bought every book/all the books"
- b. { meiben shu } wo dou mai le  
suoyou de shu I all buy asp.  
{ every book}  
all book  
"I bought every book/all the books"

While both are grammatical, (b) seems to be a more natural way of



rendering the same meaning than (a). The subject/object difference is most clearly reflected by the quantifier determiner renhe 'any' and universal quantification signalled by reduplication of classifiers (cf. Chao 1968:78).

- (271) a. \*Lisi xinren renhe ren  
           trust any person  
           "Lisi trusts anyone"
- b. Renhe ren Lisi dou xinren  
           any person all trust  
           "Lisi trusts anyone"
- c. \*women zhunshou renhe falu  
           we obey any law  
           "we obey any law"
- d. women Renhe falu dou zhunshou  
           we any law all obey  
           "we obey any law"
- (272) a. \*ta dong jianjian shi  
           s/he understand CL-CL matter  
           "S/he understands everything"
- b. jianjian shi ta dou dong  
           CL-CL matter s/he all understand  
           "S/he understands everything"
- c. \*Lisi xi le gege xiongmao  
           wash asp. CL-CL panda  
           "Lisi washed every panda"
- d. Lisi gege xiongmao dou xi le  
           CL-CL panda all wash asp.  
           "Lisi washed every panda"
- e. \*Zhangsan ma le zhangzhang zhuzi  
           wipe asp. CL-CL table  
           "Zhangsan wiped every table"
- f. Zhangzhang zhuzi Zhangsan dou ma le  
           CL-CL table all wipe asp.  
           "Zhangsan wiped every table"

As we can see from the above examples, reduplicated classifiers as well as renhe 'any' cannot occur in postverbal position, but may

appear in preverbal position quantified by dou. This is surprising because if these NPs are operators, they can land in VP as a legitimate adjunction site, and there is no general principle that will rule out the resultant L<sub>F</sub> representations. The problem of having universal quantifier NPs in both subject and object position can be understood if we assume that basically they act as variables. Some of them, i.e. mei CL N 'every N' and suoyou N 'all N', however, have gradually acquired the ability to act as operators when occurring in object position, but they do not seem comfortable in their role as operators, hence the tendency to prepose them.

Note that the essential fact about the language we are trying to capture is its topic-prominent characteristic and the relationship of that property to quantification. The nature of the topic in topic-prominent languages can be understood in the sense of Chafe (1976:50): "what the topics appear to do is to limit the applicability of the main predication to a certain restricted domain...Typically,..the topic sets a spatial, temporal or individual framework within which the main predication holds." One could view this property of topic-prominent languages in the light of the insights of logicians in their work on modal logic. Scott (1980:149) introduces the idea of quantificational sentences which do not have truth values per se but only receive a truth value relative to a particular index. In first order logic, if we have a domain D of objects and x ranges over D, the formula  $\forall x P(x)$  will have a truth value. In Scott's formulation, however, the indexical formula (273) replaces the formula  $\forall x P(x)$ , the dot representing an

indefinite index.

(273)  $\forall x P(x)$

This latter formula will not have any truth value even if we know what the predicate means; instead, it will be true or false relative to an index, i.e. a kind of point of reference. The range of the variable will remain unknown until we have specified  $i$ . The index  $i$  can be thought of as a tuple of coordinates  $(w, t, p, a...)$ : examples of the coordinates are possible worlds ( $w$ ), time ( $t$ ), position or location ( $p$ ), or agents ( $a$ ). Borrowing this notion of Scott's, we could view the nature of topic-prominence in terms of quantification. In this perspective, topic-prominent languages are languages which require a well-formedness condition on quantificational formulas of the form (273). This requires that the index should be able to be read off from the SS representation. Since topics in topic-prominent languages set up a spatial, temporal or individual framework, they in essence provide the index for the interpretation of the quantification formula. Thus a structure such as Fig. 22 can be translated into a logical formula

(274)  $\exists x_i P(x)$

where  $i$ =an instance of time "just now" and  $P$ ='come to look for you'. Relative to this point of temporal reference, the formula (274) acquires a truth value. In terms of semantic representation, as observed in Bar-Hillel (1954), indexical expressions are clearly needed for any language to denote spatial and temporal deictic elements in a sentence. A sentence such as "everybody is hungry" clearly can have a truth value only relative to the time of the

speech event. Thus the difference between topic-prominent languages such as Chinese and subject-prominent languages such as English does not lie in semantic representation, but rather in syntax. It seems plausible that in topic-prominent languages, it is required that a formula such as (274) be made explicit in syntax and that the index or point of reference  $i$  should always be present to frame the sentence. In other words, a strong isomorphism between syntax and semantic representation is required for topic-prominent languages. Our assumption about QR adjoining to  $S''$  is consistent with this intuitive understanding of topic-prominence. Landing a Q-NP next to a topic will mean at LF it will always be adjacent to an index necessary for its interpretation.

While the insights of Chafe and Scott help us gain an informal understanding of the syntactic assumptions we have posited, we have seen that these intuitive notions by themselves will not be adequate to account for the referentiality of NPs contained within complex NPs (cf. Fig. 16-17), and the range of topicalization examples we discussed (cf. 264-266). Other syntactic principles such as the Condition on Proper Binding and the PCC are required for such a purpose.

Having discussed the motivation for adjoining Q-NPs to  $S''$  rather than  $S$ , we now show how the remaining distributions of the numeral phrases can be accommodated in our framework. As observed earlier (cf. 231), numeral phrases may occur as objects of prepositions, and PPs can be either daughters of  $S$  (in the case of optional preposable PP adverbials) or daughters of VP (as in the

case of PPs subcategorized by the verb, e.g. Ba phrase). Since PPs can be an adjunction site for QR, we can derive LF representations with properly bound NP traces.

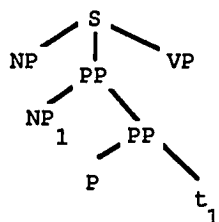


Fig. 23a

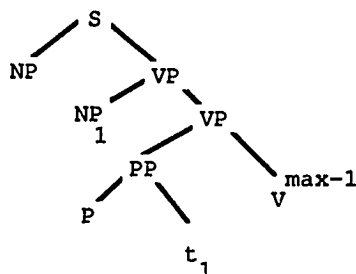


Fig. 23b

As Fig. 23a shows, if the PP branches off from S, the quantifier phrase  $NP_1$  can adjoin to PP; if the PP forms part of the VP, as in Fig. 23 b, then  $NP_1$  can adjoin to either PP or VP. In the latter case, since  $NP_1$  has scope over VP, by our Scope Domain principle it will have scope over the entire sentence. This means that  $NP_1$  thus adjoined must have a referential reading. While in the former case (in Fig. 23a),  $NP_1$  does not c-command VP, one may derive the referential reading by a conjunctive interpretation of the three daughters of S. Take for example the sentence (275).

- (275) [Zhangsan [zai sange difang] zuo guo shi]  
           at three-CL place work asp.  
       "Zhangsan has worked at three places before"

Let  $e$  denote the event in (275), if  $j$ =Zhangsan,  $P$ ='has worked',  $y$ =place, the sentence can be rendered as "there is an event  $e$  such that  $P(e, j)$  and there are three places  $y$  such that  $AT(e, y)$ ." Implicit in this informally stated formula is a referential reading of the numeral phrase contained within the PP adverbial.

Another set of facts we would like to account for within our

framework is why modal elements can sanction numeral phrases in subject position and why in such cases the only reading obtainable is a non-referential one (cf. 246-251). Here we need to make two assumptions: one is that at LF modal verbs and adverbs must be adjoined to a S" node. This would mean that modal elements display the same effect as dou in blocking S" tree pruning. Secondly, modal verbs are main verbs. We have seen that making the first assumption will allow us to account for why dou can coindex across a modal adverb or domain adverb (cf. section 1.1.1, Fig. 4). The second assumption is a natural one to make for Chinese as modal verbs, like other verbs, can be negated, can appear in A-not-A form, and can be centers of predicates, as the following illustrate.

- (276) a. Lisi bu neng lai  
           not can come "Lisi cannot come"
- b. Lisi neng bu neng lai?  
           can not can come "Can Lisi come?"
- c. neng (as in a response to b)  
           can
- (277) sange ren neng wancheng renwu  
        three-CL person can complete task  
        "The task can be completed by three people"

We are thus assuming that modal verbs are verbs that take clausal complements having null subjects controlled by the matrix subject. By our assumptions, an intermediate stage of the LF derivation of (277) will be as follows, when the modal verb rests in topic adjunct position.

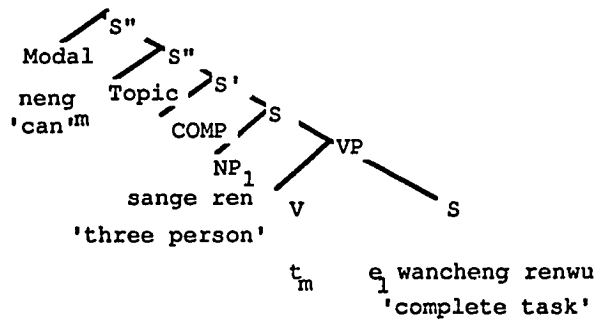


Fig. 24

Here,  $NP_1$  has two possible adjunction sites, the lower  $S''$  and the upper  $S''$ . If  $NP_1$  adjoins to the upper  $S''$ , in which case it will have scope over the modal verb, resulting in a referential reading of the noun phrase, PCC will be violated. The path connecting the modal verb and its trace  $t_m$  is  $\{S'', S'', S', S, VP\}$ , which overlaps with the path connecting  $NP_1$  and its trace  $\{S'', S'', S'', S'\}$ . However, if  $NP_1$  adjoins to the lower  $S''$ , the resulting path connecting  $NP_1$  and its trace will be embedded within the modal path, obeying the PCC. This means the only well-formed LF representation is one where the subject quantifier phrase must have narrow scope vis-a-vis the modal verb, hence a non-referential reading of the quantifier phrase.<sup>50</sup>

In this section, we have described the distribution of numeral phrases in Chinese and the contexts in which they have referential or non-referential readings. We have tried with some success to account for these distributions in terms of assumptions about the adjunction sites of QR, the ability of numeral phrases to function either as operators or as variables, and other general principles such as the PCC.<sup>51</sup> We would like to conclude the discussion by

considering the grammatical status of the following set of sentences and how our analysis throws light on possible dialectal/idiolectal variations.

- (278) a. ?? sange jiaoshou zou le  
           three-CL professor leave asp.  
           "Three professors left"
- b. [ [sange jiaoshou] de fangzi] hen kuanchang  
           three-CL professor nom house very spacious  
           "houses (accomodating)three professors are very spacious"
- c. [[liangge xiaohai zou gangsuo] hen weixian]  
           two-CL child walk tightrope very dangerous  
           "it is dangerous for two children to walk the tightrope"
- d. ?\*zhe ge xiaotou [sange jingche zhua le t]  
           this CL thief three-CL cop arrest asp.  
           "This thief was arrested by three cops"
- e. \* sange jiaoshou, tamen renshi t  
           three-CL professor, they know  
           "they know three professors"

Recall that we attributed the ungrammaticality of (a) to the lack of a S" node for QR and the lack of an operator in the sentence. In (b), where an NP adjunction site is possible, a S" is unavailable, so only a NP internal reading can be derived. (c) has only an embedded clause internal reading for the same reason. (d) is ruled out, as adjoining the numeral phrase to S" will violate the PCC, and self-adjunction is ruled out; (e) is excluded by the Bijection principle. Now it is a fact that the unacceptability of sentences such as (a) and the availability of an external reading for sentences such as (b) and (c) is not absolute. Some speakers can obtain a referential reading of (a) as well as an external reading of (b) and (c). However, there is a sharp difference in the grammaticality of the (a-c) sentences vs that of (d-e), so that even



for speakers who accept the former, the latter is still considered ill-formed.

This idiolectal variation can be accommodated in our framework in terms of adjunction sites. Thus for speakers who accept (a) and obtain referential readings in (b-c), we assume that in fact a null topic is assumed by the speaker so that QR can adjoin the NP to a S" dominating the null topic. This would mean that the numeral phrase in (a) , (b) and (c) in fact has S" as adjunction site, giving rise to a referential reading of the NP in all three cases. In (d) however, if the subject numeral phrase is adjoined to S", the path connecting it and its trace will overlap with the path linking the topic and its trace. On the other hand, since the ungrammaticality of (e) has nothing to do with assumptions about adjunction sites, the possibility of adjoining to S does not improve the grammaticality status of (e).

### 1.2.2 Universal Generalization of Singular Numeral Phrases

In two types of contexts, a singular NP can be interpreted as if it were a universal quantifier. This section seeks to understand the syntactic and semantic factors that condition such an interpretation. We will begin by looking at sentences consisting of a singular NP in preverbal position, the quantificational adverb dou and the negator bu. As (a) shows, in the presence of dou and the negator, the singular noun phrase can become in effect a universal quantifier. To see what factors contribute to this effect, we must examine the behavior of numeral phrases under the scope of negation.

- (279) a. Women yiben xiaoshuo dou bu mai  
we one-CL novel all not buy  
"We are not buying any novel"
- b. Women bu mai xiaoshuo  
we not buy novel  
"We are not buying novels"
- c. ??Women bu mai yiben xiaoshuo  
we not buy one-CL novel  
"We are not buying a novel"
- d. Women wang le mai yiben xiaoshuo  
we forget asp. buy one-CL novel  
"We forgot to buy a novel"
- e. \*Women yiben xiaoshuo bu mai  
we one-CL novel not buy
- f. ??Women dou bu mai yiben xiaoshuo  
we all not buy one-CL novel  
"We all are not buying a novel"
- g. Yiben xiaoshuo women dou bu mai  
one-CL novel we all not buy  
"We are not buying any novel"

Consider (b), (c), (d). The examples indicate that numeral phrases cannot occur under the scope of negation. Either the singular

numeral phrase is not used or the negator must be left out: the two seem to be incompatible with each other. The Chinese facts echo parallel phenomena about English which have been observed by Lasnik (1975)-that a referential reading of a numeral phrase cannot appear under the scope of negation. We know that the negator bu is a verb phrase negator rather than a sentential negator as in general in does not induce opacity on the subject.<sup>52</sup> Thus one explanation that might be proposed to account for this distribution of numeral phrases along the lines of Lasnik (1975) is to say that certain Q-NPs such as numeral phrases are inherently referential, and cannot be weakened to a non-referential reading by a negator. Since this is incompatible with the effects of a negator, numeral phrases cannot appear within the scope of negation. This account cannot be right for Chinese, since as we have seen, numeral phrases generally cannot occur in matrix subject position in a referential role. If they were inherently referential, they would not be showing the kind of subject/object asymmetry we have observed.

Before we propose our view of the interaction of negation and numeral phrases, we note from (a,g) that to express the formula " $Ax-P(x)$ " or " $\neg ExP(x)$ " with a numeral phrase in Chinese, the numeral phrase can occur in the sentence but only in preverbal position. We suggest that the principles we have been assuming can rule out occurrence of numeral phrases under the scope of a verb negator. First of all, note that since the negator is part of VP, adjunction of the object NP to VP (its only adjunction site) must by necessity create a referential reading of the numeral phrase, as Fig. 25

shows.

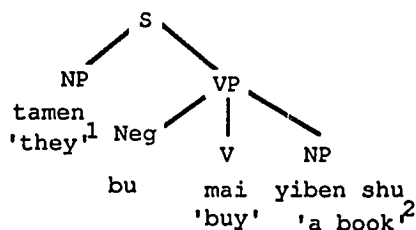


Fig. 25

This leads to a violation of the isomorphic mapping principle which requires that scope relations at LF preserve c-command relations at SS. The logical formula of the reading of the structure of Fig. 25 will be "Ex=book, -Buy(they, x)", with a book having wide scope over negation. At SS, however, the negator has scope over a book, contradicting the isomorphism principle. Thus the structure in Fig. 25 is ungrammatical. Recall from our discussion in Section 1.2 that numeral phrases can function both as an operator and as a variable. If NP<sub>2</sub> here functions as a variable, it cannot be bound by bu 'not', since the negator does not bind nominals. Thus (279c) and (279f) are ungrammatical whether NP<sub>2</sub> is taken as an operator or as a variable. (d) is well-formed because there is no negator in the sentence and as predicted by our analysis, the interpretation of the NP there is a referential reading.

To retain the numeral phrase and at the same time obey the isomorphic mapping principle, an alternative is available, which is to topicalize the singular NP, as in 279(a) and (e). However, only one of them is grammatical. A glance at Fig. 26 will help understand why (e) is ill-formed and (a) well-formed.

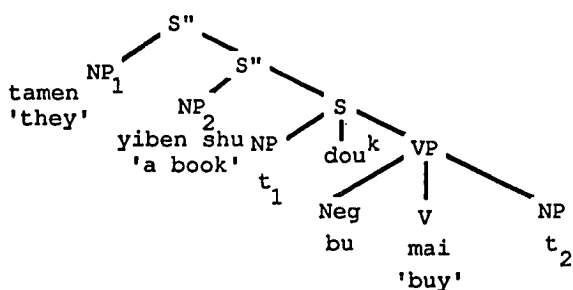


Fig. 26

From our earlier discussion about the Bijection Principle prohibiting an operator from binding two variables, we know that in this configuration if  $NP_2$  assumes the option of an operator, it will not be able to further adjoin, lest a Bijection violation result. At the same time, it cannot assume the status of a variable if dou is absent since the Condition on Proper Binding will be violated; thus, the resultant LF representation of (279e) is ill-formed. If, however, dou is included, the numeral phrase is likewise prevented from functioning as an operator by the Bijection principle. However, assuming the numeral phrase to be a variable, dou can bind it, and thus (279a) is well-formed.

A new problem arises if we choose the latter analysis, since we know that a singular NP coindexed with dou will violate its plurality requirement. This is borne out by the fact that if the negator is absent, the sentence with dou alone is ungrammatical, and replacing the singular numeral phrase with a plural numeral phrase will immediately yield grammatical sentences.

- (280) a. \*Zhangsan yiben shu dou mai  
          one-CL book all buy
- b. Zhangsan liangben shu dou mai  
          two-CL book all buy

"Zhangsan bought both books"

It appears, therefore, that in (279a) the grammaticality of the sentence crucially depends on the presence of both dou and the negator. To see why the sentence can still be grammatical despite violation of the plurality requirement, we need to first explain why bu as a verb phrase negator, which does not have scope over the numeral phrase, should have an effect on the numeral phrase. The puzzle can be resolved if we consider the possibility of bu raising to amalgamate with dou in the structure in Fig. 26. The supporting evidence comes from the fact that modal verbs, which normally can intervene between dou and bu, cannot do so in (279a), as demonstrated below:

- (282) a. Tamen dou yinggai bu mai shu  
          they all should not buy book  
          "They all should/are obliged to not buy books"
- b. ??Tamen yiben shu dou yinggai bu mai  
          they one-CL book all should not buy

Note also that a singular numeral phrase coindexed with dou will not necessarily behave like a universal quantifier whenever it is in the scope of negation. In the following sentences, the singular numeral phrase coindexed with dou is found within the scope of the sentential negator bu shi. However, the sentence is ungrammatical.

- (282) c. \*bushi [tamen yiben shu dou mai]  
          not-be they one-CL book all buy

It seems that Neg must form a unit with dou to be able to transform a singular numeral phrase into a variable. Seen in this light, the SS representation of (279a) will be the following.

- (283) [tamen<sub>1</sub> [yiben shu<sub>2</sub><sup>k</sup> [t<sub>1</sub> [dou<sup>k</sup> bu] [mai t<sub>2</sub>]<sub>VP</sub>]<sub>S</sub>]<sub>S</sub>]<sub>S</sub>"

they one-CL book all neg buy

We have seen that adjoining NP<sub>2</sub> to S" will amount to interpreting it as a quantifier, which will violate the Bijection principle; seen as a variable, it can be bound by dou, but this goes against the plurality requirement of dou. Under the additional impact of Neg, it seems that the plurality restriction can be annulled. Just as in the logical formula "Ax-P(x)", the universal quantifier has the negator within its scope, so at SS, dou precedes bu, preserving the isomorphic principle. From our analysis, it will also follow that a sentence like (279g) will be equivalent to (279a), since the same argument will apply as long as the singular phrase is in preverbal position.

All along it has been assumed that sentences such as (283) are topicalization structures. What of the possibility that the singular NP and the [dou + bu] unit form a single constituent meaning "Ax-"? In other words, how do we know that the singular phrase originates from object position besides the fact that semantically it serves the role of patient? In a sense, our analysis is necessitated by the Projection Principle which states that the subcategorization properties of the verb should be realized at every level of grammar (Chomsky 1982). We will raise two additional arguments against any quasi-lexical analysis of the facts being discussed. One is that there is no restriction on the type of singular numeral phrases that can serve as variables in such an environment. The variable transformation at work here is a very general and productive process, as the following illustrate.

(284) a. zhe jige laoshi, yige youqian de xuesheng dou bu yaoqing  
 this few professor one rich nom. student all not invite  
 "These few professors did not invite any rich student"

b. Women yige yundongyuan dou bu renshi  
 we one-CL sportsman all not know  
 "We don't know any sportsman"

To say that we have a lexical combination here is to lose sight of the generality of the process. The more important piece of evidence comes from the extraction possibilities from the object position. It appears that generally topicalizing a NP from an object position is disallowed if the NP controls a null subject of a clausal complement, as in (285).

(285) a. \*zhege xuesheng, wo yao t [e xi chezi]  
 this student I want t wash car  
 "This student, I want (him) to wash the car"

b. \*Zhangsan, wo bi t [e zuo gongke]  
 I force do homework  
 "Zhangsan, I forced (him) to do homework"

If the singular numeral phrase is topicalized from object position in a similar structure, we should expect the resulting sentence to be ill-formed. (286) bear out this prediction.

(286) a. Ta (\*bu) qing yige ren [e da majiang]  
 s/he (not) invite one person play majong  
 "S/he (did not) invite(d) someone to play majong"

b. \*Ta yige ren dou bu qing t [e da majiang]  
 s/he one person all not invite t play majong  
 "S/he didn't invite anyone to play majong"

A final observation about this context for universal generalization of singular NPs is that the singular phrase is not restricted to NPs originating from object position. It could apply equally well to singular noun phrase in subject position, as (287a-b) illustrate. In each of these sentences, the singular numeral phrase occupies



subject position at DS and both can be bound by [dou bu]. In (287a) the singular NP is the subject of an intransitive clause, while in (287b) the singular phrase is the subject of a transitive clause. This does not come as a surprise, since nothing in our analysis requires the singular NP to be a DS object.

(287) a. Tamen yige ren dou bu qu  
 they one person all not go  
 "None of them are going"

b. zhege xuexiao yige laoshi dou bu mai caipiao  
 this school one teacher all not buy lottery ticket  
 "No teacher in this school buys lottery tickets"

Our foregoing analysis will apply equally to (287a-b), the only interpretation consistent with general principles being one where the singular NP is understood as a variable.

Our analysis of the interaction of dou with bu enables us to explore an issue we raised earlier: with regard to dou-coindexing, if more than one constituent can be quantified by dou, does dou coindex with only one of them or with all of them? Consider the sentences

- (288) a. \*[yiben xiaoshuo] meige ren<sup>k</sup> dou<sup>k</sup> bu kan  
           one-CL novel every person all not read
- b. \*<sup>2</sup>[liangben xiaoshuo] meige ren<sup>k</sup> dou<sup>k</sup> bu kan  
           two-CL novel every person all not read
- c. \*[yiben xiaoshuo] yige ren<sup>k</sup> dou<sup>k</sup> bu kan  
           one-CL novel one person all not read

We know that the universal quantifier meige ren functions as a variable in subject position and needs to be bound by dou. Singular numeral phrases, on the other hand, can be either an operator or a variable. In (288a,b,c), as argued before, the topicalized numeral

phrases cannot adjoin to S", or else a Bijection violation will result. Consequently they must function as variables. But in (288a,b), since the universal quantifier has taken the operator dou, there is no additional operator to bind these topicalized NPs. Thus, neither of the sentences are acceptable: (288a) cannot mean "everyone of them didn't see anyone", and (288b) cannot be understood as "everyone of them didn't see either of the two books". In (288c), dou cannot coindex with the topicalized NP lest the Crossover Constraint on dou-coindexing be violated. Thus dou can only bind the subject NP yige ren, leaving the topicalized NP unbound, hence the ungrammaticality of the sentence. In this way, the behavior of singular numeral phrases in the context of [dou+bu] provides us evidence that dou-coindexing only applies to one of the constituents preceding dou.<sup>53</sup>

The second type of configuration where a singular NP can be generalized into a universal quantifier is a sentence where both subject and object positions are occupied by numeral phrases. Consider the situation where the singular NP is found in subject position.

- (289) a. [zhege xuexiao [yige laoshi guan wuge xiaohai]<sub>S</sub>]<sub>S</sub>"  
           this school     one teacher take-care five child  
           "(in)this school, each teacher takes care of five children"  
           "One teacher in this school takes care of five children"
- b. [tamen [ yige ren     kai   liangmen ke]<sub>S</sub>]<sub>S</sub>"  
           they   one-CL person offer two   course  
           "(as for) them, each person offers two courses"  
           "One of them offers two courses"

Based on our earlier observations, we know that the topic is

necessary to allow the numeral phrases to occur as the subject of the sentence. Without the topic, the presence of the object numeral phrase will not make the sentence grammatical. We would therefore predict that the NP yige laoshi 'one teacher' in (a) can adjoin to S", thus giving a referential interpretation of the NP. This is indeed one of the two readings of the sentence, which also has a reading where yige laoshi is generalized so that it becomes equivalent to meige laoshi 'every teacher'. Notice that this universal generalization is entirely due to the occurrence of the object NP, as omission of the latter will immediately render the sentence unambiguous. (290) below only has the referential interpretation of the singular NP.

- (290) zhege xuexiao [yige laoshi zou le]  
       this school one teacher go asp.  
       "(in) this school, a teacher has left"

Another interesting fact about this structure is that aspect does not seem to be a relevant factor, since universal generalization will also occur even with the perfective aspect, which individualizes the event.

- (291) zhege xuexiao [yige laoshi mai le wudong fangzi]  
       this school one teacher buy asp. five house  
       "One teacher (in) this school bought five houses"  
       "Each teacher (in) this school bought five houses"

The above sentence, like (289), is ambiguous between a singular reading and a universal reading of the subject NP.

As numeral phrases in Chinese can function as predicates, the above facts hold equally if the VP itself is a Q-NP.

- (292) a. zhe zhong xigua [yige wu kuai]  
       this kind watermelon one five dollar

"(as for) this kind of watermelon, it is five dollars each"

- b. tamen [yi zhu liangge ren]  
they one team two person  
"(as for) them, each team (consists of) two persons"

Two additional points should be observed about the conditioning factors for this type of universal generalization. One is that it applies most generally to singular numeral phrases. If we place a non-singular phrase in subject position instead, the NP will undergo the same effect only if the verb does not carry an aspect marker.

- (293) a. zhege xuexiao [liangge laoshi mai le wudong fangzi]  
this school two teacher buy asp five house  
"two teachers (from) this school bought five houses"
- b. zhege xuexiao [ liangge laoshi guan wuge xiaohai]  
this school two teacher take-care five child  
"(in) this school, two teachers take care of five children"  
"(in) this school, every pair of teachers takes care  
of five children"

Thus (293a) is unambiguous: it can only show a scope-independent interpretation of the two Q-NPs, i.e. a group reading where a total of two teachers bought a total of five houses. If, however, the verb lacks an aspect marker, as in (b), then the sentence can have the reading "every pair of teachers takes care of five children", in addition to the referential reading of the subject NP. Another important fact about this phenomenon is that not every Q-NP in object position can bring about universal generalization. This effect can be achieved only by numeral phrases and the quantifier determiners xuduo, henduo 'many' as well as the wh-word duoshao 'how many/how much', and not by any of the universal quantifier determiners mei, renhe, suoyou.

- (294) a. zhege xuexiao [yige laoshi guan henduo xiaohai]  
this school one teacher take-care many child



e. yiyao fei duoshao?  
 medical fee how-much  
 "how much is the medical fee?"

f. zhege xuexiao [xuesheng henduo]  
 this school student many  
 "(as for) this school, their students are many"

Precisely this same set of quantifiers correspond to those which can be used as predicates, as (292a-b) and (296e-f) demonstrate. One might suggest that the unavailability of a universal reading for the context of suoyou 'all' is due to pragmatics: in (295b), for example, a situation where all the cars are bought by all of them is unlikely. This explanation does not seem to apply to (294b) as clearly all the children can come under the care of all the teachers.

Do the same facts hold if the singular NP occurs in object position, with the other Q-NP in subject position? It appears that universal generalization in such an arrangement will arise only if the verb does not take an aspect marker, as shown in (297).

- (297) a. zheli [sange laoshi guan yige xiaohai]  
 here three teacher take-care one child  
 "here, three teachers take care of one child"
- b. Tamen [sange ren mai le yibu qiche]  
 they three person buy asp.one car  
 "Three of them bought a car"
- c. Tamen [sange ren fuze yibu qiche]  
 they three person responsible one car  
 "(as for) them three persons are responsible for a car"

In the above sentences, while (297a) and (297c) are ambiguous, (297b) only has a referential reading of the subject NP. Since the dependence of universal generalization on verb aspect witnessed here

parallels our observations about (293), we can regard (297) as a special case of a more general situation where the Q-NP in subject position is a non-singular NP. In other words, we are suggesting that the universal generalization only occurs to the subject NP rather than to the object NP, which only has a conditioning effect. The fact that with non-singular subject NPs, the same constraint on the set of object Q-NPs that can serve as triggers for universal generalization holds true supports our analysis, as (298) demonstrates.

(298) zhege xuexiao [liangge laoshi guan suoyou de xiaohai]  
 this school two teacher take-care all nom child  
 "(in) this school, two teachers take care of all the children"

Just as in (294b), (295b) universal generalization does not apply to the singular subject NP in the presence of universal quantifier determiners in object position, so in (298) a universal reading is unavailable on liangge laoshi 'two teachers', the sentence being unambiguous. Another piece of evidence is that if we have a sentence with singular numeral phrases occupying both subject and object slots, the universal reading does not apply to both NPs.

(299) zhege xuexiao [yige laoshi guan yige xiaohai]  
 this school one teacher take-care one child  
 "(in) this school, one teacher takes care of one child"  
 "(in) this school, each teacher takes care of one child"  
 "(in) this school, each child is taken care of by one teacher"

The sentence can mean "every teacher takes care of a child" or "each child is taken care of by one teacher" and cannot be understood as "every teacher takes care of every child".

We have seen that if a numeral phrase appears in subject

position, another numeral phrase in object position can trigger universal quantification. One might probe further and ask whether this quantificational effect will be blocked in the case of a ditransitive sentence, or if the other numeral phrase serves as a prepositional object. It seems that exactly the same results are obtained.

- (300) a. tamen [yige ren song shu gei wushige ren]  
 they one person send book to fifty person  
 "(as for) them, each person sends books to fifty persons"  
 "One (of) them sends books to fifty persons"
- b. tamen [yige ren song sanfen liwu gei Zhangsan]  
 they one person give three gift to  
 "(as for) them, each person gave three gifts to Zhangsan"  
 "One (of) them gave three gifts to Zhangsan"
- c. tamen [yige ren mai le sanfen liwu gei Zhangsan]  
 they one person buy asp. three gift for  
 "(as for) them, each person bought three gifts for Zhangsan"  
 "One (of) them bought three gifts for Zhangsan"
- d. tamen [liangge ren mai sanfen liwu gei Zhangsan]  
 they two person buy three gift for  
 "(as for) them, two persons buy three gifts for Zhangsan"  
 "Every pair (of) them bought three gifts for Zhangsan"
- e. tamen [liangge ren mai le sanfen liwu gei Zhangsan]  
 they two person buy asp.three gift for  
 "(as for) them,two persons bought three gifts for Zhangsan"

In (a-c), the singular numeral phrase can be interpreted as having universal force; in (d), where the verb does not carry an aspect morpheme, the non-singular subject NP can also receive a universal reading meaning "every pair"; however, in (e) the non-singular subject NP can only be interpreted referentially because of the presence of the aspect marker. The same picture is true of Q-NPs serving as prepositional objects in preverbal position, as in (301).



- (301) a. zhe jige jingcha [yige ren [zai wuge difang] xunluo]  
 this several cop one person at five place patrol  
 "(as for) these several cops, each person patrols at five places"
- b. zhe jige jingcha [liangge ren [zai wuge difang] xunluo]  
 this several cop two person at five place patrol  
 "(as for) these several cops, every pair patrols five places"

Sentence (301a) means "every one of these several policemen patrols in five places" and (301b) corresponds to the interpretation "every pair of policemen patrols at five places". If the numeral phrases occur in direct object and prepositional object positions respectively, the universal reading disappears, as in (302).

- (302) a. ta ji le [yi ben shu] gei [sange tongxue]  
 s/he sent asp one book to three student  
 "s/he sent one book to three students"
- b. ta fang le [yi kuai bu] zai [liangzhang zhuo shang]  
 s/he put asp. one cloth at two table on  
 "s/he put a piece of cloth on two tables"

In the above sentences, it is impossible to obtain the reading "s/he sent every book to three students" or "s/he put every piece of cloth on two tables".

The contexts for universal generalization can be summarized in terms of the following trees.

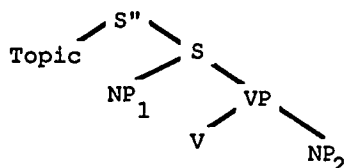


Fig. 27a

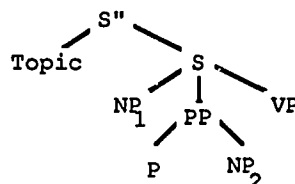


Fig. 27b

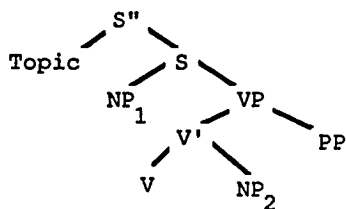


Fig. 27c

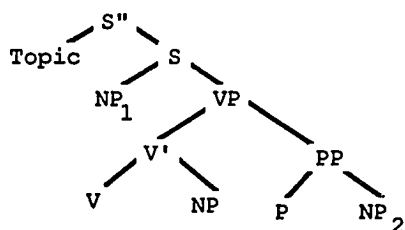


Fig. 27d

If  $NP_1$  is a singular numeral phrase, another weak quantifier  $NP_2$  in any of the other positions can trigger a universal reading of  $NP_1$ , irrespective of the aspect of the verb. If  $NP_1$  is a non-singular numeral phrase, a weak quantifier  $NP_2$  in any of the positions indicated in the above figures can also trigger universal generalization, if the verb does not have an aspect morpheme. Abstracting away from the effects of verbal aspect, we state the following generalization:

(296) Condition for Universal Generalization

In a structure  $[XP [NP VP]_S]_S$  or  $[[NP VP]_S XP]_S$ ,  
 , if NP of S (i.e. the subject) dominates a numeral phrase,  
 and another daughter of S dominates a weak quantifier,  
 prefix a universal quantifier to S

This condition has the effect of transforming a structure of the form  $[_S \text{ Topic } [_S \dots]]$  into  $[_S \text{ Topic A } [_S \dots]]$ . It embodies the view that the constituents of S form a quasi-predicate denoting a kind of mapping arrangement between two sets of objects.<sup>54</sup> Thus sentences like (289b) and (292) are tantamount to predicates "two courses per person" and "two persons per team", each holding of the

respective topic. The prefixation of the universal quantifier is to indicate that the mapping arrangement denoted by the quantifier holds universally relative to the individuals in the domain specified by the topic. In other words, the propositions in such sentences behave as if the subject NP is a restricted variable predicated on by the VP, so that  $[NP_x VP]_S$  is equivalent to  $P(x)$  and the prefixation of an unselective universal quantifier binds the open variable corresponding to the subject NP. Thus  $[Topic [NP_x VP]_S]_S$  amounts to  $[Domain\ of\ specification\ \forall x\ P(x)]$ .

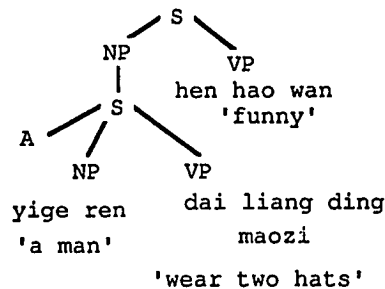


Fig. 28a

Notice that in all the examples so far discussed, the topic appears in the sentence mainly to license the occurrence of the subject numeral. Other environments are also possible. For example, as we have seen, a sentential subject can contain a numeral subject, as in Fig. 28a above. By our Condition on Universal Generalization, a universal quantifier will be prefixed to the S of the sentential subject, and a universal reading of the subject NP can occur. The predication "wearing two hats" holds of the subject variable  $x$ =man, which is bound by the prefixed universal quantifier. Likewise, if the singular NP occurs within a complex NP, our condition will also

allow us to assign universal force to the embedded numeral phrase.  
 Thus the predicate  
 "supervising fifty workers" holds of x=company manager", a variable  
 bound by the unselective universal quantifier.

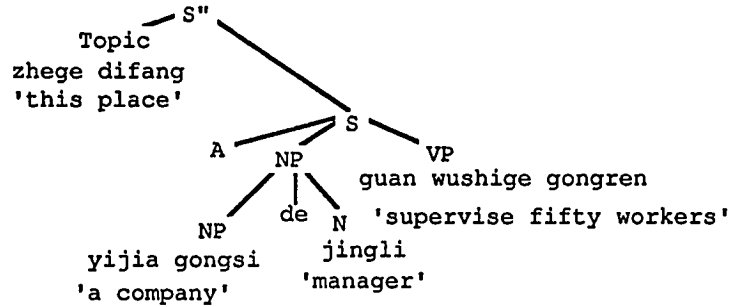


Fig. 28b

Thus, the sentence in the above figure is ambiguous between the interpretation '(as for) this place the manager(s) of each company supervise(s) fifty workers' and the (pragmatically unlikely) interpretation '(as for) this place, managers of single companies supervise fifty workers.'

### Summary of 1.2

In this section we have tried to explain the constraints on the distribution of numeral phrases in terms of the rule of QR, the dual nature of numeral phrases (as operators and variables), and conditions on LF such as the PCC. We have also made a number of generalizations about the conditions under which a singular numeral phrase in topic/subject position can serve as a variable to be quantified universally. That the subject/topic position disfavors numeral phrases is clearly language specific and, as we have seen, linked to topic prominence and to the variable property of

quantifier phrases in Chinese. Such a property induces a volatile characteristic on the referentiality of singular NPs in subject/topic position.

### 1.3 Quantifier Scope

This section studies how quantifier scope is determined in Chinese and how general principles governing quantifier scope can contribute to a more general understanding of quantification phenomena in Chinese. It will be argued that QR has essentially different properties than wh-movement and that the clauseboundedness of QR can be best explained in terms of the Binding principles.

#### 1.3.1 C-command and Linearity Conditions on Scope Interpretation

In S.F.Huang (1980), the first study of quantifier scope in Chinese, it is observed that the universal hierarchy for quantificational scope proposed by Ioup (1975) does not apply to Chinese. Ioup argues on the basis of data from 14 languages that the relative scope of quantifier phrases follows the following hierarchy.

Topic> Deep and Surface subject >Deep or surface subject  
> Indirect object > Prepositional object > Direct object

Ioup argues for the importance of grammatical relations in determining relative scope by referring to examples such as the following.

(304) a. Every girl took a chemistry course

b. A chemistry course was taken by every girl

c. Every chemistry course was taken by a girl

In (a) the strongly preferred reading is one where 'every girl' has wide scope over 'a chemistry course'. A Q-NP which is both deep and surface subject always has wide scope over other Q-NPs. In (b), although 'a chemistry course' is the surface subject of the sentence, the preferred reading (according to Ioup) is for 'every girl' to have wide scope. (c) parallels (b) and again 'a girl' tends to have wide scope over 'every chemistry course'. From these examples, it seems that a deep structure subject, even when appearing as a surface prepositional object, still enjoys wide scope superiority. On the basis of such evidence as (305), Ioup further argues that indirect objects tend to have wide scope over direct objects.

(305) a. I told every child a story

b. I told a story to every child

c. I told every story to a child

d. I told a child every story

(305a-b) show that 'every child' has preferred wide scope reading, irrespective of relative linear order vis-a-vis 'a story'; (305c-d) show that 'a child' has preferred wide scope, again regardless of linear order. The common point between these two pairs of sentences is that the NP that tends to take wide scope is the indirect object rather than the direct object. This has led Ioup to the claim that it is grammatical relations, not linear order, that is relevant for scope assignment.

S.F.Huang (1980) argues against Ioup's position and proposes that for Chinese the sole relevant parameter for scope interpretation is SS linear order. If a constituent  $\alpha$  precedes another constituent  $\beta$  at SS,  $\alpha$  will take scope over  $\beta$ . Huang's claim is supported by examples such as the following.

- (306) a. meige ren dou xuan yimen huaxueke  
 every person all take one chemistry course  
 "everyone takes a chemistry course"
- b. you yimen huaxueke meige ren dou xuan le  
 have one chemistry course everyone all take asp.  
 "there is a chemistry course that everyone has taken"
- c. meige xuesheng dou you yiti bu hui  
 every student all have one-problem not know  
 "every student has a problem (he) doesn't know"
- d. you yiti meige xuesheng dou bu hui  
 have one-problem every student all not know  
 "there is a problem which every student does not know"
- e. ta tiantian bu shangxue  
 s/he everyday not go-to-school  
 "Everyday, s/he doesn't go to school"
- f. ta bu tiantian shangxue  
 s/he not everyday go-to-school  
 "s/he doesn't go to school everyday"
- g. Zhangsan keneng bu canjia huiyi  
 may not join meeting  
 "it is possible that Zhangsan will not attend the meeting"
- h. Zhangsan bu keneng canjia huiyi  
 not may attend meeting  
 "it is not possible for Zhangsan to attend the meeting"

It is clear from (a-d) that Ioup's grammatical relations hierarchy fails to predict scope relations in Chinese. While in (a) meige ren 'everyone', the deep and surface subject, has scope over the direct object yimen huaxue ke 'a chemistry course', in (b) the direct object occupying surface subject position has scope over the DS

subject meige ren, contradicting Ioup's hypothesis. In (c), the DS and SS subject meige xuesheng 'every student' has scope over the direct object yiti 'one problem', which in turn has scope over negation. (d) on the other hand shows that the direct object yiti 'one problem' occupying initial position preceding the DS subject has scope over the latter, which also in turn has scope over negation. Clearly, linear order can account for these sentences while Ioup's grammatical hierarchy cannot. As S.F. Huang has observed, Ioup's hierarchy also fails to account for scope relations involving other logical operators such as modals, adverbs and negation, whereas SS linear order can be easily extended to such operators. In (e) the adverb tiantian 'everyday' has wide scope over negation, while in (f) with a switch in relative linear order, the reverse scope relation obtains. (g) and (h) show that with respect to modals and negation, linear precedence determines scope order.

The type of evidence provided by S.F. Huang is restricted by and large to simple clauses, and the scope order of Q-NPs embedded in sentential subjects and complex NPs was not investigated. J.Huang (1981,1982) examines quantifier scope in Chinese on the basis of a wider range of data, and argues that it is not SS linear order but SS c-command relations that constitutes the relevant parameter for determining scope relations. A c-command hypothesis claims that if a quantificational expression  $\alpha$  c-commands another quantificational expression  $\beta$  at SS,  $\alpha$  will have scope over  $\beta$ . Notice that in all the sentences in (306) linear order is often confounded with hierarchical order (cf. a-e). Figure 29 illustrates this point.



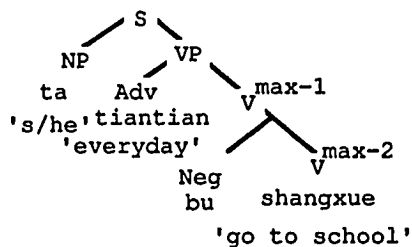


Fig. 29

If one adopts a binary branching assumption, a position assumed by Huang, the sentence shown in the figure cannot decide between the linear order hypothesis and the c-command hypothesis. The crucial data must come from cases where linear order and hierarchical relationship diverge, as in the case of sentential subjects and clausal complements of prepositions preceding a negator, shown in (307).

(307) a. [you wuliuge ren xuan zhemen ke] dui dajia dou hao  
 have five-six person take this course to everyone all good  
 "that there are five or six people taking this course  
 is good for everyone"

b. zhejian shi gen [Zhangsan mei lai] meiyou guanxi  
 this matter with not come not have relation  
 "This matter has nothing to do with (the fact) that  
 Zhangsan didn't come"

c. [meige ren dou lai] wo bu tongyi  
 every person all come I not agree  
 "I don't approve (of the fact that) everybody is coming"

(307a) cannot be interpreted as "for each of the persons  $x$ , that  $x$  takes the course will be good for everybody", i.e. the Q-NP wuliuge ren in the embedded clause cannot have wide scope over the Q-NP dajia in the matrix clause. Similarly, in (b) the negator in the lower S cannot take wide scope over the negator in the matrix

clause, so the sentence cannot mean "it is not the case that the matter has nothing to do with the fact that Zhangsan came". In (c) where we have a sentential topic, again the matrix Neg must have scope over the universal quantifier in the topicalized clause, although the latter precedes the former at SS. It should be noted that while these sentences show that a logical operator in a matrix clause has wide scope over another in an embedded clause, despite the fact that the latter precedes the former, they by themselves do not lend direct support to the c-command hypothesis, since in all the examples, the logical operator in the matrix clause does not c-command that in the embedded clause. In (c), there is the additional factor of dou, whose effect we have seen is clausebounded. Nonetheless, this evidence does refute the linearity hypothesis.

A significant contribution of Huang (1982) lies in the finding that scope facts in NP internal quantification can also be predicted by a c-command hypothesis. The relevant examples are given in (308). In each sentence, the Q-NP/QP in specifier position has scope over the Q-NP/QP in the N position.

- (308) a. wo mai le [sange ren        de [mei ben shu]]  
           I buy asp. three person nom every-CL book  
           " There are three x=persons such that I bought  
               every book of x"
- b. [meige [liangge ren de fangjian]] wo dou xihuan  
           every two person nom room        I all like  
           "I like every two-person room"

These facts have special theoretical interest in the light of the quantificational theory developed in May (1977). If we apply QR to

the Q-NPs in the complex NP, we will be able to derive the correct interpretation of (308a) but will fail to predict the correct interpretation of (308b). To see why this is so, let us examine Fig. 30a-b.

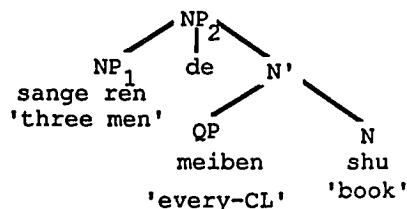


Fig. 30a

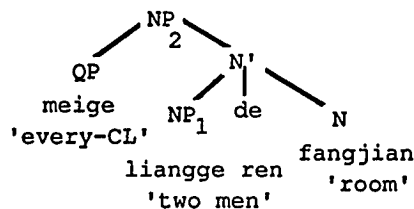


Fig. 30b

In Fig. 30a, which corresponds to (308a), the relevant Q-NPs that will be affected by QR are NP<sub>1</sub> and NP<sub>2</sub>.<sup>55</sup> If NP<sub>2</sub> adjoins to an XP and then NP<sub>1</sub> adjoins, the trace left by NP<sub>1</sub> in NP<sub>2</sub> will be properly bound, as in Fig. 31a, and the LF representation gives the correct reading, one in which sange ren 'three men' has scope over the containing NP<sub>2</sub>.

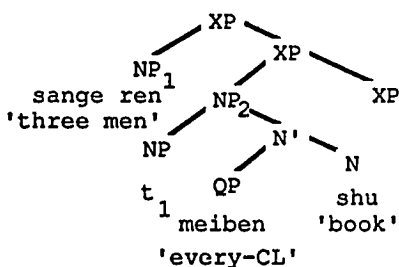


Fig. 31a

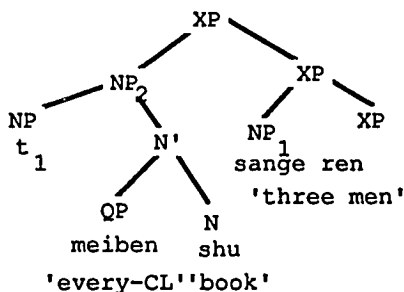


Fig. 31b

If, however, we adjoin NP<sub>1</sub> first, followed by NP<sub>2</sub>, the trace left by NP<sub>1</sub> will not be properly bound, as Fig. 31b shows. Thus May's rule of QR can derive the correct interpretation of the sentence. Turning to Fig. 30b, which corresponds to (308b), we see that the

facts are more complicated. Here the relevant NPs affected by QR would be liangge ren 'two men' and the embedding NP. By the same token, the only legitimate adjunction procedure will be to first adjoin NP<sub>2</sub> followed by NP<sub>1</sub>, or else the trace of NP<sub>1</sub> will fail to be bound properly bound. This would, however, lead us to a reading where liangge ren 'two men' will have scope over the dominating NP, so that (308b) will mean "For two persons x, I like every room of x", which reading is not permitted. How can one accommodate the Chinese facts within the framework of May? Huang tries to escape the predicament by assuming that adjunction should not be restricted to S but should be extended to N' (cf. Higginbotham and Fiengo), so that in Fig. 30b, while NP<sub>2</sub> adjoins to an XP, NP<sub>1</sub> can stay within the embedding NP and adjoin to N' instead, as in Fig. 32. The option of adjoining to N' is available to NP<sub>1</sub> in Fig. 30 as well, but as can be seen in Fig. 32b, the resulting structure will contain an unbound trace, and is thus ill-formed.

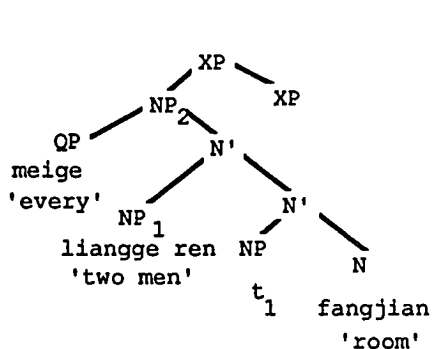


Fig. 32a

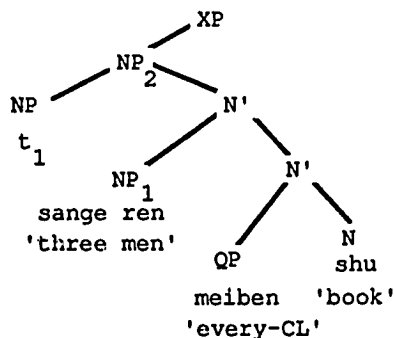


Fig. 32b

By raising quantifiers to N', Huang is able to explain why in (308b), the NP internal reading is a legitimate reading, but it is

still necessary to explain why the NP external reading is not a possible reading for Chinese. To do this, Huang invokes a modified version of the c-command condition for mapping from SS to LF.

(309) General condition on Scope Interpretation (Huang :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"

The general condition will accommodate the scope order of quantifier phrases and other quantificational expressions such as adverbs, modals, and negation, as well as the bounding effects of QPs just discussed in NP internal quantification.<sup>56</sup>

We will argue below that both linear order and hierarchical relations are relevant to scope interpretation in Chinese, and the relevant hierarchical relations should be expressed in terms of command (cf. Langacker 1963) rather than c-command. First of all, we propose to modify Huang's General Condition on Scope Interpretation as (310) to incorporate command relations rather than c-command relations as a relevant parameter. This revision is necessary because as we have seen, in sentences such as (307a-c), where neither the matrix Q-expression nor the Q-expression in the embedded clause c-command each other, the matrix Q-expression has wide scope. The relevant relationship between the two expressions can be captured in terms of command rather than c-command.

(310) General Condition on Scope Interpretation (revised)

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

The two clauses of the above condition apply disjunctively. Thus in examples such as (306a) meige ren dou xuan yimen huaxue ke "Everyone takes a chemistry course", the two Q-NPs command each other, and clause (ii) of the revised General Condition will apply, forcing the subject NP to have scope over the object NP at LF. In cases such as (307a-c), where one of the Q-NPs is in a higher clause than the other, i.e. where one Q-NP asymmetrically commands the other, clause (i) of the General Condition applies, as a result of which the Q-expression in the matrix clause will have scope over that in the lower clause.

Below we consider examples which demonstrate the relevance of linear order. Before providing the supporting evidence, we note first of all that judgments about scope ambiguity may sometimes be confounded with pragmatic inference. For instance, Huang (1981) claims that the following sentence, where the direct object and the indirect object c-command each other, is ambiguous with either Q-NP able to have scope over the other.

(311) Zhangsan mai le liangben shu gei meige ren

buy asp two-CL book for every person  
"Zhangsan bought two books for everyone"

Judgment of the ambiguity of sentences such as these is very subtle, and as Zwicky and Sadock (1975) have observed, an inherent problem in testing quantifier scope ambiguity is that an entailment relationship exists between the two interpretations. Thus in (306a), the reading where 'every student' has narrow scope entails the reading where 'every student' has wide scope, since if 'every student is taking the same chemistry course', then for every student x, x is taking a course, which happens to be the same for every student.<sup>57</sup> The same would hold of (311), if liangben shu 'two books' has wide scope, this reading being also consistent with an interpretation where meige ren 'everyone' has wide scope.

Despite inherent problems in ascertaining scope order, we argue that there are three types of evidence showing that linear order is involved in scope interpretation, and that if two Q-NPs command each other, it is linear order that governs relative scope. Consider the following three types of situations: (a) where two Q-NPs occur in postverbal position, each c-commanding and commanding the other, and both are inside the VP projection; (b) a Q-NP is found in a PP preceding the verb and another Q-NP appears in direct object position; the two command each other but neither c-commands the other, since they are in the same minimal clause but different maximal projections; (c) both Q-NPs are in postverbal position with the first Q-NP within a complex NP asymmetrically c-commanded by the second Q-NP. Examples (312,b,d) and (313) below belong to the first type of situation, while (312c,e) fall into the second type of

situation.

(312) a. \* meige nanhaizi dou xihuan yige nuhaizi<sub>i</sub>. Ta<sub>i</sub> hen piaoliang  
every boy all like a girl s/he very pretty  
"Every boy likes a girl<sub>i</sub>. She<sub>i</sub> is very pretty"

b. Zhangsan jieshao yige nuhaizi<sub>i</sub> gei meige tongxue.  
introduce one girl to every classmate  
Ta<sub>i</sub> hen piaoliang  
s/he very pretty.  
"Zhangsan introduced a girl<sub>i</sub> to every classmate. She<sub>i</sub>  
is very pretty"

c. \*Zhangsan gei meige tongxue jieshao yige nuhaizi<sub>i</sub>.  
to every classmate introduce one girl  
Ta<sub>i</sub> hen piaoliang.  
s/he very pretty.  
"Zhangsan introduced a girl<sub>i</sub> to every classmate. She<sub>i</sub> is  
very pretty."

d. Lisi tuijian yige xuesheng<sub>i</sub> gei meige daxue.  
recommend one student to every university  
Ta<sub>i</sub> hen congming  
s/he very intelligent  
"Lisi recommended a student<sub>i</sub> to every university.  
S/he<sub>i</sub> is very intelligent."

e. \* Lisi gei meige daxue tuijian yige xuesheng<sub>i</sub>.  
to every university recommend one student  
Ta<sub>i</sub> hen congming  
s/he very intelligent  
"Lisi recommended a student<sub>i</sub> to every university.  
S/he<sub>i</sub> is very intelligent."

(313) a. Zhangsan xie le liangshou shi gei meige tongxue  
write asp. two poem for every classmate  
"Zhangsan wrote two poems for every classmate"

b. Zhangsan ji le yizhang shengqing biao gei meijia gongshi  
mail asp. one application form to every company  
"Zhangsan mailed an application form to every company"

c. \*Zhangsan fang le yifeng xin zai meizhang zhua shang  
put asp. one letter at every table on  
"Zhangsan put a letter on every table"

d. \*Zhangsan zhong le yike shu zai meige huayuan li  
plant asp. one tree at every garden in  
"Zhangsan planted a tree in every garden"

Consider first the situation where the two Q-NPs commanding and



c-commanding each other occur in postverbal position. In (312b-d), the wide scope reading of the first Q-NP yige nuhai 'a girl' is seen from the fact that coreference is possible. In (312c,e), where the singular NP yige nuhai 'a girl' is in the scope of the first Q-NP meige tongxue 'every classmate', such coreference is ruled out. The second piece of evidence showing that the first NP has scope over the second if either c-commands the other is given in (313a-d). (a) and (b) can only be understood if the 'two poems' in (a) and 'the application form' in (b) are the same one(s) for 'every classmate' and 'every company' respectively. Our view gains strong support from (c)-(d), as the unacceptability of these sentences readily receives an explanation if we assume the first NP has scope over the second. These sentences are pragmatically odd because in (c) it is impossible to put the same letter on every table; nor can we find for (d) a real world situation where the same tree can be planted in every garden. If it is possible for the second NP to have scope over the first, the unacceptability of these sentences cannot receive a satisfactory explanation, since the latter scope order is pragmatically sound. The absence of the latter reading argues strongly for the relevance of linear order to scope determination.

Consider now the situation where a Q-NP is in a preverbal PP and another Q-NP is a direct object, as in (312c,e). In these cases, the Q-NPs command each other, but neither c-commands the other. In the two sentences, it is the first Q-NP that has wide scope over the second Q-NP yige N, as reflected by the impossibility of cross-sentential coreference. Linear order determines scope order in

these cases. Below are some more examples.<sup>58</sup>

- (314) a. Zhangsan [wei meige pengyou] zuo le liangjian haoshi  
for every friend do asp. two good thing  
"Zhangsan did two good things for every friend"
- b. Lisi [xiang meige tongxue] jiang le liangju hua  
to every classmate say asp. two utterance  
"Lisi said two utterances to every classmate"
- c. Wo [ti meige laoshi] pai le san zhang zhao  
I for every teacher take asp. three picture  
"I took three pictures for every teacher"
- d. Ta [gen sanjia gongsì] qian le wuge hetong  
s/he with three company sign asp. five contract  
"S/he signed five contracts with three companies"
- e. Laowang [duì suoyou de tongxue] chang le yishou ge  
to all nom. classmate sing asp. one song  
"Laowang sang a song to all classmates"
- f. \*[cong yige difang] pao lai meigeren  
from one place run come everyone  
"from one place came everyone"
- g. [cong meige difang] pao lai yige ren  
from every place run come one person  
"A man came from every place"

Even in the absence of dou, the interpretation of (a) and (b) is one where the prepositional object has wide scope. Scope dependency is related to the types of quantifiers involved. In the (c-d) sentences, where only numeral phrases are involved, the only reading available is a scope independent reading; in (c) the event involves a total of two teachers and three pictures; in (e) it is possible to have a non-distributive reading of suoyou tongxue 'all classmates'. This, of course, does not necessarily imply that the second NP has wide scope, since the interpretation is also consistent with a scope independent reading. (f) and (g) will dispel any doubt about the effects of linear order. While (g) is well formed, (f) is

unacceptable, again easily accountable if we assume that scope order follows linear order in these examples, since it is pragmatically odd to have the situation where 'everyone came from one place'. Thus, it appears that the relevant notions for scope interpretation in Chinese are those of command and linear order, with the first factor taking precedence over the second. If a Q expression  $\alpha$  asymmetrically commands another Q expression  $\beta$  at SS, the former will have scope over the latter at LF. If, however, each commands the other, the one that comes first will have wide scope irrespective of c-command relations.

The last type of situation we consider shows that linear order overrides c-command relations in scope interpretation. Consider the case where a Q-NP  $\alpha$  precedes another Q-NP  $\beta$  but  $\alpha$  is asymmetrically c-commanded by  $\beta$ , as below.

- (315) a. Wo [ gei le [[meige pengyou]<sub>1</sub> de xiaohai] yige wanju<sub>2</sub>]<sub>VP</sub>  
 I give asp every friend NOM child one toy  
 "I gave a toy to children of every friend (of mine)"
- b. Wo gei le [[yige pengyou]<sub>1</sub> de xiaohai] meige wanju<sub>2</sub>]<sub>VP</sub>  
 I give asp one friend NOM child every toy  
 "I gave every toy of children of a friend (of mine)"

In the above sentences, the first Q-NP embedded within the complex NP must have scope over the second Q-NP and the reverse scope reading cannot be obtained. Thus (315a) means "for all x=friend of mine, I gave a toy to children of x"; (315b) has only the reading "for some x=friend of mine, I gave every toy to children of x", and the interpretation "for every y=toy, there is x=some friend of mine, such that I gave y to children of x" is unavailable. Since the second Q-NP asymmetrically c-commands the first Q-NP, the examples

show that linear order rather than c-command is the crucial determinant of scope order when two Q-NPs command each other.<sup>59</sup>

### 1.3.2 Isomorphism in Chinese Syntax

In what follows we account for a range of quantificational phenomena in Chinese in terms of the revised General Condition on Scope Interpretation. A strong isomorphism between c-command and precedence relations at SS and scope relations at LF will be observed, pointing to a salient characteristic of Chinese syntax. We will begin by returning to the crossover phenomenon noted in our earlier discussion on dou-coindexing, as illustrated by the following examples.

- (316) a. Women [zai liangge difang<sup>k</sup>] dou<sup>k</sup> xi le zao  
           we     at   two   place   all take asp. bath  
           "We took a bath at both places"
- b. \*women [zai yige difang<sup>k</sup>] dou<sup>k</sup> xi le zao  
           we     at   one   place   all take asp. bath
- c. Tamen<sup>k</sup> dou<sup>k</sup> mai le shenme?  
           they all buy asp. what  
           "what did they all buy?"
- d. Tamen shenme<sup>k</sup> dou<sup>k</sup> mai le  
           they what all buy asp.  
           "They bought everything"
- e. \*Tamen<sup>k</sup> shenme dou<sup>k</sup> mai le  
           they what all buy asp.  
           "What did they all buy?"

Examples (a-b) indicate that dou-coindexing must not cross another Q-NP. In (b) by the Crossover Constraint (158), dou can only coindex with yige difang 'a place', violating the plurality requirement of dou. Thus the sentence is ill-formed. (d) and (e) illustrate the

prohibition against crossing a wh-operator. Thus a sentence with the same sequence of morphemes as (d) cannot be understood as a question with dou coindexed with tamen, crossing the wh-word, i.e. it cannot mean the same as (c). If (e) were possible, we would have a SS as in Fig. 33. As can be seen from the figure, the structure can be ruled out by the Condition on Proper Binding, since the wh-word must move into COMP, which does not c-command the Topic. The structure will also violate the PCC at LF as the path between NP<sub>1</sub> and t<sub>1</sub> will overlap with the path binding NP<sub>2</sub> and dou.

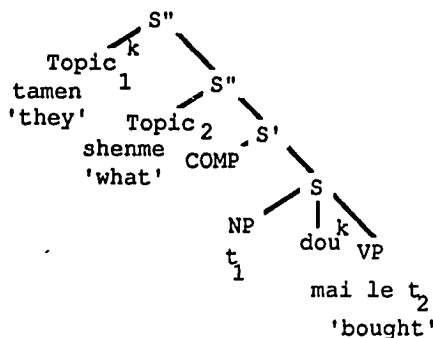


Fig. 33

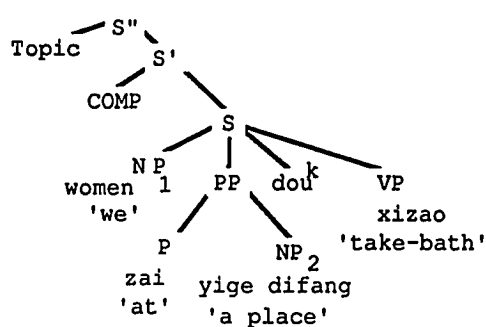


Fig. 34

Another way of looking at the structure is to say it violates the General Condition on Scope Interpretation. The isomorphic principle requires that for an interpretation such as that in (c), whether the wh-word has wide or narrow scope, [tamen<sup>k</sup>...dou<sup>k</sup>] at SS must not contain an operator; the latter must lie outside the dou-operator chain, and must either precede the latter or be preceded by the latter.

If we turn to the SS of (316b), the applicability of the isomorphic principle can again be demonstrated. Here at LF, women<sup>k</sup>

can adjoin to S", while yige difang can adjoin to PP. Thus the two binding paths involving NP<sub>1</sub> and NP<sub>2</sub> need not intersect and escape the constraint of the PCC. So why is this interpretation in (b) ungrammatical? The isomorphic principle can be invoked, because whether yige difang has wide or narrow scope vis-a-vis the quantifier chain meige<sup>k</sup>..dou<sup>k</sup>, it must lie outside the quantifier chain to conform to the General Condition on Scope Interpretation.<sup>60</sup>

A second type of evidence in support of the isomorphic mapping principle comes from the interaction of dou with question particle questions and A-not-A questions. In Chinese, it is well known that a yes/no question can be formed in the following two ways: by having the verb assume an A-not-A frame, or by using a question particle ma, as in:

- (317) a. ni qu bu qu Beijing?  
           you go not go  
           "Are you going to Beijing?"
- b. ni qu Beijing ma?  
           you go           question part.  
           "Are you going to Beijing?"

As observed in Li and Thompson (1981), the A-not-A question is neutral, whereas the ma-question often entails a pragmatic presupposition.<sup>61</sup> The interesting issue with respect to the quantificational adverb dou is that it can occur in a ma question but not in an A-not-A question.

- (318) a. ??? meige ren   dou hui bu hui shaocai?  
           every person all know not know cook  
           "Is it the case that everyone knows how to cook?"
- b. meige ren   dou hui shaocai ma?  
           every person all know cook part.  
           "Is it the case that everyone knows how to cook?"

- c. \*shei dou hui bu hui shaocai?  
 who all know not know cook  
 "Does everyone know how to cook?"
- d. shei dou hui shaocai ma?  
 who all know cook part.  
 "Does everyone know how to cook?"
- e. \*shei hui bu hui shaocai?  
 who know not know cook

To understand why dou is permitted in a ma-question and not in an A-not-A question, we will assume along with Huang (1982) that the A-not-A operator is clause internal in the VP, and that the realization of the A-not-A form of the verb takes place at the level of Phonetic Form (PF). The SS difference between (a) and (b) is illustrated in Fig. 35a-b.

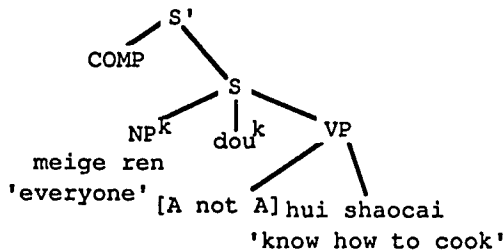


Fig. 35a

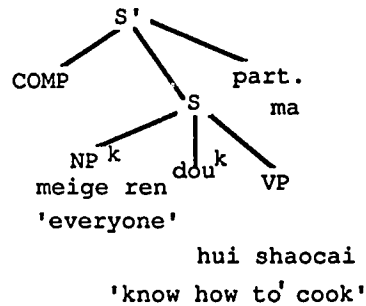


Fig. 35b

The logical formula for a yes/no question reading of a sentence like (318a) will be "Q [ Ax, P(x) ]", where Q=yes/no question operator, and P is the predicate "know how to cook", which can be paraphrased as "is it the case that everyone knows how to cook". The logical formula of (318a) cannot be one where Q has narrow scope, i.e. it cannot be "Ax [ Q P(x) ]", paraphrasable as "for all x, is it the

case that  $x$  knows how to cook". The difference between the two formulas can be seen from their respective negation forms. Negation of the first formula will result in " $\neg Q [Ax, P(x)]$ ", equivalent to "is it not the case that everyone knows how to cook". Negation of the second formula, however, will be " $\neg Ax [Q P(x)]$ ", which can be expressed as "not for all  $x$ , is it the case that  $x$  knows how to cook?". Clearly the natural language interpretation corresponds to the first logical formula. Once the fact that the question operator should have scope over the entire proposition is established, we see from Fig. 35b that at SS, ma and the universal quantifier phrase command each other, but ma lies outside the S in which the Q-NP is contained. In Fig. 35a, while the A-not-A operator and the universal quantifier command each other and are both contained within S, the former is preceded by the latter. Thus the A-not-A question violates the isomorphic principle, whereas the ma question is consistent with it<sup>62</sup>, hence the grammaticality of the latter but not the former.

The same observations hold for (318c-d). In these sentences the wh-word will take the place of meige ren in the two figures. The wh-word cannot move into COMP, as it will violate the Bijection Principle as well as the doubly-filled COMP filter, since as noted in Huang (1982), a sentence like (e) is ill-formed. Serving as a [-wh] variable, it will be bound by dou, and the difference between the hierarchical position of ma and A-not-A will explain why (d) is well-formed and not (c).

The interaction of dou with modals displays a similar



phenomenon: dou cannot quantify past a modal, as in

- (320) a. \* women<sup>k</sup> neng dou<sup>k</sup> qu  
          we       can   all   go
- b. women<sup>k</sup> dou<sup>k</sup> neng qu  
          we       all   can   go  
          "All of us can go"
- c. \*zhe jige xuesheng<sup>k</sup> ken dou<sup>k</sup> nuli  
          this few   student willing all work-hard
- d. zhe jige xuesheng<sup>k</sup> dou<sup>k</sup> ken nuli  
          this few student   all willing work-hard  
          "These few students are all willing to work hard"

Here since dou primarily a nominal quantifier, whereas a modal is a predicate modifier, the two do not really interact: "we can all go" is semantically the same as "All of us can go" and "these few students are willing to all work hard" is equivalent to "All of these few students are willing to work hard". Thus the surface order is made to conform to scope order at Logical Form, with dou preceding the modal verb.<sup>64</sup>

Below we provide two further examples of isomorphism in Chinese syntax. The first example is concerned with the optional loss of [+wh] feature of wh-words under the scope of another operator. As observed in Lu (1980:445) and Huang (1982), a wh-word in the scope of negation can be interpreted as an indefinite pronoun.

- (321) a. Zhangsan mei mai shenme (?)  
          not buy   what  
          "Zhangsan didn't buy anything/Zhangsan didn't buy much"  
          "what didn't Zhangsan buy?"
- b. Zhangsan bu xiang xuan shenme ke (?)  
          not want take   what course  
          "Zhangsan doesn't want to take any course"  
          "What course(s) does Zhangsan not want to take?"
- c. Zhangsan wang le mai shenme ?  
          forget asp. buy what

"What did Zhangsan forget to buy?"

Both (a) and (b) are ambiguous; they could be understood as a statement or as a question. The weakening of the wh-word in such a context can be viewed as an instantiation of the isomorphic principle, since if these sentences are interpreted as questions, the wh-word in COMP position at LF will precede the negator. A way to circumvent this mismatch is not to move the wh-word so that it becomes a variable within the scope of negation. A rule of existential closure triggered by the presence of negation will apply to bind the variable. It is interesting to note that to get a question reading in these sentences, the question word needs to be stressed, reflecting the unmarked interpretation which conforms to SS configuration. The contrast between (a) and (c) should also be noted. In (c) since there is no negator, and the only reading is that of a question. In cases where only one of the two possibilities is available, the question word must take on a [-wh] feature.

Consider the following examples observed in Lu (1980:429).

(322) a. ni yao bu yao chi dian shenme?

you want not want eat CL what

"Do you want to eat something?"

b. zuijin ni kan guo shenme mei you?

recently you read asp. what not have

"Have you read anything recently?"

Both sentences contain a A-not-A operator and a wh-word. As we have seen in (318e), if the wh-word is in subject position, the sentence is ungrammatical since the two question operators will both occupy COMP. In (322 a,b), the same reasoning will also apply, since there is only one COMP position. However, since the wh-word falls within

the scope of the A-not-A operator, the A-not-A operator takes preference and moves into COMP, and the wh-word left behind is weakened into a variable in accordance with our scope principle. In this way, a doubly-filled COMP is avoided.<sup>65</sup>

Our last example demonstrating isomorphism in Chinese syntax concerns the relative scope of wh-words and the universal quantifier. Compare the two sentences below.

- (323) a. shei kanjian le meige ren?  
          who see asp. every person  
          "who saw everyone?"
- b. meige ren dou kanjian shei?  
          every person all see who  
          "Who did everyone see?"

It is clear that (a) has only one reading, where the wh-word will have scope over 'everyone'. It is also clear that the interpretation of (b) is not as clearcut as that of (a). With some speakers (e.g. Huang 1982), (b) is regarded as on a par with (a), with the question word having wide scope. Consultation with a number of native speakers has revealed a wide scope reading of 'everyone', so that an answer to (b) could be 'John saw Mary, Paul saw Jane, ..'. If our judgments are correct, (323) represents another instance where scope order can be predicted from SS linear order, since in (a) the wh-word precedes the universal quantifier at SS, whereas in (b) the reverse obtains. Thus in (a) the wh-word has wide scope, while in (b) it is the universal quantifier that takes wide scope.

### 1.3.3 Clauseboundedness of Quantifier Raising

It is argued in Huang (1982) that LF movement violates subjacency, which means that QR, like wh-movement, will not be clausebounded. We believe that the evidence from Chinese does not support a parallel between QR and wh-movement, and will argue instead that QR in Chinese is essentially clausebounded and that an adequate analysis of QR phenomena must include the notion of governing category as a primitive. We will begin by reviewing representative examples of Huang's data and the thrust of his argument.

Huang observes that wh-movement violates constraints such as the Complex Noun Phrase Constraint, the Sentential Subject Constraint and can escape embedded clauses serving as objects of prepositions.<sup>66</sup>

- (324) a. [[shei xie] de shu] zui you qu?  
          who write nom book most interesting  
          "for which x, the books that x wrote are interesting"
- b. [[ta taolun shenme] de shu] zui you qu?  
          s/he discuss what nom. book most interesting  
          "for which x, the books where s/he discusses x are the most interesting"
- c. [[shei da le Zhangsan] shi ni hen bu gaoxing?  
          who hit asp.          make you very unhappy  
          "For which x, that x hit Zhangsan made you very unhappy"
- d. [[Lisi da le shei] shi ni hen bu gaoxing?  
          hit asp. who make you very unhappy  
          "For which x, that Lisi hit x made you very unhappy"
- e. zhejian shi [gen [shei lai]] zui you guanxi?  
          this matter with who come most have relation  
          "For which x, this matter has most to do with the fact that x comes"
- f. zhejian shi [gen [ni xihuan shei]] zui you guanxi?

this matter with you like who      most have relation  
 "For which x, this matter has most to do with the fact  
 that you like x"

In all the above sentences, it appears that wh-movement can escape  
 from the islands and acquire matrix scope. These examples also show  
 that there is no subject/object asymmetry in the wide scope LF  
 movement. It is also noted that wh-movement can violate the General  
 Condition on scope interpretation in Huang (1982), so that at LF,  
 the wh-word can have scope over another quantificational expression  
 which c-commands it at SS. Consider the following.

- (325) a. Zhangsan mai le [san ben [[shei] de shu]?  
           buy asp. three    who nom. book  
           "For which x, Zhang bought three of x's books"
- b. meige ren    dou mai le shenme?  
           every person all buy asp. what  
           "what did everyone buy?"
- c. meige ren    dou shuo [ shei zui congming]?  
           every person all say    who most intelligent  
           "For which x, everyone says x is the most intelligent"

In (a) shei can escape the bounding effect of the QP determiner and  
 have matrix scope; in (b), according to Huang's judgment, the object  
 wh-word shenme has scope over the subject universal quantifier; and  
 in (c) shei can be extracted from the embedded clause to have scope  
 over the quantifier in matrix subject position.

Huang also notes the wide scope property of dou in quantifying  
 wh-words. Dou seems able to raise wh-words from an embedded clause  
 into a matrix position having scope over operators in the main  
 clause.<sup>67</sup>

- (326) a. [[shei xie] de    shu] dou bu hao  
           who write nom. book all not good

"For every x, the books that x wrote are not good"

- b. [[tamen wen shei] dou keyi]  
they ask who all may  
"For every x, they may ask x"
- c. [[Lisi da le shei] dou bu hui shi wo bu gaoxing]  
hit asp who all not will make me not happy  
"For every x, that Lisi hit x will not make me unhappy"
- d. [[ni mai bu mai neiben shu] dou mei guanxi]  
you buy not buy that book all not relation  
"whether you buy that book or not doesn't matter"
- e. zhejian shi [gen[ shei lai]] dou mei guanxi  
this matter with who come all not relation  
"For every x, this matter has nothing to do with the fact  
that x came"

In each of the above examples, the wh-word moves out of the islands to be quantified by dou, gaining wide scope over the negator or the modal in the main clause. Again, as (a) and (b) illustrate, no subject/object asymmetry is observed. In addition, as (d) shows, the question operator quantified by dou can be an A-not-A operator as well as a wh-operator.

The above facts provide ample evidence in support of the argument that wh-movement at LF is unbounded, but one could still argue that this is due to the existence of COMP as an escape patch, so that successive cyclic movement is permitted, and also to the fact that indefinite NPs do not form opaque domains.<sup>68</sup> However, Huang finds further support for the unboundedness of LF movement from QR. It is noted that like wh-movement, QR violates such constraints as the Left Branch Condition, or CNPC and can escape from a verb complement, as the following demonstrate.

- (327) a. wo renshi [[meige ren] de muqin]  
I know everyone nom mother  
"I know everyone's mother"

- b. wo nian le [[ershi ge ren xie] de shu]  
 I read asp. twenty person write nom book  
 "I read books written by twenty persons"  
 "There are twenty persons, such that I read the books  
 of each of them"
- c. wo xihuan [[ta piping meigeren] de wenzhang]  
 I like s/he criticize everyone nom. article  
 "I like the article(s) in which s/he criticized everyone"  
 "For every x=person, I like the article(s) in which s/he  
 criticised x"
- d. wo yigong tingshuo [you sange ren yao lai]  
 I altogether hear have three person will come  
 "I heard that altogether three people will come"  
 "There are three people such that I heard that each of  
 them will come"
- e. wo yigong tingshuo [ta kanjian le sange ren]  
 I altogether hear s/he see asp. three person  
 "I heard that s/he saw three people altogether"  
 "For each of the three persons x, I heard that s/he saw x"

(a) has only the reading where meige ren has scope over the sentence, while (b) is ambiguous, allowing for the wide scope reading of ershige ren 'twenty people'. According to Huang, (c)-(e) are also ambiguous, all accommodating an interpretation where the quantifier adjoins to the matrix VP. Huang also observes that just as dou can induce a wide scope effect on wh-words in an embedded clause, so dou can extract a preceding Q-NP from an embedded position, as illustrated by the sentences below.

- (328) a. [[ta piping meige ren] de wenzhang] hen youqu  
 s/he criticize everyone nom article very interesting  
 "The articles in which s/he criticized everyone are very  
 interesting"
- b. [[ta piping meige ren ] de wenzhang] dou hen youqu  
 s/he criticize everyone nom. article all very interesting  
 "For every x, the articles in which s/he criticized x are

very interesting"  
"The articles in which s/he criticised everyone are very interesting"

- c. [[meige ren mai] de shu] wo bu kan  
everyone buy nom. book I not read  
" I don't read books that everyone buys"
- d. [[meige ren mai] de shu] wo dou bu kan  
everyone buy nom. book I all not read  
"For every x, I don't read the books that x buys"  
"I don't read books that everyone buys"

According to Huang, when the sentence does not have dou, as in (a) and (c), the Q-NP must stay within the lower clause and have narrow scope. If, however, dou is included in the sentence, as in (b) and (d), the sentence becomes ambiguous, allowing the wide scope reading of the Q-NP which has scope over the matrix negator. Our judgments on these examples agree with Huang except for (327c,e)<sup>69</sup>. As we shall see, this difference in judgment has implications for our analysis of the data.

By showing that QR violates the CNPC and that QR can escape from verb complements, a parallel between QR and wh-movement is established, supporting the hypothesis that LF movement is unbounded.<sup>70</sup> Below we offer an alternative analysis of Huang's data which will include other relevant examples to argue for the clauseboundedness of QR. Our argument will be structured as follows: (i) first, we review Nishigauchi's analysis of wh-movement from complex NP (cf. examples in (324)), agreeing with his claim that the CNPC is in fact not violated; (ii) then we will analyze the sentences involving the interaction of wh-movement and dou-quantification (cf. examples of (326)) using the idea of feature percolation, again showing that the CNPC is not violated in these

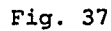


cases; (iii) next, we highlight the limitations of Nishigauchi's approach with respect to wide scope QR and suggest that these cases should be handled in terms of our framework; (iv) following this, we will introduce evidence that shows the clauseboundedness of QR and reinterpret Huang's data; (v) lastly, we will argue that there is a subject/object asymmetry in terms of QR from a complex NP, and that this phenomenon is best analyzed using the notion of governing category.

The claim that wh-movement is unbounded has sparked off a great deal of discussion and criticism. A keen observation made in Nishigauchi (1982) based on Japanese data and independently in Lee (1982) based on Korean bears on the nature of the response to a question with the wh-word in a complex NP. It appears that a response to a question such as (329) will not be complete if only the identity of the individual is given.

- (329) a. [[shei xie] de shu] zui you qu?  
           who write nom book most interesting  
           "for which x, the books that x wrote are interesting"

Instead of Zhangsan, one would normally have to say Zhangsan xie de '(that which) is written by Zhangsan' or Zhangsan de 'Zhangsan's'. This shows that what is being questioned is not the wh-word itself but rather the entire complex NP. Nishigauchi suggests that what is going on is a kind of pied piping, so that the entire complex noun phrase moves to the matrix COMP, and then the wh-word moves into the COMP of the relative clause, as in:



Nishigauchi's idea of feature percolation can be extended to

cover a range of Chinese data. We will assume that the feature of an XP can be percolated onto its specifier position and that the feature of S' can be percolated to COMP. At LF, (330) will have the following structure:

- (330) a. [[shei xie] de shu] dou bu hao  
           who write nom. book all not good  
           "For every x, the books that x wrote are not good"
- b. [[Lisi taolun sheme] de shu] dou hen hao  
           discuss what nom. book all very good  
           "For every x, the books (in which) Lisi discusses x  
           are very good"

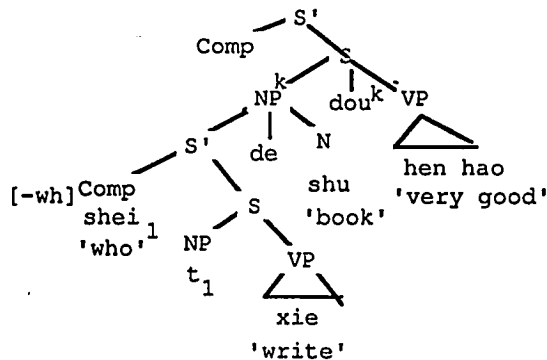


Fig. 38

By our assumption about percolation, the lower [-wh] COMP will receive an index from dou at SS where dou-coindexing takes place, since S' is the specifier of the complex NP and the feature it receives will be passed on to COMP. Once the wh-word shei moves into the lower COMP, it will be coindexed with dou, which means that it cannot move up to the matrix COMP, or else a Bijection violation will result. Recall that numeral phrases in Chinese can have the option of functioning as an operator or as a variable. Residing in the lower COMP, which is a [-wh] COMP, the wh-word can serve as a

variable bound by dou. Thus the logical interpretation of the sentence will be informally as "Ax the books that x wrote are very good". What seems to be a subjacency violation is in fact a case of wh-word assuming the status of a variable bound by a universal quantificational adverb in the matrix clause. Since our analysis hinges only on the lower COMP being marked with a dou feature, it does not matter where the wh-word in the lower clause originates from. Thus we predict no subject/object asymmetry, and the LF derivation of a sentence like (330b), where the wh-word is in object position in the relative clause, is expected to be the same as that for (330a). For sentences where the embedded clause is a sentential subject or a prepositional object, as in (326 b,c) the same argument holds. We have seen from our discussion of dou that it can coindex with a subject or a prepositional object (cf. (83)). The only thing special here is that the subject as well as prepositional object is a S'. The dou index received by the S' percolates to COMP and the derivation from that point on will be identical to that for the complex NP cases.

Having shown an alternative analysis of the wh-movement cases, which we claim do not involve subjacency violation, we now show that an analysis in the spirit of Nishigauchi will not apply to the complex NP cases involving Q-NPs. Consider sentences such as (327b), repeated as (331), with a complex NP in object position of the matrix clause. The embedded Q-NP serving as the relative clause subject can have both NP-external and NP-internal scope if taken as an operator.

- (331) wo xihuan [[ershide ren xie] de shu]  
 I like twenty person write nom book  
 "I like books written by twenty persons"  
 "There are twenty persons such that I like the book written  
 by each of them"

Here it is hard to see why the Q-NP should need to piedpipe since unlike the case of wh-movement, where there is a fixed position for wh-words to move into, Q-NPs can adjoin to different nodes. Clearly, in the above sentence, the Q-NP can adjoin to the complex NP node giving an internal reading or it can adjoin to VP giving an external reading, these two nodes being the only available adjunction sites. In the latter adjunction, the Q-NP must move out of the complex NP violating the CNPC. Here too, unlike the wh-sentences, we do not have good evidence to show that in the external reading it is in fact the whole complex NP that moves to an A' position. The fact is simply that as long as the Q-NP adjoins within the complex NP, it will be an internal reading. To obtain the external reading, violation of CNPC is necessary.

What is interesting about QR is that not every Q-NP can violate the CNPC, there being a subject/object asymmetry in the LF movement. Consider the following pairs of sentences.

- (332) a. [[sange ren xie] de shu] hen haokan  
 three person write nom book very nice  
 "Books written by three authors are very nice"
- b. [[sange ren xie] de shu] dou hen haokan  
 three person write nom book all very nice  
 "Books written by three authors are all very good"  
 "There are three x=person, such that the books written  
 by x are very good"
- c. [[zhu gei liangge ren] de fangjian] hen kuanchang

rent to two person nom room very spacious  
 "Rooms rented to two persons are very spacious"

- d. [[ zhu gei liangge ren ] de fangjian ] dou hen kuanchang  
 rent to two person nom room all very spacious  
 "Rooms rented to two persons are all very spacious"

Two types of contrasts are illustrated here. One type of contrast is reflected by the difference between (a) and (b). It is much easier to get the wide scope reading of the Q-NP in (b) than in (a). The contrast follows immediately from our assumptions about adjunction sites and the proposal that Q-NPs in Chinese can function either as operators or as variables.

In Fig. 39a, which corresponds to (332a), the only adjunction site that will lead to a well-formed LF representation for  $NP_1$  as an operator is NP, and hence only the internal reading is possible; if  $NP_1$  assumes the role of a variable, it will be unbound, violating the Condition on Proper Binding. In Fig. 39b,  $NP_1$  likewise can only adjoin to NP. If  $NP_1$  adjoins to the complex NP, an internal reading results, and in this representation it is the complex NP that is quantified by dou "books that are written by three people are all very nice". If however  $NP_1$  is interpreted as a variable, it can be bound directly by dou. Since dou is in matrix position, such a variable binding relationship represents a NP-external reading of the numeral phrase.

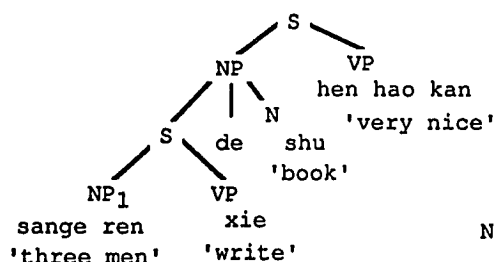


Fig. 39a

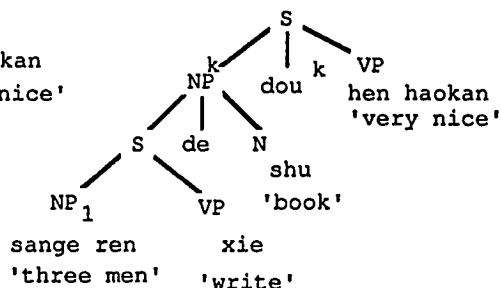


Fig. 39b

In the light of this fact, it is surprising that the same contrast is not extended to the (332c,d) sentences. In (c) only an internal reading of the Q-NP liangge ren is permitted. It cannot mean that there are two specific individuals such that the rooms rented to them are spacious. In (d) also, only an internal reading is possible with the entire complex NP quantified by dou, meaning 'each of the rooms with a two-person renting capacity'.

The same subject/object asymmetry is seen if the complex NP is found in matrix object position. As we have seen, a sentence like (333a) can have both external and internal readings.

- (333) a. wo xihuan [[sange ren xie] de shu]  
 I like three person write nom book  
 "I like books written by three authors"  
 "There are three persons such that I like books of each of them"
- b. wo xihuan [[zhu gei liangge ren] de fangjian]  
 I like rent to two person nom. room  
 "I like rooms rented to two persons"
- c. wo xihuan [[jieshao meige luyoudian] de shu]  
 I like introduce every tourist-spot nom. book  
 "I like books that introduce every tourist spot"

But surprisingly, it is extremely difficult to get an external

reading of (333b). In (333c), even when we use the universal quantifier meige, the strong preference is for an internal reading of the Q-NP. Since these judgments involve sharp contrasts rather than categorical grammaticality/ungrammaticality, one could still debate over different judgements based on different speakers. The strongest evidence for such a subject/object asymmetry is found in the universal generalization process we described earlier in section 1.2.2. It was noted that a singular numeral phrase when marked by [dou Neg] can function as a variable despite apparent violation of the plurality requirement of dou-coindexing. We see the same process at work if the singular NP is embedded within a complex NP. Consider (334).

- (334) a. [[yige ren xie] de shu] wo dou bu kan  
           one person write nom. book I all not read  
           "I don't read books written by single authors"  
           " For every x, I don't read books written by x"
- b. [[ xie yige ren] de shu] wo dou bu kan  
           write one person nom book I all not read  
           "I don't read any book written about one person"
- c. [[yige meiguoren yan] de dianying] wo dou bu hui xinshang  
           one American act nom movie I all not know appreciate  
           "I don't know how to appreciate movies acted by one  
           American actor"/ "I don't know how to appreciate movies  
           acted by any American actor"
- d. [[yan yige meiguoren]de dianying] wo dou bu hui xinshang  
           act one American nom movie I all not know appreciate  
           " I don't know how to appreciate any movie in which  
           the role of one American is played"

The ambiguity of the (a) and (c) sentences versus the lack of ambiguity of the (b) and (d) sentences is a sharp contrast accepted by every speaker I have consulted. Both (a) and (c) allow wide scope interpretation of the Q-NP in which case universal generalization



occurs, whereas (b) and (d) only permit a narrow scope interpretation. Since dou appears in all four sentences, the difference in interpretation must be attributed to the subject/object asymmetry. These examples show that QR does not allow object Q-NPs to escape the complex NP.

Another class of examples leading us to the clauseboundedness of QR is the following.

- (335) a. Tamen jushou [e zhantong le wuge jihua]  
           they raise-hand approve asp. five proposal  
           "They raised their hands and approved five proposals"
- b. Lisi zhan qilai [e chang le san shou ge]  
           stand up sing asp. three CL song  
           "Lisi stood up and sang three songs"

It is extremely difficult to obtain a wide scope reading of the Q-NP with respect to the main verb, i.e. (a) is not understood as 'for each of the five proposals, they raised their hands and approved x'. Similarly in (b), the standing up does not seem to be five separate events but rather one event. In view of the quantificational properties of Chinese we have examined, it is necessary to look at these sentences involving only one Q-NP to isolate the factor of clausematehood. This is because once two Q-NPs are involved, we are not certain whether their relative scope is due to the clauseboundedness of QR or to linear order, as command relations are confounded with linear order as well as with the effect of dou. The following illustrate this point.

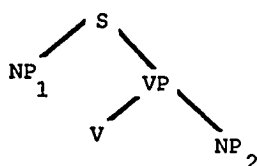


Fig. 40a

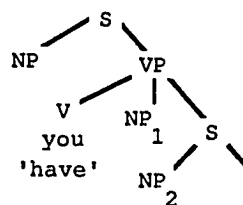


Fig. 40b

In the above figures, we know that  $NP_1$  cannot be a Q-NP unless it is supported by dou or by a topic. If it is supported by dou and has scope over another Q-NP<sub>2</sub>, we are not certain whether this is due to the effects of dou, a distributive quantifier, or due to linear order. If the Q-NPs are found in separate clauses, as in the existential structure in Fig. 40b, if  $NP_1$  has scope over  $NP_2$ , again we are not sure whether this is due to command or linear order or the clauseboundedness of QR. Thus we are left with sentences such as (335) to test for the effect of clauseboundedness. Similar observations hold if the embedded sentence contains the complex NP we have been studying, as in :

- (336) a. Zhangsan gaoshu wo [ ta xihuan [[sange ren]de shu]]  
           tell me he like three person nom book  
           "Zhangsan told me that he likes books by three persons"  
           "Zhangsan told me that there are three persons such that  
           he likes the books of them"
- b. Zhangsan shuo [ ta mai le [[meige meiguo zuojia xie] de  
           say he buy asp every America writer write nom  
           shu]]  
           book  
           "Zhangsan said that for every American writer x, he bought  
           books written by x"  
           "Zhangsan said that he bought books coauthored by all  
           American authors"

Again it seems that the Q-NP cannot adjoin to the matrix VP, having scope over the matrix sentence, so the events reported by the matrix

verb must be unindividuated single events. (a) cannot mean 'for three particular persons, Zhangsan told me he likes books written by each of them'; likewise (b) cannot be interpreted as 'for every American writer x, Zhangsan said he bought the books x wrote'. Consider now the sentences of Huang (327d,e), repeated below as (337).

- (337) wo (yigong) tingshuo [ta kanjian le sange ren]  
 I altogether hear s/he see asp. three person  
 "I heard that he altogether saw three people"  
 "There are three people such that I heard s/he saw each of them"

Here a reading where the Q-NP has scope over the matrix verb seems possible. We should be sceptical, however, of whether there is really movement out of the embedded clause or whether we are seeing an opacity phenomenon. This can be seen from the fact that if we remove the adverb yigong 'altogether', which contributes toward the transparent reading of the Q-NP, the wide scope reading disappears. The transparent reading of the Q-NP may be actually due to a performance factor affecting the speaker. Consider the following.

- (338) Zhangsan gaoshu wo { meige ren dou hui lai}  
 tell me everyone all will come  
 "Zhangsan told me that everyone will come"

It is possible to imagine the sentence true under the situation where in fact Zhangsan told the speaker at one instant that  $x_1$  will come, at another instant that  $x_2$  will come and so forth, and the speaker reporting the event sums up the situation by supplying the description meige ren 'everyone'. If such an interpretation of the Q-NP is allowed, clauseboundedness will also be violated in the English equivalent of the sentence, contrary to standard judgements

of sentences of this type (cf. May 1977, Hornstein 1984). By the same token, if one accepts this line of reasoning, one can analyze (339) as having a wide scope reading of the universal quantifier phrase, seemingly violating CNPC.

(339) John likes [the books [ that every American author wrote]]

It appears that opacity phenomena of this type, which depends heavily on performance factors should not be included in our discussion of core grammar.

We now show how the subject/object asymmetry in (332-333) can be accounted for using the notion of governing category. Here we assume along with Aoun (1985) that the trace of Q-NPs are A'anaphors, which are subject to Principle A of the Binding theory. The following definitions from Chomsky (1982) and Aoun (1985) are adopted.

(340) Principle A of the Binding Theory:

An anaphor must be X-bound within its governing category

(341)  $\beta$  is a governing category for  $\alpha$  iff  $\beta$  is the minimal category (S' or NP) containing  $\alpha$ , a governor of  $\alpha$ , and a subject accessible to  $\alpha$

(342)  $\alpha$  is accessible to  $\beta$  iff  $\beta$  is in the c-command domain of  $\alpha$  and coindexing of  $(\alpha, \beta)$  will not violate the i-within-i condition

(343) i-within-i condition

$*[\alpha^i \dots \beta^i \dots]$

We will also assume that if no governing category is available by the above definitions the root clause will be the governing

category.

The structures in the two figures below summarize key examples in the data covered, which are repeated below.

- (344) a. [[sange ren xie] de shu] hen haokan  
 three person write nom book very nice  
 "Books written by three authors are very nice"
- b. [[sange ren xie] de shu] dou hen haokan  
 three person write nom book all very nice  
 "Books written by three authors are all very good"  
 "The books written by each of (those) three persons are very good"
- (345) a. wo xihuan [[sange ren xie] de shu]  
 I like three person write nom book  
 "I like books written by three authors"  
 "There are three persons such that I like books of each of them"
- b. wo xihuan [[zhu gei liangge ren] de fangjian]  
 I like rent to two person nom. room  
 "I like rooms rented to two persons"

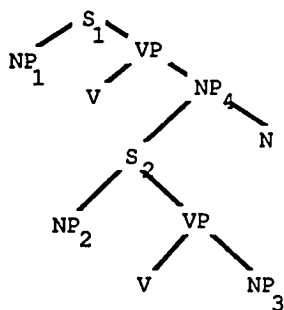


Fig. 41a

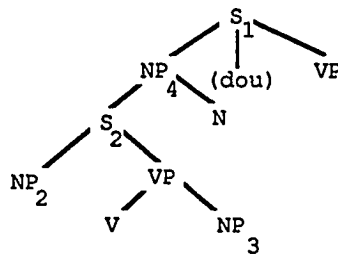


Fig. 41b

In the configuration shown in Fig. 41a, if NP<sub>2</sub> is the Q-NP concerned (as in 345a), it will have the INFL of S<sub>2</sub> as governor<sup>72</sup>, but it will not have an accessible subject in the lower clause as Chinese has no AGR. The head noun N cannot be an accessible subject to NP<sub>2</sub> either, since coindexing the two will violate the i-within-i condition. Thus the accessible subject will have to be NP<sub>1</sub> in the matrix clause,

and the matrix S will be the governing category. By Principle A of the Binding Theory,  $NP_2$  must adjoin to an A' position within the governing category. We see that there are two adjunction sites that will satisfy this condition, to wit, VP and  $NP_4$ . Thus the quantifier phrase in the subject position of a complex NP can have both external and internal readings if the complex NP itself is in matrix object position. If  $NP_4$  is in matrix subject position, as in Fig. 41b, the governing category of  $NP_2$  (cf. 344a,b), which has no accessible subject, will by default be the matrix clause. In this structure, the only adjunction site for  $NP_2$  will be  $NP_4$ , hence an internal reading is always available if  $NP_2$  is taken as an operator, with or without dou. If, however,  $NP_2$  is regarded as a variable, it will remain unbound in the absence of dou. Thus, (344a) cannot have an external reading. If, on the other hand, dou is included as in (344b),  $NP_2$  as a variable can be directly bound by dou, resulting in an external reading. Both interpretations are possible because in both cases, the binding paths lie within the governing category of the Q-NPs concerned, i.e. the matrix clause.

Now consider the case where  $NP_3$  in object position is the quantifier phrase concerned (as in 333b). By our definition, in both Fig.41a and Fig.41b  $NP_3$  will have  $NP_2$  as an accessible subject, since coindexing the two will not violate the i-within-i condition. Hence the relative clause is the governing category. By our Binding Principle A, the trace of  $NP_3$  must be bound within the relative clause. Thus if  $NP_3$  functions as an operator, it will only have the VP of the relative clause as its only adjunction site, and only an

internal reading will be produced. If NP<sub>3</sub> serves as a variable, it will also be directly bound by dou. However, in this case the operator binding the variable lies outside the governing category of the latter, which means the variable is unbound within its governing category. This is incompatible with Principle A of the Binding theory, since these empty categories bound by quantifier operators are assumed to be A' anaphors and must therefore be A' bound within their governing category. Note that the governing category for NP<sub>3</sub> will be the relative clause irrespective of the location of the complex NP in the matrix clause. Thus in the configuration in both figures, we expect only an internal reading of NP<sub>3</sub>.<sup>73</sup> This explains why in (332 c,d), only internal readings of the Q-NP are available.

Since in Fig. 41a, the matrix S<sub>1</sub> will be the governing category for NP<sub>2</sub>, we would expect that if S<sub>1</sub> is embedded as a complement of another verb, the Q-NPs concerned cannot raise to adjunction sites beyond S<sub>1</sub>, or else Principle A will be violated. This explains why QR can move NP<sub>2</sub> out of the complex NP but can do so no further. Thus in (336a,b), while the Q-NP within the complex NP can have scope over the clausal complement of the matrix verb gaoshu 'tell', it cannot have scope over the root clause.

In Fig. 41b, the situation is more complicated. Let us consider two cases of further embedding, one with dou included, and one without dou.

- (346) a. Lisi gaoshu wo [[sange ren xie] de shu] hen hao]  
           tell me three person write nom book very good  
           "Lisi told me that books written by three authors are good"  
           "There are three persons such that Lisi told me that the

books of each of them are good"

- b. Lisi gaoshu wo [[sange ren xie] de shu] dou hen hao]  
 tell me three person write nom book all very good  
 "Lisi told me that books written by three authors are all  
 very good"  
 "Lisi told me that there are three persons such that the  
 books written by each of them are all very good"

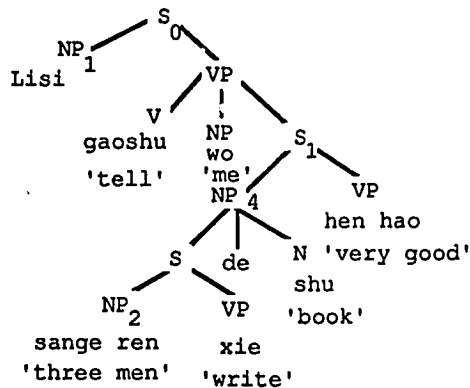


Fig. 42a

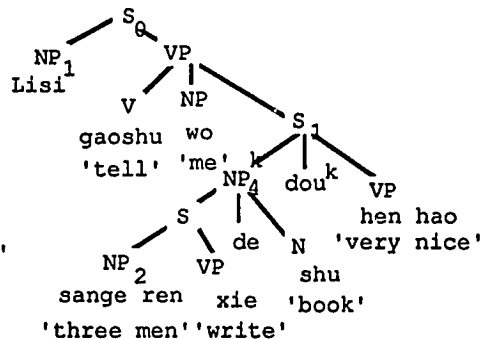


Fig. 42b

Fig. 42a and Fig. 42b correspond to (346a,b) respectively. In both structures, since the accessible subject of NP<sub>2</sub> is NP<sub>1</sub>, S<sub>0</sub> will be the governing category for NP<sub>2</sub> in both trees. In Fig. 42a, NP<sub>2</sub> has two adjunction sites, NP<sub>4</sub> and VP. If adjoined to NP<sub>4</sub>, it will have an internal reading; if adjoined to VP of S<sub>0</sub>, it will have matrix scope. It seems that the ambiguity is indeed possible with (346a), which can have the meanings (i) "there are three persons such that Lisi told me that their books are good," or (ii) "Lisi told me that books written by three authors are good".

In Fig. 42b, NP<sub>2</sub> also has S<sub>0</sub> as governing category. Because of the presence of dou, NP<sub>2</sub> can either function as an operator and adjoin to the matrix VP or NP<sub>4</sub>, or it can function as a variable bound by dou. Thus it would seem that in principle three readings



should be possible. In addition to the readings (i) and (ii) of (346a) (cf. Fig. 42a), in theory a third reading where NP<sub>2</sub> has scope over S<sub>1</sub> but not S<sub>0</sub> should be available: (iii) "Lisi told me that there are three people such that the books of each of them are very good." However, the sentence only has the meanings (ii) and (iii), but not the reading (i), the interpretation where it has scope over S<sub>0</sub>. This is due to the effect of clauseboundedness of dou, which cannot quantify a NP containing a variable which is not bound within the domain of dou.

How can we account for the subject/object asymmetry found in (334)? The SS of (334a) and (334b) are shown in Fig. 43a and Fig. 43b respectively.

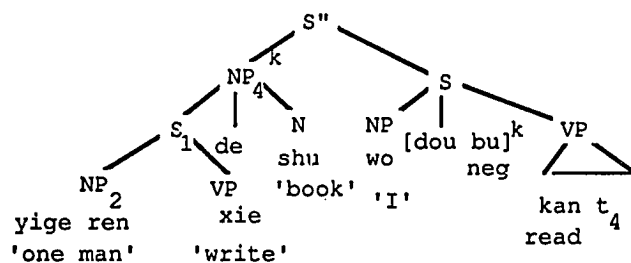


Fig. 43a

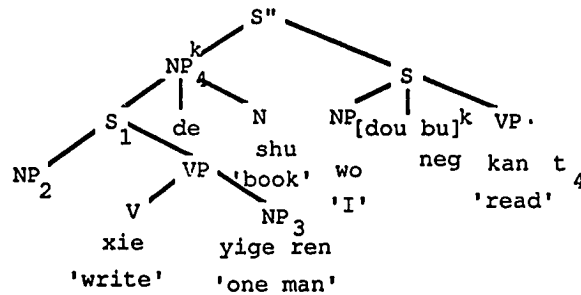


Fig. 43b

Thus at LF, the governing category of NP<sub>2</sub> in Fig. 43a will be S". Thus NP<sub>2</sub> can adjoin to NP<sub>4</sub> or to S". If adjoined to S", it will violate the PCC as the binding path of NP<sub>2</sub> {S", S", NP<sub>4</sub>, S} will overlap with the binding path of NP<sub>4</sub> {S", S}. If NP<sub>2</sub> adjoins to NP<sub>4</sub>, the operator [dou bu] will only have an effect on the top NP<sub>4</sub> and the feature will not percolate to an adjunct sister of NP<sub>4</sub>, an adjunct not being a specifier. Therefore the internal interpretation "I don't read books written by single authors" results.

A second well-formed representation is possible here, one where NP<sub>2</sub> remains in situ as a variable directly bound by [dou bu]. Such binding is permitted because the binder is located within the governing category of the bindee. Thus the reading "for all x, I don't read books x wrote" can be derived. In Fig. 43b, NP<sub>3</sub> has S<sub>1</sub> as its governing category, so if NP<sub>3</sub> is an operator its trace must be bound within S<sub>1</sub>. This means that the only reading is the internal interpretation. Here if NP<sub>3</sub> is taken to be a variable, it can of course be directly bound by dou. But since dou lies outside the governing category of NP<sub>3</sub>, the binding is illicit by Principle A of the Binding principles, and consequently a universal reading of the

singular numeral phrase cannot be obtained.

So far we have been assuming that Q-NPs are A' anaphors without supporting the position. The parallel between the distribution of the external readings of Q-NPs and the reflexive taziji<sup>74</sup> can be seen from the following sentence.

- (348) a. [Lisi<sub>i</sub> zui xinshang [[ta ziji<sub>i</sub> xie] de shu]]  
          most enjoy       /he self write nom book  
          "Lisi enjoys books written by he himself most"
- b. Lisi bu zhida [Zhangsan<sub>i</sub> taoyan ta ziji<sub>i</sub>] de yuanying]  
          not know                   dislike himself nom. reason  
          "Lisi doesn't know the reason why Zhangsan dislikes himself"
- c. Lisi<sub>i</sub> shuo [[[taziji<sub>i</sub> xie ] de shu] zui hao]  
          say    himself write   nom book most good  
          "Lisi said that the books that he himself wrote are the best"

As shown in (a) and (c), if the reflexive occurs in subject position of the relative clause, it can only be bound by something outside the complex NP; if it is in object position, it is bound within the relative clause, as indicated by (b). As (c) demonstrates, if the reflexive is the subject of the relative clause of a complex NP serving as the subject of an embedded clause, the reflexive is bound by the matrix subject, as in this case the governing category of the reflexive is the matrix clause, and the only available antecedent is the matrix subject. Thus the relevant governing category for the reflexive in Chinese is identical with the governing category for the Q-NP, the only difference between the two being that the reflexive needs to be A-bound within the governing category, whereas the Q-NP trace needs to be A' bound.

Thus far, we have examined a range of data from Chinese which

could be inter-related by assuming (a) that QR obeys locality conditions and must be bounded within the governing category of the Q-NP undergoing QR; (b) that Q-NPs in Chinese can serve the dual role of operators and variables, and (c) S is not an adjunction site for QR in Chinese. It should be noted that our success in accounting for the data crucially depends on postulating a level of Logical Form and the rule of QR. In the next section, we will examine how our findings in this section relate to our earlier discussion of the isomorphic scope interpretation principle in 1.3.1.

#### 1.3.4 QR and the Scope Interpretation Principle

In an earlier section (1.3.1), we have seen that the relative scope of Q-NPs in a sentence is not free but can be predicted by our General Condition on Scope Interpretation (310), repeated below as (349).

##### (349) General Condition on Scope Interpretation

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;

As stated, the above condition is a sufficient condition, so that whenever the relative positions of the two Q-NPs satisfy the requirements of (349), the relative scope of the Q-NPs can be determined. In the preceding section, we have also seen that the

referential ambiguity found in complex NPs can be analyzed in terms of QR, adjunction sites and the notion of governing category. The range of ambiguities displayed is circumscribed by the Binding principles. It appears, then, that we have been analyzing two bodies of facts using different principles. For clauses containing two Q-NPs, the relative scope of the quantifier phrases can be derived by our isomorphic principle (349). This renders QR redundant, as the sole information required for scope determination is SS hierarchical and linearity relations. On the other hand, when we turn to the quantifiers embedded in complex NPs, we found it crucial to motivate QR and governing category as theoretical primitives, since such a move allows us to relate a set of ambiguity judgments at the level of Logical Form. The natural question to raise is: what is the relationship between the isomorphic mapping rule (349) and QR, which as we have seen obeys locality conditions? Is there any overlap between the condition governing QR and the scope principle? This is the main issue we wish to address in this section.

We would like to present two major points in our argument. Firstly, our scope principle stated as a sufficient condition is too strong and clause (ii) of the principle should be phrased instead in the form of a necessary condition. Secondly, the relevant factor in the scope condition should be g-command instead of command, g-command defined as follows:

" $\alpha$  g-commands  $\beta$  iff neither dominates the other  
and the node representing the governing category  
of  $\alpha$  dominates  $\beta$ "

Let us first examine the facts that suggest the inadequacy of the scope principle. Consider the following sentences in which the first Q-NP is contained within a possessive phrase and the second Q-NP is found in the matrix clause.

(350) [[sange ren]<sub>1</sub> de fangjian]<sub>2</sub> keyi rongna [wuge ren]<sub>3</sub>  
 three person NOM room can house five person  
 "Triple rooms can house five people"

(351) [[sange ren]<sub>1</sub> de fangjian]<sub>2</sub> dou keyi rongna [wuge ren]<sub>3</sub>  
 three person NOM room all can house five person  
 "Triple rooms can all house five people"  
 "There are three persons such that the rooms of each of them can house five persons"

(352) [[ $\alpha$ ]<sub>NP1</sub> N]<sub>NP2</sub> (dou) V  $\beta$  ]<sub>S</sub>

(350) is unambiguous, having only the interpretation where the first Q-NP sange ren 'three people' has internal scope "triple rooms can house five people". As we explained in the last section, this is due to the fact that if sange ren functions as an operator, it has no adjunction site outside of NP<sub>2</sub> and as a variable it has no operator to bind it. With dou added, the sentence becomes ambiguous, as in (351), since an additional option becomes available: NP<sub>1</sub> sange ren can be bound by dou. On the reading where dou binds NP<sub>2</sub> and NP<sub>1</sub> adjoins internally, the sentence means "each of the triple rooms can house five people", with the quantified NP<sub>2</sub> having wide scope over NP<sub>3</sub>. On the other reading where NP<sub>1</sub> is bound directly by dou, the sentence is understood as "the rooms of each of the three people can house five people", with NP<sub>1</sub> having wide scope over NP<sub>3</sub>.

The problem posed by such data can be explained in terms of the schematic representation (352). We are given two Q-NPs,  $\alpha$  and  $\beta$ , with the former preceding the latter. At the same time,  $\alpha$  and  $\beta$

command each other. Now if we apply clause (ii) of the scope condition, we should expect  $\alpha$  to have scope over  $\beta$  irrespective of whether don is present. The fact that in (350)  $NP_1$  cannot have scope over  $NP_3$  shows that the second clause of our scope condition (349) fails to make the right prediction. In (351),  $NP_1$  may or may not have scope over  $NP_3$  depending on whether it functions as an operator or as a variable, but it does not have to. This suggests that perhaps clause (ii) of the scope interpretation principle should not be given as a sufficient condition but rather as a necessary condition.

Let us then restate the scope principle as a necessary condition, so that if a Q-NP  $\alpha$  and another Q-NP  $\beta$  command each other,  $\alpha$  can have scope over  $\beta$  only if (a)  $\alpha$  commands  $\beta$  and (b)  $\alpha$  precedes  $\beta$ . This would be compatible with the sentences (350-351) as well as simple clauses containing two Q-NPs discussed in 1.3.1. If we have two Q-NPs in the configuration (353), each commanding the other,

(353) [... $\alpha$ ... $\beta$ ...]s

clearly  $\alpha$  satisfies the scope condition, but  $\beta$  does not. This means that only  $\alpha$  may have scope over  $\beta$ , which is consistent with the fact that (353) has only the reading in which  $\alpha$  has scope over  $\beta$ .

Having restated clause (ii) of the scope principle as a necessary condition, the next question we ask is: given two mutually commanding Q-NPs  $\alpha$  and  $\beta$ , with the former preceding the latter, what are the other requirements that need to be satisfied before  $\alpha$  can have scope over  $\beta$  ? Before tackling this question, we first revise

the scope condition so that command is replaced by g-command. This revision is motivated by some of the facts considered in the preceding section.

(354) [[sange ren<sub>1</sub> qi ]<sub>S</sub> de zixingche]<sub>2</sub>dou you [liangge xinhaodeng]<sub>3</sub>  
 three person ride NOM bike all have two signal-light  
 "Bikes ridden by three people all have two signal lights"  
 "There are three persons such that the bikes each of them  
 rides have two signal lights"

(355) [[ qi sange ren<sub>1</sub> ]<sub>S</sub> de zixingche]<sub>2</sub>dou you [liangge xinhaodeng]<sub>3</sub>  
 ride three person NOM bike all have two signal-light  
 "Bikes ridden by three persons all have two signal lights"

(356) [[[  $\alpha$  V... ]<sub>S</sub> N]<sub>NP</sub> dou V  $\beta$  ]<sub>S</sub>

(357) [[[...V $\alpha$  ]<sub>S</sub> N]<sub>NP</sub> dou V  $\beta$  ]<sub>S</sub>

(354) and (355) are parallel to (351) except that in this case the first Q-NP is contained within a relative clause. We noted earlier that these sentences exhibit a subject/object asymmetry so that when the first Q-NP is in an embedded subject position as in (354), NP<sub>1</sub> can have scope over NP<sub>3</sub>. Thus (354) is ambiguous. It can mean about "Bikes ridden by three persons all have two signal lights" or "there are three persons such that the bikes of each of them have two signal lights". On the internal reading, NP<sub>1</sub> adjoins to NP<sub>2</sub>, whereas on the external reading NP<sub>1</sub> functions as a variable bound by dou. Turning to (355), where NP<sub>1</sub> is located in embedded object position, we find the sentence can only be understood as "bikes ridden by three persons all have two signal lights".

The problem presented by this pair of sentences can be illustrated by the schematic representation of (356) and (357), which correspond to (354) and (355) respectively. In both cases, since  $\alpha$  does not command  $\beta$ , we would not expect  $\alpha$  to have scope over



$\beta$ . But in (356), sange ren 'three people' can in fact have scope over liangge xinhaodeng 'two signal lights'. Now the difference between (356) and (357) is that in the former,  $\beta$  falls inside the governing category of  $\alpha$ , which is the root clause, whereas in the latter sentence,  $\beta$  lies outside the governing category of  $\alpha$ , which is the relative clause. In the light of these facts, it appears that the notion of command should be revised in such a way as to incorporate the notion of governing category. The general scope interpretation principle can therefore be revised as follows:

(358) General Condition for Scope Interpretation (Interim Revision)

Given two Q-NPs/Q-expressions  $\alpha$  and  $\beta$ ,

$\alpha$  can have scope over  $\beta$  only if

- (i)  $\alpha$  g-commands  $\beta$  (i.e. the node representing the governing category of  $\alpha$  dominates  $\beta$ )

and (ii)  $\alpha$  precedes  $\beta$

The above revision is compatible with the data presented thus far in this section, but consideration of other facts indicates that this revision may be too weak. It will fail to account for a sentence such as (359), which has only the reading where the matrix Q-NP takes scope over the embedded Q-NP. The sentence below can only mean "for all  $x$ , that Lisi bought three houses is good for  $x$ "; it cannot have the interpretation "there are three  $y$ =house, such that that Lisi bought  $y$  is good for everybody".

- (359) [[Lisi mai le sandong fangzi<sub>1</sub>] dui meige ren<sub>2</sub> dou hao  
 buy asp three house to every person all good  
 "That Lisi bought three houses is good for everybody"]

Here, Q-NP<sub>1</sub> sandong fangzi 'three houses' is in object position of a

sentential subject and its governing category is the embedded clause. Since the governing category of  $NP_2$  is the matrix clause,  $Q-NP_1$  does not g-command  $Q-NP_2$  but  $Q-NP_2$  asymmetrically g-commands  $Q-NP_1$ . According to (358), for a Q-NP to have scope over another, both the g-command and precedence conditions need to be fulfilled. In the above sentence,  $Q-NP_1$  precedes but does not g-command  $Q-NP_2$ ; on the other hand,  $Q-NP_2$  g-commands but does not precede  $Q-NP_1$ . This means that neither Q-NP can have scope over the other, which is contrary to fact.

The fact appears to be that if a Q-NP asymmetrically g-commands another Q-NP, the former will always have wide scope over the latter, irrespective of precedence relations; the linearity condition is involved only in the case when two Q-NPs g-command each other. This implies that we need to divide the original general scope condition (349), as before, into two separate clauses. The first clause should be stated as a sufficient condition, while the second clause should be stated as a necessary condition.

(360) General Condition for Scope Interpretation (Revised)

Given two Q-NPs  $\alpha$  and  $\beta$

- (i) if  $\alpha$  asymmetrically g-commands  $\beta$ ,  
 $\alpha$  will have scope over  $\beta$
- (ii) if  $\alpha$  and  $\beta$  g-command each other,  
then  $\alpha$  can have scope over  $\beta$  only if  
 $\alpha$  precedes  $\beta$

Clause (i) of the revised general condition will correctly account

for sentences such as (359), while the other cases discussed earlier in this section can be covered by clause (ii).

With this revision, we return to the issue of the relationship between QR and a scope condition such as (360). Since clause (ii) of (360) is a necessary condition, this implies other requirements need to be fulfilled before a Q-NP can take scope over another Q-NP situated within the same governing category. The additional requirement seems to be a constraint on LF representations:

(361) at LF, the operator of  $\alpha$  must Reinhart-c-command

the operator of  $\beta$

This additional constraint explains why in (350) NP<sub>1</sub> cannot have scope over NP<sub>3</sub> but in (351) a wide scope reading of NP<sub>1</sub> is possible. Consider the structure in Fig. 44a.

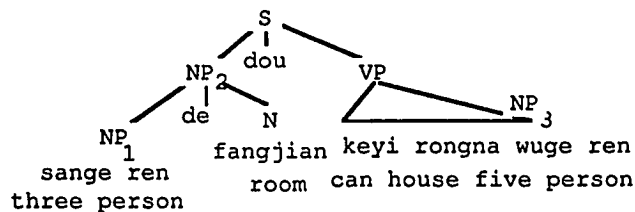


Fig. 44a

In the above figure, if dou is absent, NP<sub>1</sub> can only adjoin to NP<sub>2</sub>, while NP<sub>3</sub> will adjoin to VP at LF. NP<sub>1</sub> in adjoined position clearly does not Reinhart-c-command NP<sub>3</sub> in VP adjoined position. Therefore, although NP<sub>1</sub> g-commands and precedes NP<sub>3</sub> it cannot have a well-formed representation in which the operator of NP<sub>1</sub> c-commands that of NP<sub>3</sub> at LF. Consequently a wide scope reading of NP<sub>1</sub> is not possible. However, if dou is present, as shown in Fig. 44a, it can

bind  $NP_1$ , with the result that at LF the operator of  $NP_1$  c-commands the operator of  $NP_3$  (adjoined to VP) and therefore  $NP_1$  can have wide scope over  $NP_3$ .

A similar analysis can be extended to the contrast between (354) and (355), as illustrated in Fig. 44b.

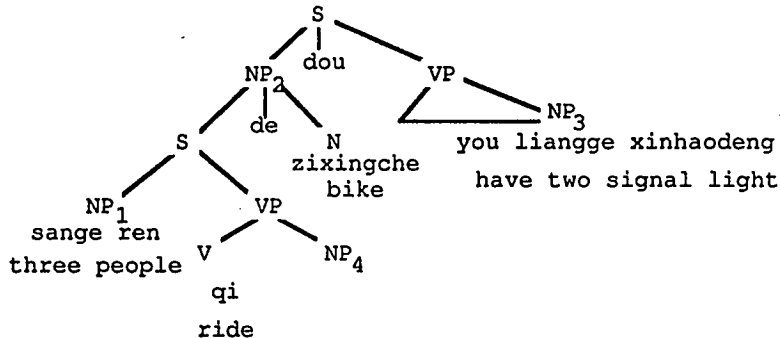


Fig. 44b

Here, if sange ren is in object position of the relative clause (i.e. in position of  $NP_4$ ), it will not g-command  $NP_3$  and therefore sange ren in object position of the relative clause can never have scope over  $NP_3$ , as we have seen from the lack of ambiguity of (355). However, if sange ren is in subject position of the relative clause, as in Fig. 44b, it can be directly bound by dou, and on this option the operator of  $NP_1$ , i.e. dou, clearly c-commands the operator of  $NP_3$  adjoined to VP. Thus  $NP_1$  can have scope over  $NP_3$ . If, on the other hand, dou does not coindex with  $NP_1$ , but with  $NP_2$ , then  $NP_1$  can only adjoin to  $NP_2$  and it will not c-command  $NP_3$  at LF. On the latter option, it cannot have scope over  $NP_3$ .

Consideration of the behavior of Q-NPs embedded in complex NPs with respect to other Q-NPs in the sentence has led us to the

following position: scope interpretation in Chinese does not depend solely on the isomorphic principle we have been assuming in preceding sections, but requires in addition certain constraints such as (361) on the well-formedness and configurational properties of LF representations.<sup>75</sup> This means that the SS properties of a sentence alone will not suffice to decide on whether one Q-NP can have scope over another. Information about properties of the LF representation of the sentence is necessary to determine the relative scope of two Q-NPs.

### Summary of 1.3

In this section, we have shown that the SS factors relevant to the determination of quantifier scope are g-command relations and linear precedence at SS. A strong tendency for the syntax of Chinese to conform to an isomorphic mapping between surface structure and logical form is observed. In our investigations into the referential ambiguities of quantifier phrases in complex NPs, we saw that an adequate analysis of the range of facts calls for theoretical constructs such as QR and governing category. It is also argued that QR shows different properties from wh-movement in that it is essentially clause-bounded and that its freedom of movement is governed by generalized binding principles. The scope interaction of Q-NPs in complex NPs with other Q-NPs within the sentence suggests that our isomorphic scope principle should be stated partly as a necessary condition, and that SS information alone is not sufficient to account for the conditions under which a Q-NP can have scope over another. To achieve the latter objective, we need to appeal to a

level of Logical Form.

# Notes to Chapter One

<sup>1</sup>A classifier is an obligatory component of a noun phrase containing a determiner, irrespective of whether the head noun is a count noun or mass noun.

(a) { nei } \*(liang) che  
       san  
       { that } CL for car  
       three vehicle  
       "This car/three cars"

(b) { zhe } \*(gen) gunzi  
       wu  
       { this } CL club  
       five  
       "This club/five clubs"

(c) { nei } \*(bei) shui  
       yi  
       { that } glass water  
       one  
       "that/one glass of water"

(d) { zhe } \*(zhong) yan  
       yi  
       { this } kind salt  
       one  
       "this/one kind of salt"

(a) and (b) are instances of count nouns and (c-d) examples of mass nouns. Classifiers that denote individual objects such as liang 'classifier for vehicle' and gen 'rod' are listable. While these classifiers have certain semantic features that restrict the kind of nouns they can modify, which classifier should go with which head noun is by and large not rule-governed. For example, gen cooccurs with nouns that denote rod-like objects. Gen can occur with gun 'club' and also with yaqian 'toothpick' but not with bi 'pen'.

<sup>2</sup>Ge is a general classifier applicable to all individual nouns (cf. Chao 1968:588).

<sup>3</sup>Quan, like dou, can also be used as an adverb. Its property will be discussed in Chapter 2. As noted in Lu (1980:402), quan can function as a predicate meaning 'complete', as in

zhe tao zhazhi        quan bu quan?  
 this CL magazine complete not complete  
 "Is this set of magazines complete?"

<sup>4</sup>It is interesting to note that there seems to be a gap in the pattern in that dou does not combine with weisheme 'for what reason/why' to form the equivalent of "for whatever reason". George Bedell has drawn my attention to similar facts in Japanese cf. Kuroda (1979), Martin (1985).

<sup>5</sup>meige ren is glossed here as everybody/everyone because mei can cooccur with a singular numeral phrase whereas suoyou cannot. Contrast (a) and (b) below.

(a) mei yige ren        dou    qu le

every one person all leave asp  
"Everyone has left"

(b) \*suoyou yige ren dou qu le  
"All have left"

<sup>6</sup>The sentence is of course well-formed under the even interpretation of dou, meaning 'even Zhangsan has fallen asleep'.

<sup>7</sup>It should be noted that even without dou (53) and (54) are not synonymous:

(53a) [e lai le keren]  
come asp. guest  
"guests have arrived"

(53b) [keren lai le]  
guest come asp.  
"the guests have arrived"

It is well known that bare NPs in preverbal position often receive a specific interpretation, whereas those in postverbal position receive a non-specific interpretation.

<sup>8</sup>Samuel Cheung and Ren hong-mo have drawn my attention to the fact that (56) is in fact quite common in Beijing Mandarin. This fact is noted in Lu (1980:153). In section 1.1.3, I will show that our formulation allows us to view this dialectal variation in an interesting light.

<sup>9</sup>Chao (1968:780) observes that the ambiguity of this type may be resolved by stressing, so that if there is more than one quantifiable constituent before dou, stress placement signals the one that is being quantified. This phenomenon is also noted in Lu (1980:153). Clearly, whether sentences like (61) indeed allow the reading where dou quantifies both topic and subject would require more evidence than mere intuitive judgment, as the vagueness of plural and conjoined NPs themselves can lead to a seemingly quantified reading in the absence of dou. I will leave this issue aside but will show later that in fact dou quantifies only one of the constituents.

<sup>10</sup>It is well known that in Chinese a verb-object predicate construction cannot take complements (cf. Ding 1961). This constraint was formalized in terms of X-bar theory in Huang (1982), so the verb phrase can be head-initial only at the zero bar level. One way of avoiding the V' constraint is by means of preposing the object to a preverbal position to become the object of the preposition BA, which means 'dispose'. The preposed object must be specific.

<sup>11</sup>We assume here that dou is both a sentence adverb and a predicate



adverb and can be base-generated under S or under VP. In the phrase structure shown in Fig. 1, dou is generated under S. Alternatively, one can also have a structure such as

[NP [dou VP]]

but as we shall see, this will be ruled out by the prohibition against vacuous quantification, as dou will have nothing to quantify within its projection. The distribution of dou will be discussed in Section 1.1.2.

- 12As observed in note 9, where the number of candidate NPs preceding dou exceeds one, it is difficult to say whether it is vagueness or genuine ambiguity that is involved.
- 13The clauseboundedness of dou was first observed in Huang (1981).
- 14The two sentences are well-formed on the even reading of dou, which has been excluded from our present discussion.
- 15Following standard usage, a restricted quantifier is taken to mean "a quantifier restricted to a proper subset of the domain of individuals, the subset being specified by a predicate (cf. Marciszowski 1981:285)". Thus instead of (x) (Px-->Qx), one can write ( $\alpha$ ) Q ( $\alpha$ ) where  $\alpha$  ranges over the kind of objects specified by the predicate P. In a NP such as every boy, the common noun boy serves as a restrictive term corresponding to the predicate P. Domain and modal adverbs are analogous in that they restrict the quantifiers to the individuals in the worlds specified by them.
- 16It seems reasonable to assume that these manner adverbs are predicate modifiers, as none of them can be preposed before the subject. To use two criteria from Stalnaker (1973) for distinguishing sentence modifiers from predicate modifiers, none of the manner adverbs can induce opacity on the subject, and additionally none of them can have a sentence adverb within their scope.
- 17In our brief discussion of the interaction of dou with the adverbs, we have left out subject-oriented adverbs like gaoxing de 'happily' or xiaoxin de 'carefully'. In general, a sentence with dou following these adverbs do not seem totally unacceptable

?tamen hen xiaoxin de dou ba men suo shang le  
 they very carefully all door lock up asp.  
 "They carefully locked up the door"

This may be due to the fact that the adverbial can often be interpreted as a predicate, so that the sentence can

be understood as a conjunction of two clauses, one describing the action, and the other describing the psychological state of the subject. The above sentence can be rendered as  
 tamen [hen xiaoxin] [e dou ba men suo shang le]  
 they very careful all door lock up asp.  
 with dou quantifying a null pronominal subject interpreted as coreferential with tamen.

- <sup>18</sup> I am grateful to Robin Clark for drawing my attention to Lewis' work and the possibility of an analysis of dou along Lewis' lines.
- <sup>19</sup> The fact that dou cannot follow a manner adverbial will not be accounted for in terms of phrase structure, but rather by general principles of LF. The issue of the relative position of dou with respect to modals, which in my present analysis will be treated as main verbs, will be deferred until section 1.3.2.
- <sup>20</sup> It is unquestionable that if sentences such as (135-138) can be understood as a question, they can be so only on an echo question reading.
- <sup>21</sup> Tim Stowell has drawn my attention to similar facts in French. cf. Obenauer (1983).
- <sup>22</sup> The situation in English is more complex and does not exactly parallel the Chinese data, since the following are grammatical (George Bedell, personal communication).

- (i) who all saw John?
- (ii) what all did John buy?
- (iii) the men who all/each knew the boy
- (iv) the men each/all of whom knew the boy

(i) and (ii) appear to be counterexamples to the Bijection principle. (i) means "for which set of individuals y such that all of y saw John" and (ii) means "for which set of objects y such that John bought all of y". The LF representation of (i) will be

[who<sub>1</sub> [t<sub>1</sub><sup>k</sup> all<sup>k</sup> saw John]]

where the wh-trace is bound by the wh-operator and by all. However, closer inspection reveals that all in these sentences seems to form a lexical unit with the wh-word, since if all is moved to a position non-adjacent to the wh-word the sentence becomes ungrammatical.

- (v) \*who did Paul say [t all left]?
- (vi) \*what did John all buy?
- (vii) \* what did Paul say [John all bought t]?
- (viii) ?who all did Paul say [t left]?

(ix) ?what all did Paul say [John bought t]?

If sentences such as (i-ii) are grammatical but sentences such as (v-ix) are acceptable, this shows that all and the wh-word have to move as a single constituent. Thus (i)-(ii) involve special lexical items and do not refute the Bijection principle. As for (iii-iv), one should observe that in the LF representations of the NPs in question the wh-word will be in a [-wh] COMP, as in

the men [who<sub>1</sub> [ t<sub>1</sub><sup>k</sup> each<sup>k</sup> knew the boys]]

There is evidence from Chinese that a variable can be bound by operators of the same type (cf. 152).

- <sup>23</sup> As described in Lu (1980), the typical sentence where we find wh words functioning as indefinite pronouns are sentences containing negation and also interrogative sentences. Why this is so will be dealt with in section 1.3.2.

- <sup>23a</sup> As will be argued in section 1.2.1, universal quantifier phrases like meige ren 'everyone' can function as variables and thus they need not adjoin when bound by dou. In this view, the stronger version of the Bijection principle (147) will be observed.

- <sup>24</sup> Dou-coindexing does not apply to the topic trace of tamen in object position, since the coindexing occurs at SS.

- <sup>25</sup> In May (1977) the Condition on Proper Binding is stated as "every variable in an argument position of a predicate must be bound." To account for the cases we are examining here, which include variables in topic position, we need to relax the condition so that it will apply to all variables in both argument and non-argument positions. May's formulation is motivated by quantificational phenomena related to raising constructions, as the scope ambiguity of sentences such as "someone is likely to win" can be accounted for by quantifier lowering of someone. To allow for this, the Condition on Proper Binding stipulates that this does not apply to variables in non-argument positions such as subjects of raising predicates. This may not be the best way of handling the facts, especially in view of Burzio(1981)'s criticism of May.

- <sup>26</sup> The PCC also seems to make wrong predictions with some cases of topic binding. For example the following LF representation will be ruled out by this condition, since the path connecting NP<sub>1</sub> and t<sub>1</sub> is (S'', S'', S', S) which overlaps with the path connecting NP<sub>2</sub> and t<sub>2</sub>, (S'', S', S, VP):

[Topic<sub>1</sub> [Topic<sub>2</sub> [Comp[ t<sub>1</sub> V t<sub>2</sub>]<sub>S</sub>]<sub>S</sub>]<sub>S</sub>]<sub>S</sub>"]<sub>S</sub>"

But clearly such sentences are possible, as in

[Tamen<sub>1</sub> [zhexie yifu<sub>2</sub> [Comp[ t<sub>1</sub> yijing xi le t<sub>2</sub>]]]]  
 they these clothes already wash asp  
 "As for them, these clothes they have washed"

However, these structures seem to be sensitive to verbal aspect. If the durative aspect morpheme zai is used instead of the perfective aspect marker le, the reading where both NPs are topicalized cannot be obtained.

\*[tamen<sub>1</sub> [zhexie yigu<sub>2</sub> [ t<sub>1</sub> zai xi t<sub>2</sub>]<sub>S</sub>]<sub>S</sub>]<sub>S</sub>"  
 they these clothes DUR wash  
 "As for them, these clothes they are washing"

- <sup>27</sup>It is possible to get the reading as an echo question if we use shenme ren 'what man' rather than shei 'who', better still if the wh-phrase is a more complex structure, as in

[shenme yang de nuhaizi]<sub>1</sub> [dayixuesheng] dou xihuan t<sub>1</sub>?  
 what kind nom. girl freshmen all like  
 "What kind of girls are liked by all freshmen?"

Additionally, it is easier to get the reading if there is a pause following the topicalized wh-object. This comes as no surprise since we know from Chao (1968) that one of the phonological markers of topics is a potential pause following the topic.

- <sup>28</sup>The remaining possibility is for weishenme 'for what' to remain as a [-wh] variable meaning 'for x'. This alternative is however ruled out because there will be nothing to bind the open variable.
- <sup>29</sup>In fact, our theory predicts that a question like (170) presupposes the plurality of the entities queried. This seems to be borne out by the fact that in the example cited in Lu (1980), the question word is often marked by the classifier xie, meaning 'some', as in

Zhangsan dou mai le xie shenme?  
 all buy asp. some what  
 "what all did Zhangsan buy?"

- <sup>30</sup>It should be noted (N. Hyams, personal communication) that a LF representation such as

[NP<sub>1</sub><sup>k</sup> [NP<sub>2</sub><sup>k</sup> dou<sup>k</sup> VP]]

where dou binds more than one constituent violates the Bijection principle, since the operator binds two different terms. Thus on theory-internal grounds, it would be desirable to exclude the possibility of multiple dou-coindexing.

<sup>31</sup>In (196b) and (197b) the reading where dou is coindexed with the time adverb jintian 'today' zuotian 'yesterday' is not available because if these adverbs are quantified, it would mean the events are repeated over a stretch of time, a pragmatically impossible reading.

<sup>32</sup>I am assuming that S" is an XP and an adjunction site for QR at LF. This seems to be necessary for capturing the facts I am presenting here. More evidence will be given to support this position in section 1.2.1. I am also assuming sentences (201) and (203) are derived from a DS such as the following:

[Topic[NP[[V NP]<sub>v</sub>, [P NP]]<sub>vp</sub>]<sub>s</sub>]<sub>s</sub>"

where the prepositional object is topicalized followed by preposition deletion. A similar derivation holds for (202), except that here the PP is preverbal.

[Topic [NP [PP [V NP]]<sub>vp</sub>]<sub>s</sub>]<sub>s</sub>"

<sup>32a</sup>If we view dou as an operator, the quantifier-bare NP (NP<sub>3</sub>) is already bound by an operator at SS, and thus further adjunction is not necessary.

<sup>33</sup>Alternatively, the entire PP can be topicalized, as (201b) is synonymous with

[[gei zhe wuge laoshi]<sub>pp</sub> [wo dou song le yizhang hua t]<sub>s</sub>]<sub>s</sub>"  
to this five teacher I all give asp. one picture

<sup>34</sup>In this respect it differs from English each in that as observed in Burzio (1981), each must be c-commanded by its antecedent at DS. Also for English, the antecedent must in general be animate and not found within a PP. These restrictions do not hold for dou.

<sup>35</sup>Conceptual formulations of pragmatic referentiality or discourse referentiality (Givon 1982, Dubois 1980), which take into account what the speaker intends to refer to in a particular communicative context are not followed here. For example, Givon (1982) observes a contrast between the following sentences.

- (a) so after work I went to the library and sat there and I read a book and it was an excellent book...
- (b) so after work I went to the library and I had nothing to do ; so I read a book and a couple of newspapers and then went home....

In both cases a book is logically referential. But the NP is pragmatically referential in (a) and not in (b). In (b), although a book is referential, the speaker has no intent to



"A tall pretty girl came"

- <sup>40</sup>In this regard, numeral phrases seem to differ from Q-NPs such as 'everybody'. As observed in Prior (1976), Evans (1980) universal quantifiers such as 'everybody' do not refer. When someone utters a sentence of the form "All Xs are Y" or "Every X is a Y", it is infelicitous to ask "who is a Y?" These observations apply to Chinese as well, since it would be pragmatically odd to ask for the identity of the agents in sentences such as

A: meige ren    dou qu le  
    every person all go asp.  
    "everyone has left"  
B: ? shei qu le?  
    who go asp  
    "who left?"

An alternative view of this infelicity is that it results from a pragmatic deviance rather than from the inability of everyone to refer. If the latter view is taken, then everyone can be regarded as referential.

- <sup>41</sup>The presence of other operators in the clause can of course complicate the picture, e.g. the numeral phrases can have a referential reading if quantified by dou.

[ruguo sange ren    dou lai] zhenme ban?  
if    three person all come how do  
"What should one do if the three (of them) all come?"

- <sup>42</sup>A semantic distribution of the quantifiers occurring in matrix subject position should be observed.

\*sange ren qu le "Three persons left"  
\*meige ren qu le "Everyone left"  
\*renhe ren qu le "anyone left"  
\*suoyou ren qu le "everyone left"  
henduo ren qu le "many people left"

It seems that the exception to this generalization is henduo 'many', which has two interesting properties. Notice that the numeral phrases are non-monotonic quantifiers (cf. Barwise and Cooper 1982). Given the fact that e.g. "three males left", we cannot derive either "three fathers left" or "three persons left". Numeral phrases are also what Milsark (1978) calls weak quantifiers in that they can occur in existential constructions. On the other hand, the universal quantifiers are monotonic as well as strong in not being able to occur in existential constructions. henduo 'many' on the other hand is a weak, monotonic quantifier. In addition, it has the property of being able to function generally as a predicate, e.g.

zheli dongxi henduo  
 here thing many  
 "There are many things here"

One might suggest that it is this predication property of henduo that enables it to occur in subject position, so that one may reanalyze henduo as a predicate of a relative clause modifying the subject head noun, as in

[[ e henduo]<sub>S</sub> (de) ren]<sub>Np</sub> qu le  
           many           nom. person go asp.

Complex NPs are of course allowed in subject position.

- <sup>43</sup>Evans observes, for example, that phrases like 'everyone' do not introduce referents, as in

"Every congressman<sub>i</sub> came to the party, and \*he<sub>i</sub> had a marvellous time."

Note that if they replaces he, the sentence becomes grammatical. This suggests that its inability to bind pronouns cross-sententially may be due to the agreement properties of every rather than to inherent semantic properties of the universal quantifier. If that is the case, the view that every is non-referential is not entirely valid.

- <sup>44</sup>In our argument two different types of c-command are used. The c-command assumed for the Condition on Proper Binding is Reinhart's original definition of c-command. On the other hand, the Scope Domain Principle (following May 1985), uses AS c-command, i.e. an element c-commands another element iff neither dominates the other and the first XP dominating the first also dominates the second. It is also assumed (following May) that in the case where the XP is a node projection such as

$[\alpha \text{ } [ \beta \text{ } \dots ]_{XP}]_{XP}$

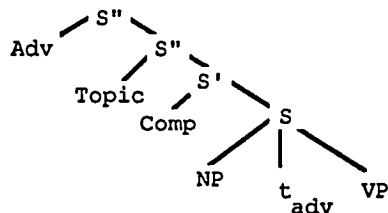
$\alpha$  c-commands  $\beta$  iff every member of the first XP projection dominating  $\alpha$  also dominates the latter. Thus here,  $\alpha$  c-commands  $\beta$  but not vice versa.

- <sup>45</sup>Like May (1977), we do not deal with the opaque reading of the object numeral phrase, which arises with irrealis verbs such as want. As observed by May, the transparent reading of the object Q-NP is always available, whereas the availability of



the opaque reading depends on the verb. The transparent reading is the unmarked reading which should be captured by the grammar.

- <sup>46</sup> We are leaving aside the issue of subjacency until section 1.3.3 and will simply assume that movement out of a complex NP is permissible.
- <sup>47</sup> As we will see from section 1.3, the binding of Q-NP traces by operators at LF is governed by the Binding Principles. It is permissible for a Q-NP in the matrix clause to bind its trace in the embedded subject position.
- <sup>48</sup> The success of our analysis crucially depends on the assumption that sentential subjects are analyzed as in Fig. 18 with a S node dominated by a NP node. If sentential subjects are not represented in this way (cf. Koster 1978), alternative accounts need to be found to explain the referential properties of numeral phrases in these contexts.
- <sup>49</sup> Note the structure is also ill-formed according to the PCC, as the path connecting NP<sub>2</sub> and the intermediate trace {S".S"} overlaps with the path connecting the intermediate trace and t<sub>2</sub> in object position {S",S,VP}. However, it is not clear whether the PCC should apply here because the same quantifier chain is involved in this case. If PCC should apply to such a case, it would also rule out successive wh-movement for the same reason.
- <sup>50</sup> Our analysis would also predict that if we have a modal adverb which is clearly not a verb, e.g. *yexu* (which cannot be negated, or take A-not-A form), subject numeral phrases should also be allowed and that both referential and non-referential readings should be possible, since in the following structure, no PCC violation would result whether NP<sub>1</sub> adjoins to the lower or upper S".

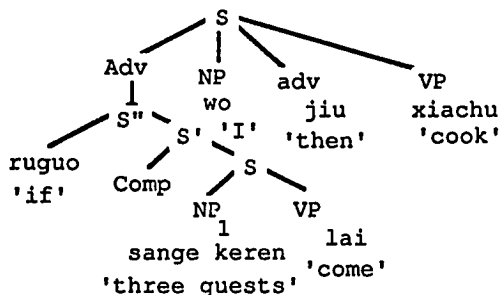


In a sentence such as

[sange ren] yexu yijing wancheng renwu  
 three person perhaps already complete task

the numeral phrase seems to have both a referential reading and a non-referential reading.

- <sup>51</sup>At this point, we do not have a structural analysis of numeral phrases occurring in hypothetical clauses (cf (256)), and why the reading there must be non-referential. One might propose a structure such as the following



Here S'' will not be pruned because it branches. NP<sub>1</sub> can then adjoin to S'' and the interpretation of NP<sub>1</sub> will remain clause-bounded, a non-referential reading. But we believe that the semantics of the conditional contributes to the non-referential interpretation because not all subordinate clauses show this property. If the subordinate clause is a before or after clause, the numeral phrase seem to be excluded from subject position, as in

?[sange keren zou le zihou] women jiu xiachu  
 three guest leave asp. after we then cook  
 "We will cook after three guests have left"

The sentence can be understood only if the matrix clause has an understood topic, in which case only a referential interpretation of the numeral phrase can be obtained.

- <sup>52</sup>For instance, substitutivity of identicals is observed, as the following sentences have the same truth value.

meiguo zongtong bu gao  
 America president not tall "The American President is not tall"

leigen bu gao  
 Reagan not tall "Reagan is not tall"

It is hard to test the effect of bu on Q-NPs in subject position because these normally occur with other operators. The sentence

meige ren dou bu lai "Everyone is not coming"

cannot have an interpretation where Neg has scope over the subject meaning 'not all'.

For sentence negation, [bu shi] "not be" is used instead, which can negate any constituent. Thus

women bushi mai yiben xiaoshuo  
 we not be buy one novel  
 "We are not buying one novel"

bushi women mai yiben xiaoshuo  
 not be we buy one novel  
 "it is not the case we are buying a novel"

We can capture this fact that bushi at LF adjoins to S" having sentential scope. It should be pointed out that in general it is easier to have a numeral phrase within the scope of aspectual negator meiyou. The sentence below is much better than (279c).

?women meiyou mai yiben xiaoshuo  
 we not have buy one novel "we didn't buy a novel"

This could be attributed to the fact that the morpheme you has verbal properties (e.g. in being able to assume A-not-A form). A parallel situation holds for verbs such as want

women bu xiang [e mai yiben xiaoshuo]  
 we not want buy one novel  
 "we don't want to buy a novel"

In these cases, while the numeral phrase is still under the scope of negation, the negator is not found in the same clause or verb phrase as the numeral phrase, hence the weakened negating effect.

<sup>53</sup>It should be noted that the following sentence sounds acceptable.

[meiben xiaoshuo<sub>1</sub> [meige ren dou kan le t<sub>1</sub>]  
 every novel every person all read asp.  
 "Every novel, everybody has read"

Since we argue here that the universal quantifier NPs behave like variables, it must be the case that they are simultaneously bound by the same operator. This appears to be a permissible violation of our Bijection principle, cf (152).

<sup>54</sup>There are syntactic arguments against such a semantic view because the structure [Q-NP<sub>1</sub> V Q-NP<sub>2</sub>]<sub>S</sub> is a very productive construction, with no restriction imposed on the type of noun phrases within it. In addition, insertion of other constituents within the construction is possible, e.g.

[tamen yige ren changchang guan wuge xiaohai]  
 they one person often take-care five kid  
 "As for them, one person often takes care of five kids"

At this point we are relying on a semantic account to make sense of the facts. Our conception is based on similar ideas developed in Heim (1982).

- 55 May's Rule of QR is subject to the Condition on Analyzability, which states that " if a rule  $\phi$  mentions SPEC, then  $\phi$  applies to the minimal [+N] phrase dominating SPEC, which is not immediately dominated by another [+N] phrase. When applied to the structure in Fig. 30a, the SPEC of the NP is QP, so QR applies to the NP of which the QP is SPEC by this condition, i.e. NP<sub>2</sub>. As Huang observes, this condition mainly prevents extracting a head away from its periphery.
- 56 Strictly speaking, Huang's General Condition on Scope interpretation will not govern the NP internal quantification cases such as (30a,b), because the relevant Q-NPs show a relationship of dominance rather than c-command (cf Fig. 30 a,b). It is of course true that the QPs (quantifier +CL) in the structures show a relationship of c-command. In Fig. 30a, sange 'three+CL' c-commands meiben 'every+CL'. In Fig. 30b, meige 'every+CL' c-commands liangge 'two+CL'.
- 57 I am grateful to Tim Stowell and Ken Wexler for drawing my attention to such an entailment.
- 58 In these examples meige N can occur without dou support because they are in prepositional object position and not in subject position, with PP available as adjunction site.
- 59 It should be noted that (315) is an apparent violation of the V' constraint proposed in Huang (1982). These sentences may sound a little awkward because of the complex NP objects, but they are grammatical sentences. Further the scope interpretation is unambiguously one which is predicted by linear order.
- 60 Another generalization that can be made for Fig. 33-34 is that the Crossover constraint on dou-coindexing operates at LF, and applies when both the operator and its trace are crossed over. Thus in Fig. 33, the wh word and its trace remain within the binding path of dou. In Fig. 34, NP<sub>2</sub>, which adjoins to PP, and its trace will also be within the path of dou.
- 61 As observed in Li and Thompson (1981:550), the A-not-A question in used in a context in which "the questioner has no assumptions concerning the proposition that is being questioned and wishes to know whether it is true." Thus, for example, in a situation where one finds out that someone's surname is not the same as one has supposed, one cannot use an A-not-A question, but must use a ma question, as in  
ni xing Li ma?  
you surname part.

"Do you have surname Li?"

<sup>62</sup> Note that our revised general condition on scope interpretation does not apply here. The universal quantifier and the ma operator c-command as well as command each other, so hierarchically they are of the same rank. The Linearity Condition should predict that the universal quantifier, which precedes ma at SS, should have wide scope, contrary to the interpretation available. It may be that linear precedence is relevant only to constituents within the proposition.

<sup>64</sup> In an insightful study of scope order of adverbs, Teng (1983) classifies adverbs into subject-oriented adverbs and VP-oriented adverbs, as well as adverbs that can quantify both subject and VP. He observes that there is a constraint against ordering a VP-oriented adverb before a subject-oriented adverb. Thus we might account for (320a-d) using this principle. We believe that our condition on scope interpretation is more general in that Teng's proposal, which observes that the directions/paths of quantification of two adverbs cannot cross each other, will not be able to account for the Cross-over effects of dou with respect to wh-words and Q-NPs, since the latter are neither subject-oriented nor VP-oriented modifiers.

<sup>65</sup> The fact that an A-not-A operator cannot cooccur with a wh-operator can be seen from the following.

\*shei mai bu mai huozai?  
who buy not buy matches  
\*Does who (want to) buy matches?"

<sup>66</sup> Huang analyzes the preposition gen in (324d,e) as a complementizer. It is treated as a preposition here. Nothing, however hinges on this difference of treatment.

<sup>67</sup> Huang (1981) gives the following rule of dou-quantification:

"for every universally quantifiable NP preceding dou, if it does not already c-command dou and a coindexed variable, then Chomsky-adjoin it to the lowest possible node, leaving a trace behind as its variable, so that it may c-command both dou and the variable."

As we will see later, our general account of dou-coindexing will render this ad-hoc rule unnecessary.

<sup>68</sup> For Huang, the crucial evidence for wh-movement violating subjacency comes from the sentence

ta xiang zhidao [shei mai le shenme]

which in his judgment is three ways ambiguous, having two question readings and a declarative reading. Our judgment differs from his, as only the declarative reading is possible for us, i.e. "S/he wants to know who bought what".

- <sup>70</sup>We are leaving aside issues such as the Definiteness constraint, as in

Our argument will concern cases where wide scope movement is possible.

- [sanben<sub>2</sub> [t<sub>2</sub> [shei de shu]]]  
three who nom book

<sup>72</sup>The fact that subject position is a properly governed position in Chinese can be seen from the lack of that-trace effects in syntactic movement in Chinese (cf Huang 1982), as illustrated by

<sup>73</sup> For the structure shown in Fig. 41b, we can derive that fact that NP<sub>3</sub> can only have an internal reading by invoking our Feature percolation convention, as the index of you will not be passed to NP<sub>3</sub>. So one need not resort to the notion of governing category on the basis of evidence such as Fig. 41b. However, feature percolation will not be relevant to Fig. 41a where you is absent, and the availability of an internal reading

of NP<sub>3</sub> still necessitates the hypothesis that governing category is relevant.

<sup>74</sup>As observed in Liu (1984), in Chinese ta ziji is a truer reflexive than ziji, which has long distance coindexing properties.

(a) Zhangsan<sub>i</sub> shuo [Lisi<sub>j</sub> taoyan ziji<sub>k</sub>]  
say dislike self

(b) Zhangsan<sub>i</sub> shuo [Lisi<sub>j</sub> taoyan ta ziji<sub>k</sub>]  
say dislike s/he self

In (a) , i=j or i=k; but in (b) k=j, k cannot be=i.

<sup>75</sup>Alternatively, one may eliminate clause (i) of the revised General condition for scope interpretation (360) altogether, since it can be derived from QR ,the LF condition (361) and the requirement that the traces of Q-NPs need to be bound within their governing category. This would mean that the language-specific scope principle we need for Chinese is simply a linearity condition.

## Chapter Two

### Acquisition of Quantificational Scope in Chinese

#### 2.1 A Principled Account of Acquisition of Quantificational Scope

##### 2.1.0 Introduction

The acquisition of quantificational competence has been a subject of considerable interest in the past two decades and has attracted a number of experimental studies by psychologists and linguists. The pioneering work was Inhelder and Piaget (1964), who studied children's interpretation of universal quantifiers in the context of class inclusion. In their experiments, four- to seven-year-olds were tested on their understanding of questions such as "are all the circles blue?" or "are all the red ones squares?", where a property or attribute expressed as an adjective or noun is predicated of a subject quantifier phrase. Smith (1980) represents a more recent effort in the same direction; she investigated four- to seven-year-olds' understanding of similar types of test questions involving single quantifier phrases<sup>1</sup>; the experimental design she used did not rely on visual stimulus but rather on the child's ability to respond freely to the questions based on their common knowledge. The child's interpretation of all and some received further attention in the work of Roeper and Matthei (1975), which was also the first to report on how children aged between three and nine understood the relative scope of all and not in sentences such as 'not all the circles are black.' The acquisition of the relative



scope of quantifiers and negation was examined in a subsequent study by Ianucci and Dodd (1980), in which subjects aged between five and thirteen were tested on their interpretation of sentences with all and some preceding not as well as sentences with not preceding all.

There have also been a number of studies which explore children's understanding of sentences containing more than one quantifier phrase. Donaldson and Lloyd (1974) tested a small sample of children (N=14) on sentences with both a universal quantifier and an existential quantifier (e.g. Each car is in a garage) as well as sentences involving just a universal quantifier (e.g. All the garage doors are shut). Carpenter (1984) investigated four to nine year-olds' interpretation of the relative scope of two quantifier phrases within a complex NP (e.g. Did every elephant on some planet get striped?), with a view to testing the validity of such conditions on LF as the Condition on Proper Binding and the Condition on Analyzability as proposed in May (1977).

There have also been theoretical accounts of acquisition of quantification by philosophers and linguists. Notable amongst these is Quine (1973), who speculates that the origin of variable binding operations may lie in an interplay of the child's mastery of relative clauses and interrogatives with his/her grasp of universal categorical statements of the form "Every  $\alpha$  is a  $\beta$ ". Taking a view diametrically opposite to Quine's, Fodor (1980) reasons that if the child learns by means of a process of hypothesis testing and confirmation, the operator-variable binding mechanisms of

first-order logic must be innate, as the formulation of the hypothesis itself entails a language as rich as predicate calculus. More recently, Hornstein (1984) has proposed an even more constrained view than Fodor's in terms of the framework of Government and Binding, and has argued that quantificational competence is acquired by setting the values of certain parameters of UG.

The question of how children acquire quantificational competence presents a particularly interesting learnability problem from the perspective of UG, because the linguistic knowledge required for such a competence seems highly abstract and not learnable from experience. In order to interpret a sentence consisting of two Q-NPs such as (1), a child not only needs to

(1) Everyone saw a film

understand the quantifiers, but would also need to have an apparatus for representing operator-variable relationships and for determining the relative scope of the two quantifier phrases. Given the well-known fact that little or no explicit instruction goes on in child language acquisition and that the child has only positive evidence to base his linguistic hypotheses on (cf. Brown and Hanlon 1968, Wexler and Culicover 1980, Hornstein and Lightfoot 1981), an understanding of how such an abstract form of knowledge can evolve in the child will shed light on the principles of UG as well as on other learning principles that govern language acquisition.

This chapter focusses on the acquisition of an essential aspect

of quantificational competence, namely, the acquisition of quantifier scope. It is divided into two major sections: first, a principled account of how quantifier scope is acquired will be sketched. This account will be based on the conception that language acquisition is a highly constrained and deterministic process and that it largely involves the setting of values for various parameters of UG on the basis of positive evidence (cf. Chomsky 1981, Hyams 1983, Borer and Wexler 1986). A parameter of scope order will be proposed, with evidence drawn from Chinese and English; and the possible stages that children may go through as predicted by our model will be delineated. Secondly, a small-scale cross-linguistic study will be reported on how English and Chinese children aged between three and eight interpret the relative scope of universal and existential quantifiers. The implications of the data for our model will be discussed and the differences between the English and Chinese data will be analyzed in terms of the syntactic differences between the two languages. A subsection of the experiment we will report is concerned with marked scope orders and possible triggers for the acquisition of the scope interpretation principle relevant to Chinese. The specific areas investigated on this issue were the relative scope of modals and negation and topic structures. Finally, we will conclude by reviewing what the experimental data collected so far (in the present study as well as in previous works) have informed us about the acquisition of quantificational competence; further experiments that can be carried out to test the implications

of our framework will be suggested.

### 2.1.1 Linguistic Prerequisites: Learnable and Unlearnable

As we have seen in Chapter 1.3, the analysis of quantificational phenomena in Chinese with respect to the boundedness of QR requires the notion of governing category and the assumption that Q-NPs at LF are A'-anaphors. That these assumptions are well-motivated for English is supported by studies such as Hornstein (1984), Aoun (1985). As there is a fair amount of evidence for postulating these theoretical primitives, it appears that the properties of UG that must be assumed for the child are at least the following: (a) the notion of governing category and the hierarchical relations it entails (e.g. the notion of c-command). As proposed in Wexler and Manzini (in press), a governing category for an element  $\alpha$  can be thought of as consisting of  $\alpha$  plus another constituent. That constituent is subject to parametric variation: it could be a SUBJECT, an INFL, a TNS, an indicative TNS, or a root TNS. The governing category defined by these five values of the parameter form a successive subset relationship: for instance, with regard to anaphors, a governing category with value SUBJECT will be a subset of a governing category defined by value INFL. Likewise, a governing category with value INFL will be a subset of that with value TNS, and so forth. We can thus assume, following Wexler and Manzini's formulation, that children in their initial state have the notion of governing category with the unmarked value SUBJECT, i.e. the value that defines the smallest governing category. (b) The second type of

UG prerequisite will be the Binding principles relevant to A' anaphors, assuming the Extended Binding theory of Aoun(1985), to wit, Principle A of the Binding theory : 'an anaphor must be X-bound within its governing category.' (c) The rule of Quantifier Raising, which enables the child to decompose a quantifier phrase into an operator-variable pair by means of adjunction. As observed in Chomsky (1981) and Hyams (1984), LF is a level of grammar to which the child has no positive evidence, since the mapping from SS to LF involves only non-overt movement; a rule such as QR must therefore be part of UG. Fodor (1985) has also argued convincingly that variable-binding operations are not learnable by systems which are less rich than first-order quantificational logic,<sup>2</sup> and must therefore be unlearned. (d) The Condition on Proper Binding, which requires that the traces of QR be bound by c-commanding constituents. This is necessary to disallow LF representations such as the following.

(2) \* x said [ every x, [ John will leave the country]]

(3) \* x saw [ some x [ John's father]]

(4) Everyone said [John will leave the country]

(5) Someone saw John's father

Thus (4) cannot be represented as (2) at LF, and neither can (5) have a LF structure as in (3), where the variable is left free and the quantifier vacuous. In other words, the Condition on Proper Binding will rule out an interpretation such as "\*someone (reference to be picked up from discourse context) said for everyone, John will

leave the country" for (4); likewise, it will also prohibit an interpretation such as "\*someone (reference to be picked up from discourse) saw for someone, John's father" for (5).<sup>3</sup>

Even with the four primitives of UG given above, the child will still not be in a position to interpret quantifier scope. To achieve competence in handling scope relations, the child would need to assign NPs to categories, so that quantifier phrases can be separated from non-quantifier noun phrases. This is necessary because only quantifier phrases undergo QR. It appears that two steps will be involved in the identification of Q-NPs. One is that the child would need to understand the semantics of the noun phrase concerned. If the noun phrase denotes quantity, either in an absolute or relative sense, then the noun phrase will be identified as [+quantifier]. Thus singular NPs of the form [yi-CL-N] / [a/some N] and numeral phrases can be established as [+quantifier] on the basis of cardinality. NPs involving all, every, each, mei-CL 'every', suoyou 'all' can also be categorized as [+quantifier] once the child realizes that such phrases imply an exhaustion of the entities of the set satisfying a propositional function. By this criterion, proper names such as John, Lisi and definite descriptions such as zhetou gou 'this dog', the man over there will be assigned [-quantifier] status, as these terms do not describe quantity.

As Hornstein (1984) suggests, quantifier phrases should be subclassified since noun phrases having the [+quantifier] feature can show very different syntactic properties. Hornstein proposes a

major division between two types of quantifiers based on (a) whether the NP can undergo QR to form operator-variable pairs, (b) whether it shows interpretive dependence, (c) whether it can bind pronouns it does not c-command and whether it can bind pronouns across sentences, and (d) whether it is subject to the Leftness Condition, the constraint that states a variable cannot be coindexed with a pronoun to its left. It appears that certain Q-NPs such as everyone and someone are bona fide quantifiers in that they can undergo QR and are subject to locality conditions. These quantifiers are basically clause-bounded, and cannot have scope over another quantifier outside of their governing category. Thus in (6), everyone must be bound at LF within the embedded clause. The sentence cannot mean "For every x, there is a y such that y said that John saw x". These quantifiers are called Type II quantifiers.

(6) Someone said [that John saw everyone]

(7) Someone saw everyone

(8) \*Take every number<sub>i</sub>. Divide it<sub>i</sub> by two.

(9) \*If Bill likes everyone<sub>i</sub>, then Sam lends him<sub>i</sub> money

(10) \*[That he<sub>i</sub> was drafted] shouldn't bother every patriot<sub>i</sub>

Another property shown by quantifiers of this type is the relative scope property of quantifiers (cf. Keenan 1971). As shown in sentences such as (7), each of the quantifiers can fall within the scope of the other; the range of a variable bound by a quantifier can be dependent on that of the variable bound by another quantifier. In other words, these quantifiers show interpretive dependence. As

(8-10) illustrate, Type II quantifiers cannot bind pronouns they do not c-command and consequently cannot coindex with pronouns in a different sentence. Further, these quantifiers obey the Leftness Condition in not being able to be coreferential with a non-c-commanding pronoun to its left.

On the other hand, there are other quantifiers such as a certain N, anyone which behave in exactly opposite ways to the Type II quantifiers. These quantifiers, called Type I quantifiers, do not undergo QR, as reflected in their ability to violate scope islands and the fact that they can be interpretively independent.

(11) Someone said [that John saw a certain woman]

(12) Everyone saw a certain man

(13) If Bill likes anyone<sub>i</sub>, then Sam lends him<sub>i</sub> money

(14) Take any number<sub>i</sub>. Divide it<sub>i</sub> by two

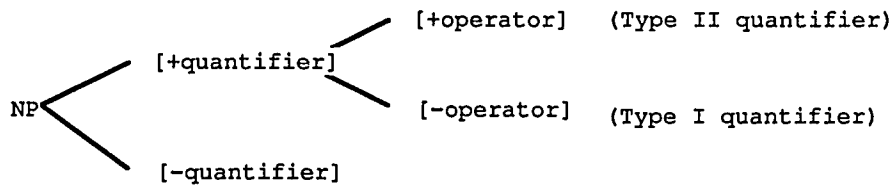
(15) [That he<sub>i</sub> was drafted] should not bother any patriot<sub>i</sub>

In (11), for example, a certain woman must have scope beyond its governing category, i.e. the embedded clause, so that the sentence should be interpreted as 'for a certain woman x, there is a y such that y said John saw x'. While (7) is ambiguous, (12) has only the reading where a certain woman has wide scope. In other words, the reference of a certain woman is taken independently of the quantifier everyone in the sentence. (13-15) illustrate the fact that a Type I quantifier can bind a pronoun it does not c-command as well as a pronoun in a different sentence than it is, and that it can violate the Leftness Condition.



The main distinction underlying the cluster of differences between the two quantifier types is that Type I quantifiers do not undergo QR; they behave like names and are subject to Principle C of the Binding theory. Since they behave like referential expressions, they can always have wide scope, be interpretively independent, and coindex with pronouns in discourse freely without having to obey various structural constraints on pronominal binding. Type II quantifiers, on the other hand, undergo QR, which is locally bound. Since a variable-binding operation is involved, they have to obey structural constraints on binding such as the Condition on Proper Binding and the Leftness Condition. This accounts for their inability to bind pronouns they do not c-command or pronouns across discourse, as well as their inability to coindex with pronouns to their left, even if the latter do not c-command them.<sup>4</sup> Type II quantifiers are subject to Principle A of the Binding theory.

In this view of Hornstein's, the crucial distinction separating these [+quantifier] elements is whether they form operator-variable relationships at LF, and to mark such a distinction, he proposed an additional parameter of UG: [+/- operator]. Type II quantifiers such as everyone, someone receive the feature [+operator], whereas Type I quantifiers such as a certain N, any N will be assigned the feature [-operator]. Thus NPs are subclassified according to the following scheme, which is assumed to be innate.



The task of identifying Q-NPs is reduced to the task of setting the +/- values of these two parameters. As we suggested earlier, the semantics of the noun phrase will tell the child whether a NP is [+quantifier]. When deciding whether a [+quantifier] NP is [+operator], the child will, according to Hornstein, rely on syntactic data such as whether the Q-NP in question can bind a pronoun it does not c-command or whether it can bind pronouns across sentences boundaries, as in (13-14). Hornstein proposed that the unmarked value of the [+/-operator] parameter be [+operator], so that the child assumes that a [+quantifier] phrase can undergo QR unless positive evidence pointing to the contrary (such as (13-15)) is presented. In this way, fairly simple data will allow the child to fix the relevant parameters for identification of the elements that are moved by QR. An important argument raised by Hornstein for having [+operator] as the unmarked value is that if [-operator] is assumed to be the default value, it would be very difficult for the child to separate universal quantifiers such as any and every into two categories. This is because in order for the child to discover that every, unlike any, cannot bind pronouns it does not c-command, or that it cannot bind pronouns across sentences, the child would need to have negative evidence such as (8-9), which occurrence in the child's primary data is highly unlikely. On the

other hand, sentences such as (13-14) are fairly common sentences in the language, presumably easily accessible to the child. Thus it would simplify the learning task if [+operator] is taken as the unmarked option.

While Hornstein's proposal to incorporate a syntactic dimension into the classification of quantifiers captures an insight and should be maintained, we would like to present two arguments concerning the identification of Q-NPs which differ from his. One is that we believe the unmarked value for the [+/-operator] parameter is [-operator] rather than [+operator]. Secondly, we suggest that the main clue the child relies on for sorting out the Type I and Type II quantifiers is whether the noun phrase in question shows interpretive dependence. If the NP allows its referential value to be functionally dependent on another logical operator, the child would classify the item as [+operator]. Until such evidence is available to the child, the [+quantifier] NP will be regarded as essentially non-binding in character. Our position is based on the following considerations.

Firstly, there does not seem to be a sharp demarcation between Type I and Type II quantifiers according to the cluster of syntactic properties discussed above: not all quantifiers of the same type behave in exactly the same way with regard to the set of distinguishing properties. If we consider, for instance, the quantifier's ability to bind pronouns it does not c-command and pronouns across sentence boundaries, it appears that among Type II

quantifiers, a N and all the N fail to pattern with every N, and even every N can, in some contexts, bind pronouns it does not c-command. As (16-19) illustrate, these Type II quantifiers can violate the constraints on pronominal coindexing which quantifiers such as every are generally subject to.<sup>5</sup>

(16) Take a book<sub>i</sub>. Sit down and read it<sub>i</sub>.

(17) Open all the drawers<sub>i</sub> and wash them<sub>i</sub> with soap.  
every drawer<sub>i</sub> it<sub>i</sub>

(18) If you loan me all the books<sub>i</sub> now, I will return them<sub>i</sub> to you next week.

(19) If you draw me a picture<sub>i</sub>, I will frame it<sub>i</sub> in my office.

If quantifiers like a book and all the drawers are initially treated as [+operator], these instances should force the child to reanalyze them as [-operator] according to Hornstein's criteria. Does that mean that the [+operator] feature will be retained and a certain degree of cross-classification will be tolerated? If that is the case, it would stand to reason to argue that quantifiers such as any, which are supported by positive evidence akin to (16-19), should be treated in exactly the same way and be classified as both a Type I and a Type II quantifier.

Another example illustrating the lack of sharp boundary between Type I and II quantifiers vis-a-vis the complete set of Hornstein's criteria is that the quantifier any, while being able to bind pronouns across discourse, is nonetheless constrained by locality conditions. Thus in sentences such as (20), the universal quantifier cannot escape the scope island and have scope over the subject

existential quantifier.

(20) Someone said [that John did not take any examination]

The sentence cannot be understood as "for all x=examination, there is a y such that y said that John did not take x". Thus any can be placed in the Type I category on the basis of a subset of the criteria, when in fact it may exhibit properties similar to Type II quantifiers.

Another major problem with adopting a set of criteria that do not consistently differentiate the two types of quantifiers is that it presupposes that the criteria themselves are in some sense unlearned. To be able to sort out quantifiers into different types, the child would need to have knowledge of the criteria for differentiation; implicit in Hornstein (1984) is the suggestion that the criteria themselves are part of the child's initial state. While criteria such as locality conditions for QR and interpretative dependence seem to be sound candidate principles of UG, such criteria as pronoun coindexing may not hold across languages. In Chinese, for example, whether a noun phrases can coindex with pronouns it does not c-command or whether it can coindex with pronouns in a different sentence does not suffice to classify quantifiers, as the following indicate.

(21) ruguo meige ren<sub>i</sub> dou lai, wo hui qing \*ta<sub>i</sub> chi haixian  
          suoyou ren<sub>i</sub>  tamen<sub>i</sub>  
          if everyone all come I will treat \*him/her eat seafood  
          all  them  
          "If everyone comes, I will treat them to seafood"

- (22) BA meige tongxue<sub>i</sub> dou jiao lai. Jiao \*ta<sub>i</sub> zuo gongke  
suoyou tongxue<sub>i</sub> tamen<sub>i</sub>  
 every student all ask come ask \*him/her do homework  
 all students  
 "Ask every student/all students to come. Ask them/\*him/\*her to  
 do his/her homework"

In the above sentences, both meige N and suoyou N can coindex with pronouns quite freely as long as the pronoun is plural and not singular.<sup>6</sup> In other words, the Chinese child will have occasion to hear the well-formed versions of (21-22), which will lead him to place these universal quantifiers in the same category as referring expressions (Type I). But as is clear from our discussion in Ch. 1, these quantifiers undergo QR and have to be A'-bound within their governing category. Thus the criterion on pronoun coindexing will mislead the child into a wrong classification. In Chinese, too, the Leftness condition will also fail to differentiate quantifiers due to the language-specific fact that generally a pronoun in a subordinate clause preceding another NP in the main clause cannot be coreferential with the latter.

- (23) \*[gongsì jiēpíng le ta<sub>i</sub>] shì Zhāngsān<sub>i</sub> hěn shāngxīn  
 \* tamen<sub>i</sub> meige rén<sub>i</sub> (dou)  
 \* suoyou rén<sub>i</sub> (dou)  
 \* [Zhāngsān he Lisi]<sub>i</sub>  
 company fire asp. him/her make Zhāngsān very sad  
 them everyone all  
 all all  
 Zhāngsān and Lisi  
 "(that) the company fired him/her/them made Zhāngsān/everyone/  
 all/Zhāngsān and Lisi very sad"

As (23) shows, whether the noun is singular or plural, and whether the relevant antecedent NP is a proper name or a conjoined NP or any of the universal quantifiers, such coindexing will be ruled out.

In the preceding discussion we have observed a number of

problems with using the Leftness Condition and the c-command restriction on pronoun coreference as criteria for distinguishing [+operator] quantifiers from [-operator] quantifiers. We suggest here that the crucial criterion relevant to the fixing of the value for this parameter is whether the [+quantifier] element in question is able to show interpretive dependence and whether it can fall within the scope of other logical operators. In the absence of positive evidence to this effect, the child will assume that the quantifier phrase is [-operator]; if evidence demonstrates the contrary, the child will classify the NP as [+operator] and will know immediately from Principle A of the Binding theory that the quantifier phrase is subject to locality conditions. This is because the traces of operators are A' anaphors at LF. The kind of data the child requires to establish [+operator] status is very simple: sentences such as the following:

(24) Everyone will get a cookie

(25) Not everyone went to the party

Taking the reading of (24) where the subject NP has wide scope over the object NP, we have a situation where a child receives input that the interpretation of a cookie depends on that of the quantifier everyone; in (25), everyone falls within the scope of another operator (i.e. Neg) and must have narrow scope with respect to not. That will suffice for the child to assign a cookie and everyone to the [+operator] category. Note that similar data is not available for quantifiers such as a certain N, since it has the property of

interpretive independence and is thus not sensitive to the presence of other quantificational elements. In (26-27) below, clearly the reference of a certain N is fixed irrespective of the effect of other quantifiers in the sentence.

(26) Everyone taught a certain class last year.

(27) John didn't see a certain man.

With any, in sentences consisting of only two quantificational elements, evidence bearing on its interpretive dependence will be hard to come by, since any always has scope over negation if it is analyzed as a universal quantifier, and it does not interact with other quantifiers in the absence of a downward-entailing expression.<sup>7</sup>

(28) John doesn't know anyone

(29) \*someone saw anyone

(30) No student did any of the homework

(31) Any of the dolls will look nice in a new dress

(28) is unambiguous, having only the reading where anyone has wide scope over negation, "for all x, John doesn't know x". (29-30) show that any requires the presence of an additional operator to license its presence. As in (28), any in (30) only has the reading "for all x=homework, there is no y=student, such that y did x", again with any taking wide scope. As can be seen from (31), while any can have another quantifier (i.e. a new dress) within its scope, evidence will not be available for the child that any as a universal quantifier will be interpretively dependent on another quantifier.



Thus any will remain in the category [-operator].<sup>8</sup>

A strong motivation for emphasizing the central role of interpretive dependence as a criterion for distinguishing operators from non-operators stems from the fact that by this criterion, all definite descriptions and proper names will be categorized as non-operators, irrespective of the number of entities they denote.

(32) Everyone saw those three prisoners in court

(33) Someone kissed John and Mary

(34) All of us recognized the boys over there

In all the above sentences the definite NPs are clearly referentially independent of the preceding Q-NPs, indicating that they lack the characteristic property of operators. On the other hand, most noun phrases containing quantifier determiners (irrespective of whether they can bind pronouns across discourse) demonstrate scope dependence in at least some contexts.

(35) Everyone bought three tickets

(36) Every teacher of this class likes most of the students

(37) Two of the managers fired some of the workers

(38) Three boys followed two girls

(39) Somebody loves somebody

(40) Most professors admire most students

(35-37) demonstrate that quantifier phrases such as three tickets, most of the students, some of the workers can be interpretively dependent on another quantifier. In (36), most of the students is within the scope of the subject NP, because although the group of

students liked by every teacher has to exceed half the number of students, the group of students liked by various teachers could be different. As can be seen from (38-40), quantifiers like some N, most N and numeral phrases need not always enter into scope dependencies with other quantifiers, as the predominant readings of these sentences are scope-independent readings. Thus the strongest reading for (38) is one where a group of three boys followed a group of two girls. In (40) the choice of students does not have to rely on the choice of professors; and in (39) the two individuals denoted by somebody can be determined irrespective of the values chosen for the other. The point is that whatever the behavior of these quantifiers in certain contexts, evidence such as (35-37) will be available to the child helping him to identify these NPs as operators. In our view, then, with the exception of quantifiers such as a certain N, [+quantifier] elements are generally operators; in the acquisition process, children will have to discover for themselves which of the items in their quantifier inventory are operators, using the criteria of interpretive dependence.

Our assumptions about the default value of the operator parameter are consistent with two notions. One notion is that the interpretive dependence property reflects the status of quantifier operators as A' anaphors at LF. The traces left by these Q-NPs are anaphoric in the sense that the range of the values is delimited by the values of the antecedent variables bound by another quantifier. Another notion reflected by having [-operator] as the unmarked value

is that referentiality in natural language is the unmarked case (cf. Jackendoff 1983:69), so that a singular NP such as a book or a numeral phrase such as three tickets are not initially interpreted as A' anaphors but are instead taken as names. Whether this principle is true is of course an empirical question; as we will see in later sections, some support can be found for the underlying assumptions of our proposal.

If referentiality is considered the unmarked case for all NPs, the child's identification of quantifiers and operators can be conceived of as involving three different types of clues. The first type of clue concerns the semantics of the quantifiers, the detection of the NP as denoting quantity. The second type of clue which can guide the children as an intermediate step is whether the NP can function non-referentially in a sentence. On the basis of data such as (41-45), the child can deduce from their non-referentiality that NPs like a N, every N, and all the N are possible candidates for operator status.

(41) Who has got a pen?

(42) John is a doctor

(43) Every dog barks

(44) I didn't see everybody.

(45) Not all of them are nice

The child will deduce from (41-42) that a N is often used not to refer to a particular individual and from (43-45) that everybody and all are typically non-referential. Non-referentiality alone,

however, does not suffice for the operator property, since not all non-referential phrases show the relative scope property of quantifiers. As Hornstein has observed, generics are generally scope independent. This seems to be true in both English and Chinese.

(46) A beaver builds every dam itself

(47) Everybody loves a lover

(48) [meige ren] dou mai le [liang jian yifu]  
 everyone all buy asp two CL outfit  
 "everyone bought two outfits"

(49) [liangjian yifu] [meige ren] dou mai le  
 two CL outfit everyone all buy asp  
 "(the) two outfits, everyone bought"

(50) [yige hao zhongyi] neng zhi hao [suoyou de fengshi bing]  
 one good Chinese-doctor can cure all NOM rheumatism  
 "A good Chinese doctor can cure all kinds of rheumatism"

(51) [suoyou de fengshi bing] [yige hao zhongyi] dou neng zhi hao  
 all NOM rheumatism one good Chinese-doctor all can cure  
 "All kinds of rheumatism, a Chinese doctor can cure"

We know that in English an existential quantifier in subject position can fall within the scope of a universal quantifier in object position: in a sentence such as "a book was checked out from every library", a book may have narrow scope. Generic NPs such as a beaver and a lover in (46-47), however, do not exhibit such a characteristic. (46) cannot have the reading "for every dam x, there is a y=beaver, such that y builds x itself"; likewise, (47) does not receive the interpretation "for every x, there is a y=lover such that x loves y". Rather, in each sentence, the generic NP has wide scope, so that (46) means "for every x, if beaver (x), x builds every dam itself" and (47) may be represented as "for every x, if

lover (x), everybody loves x". Turning to the Chinese examples (50-51), recall that the generic phrase in Chinese can only occur in subject position in the presence of a modal. The fact that generics in Chinese do not show interpretive dependence is evidenced by the semantic equivalence of (50) and (51) and the lack of such equivalence in (48-49). In the latter pair of sentences, it is always the case that the Q-NP which comes first takes scope over the other. In the former pair, however, both mean "for all x, if x is a Chinese doctor, x can cure all kinds of rheumatism", showing that the generic phrase does not interact at all with the universal quantifier.<sup>9</sup> Thus although non-referentiality serves as an important clue for the child, explicit data bearing on the interpretive dependence of the NPs is nonetheless required. Non-referentiality, in other words, is a necessary but not sufficient condition for an NP to be ascertained as an operator.

#### 2.1.2 The Parameter of Scope Order

Having acquired the competence to identify certain Q-NPs as operators, the child is next confronted with the task of deciding on the principles for scope interpretation for his/her language. Given two operators  $\alpha$  and  $\beta$ , how can the child decide which should have scope over the other? Here we argue that a parameter of scope order is required on the basis of facts from English and Chinese. We will begin by reviewing the basic facts about scope order in the two languages. In English, it is generally well agreed (cf. May 1977, Hornstein 1984, May 1985, among others) that the scope order of

Q-NPs is free within the minimal clause, and in order for a quantifier  $\alpha$  to have scope over another quantifier  $\beta$ , it is not necessary for  $\alpha$  to c-command or precede  $\beta$  at SS. Thus in (52-53), the prepositional object phrase, while being preceded and c-commanded by the subject NP at SS, can nonetheless have scope over the latter at logical form.

(52) Someone did a favor for everyone

(53) A letter was sent to all the clients

(54) Someone said that every student should pass the examination

(55) Someone wanted every student to pass the examination

(56) Someone read [reviews of every American author]

(57) Someone read [John's reviews of every American author]

As observed in Hornstein (1984), the notion of governing category is relevant to the determination of scope, so that the more descriptively adequate generalization seems to be that a Q-NP  $\alpha$  can have scope over another Q-NP  $\beta$  only if the latter is within the governing category of the former. In other words, a Q-NP can freely have wide scope over another Q-NP within the same governing category. This can be seen from (54-57). In (54), the governing category of every student is the embedded tensed clause, and since the other Q-NP someone does not lie in its governing category, it cannot have scope over the matrix existential quantifier. Thus the sentence is unambiguous and only has the reading "for some x, x said that for every y, y should pass the examination". In contrast, the wide scope reading of every student is possible in (55), which can

receive the interpretation "for every student  $y$ , there is a  $x$  such that  $x$  wanted  $y$  to pass the examination". The sentence is thus ambiguous between a wide scope reading and a narrow scope reading of every student. The difference between (54) and (55) can be explained by the fact that in (55) the governing category of every student is the root clause, since it does not have a subject in the infinitive clause. Since someone is now contained within the governing category of every student, the latter can take wide scope over the existential quantifier. (56-57) illustrate the same point. In (56), the governing category of every American author is the root clause and the sentence can be understood in the sense that different people read reviews of different American authors. In (57), however, the governing category of every American author is the complex NP with John as its subject. Hence the sentence is most naturally understood in the sense that it is the same person that read John's reviews of every American author; the universal quantifier in this case has to be bounded within the complex NP.

The fact that Q-NPs in English can enter into scope relations with other quantifiers in violation of SS c-command and linear precedence relations can also be viewed in terms of a broader range of quantifier phenomenon. It is a well-known fact that for example, Q-NPs in subject position can have narrow scope with respect to the negator which it precedes and c-commands, as illustrated in (58), which has the interpretation 'not everyone is rich', as well as in (59), where someone can have scope over the negator.<sup>10</sup>

(58) Everyone is not rich

(59) I didn't see someone

(60) Visitors may not enter the garden

It is also the case that the relative scope of modals and negation often does not accord with SS linear order. In (60), for example, the modal precedes the negative at SS, but on the deontic sense of the modal, the dominant reading is 'visitors are not permitted to enter the garden' with the negative having scope over the modal.<sup>11</sup> As we have seen in Ch. 1, this property fails to hold of Chinese.

The facts in Chinese can be summarized by considering the following configurations:

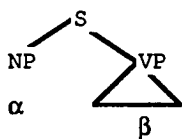


Fig. 1a

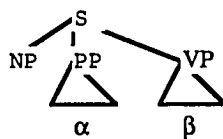


Fig. 1b

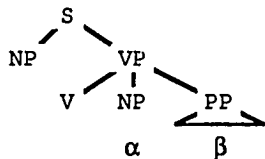


Fig. 1c

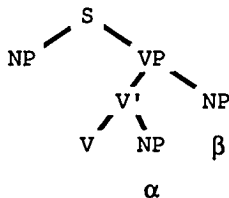


Fig. 1d

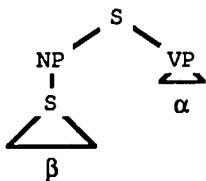


Fig. 1e

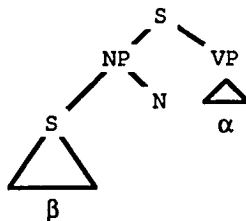


Fig. 1f

(61) a. [meige ren] dou mai le [yiben shu]  
every person all buy asp one-CL book

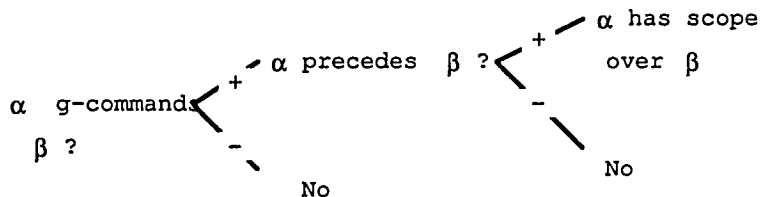


"everybody bought a book"

- b. Zhangsan [zai yige difang] ban hao le [suoyou de shiqing]  
at one place complete asp all NOM matter  
"Zhangsan completed all the errands/tasks at one place"
- c. Wo xie le [san shou shi] gei [meige tongxue]  
I write asp three CL poem for every classmate  
"I wrote three poems for every classmate"
- d. Lisi song le [meige laoshi] [yizhang hua]  
present asp every teacher one-CL drawing  
"Lisi presented every teacher with a drawing"
- e. [Zhangsan kao shang le wu jia mingpai daxue]  
Zhangsan gain-admission-to asp five-CL famous college  
shi [meige ren] dou hen jingya  
make every-CL person all very surprised  
"That Zhangsan gained admission to five colleges surprised everyone"
- f. [[ zhu gei san ge ren] de fangjian] yiding bu kuanchang  
rent to three person NOM room certainly not spacious  
"rooms rented to three persons are certainly not spacious"

The relative scope of  $\alpha$  and  $\beta$  in Fig. 1a-1f is illustrated by corresponding examples in (61a-f). Thus in (61a), meige ren 'everyone' must have scope over yiben shu 'a book'. In (61b), it must be the case that Zhangsan completed all his errands at the same place, with the first quantifier having wide scope. While in (61c) the direct object san shou shi 'three poems' has scope over meige tongxue 'every classmate', in (d) it is the indirect object meige laoshi 'every teacher' which has scope over the direct object yizhang hua 'a drawing'. (e) and (f) illustrate cases where  $\beta$  is found in an embedded clause preceding  $\alpha$  : in (e), the universal quantifier in the matrix clause must have scope over the numeral phrase in the sentential subject, while in (f) the quantifier sange ren 'three men' cannot escape the lower clause to have scope over

the matrix negator. In view of these facts, the generalization we reached on our scope interpretation principle in Ch.1 is that if a Q-expression  $\alpha$  asymmetrically g-commands another Q-expression  $\beta$  at SS (as in e,f) then  $\alpha$  has scope over  $\beta$  ( $\alpha$  g-commands  $\beta$  iff the node representing the governing category of  $\alpha$  also dominates  $\beta$ ). If, however, both g-command each other (as in a, b, c, d), linear order will determine that the preceding NP will have wider scope. The conditions under which an element can have scope over another in Chinese can be summarized using the following flowchart<sup>12</sup>:



As we saw in Ch. 1, the scope principle outlined in the flowchart will also apply for the relative scope of quantifiers and negation.

The above facts demonstrate clearly that the way quantifier scope is determined can vary from one language to another; while in English SS linear precedence is not relevant to scope order at LF, linearity assumes a crucial role in Chinese. We also know from Gil (1982) that in languages such as Batak and Tagalog, it is the patient NP that tends to have wide scope over other quantifiers in the sentence. Munro (1984) has also reported that in Pima, it is always the prepositional object or the direct object that has wide scope over the subject quantifier. Given the fact that scope dependence is a highly abstract form of knowledge and that scope

interpretation shows cross-linguistic variation, it would seem that the child requires the aid of innate principles to guide him in finding out about the relevant factors for scope determination.

While a reasonable move to make to resolve this learnability problem would be to propose a parameter of UG, (a position we will argue for shortly) an equally plausible alternative would be to see if the problem can be tackled by existing learning principles. If we consider simple cases of quantifier scope involving a universal quantifier and an existential quantifier, as in (62-63) below, the ambiguity of the sentences involves a reading where every N has scope over a N and a reading where the reverse obtains.

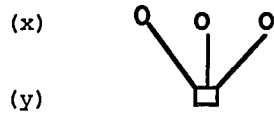
(62) Everybody is singing a song

(63) A picture was drawn by every child

Now the wide scope interpretation of a N (the second reading) always entails the wide scope reading of every N (the first reading), since the worlds in which the second reading is true is a subset of the worlds in which the first reading is true. If for example, there is a song such that every x is singing it, clearly for all x, x is singing a song. Likewise if every child has drawn the same picture, for all x=child, x has drawn a picture. In terms of the schematic representation below, situation A is compatible with both scope orders, while situation B is compatible with only one scope order. The learning problem for the child is which representation to choose when confronted with situation A.

(64)

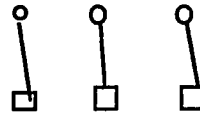
Situation A



$A \ x \ E \ y \ f(x,y)$

$E \ y \ A \ x \ f(x,y)$

Situation B



$A \ x \ E \ y \ f(x,y)$

To resolve the learnability problem, it appears at first sight that one could simply postulate a semantic principle such as (64a):

(64a) Semantic Principle for Scope Representation

Given any two Q-NPs  $\alpha$  and  $\beta$  in a language,  
their relative scope is to be represented by

(i)  $[\alpha > \beta]$  ( $\alpha$  has scope over  $\beta$ )

where the language representable by formula (i)

is a subset of the language representable by

formula (ii) (ii)  $[\beta > \alpha]$  ( $\beta$  has scope over  $\alpha$ )

Here, one invokes the subset principle (Berwick 1985) which requires the child to choose the most restrictive hypothesis, given a number of hypotheses equally compatible with the data. As Berwick explains, "the Subset Principle states that learning hypotheses are ordered in such a way that positive examples can disconfirm them, ..the ordering will force the narrowest possible language to be hypothesized first, so that no alternative target language can be a subset of the hypothesized language." Taking the situation where  $\alpha$  is the existential quantifier and  $\beta$  the universal quantifier, the conditions for the application of such a semantic principle as

(64a) is met: the class of language representable by "Ex Ay f (x,y)" is clearly a subset of the class of languages representable by "Ay Ex f (x,y)". Going by this principle, the child can assume that whenever he comes across a sentence  $[.. \alpha ... \beta ...]_S$  where  $\alpha$  is a universal quantifier and  $\beta$  an existential quantifier or vice versa, s/he should always take the existential quantifier as having wide scope, unless positive evidence suggests otherwise. Thus in situation A where everybody is singing the same song, which is a situation compatible with both scope orders, the child will select the representation with a<sub>N</sub> having wide scope. In this way, when the child hears a sentence like (62) said in situation B, where different people are singing different songs, he can learn that such a context must correspond to the representation in which the universal quantifier has wide scope over the existential quantifier. Both scope orders can therefore be learned. Consider what happens if the subset principle is not followed. If the child begins by assuming "Ax Ey f(x,y)" for situation A, then there is clearly no positive evidence that will lead him/her to the formula "Ey Ax f(x,y)", since both situations are consistent with the representation s/he has already chosen. Thus the child will have no way of acquiring full-fledged quantificational competence.<sup>13</sup>

If the semantic principle (64a) is adhered to by the child, we would expect that in early stages of acquisition, the child will interpret the existential quantifier a<sub>N</sub> as always having wide scope, which is equivalent to the referential reading of the

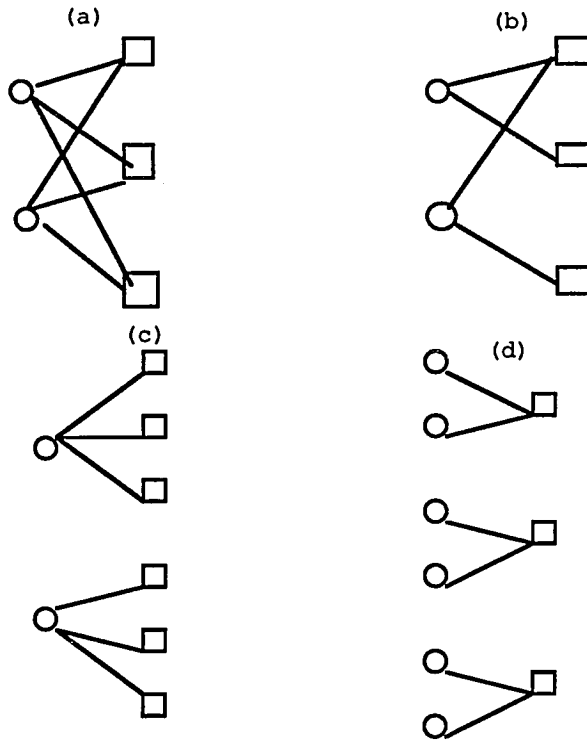
singular NP. This is intuitively appealing as it echoes our proposal that the child initially regards quantifiers as [-operator] on a par with names. Attractive as the semantic principle may seem, it alone does not seem restrictive enough for the acquisition of quantificational scope, and innate syntactic principles must be incorporated to make the learning task feasible, as we will show below.

The inadequacy of a purely semantic principle such as the (64a) for acquiring quantificational scope can be readily observed if we consider first the fact that not all scope interpretations of a sentence involve universal and existential quantifiers; nor do they all form entailment relationships. For example, the picture looks rather different if we examine sentences such as (65), which is four ways ambiguous. It appears that a semantic principle cannot be easily extended to cover these cases.

(65) Two professors taught three classes

The sentences can have a group reading 'a total of two professors taught a total of three classes'. The group reading can be complete (cf. Kempson and Cormack 1981) in the sense that each of the members of a set relates to each of the members of the other set, as illustrated in (66a) below.

(66)



○ =professor      □ =class

The group reading can also be an incomplete one where not every member of a set relates to all members of the other set, as in (b). There can also be two scope dependent readings, one in which the subject numeral phrase has wide scope, as represented in (c), and one in which the object quantifier has wide scope, given in (d). As can be observed from the above diagrams, (c) and (a) form a subset relationship: (a) can be regarded as a special case where the three classes taught by the two professors happen to be identical. Likewise, (d) and (a) also constitute a subset relationship: (a) can be viewed as a special case of (d) where the two professors that taught each of the three classes happen to be identical. However, it

is clear that neither of the situations corresponding to the scope dependent readings (i.e. (c) and (d)) are a subset of the other. In other words, while the complete group interpretation entails each of the scope dependent interpretations, neither of the latter entails each other. What that implies is that given any two Q-NPs in a simple sentence, the semantic principle (64a) cannot always instruct the child which Q-NP to interpret as having wide scope. With sentences such as (62-63), the existential quantifier should have wide scope; with sentences such as (65), the unmarked choice should be the complete group reading (a). Notice here that situation A of the schematic diagram in (64) can be regarded as a scope independent reading as well as an interpretation where the existential quantifier has wide scope. If we represent the scope independent reading using branching quantifier notation, situation A reflects the logical equivalence of the two formulas in (67) (cf. Barwise 1979).

(67)

$$\begin{array}{l} Ax \\ \quad \searrow \\ \quad \quad f(x,y) = Ey \ Ax \ f(x,y) \\ \quad \nearrow \\ Ey \end{array}$$

If that is the case, one might overcome the objection to the semantic principle by suggesting that in the unmarked case, the Q-NPs are to be interpreted independently. It is only at a later stage that the child will consider the possibility of scope dependence between the two quantifiers. But this is tantamount to saying that both Q-NPs are treated as [-operator] initially; how the



child should interpret the relative scope the relative scope of two Q-NPs once these have been identified as operators remains an unanswered question.

A more serious problem in solely assuming a semantic principle is that it fails to predict cross-linguistic differences. Consider sentences such as (62) where the subject is a universal quantifier and the object an existential quantifier. By the subset principle, the English child first assumes the representation "Ey=song, Ax=person, sing (x,y)", where the existential quantifier has wide scope or both are taken independently. Later on, in the context of situation B as in (64), s/he learns that another possible representation of the sentence is "Ax=person, Ey=song, sing (x,y)". Now the child can have two logical representations for the sentence. The problem that immediately arises is that (62) has a very different ambiguity status than its Chinese counterpart below:

(68) [meige ren] dou zai chang [yi shou ge]  
every person all DUR sing one CL song  
"everybody is singing a song"

In the above sentence, the predominant reading is one where the subject has scope over the object. While one could conceive of a situation where the songs sung by the various individuals happen to be identical, it would be nonetheless wrong to associate a wide scope representation of yi shou ge 'a song' or a scope independent branching quantifier representation with (68), in view of the distributivity of dou. For English, we have evidence from sentences such as (63) to believe that a wide scope interpretation of the

object is as legitimate as a wide scope interpretation of the subject. For Chinese, however, we have grounds to reject this possibility since the Chinese equivalent of (63) is strictly unambiguous, as (69) illustrates.

(69) chengli yige gongren mai le suoyou de dianying piao  
 city-in one worker buy asp all NOM movie ticket  
 "A worker from/in the city bought all the movie tickets"

Under no circumstances can the sentence be interpreted as "for all movie tickets  $y$ , there is a  $x$ =worker from the city, such that  $x$  bought  $y$ ". Consequently, it would be difficult to see the kind of positive evidence that will enable the Chinese child to rule out the logical representation  $s$ /he started out with (to wit, the wide scope interpretation of the object NP) but which will inform the English child to maintain these initial structures. It appears that without some syntactic principle to constrain the child's hypothesis space, the task of discerning possible scope relations in the language for each pair of Q-NPs is a formidable task. We have seen that for adult Chinese and English, the relevant parameters are  $g$ -command and linear order. Without some a priori notions of what syntactic factors will be relevant for scope interpretation, the child would have to rule out a wide range of logical possibilities before  $s$ /he can attain any degree of success, for example the hypothesis that wide scope is associated with preverbal position and narrow scope with postverbal position; or the hypothesis that the direct object always has wide scope; or more far-fetched hypotheses such as that the relative scope of two operators depends on whether the verb is a

stative verb or an action verb.

A third problem with simply assuming (64a) for scope interpretation is that the kind of model we have sketched based on the subset principle is not sufficient for handling the relative scope of negation and quantifiers, let alone the scope interaction of adverbs. Here again, no entailment relationship is found between a [Neg Q] and a [Q Neg] reading, since in the former it is the quantifier that is negated, whereas in the latter it is the verb that is negated. Neither interpretation entails each other. Unlike the case of the quantifiers in (65) where one can still have recourse to scope independent readings as the initial state, here we do not have any subset relation holding between the interpretations at all. Clearly the child would need to have some other linguistic principle to serve as a guideline for fixing the relative scope of these operators. If in any case, such cases call for syntactic parameters, then it appears that a unified principle for deciding the relative scope of Q-NPs and Q-expressions will be a simpler approach.

In view of the above considerations, we propose below the parameter of Scope Order, which can be stated as (70).

(70) The Parameter of Scope Order

"a [+operator]  $\alpha$  can have scope over another [+operator]  $\beta$  only if  $\alpha$  bears a relationship  $\chi$  to  $\beta$  at SS<sup>14</sup>

$\chi$  = g-command and (a) c-command (i) OB-c-command<sup>15</sup>

(ii) AS c-command

(b) linear      (i) precede

(ii) follow

(c)  $\phi$

The parameter states that g-command is a necessary condition and the additional requirement can range over the values c-command, linear and a null value. Each of the values c-command and linear can serve as a sub-parameter and can range over two values: OB-c-command vs AS c-command and precede/follow respectively. We further show that the default value of the parameter must not be the null option (c) but must be either (a) or (b). The reason why the unmarked value cannot be (c) follows immediately from the subset principle, as the null option is the least constrained hypothesis. If  $\alpha$  g-commands and precedes  $\beta$  or if  $\alpha$  g-commands and c-commands  $\beta$ , clearly,  $\alpha$  g-commands  $\beta$ . Thus if the null option is chosen as the unmarked value, there will be no way of arriving at the values (a) or (b) on the basis of positive evidence, which means the factors relevant to scope interpretation in some languages (e.g. linearity in Chinese) can never be discovered by the child.

Having excluded the null value as a possibility, we now ask whether (a) c-command or (b) linear should be the default option. It appears that whichever assumption we make, it will not affect the acquisition task. Let us consider the situation where linear is the unmarked option in the context of the following sentences.

(71) I [[gave everybody]<sub>v</sub>, a gift]<sub>vp</sub>

(72) John bought a gift [for everyone]<sub>pp</sub>

(73) A picture is drawn [by every child]

Suppose the child begins by assuming that  $\alpha$  can have scope over  $\beta$  only if it precedes  $\beta$ . Hearing (71) said with the interpretation where everybody has wide scope, the hypothesis is confirmed. But when s/he turns to sentences such as (72) and (73) on the interpretation where the prepositional object has wide scope, the child will realize that his initial hypothesis needs to be modified, as these Q-NPs do not precede the Q-NPs within their scope. So the child selects the next value, which is c-command. But this revised hypothesis will not work either, as in both (72-73), the Q-NPs enjoying wide scope do not c-command the constituents they have scope over. Thus the child is led to the null option, which only requires that  $\alpha$  g-command  $\beta$  to take scope over the latter. With this revision, the child can cope with all the ambiguities in (71-73) whichever Q-NP is taken to be dominant. Consider next the reverse situation where we assume the child begins by selecting the c-command option, and let us assume he begins with the more restrictive OB c-command. Hearing sentences such as (71), where everybody AS-c-commands but does not OB c-command a gift, the child is led to extend his notion of c-command to AS c-command. When s/he encounters data like (72-73), he will discover further that even AS c-command is not an accurate generalization; so the linear option is chosen. Since interpretations of (72-73) where either Q-NP has wide scope are available to the child, s/he will arrive at the conclusion that linearity, too, is irrelevant. He is thus again left with the

null option.

Now consider how the Chinese child will set the parameter if s/he begins by assuming linearity, in the light of the sentences below.

(75) Wo [[song gei le [ meige ren]]<sub>v</sub>, yizhang hua]<sub>vp</sub>  
I give asp every person one-CL drawing  
"I gave everyone a drawing"

(76) [meige xiaopengyou] dou zai chang [yishou ge]  
every child all DUR sing one-CL song  
"every child is singing a song"

(77) mama [ti meige ren]<sub>pp</sub> dou [ mai le [yishuang xie]]<sub>vp</sub>  
mom for everyone all buy asp one-CL shoe  
"Mom bought a pair of shoes for everyone"

Each of the sentences (75-77) is unambiguous with the first NP having wide scope over the second. The data therefore is totally compatible with the child's initial hypothesis and he has attained adult competence by default, with respect to quantificational scope. If, on the other hand, the child assumes OB c-command as the initial setting, then (75) will force him/her to revise the value to AS c-command, since meige ren AS c-commands yizhang hua but does not OB c-command it. But when the child encounters sentences such as (77) where neither of the Q-NPs c-commands the other, the child will need to change the value of the parameter to linear precedence. This revision will be consistent with all previous data he has experienced as well as (77). In this way, adult competence in this area can also be achieved.

At this point we do not have substantial evidence in support of either c-command or linear as the default value, but will just

assume that c-command is the unmarked option for the following reason. There is some empirical evidence (e.g. Roeper and Matthei 1975) that quantificational scope is unstable among preschoolers, who often interpret "all the circles are not black" as "not all the circles are black". If we assume that children are sensitive to linear precedence, we would predict that quantifier scope should be relatively stable beginning from an early age, as it can be assumed that linear precedence is less complex than hierarchical dominance relations. The fact that quantifier scope is unstable can be more easily accounted for if we assume that it is c-command that constitutes the unmarked value, so that before c-command is mastered, children would not have a firm grasp of quantifier scope.<sup>16</sup> In languages such as Chinese, where c-command overlaps to a large extent with linear precedence, or in languages such as English, where both linear order and c-command are irrelevant, it is difficult to test the different claims. Languages where clearly one of the two factors determines quantifier scope will be fruitful ground for deciding on this issue.

To summarize the main stages of the acquisition of quantificational scope, we note that the child equipped with certain UG prerequisites such as the notion of governing category and Condition on Proper Binding will need to first identify certain NPs as [+quantifier] and [+operator]. Subsequently, the child will be predisposed by the parameter of Scope Order to assume that a [+operator]  $\alpha$  can have scope over another [+operator]  $\beta$  only if  $\alpha$

g-commands and c-commands  $\beta$ . Fairly simple data from the two languages such as (71-73) and (75-77) will trigger the proper settings of the parameter for the two languages.

## 2.2 Experimental Studies on the Acquisition of Quantifier Scope

Given the theoretical framework as outlined above, we would like to see how English and Chinese children will interpret equivalent sentences containing a universal quantifier and an existential quantifier, as in (78-79) below.

(78) [Every child] is eating [a cake]

(79) [meige xiaopengyou] dou zai chi [yige dangao]  
every child all DUR eat one cake  
"Every child is eating a cake"

Our expectations of how children will understand the sentences depend on whether they are able to identify the Q-NPs correctly as [+quantifier] and [+operator]. Our first prediction is that if the children do not understand the semantics of the NPs, that is, if they do not understand the respective meanings of mei 'every' and yi 'a', they will have problems with (78-79) and their responses will differ sharply from adult norms. If we assume the correctness of the Fregean principle that a meaning of a sentence is constituted by the meanings of its parts, clearly the child who does not understand the meanings of the Q-NP will not be able to interpret the sentence containing the quantifiers. This is also based on earlier experimental studies (Donaldson and Lloyd 1974, Roeper and Matthei 1975, Smith 1980), which report that it is much easier for children to handle sentences with one Q-NP than those with two



Q-NPs. For example, Donaldson and Lloyd found that of the 14 subjects (age range 3;7-5;0 i.e. three years seven months to five years) they studied, only the youngest three responded to sentences such as "all the garage doors are shut" with error, and only four of the subjects showed errors in interpreting a sentence like "each garage door is shut". However, none of the children were able to give consistent responses to sentences such as "Each car is in a garage" or "Each garage has got a car in it". Roeper and Matthei also found that all of the 202 subjects they examined (age range 3-9) understood all in test sentences involving only one quantifier. However, in sentences containing all and not, as in "not all the circles are black", not more than 50% of the children gave correct responses, and only between 64% and 73% of the subjects in Grades 1,2 and 3 could give a Neg-Q interpretation to these sentences. The higher level of complexity of the cases consisting of two quantifiers can be understood in the light of the functional dependence of the quantifiers involved. While the child interpreting a single Q-NP can be said to be dealing with predicates and a set of entities, the child processing two Q-NPs will not only have to understand the reference of the two sets of entities represented by the quantifier phrases, but will also need to grasp the interrelationship between the members of the two sets. In other words, if the child is not able to assign [+quantifier] status to the Q-NPs, we would not expect interpretations showing scope dependency between the two quantifiers.

Our second prediction is that once the child has understood the meanings of individual quantifiers, but has not identified the Q-NPs as [+operator], it is possible that the child will show a response that appears to assign wide scope to the existential quantifier. Two possibilities may arise after both meige N 'every N' and yige N 'a N' have been understood as [+quantifier]: either one of the two is, in addition, assigned [+operator] status or both are regarded as operators. Consider the first situation and consider the case where meige N 'every N' is [+operator] while yige N 'a N' is [-operator]. This would mean that the latter is treated as a name, so that (78-79) will be treated on a par with "every child is eating a certain cake". The singular object phrase will, in other words, be interpreted referentially and this reading happens to be identical with the wide scope reading of the existential quantifier. If, on the other hand, yige N 'a N' is [+operator] and meige N 'every N' is [-operator], the latter will be interpreted as a set, so that the sentence will be on a par with "these men are eating a cake", with the subject quantifier being undistributed.<sup>17</sup> On such a reading, the interpretation will turn out to be again the same as the wide scope reading of the existential quantifier, with the children having the same cake. In the second situation, where both Q-NPs are identified as operators, the child will invoke the unmarked value of the parameter of Scope Order to guide his/her interpretations. In other words, children will assume that since meige xiaopengyou 'every child' both g-commands and c-commands yige dangao 'a cake', the

former should have scope over the latter, and the reading will be one with different persons eating different cakes. Thus, our third prediction is that if the child succeeds in categorizing both Q-NPs as operators, a wide scope interpretation of every N will be observed.

Below we report two experiments that explore the validity of these predictions. The experiment on Chinese covered a wider range of sentence-types than the experiment on English. The findings from Chinese will be given first, followed by data on English. An overall comparison of the two sets of data will then be made.

### 2.2.1 Experiments with Mandarin-speaking Children

#### Method

122 Mandarin-speaking children aged between three and eight years old were studied in Beijing, China. The subjects aged six and under were drawn from two nurseries, while the seven and eight-year-olds came from a primary school. With the exception of the eight-year-old group, which consisted of only 13 children, each age was represented by 20-24 subjects. To ensure an even distribution of the subjects within an age group, each half age was represented by at least eight subjects. Due to the relatively small sample size, no attempt was made to control for sex, though as far as possible an equal number of male and female children were sought. In addition, a total of 20 university students and staff aged between 19 and 36 years old were interviewed and asked to complete a questionnaire based on some of the test items administered to the children subjects. Table 1 gives details of the age and sex distribution among the subjects.

Table 1. Age and Number of  
Mandarin-speaking Subjects

<u>Age</u> (years)	<u>Number of Subjects</u>		<u>Subtotal</u>
	<u>male</u>	<u>female</u>	
3 year-old	10	10	20
4 year-old	15	7	22
5 year-old	12	8	20
6 year-old	12	12	24
7 year-old	13	10	23

8 year-old	5	8	<u>13</u>
		Total=	122
Adults	20	0	20

#### Test Items

The experiments comprised 20 picture identification tasks (three of which were training tasks) and 11 toy manipulation tasks, administered in the following sequence.

(Training tasks: three picture identification items)

A. picture identification tasks (eight items)

B. act out tasks (i) (five items)

(ii) (four items)

C. picture identification tasks (nine items) + two control  
act-out items

The three training test items were first presented; these were picture identification tasks where the child had to choose from a pair of contrasting pictures the one that corresponded to the sentence the experimenter was saying (see Appendix 1 and 3 for details). This was followed by a block of eight picture identification items (block A) and a block of nine act-out tasks. The final part of the test battery contained nine picture identification items with two act out tasks inserted near the end (block C). The body of the test items was basically structured into two halves, each roughly forming a mirror image of the other, with the center of block B as the dividing line. With two exceptions, each testing point in the experiment had two sentence tokens, each

placed in different halves of the test to ensure a certain amount of distance between pairs of tokens. The location of the correct choice in each picture set was randomized.

The items could be divided into several broad categories. Type I items examined children's understanding of single quantifiers - their understanding of dou 'all', yi 'one' and mei 'every.' Since the durative aspect marker zai occurred in a number of key test items, whether the child understood this aspect morpheme was also investigated. The durative aspect zai, which signals the ongoing nature of an event, can only cooccur with activity verbs (cf. Li and Thompson 1981:217), as illustrated below:

(80) Lisi zai dazi/ youyong  
DUR type swim  
"Lisi is typing/ swimming"

(81) \*Lisi zai pang/ gao  
DUR fat tall

The following are examples of the Type I items. (82) is a picture identification task while (83-84) are act-out items.

(82) xiongmao dou shuijiao le  
panda all sleep asp./part.  
"(the) pandas have all fallen asleep"

(83) na yike tang chulai  
take one-CL candy out  
"take one candy out"

(84) meige tanqiu dou na chulai  
every marble all take out  
"take every marble out"

Type II items formed the focal part of the experiment, as they explored the child's interpretation of the relative scope of two quantifier phrases. Examples of Type II items are given as follows.

- (85) meige xiaopengyou dou zai he yibei shui  
 every child all DUR drink one-CL water  
 "every child is drinking a glass of water"
- (86) you yige dangao [meige xiaopengyou dou zai chi]  
 have one cake every child all DUR eat  
 "there is a cake (which) every child is eating"
- (87) you yige xiaopengyou bao zhe yige wawa  
 have one child hug asp one doll  
 "A child is hugging a doll"
- (88) [yige houzi dai zhe yiding maozi] hen hao wanr  
 one monkey wear asp one hat very funny  
 "that each monkey is wearing a hat is funny"
- (89) meige taikongren/jiqiren dou shui zai yige hezi li  
 every spaceman all sleep at one box in  
 "every spaceman sleeps in a box"

(85-88) were picture identification tasks, whereas (89) was given as a toy manipulation task. In (85) a universal quantifier phrase occupies subject position, with an existential quantifier phrase in object position. The reverse order is found in (86), where the existential quantifier phrase c-commands the universal quantifier phrase. For reasons given in Ch. 1, a numeral phrase in a referential role cannot occur in matrix subject position unless it has a rich descriptive modifier or is bound by a topic. A common way of introducing numeral phrases is to use an existential verb you preceding the Q-NP, so that in effect a complex sentence is formed with you taking a NP object and a clausal complement, as in (86). (87-88) each contains two singular NPs and constitute a contrasting pair in terms of structure. As we have seen from Ch. 1, in (88) universal generalization is possible with a single NP in subject position of an embedded clause which also contains a numeral phrase elsewhere in the sentence, so that the embedded subject NP receives

a universal reading. In (87) the introduction of the singular NP yige xiaopengyou 'a child' by the existential verb you renders the latter specific. These sentences were included to see how children would interpret the referentiality of singular numeral phrases with or without the existential verb you. The relevant pictures for (85) are illustrated in Fig. 2 and those for (88) are given in Fig. 3.

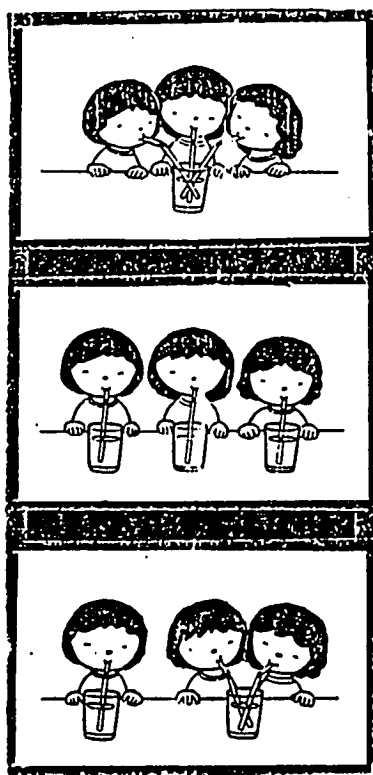


Fig. 2

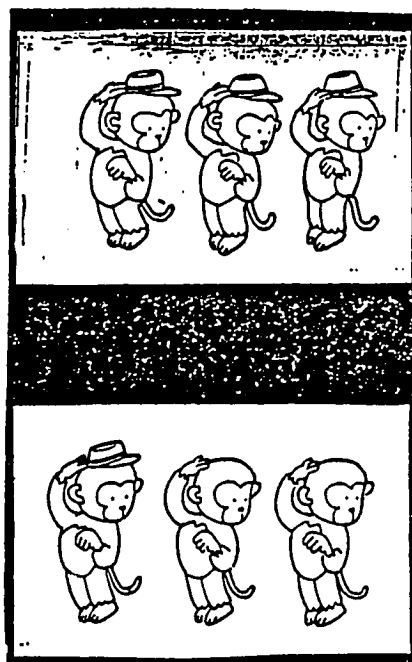


Fig. 3

(89), which is structurally identical with (85), was an act-out task in which the child was asked to position four identical objects with



respect to a stack of four tupperware boxes, as shown in Fig. 4. The design of the task was based on one assumption: for tasks such as these, where clearly the spatial arrangement of the toys is likely to affect the child's performance, a reliable indication of acquisition of adult norms can be obtained only if the spatial arrangement of the toys does not facilitate the adult reading. Since a sentence like meige jiqiren dou shui zai yige hezi li "Every spaceman sleeps in a box" is normally interpreted with the subject universal quantifier taking wide scope, so that the spacemen will be interpreted as sleeping in different boxes, the design here was to have the boxes stacked in one pile rather than laid out separately. Boxes were chosen as props because pragmatically they seemed to be neutral: a box can be used for containing an aggregate of objects but it is not necessarily used for that purpose. To control for possible configuration effects on the child, a test sentence similar to (89) was included, but in this item the prop arrangement facilitated a wide scope reading of the subject NP, as Fig. 5 illustrates. The boxes were placed in two terraced stacks, each in clear view of the child.

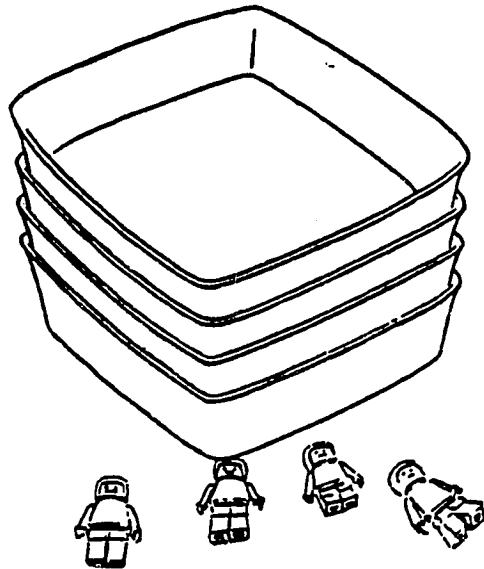


Fig. 4

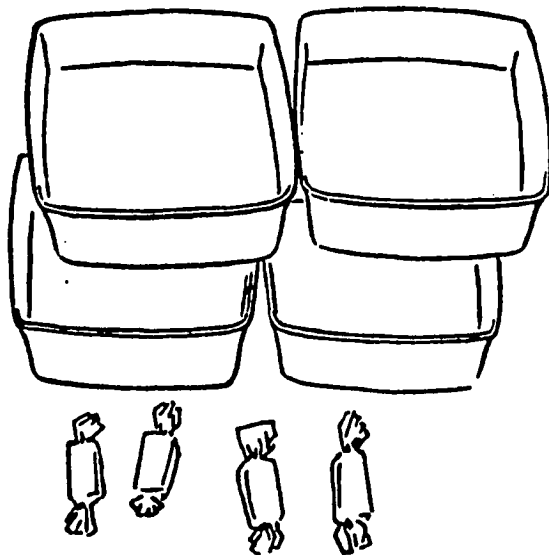


Fig. 5

The items administered to the adult subjects constituted less than half of the full test battery. A total of nine picture identification items and three act out items were given. Eight of the picture identification tasks and one of the act-out tasks were performed by all 20 adult subjects, while the remainder were completed by 12 of the subjects (see Appendix 2 for details).

#### Procedure

Each child was seen by two experimenters, one of whom was the author, for an average of 15 to 25 minutes. The child was told that a game would be played; one of the experimenters would say a sentence and the child was asked to tell the experimenter which picture the latter was talking about by pointing to it.<sup>18</sup> In the act-out tasks, the child was told to arrange the toys according to what the experimenter said. Before the test sentence was provided, the child was asked about the names of the objects in each picture in the set, as well as the actions being performed by the objects. In an act-out task, the child was asked about the names of the prop objects. If the child did not give the intended verb or noun in describing the picture or the props, the relevant terms would be mentioned to him/her. The child was told to take a careful look at all the pictures for an item before he decided on his choice. No suggestion was given that more than one choice was permitted.

The adult subjects were interviewed in groups of six to eight people. They were shown the same pictures and props for the relevant items, but were asked to check on a questionnaire the box

corresponding to the correct picture for the item concerned. In the act-out tasks, they were asked to sketch the arrangement they would select. The subjects were asked to make just one choice and select the interpretation that seemed most immediate and natural to them.

#### Results on Type I items

In the act-out items testing the child's understanding of the numeral yi 'one', the child was instructed to take out one object from a lidded plastic box containing six identical objects. As Table 2 shows, all three-year-olds had understood the meaning of the numeral yi 'one'.

Table 2. Acquisition of yi 'one' in Mandarin Chinese (act-out)<sup>19</sup>

test sentences: (i) na yi ke tang chulai  
(two tokens) take one CL candy out  
"take one candy out"

(ii) na yi ge tanqiu chulai  
take one CL marble out  
"take one marble out"

<u>Age</u> (years)	<u>No. of Subjects</u> <u>correct on both</u> <u>sentences</u>	<u>No. of Subjects</u> <u>correct on one</u> <u>sentence</u>	<u>No. of Subjects</u> <u>incorrect on</u> <u>both sentences</u>	<u>Total</u>
3	20 (100%)	0	0	20
4	22 (100%)	0	0	22
5	20 (100%)	0	0	<u>20</u>
Total=				62

As regards the picture identification item concerning the child's grasp of the durative aspect marker zai, the child had to choose from three pictures the one that showed an action in progress, as the middle picture in Fig. 6. The results on this item, provided in

Table 3, indicate that the child had understood the meaning of this aspect marker by four years of age, as 86% of the four year-olds consistently responded correctly.

Table 3. Acquisition of Durative Aspect zai in Mandarin Chinese (picture-identification)

test sentences: (i) xiaopengyou zai he shui  
                                   child           DUR drink water  
                                   "(the) child is drinking water"

(ii) zhege xiaopengyou zai chuan yifu  
                                   this child           DUR put-on clothes  
                                   "this child is putting on (the) clothes"

<u>Age</u> (years)	<u>No. of Subjects</u> <u>correct on</u> <u>both sentences</u>	<u>No. of Subjects</u> <u>correct on one</u> <u>sentence</u>	<u>No. of Subjects</u> <u>incorrect on</u> <u>both sentences</u>	<u>Total</u>
3	15 (79%)	3 (16%)	1 (5%)	19 <sup>20</sup>
4	19 (86%)	2 (9%)	1 (5%)	22
5	19 (95%)	1 (5%)	0	20
6	24 (100%)	0	0	24
7	23 (100%)	0	0	23
8	13 (100%)	0	0	13

Also included in this experiment were four items related to the child's understanding of dou. Two of these were picture identification tasks, an example of which is illustrated in Fig. 7. The correct option was the lower one where the pandas are all asleep. The results summarized in Table 4 show that only slightly more than half of the three year-olds were correct on both tasks. However, over 90% of the four year-olds could perform the item accurately and consistently, indicating that the acquisition point had been reached by four.

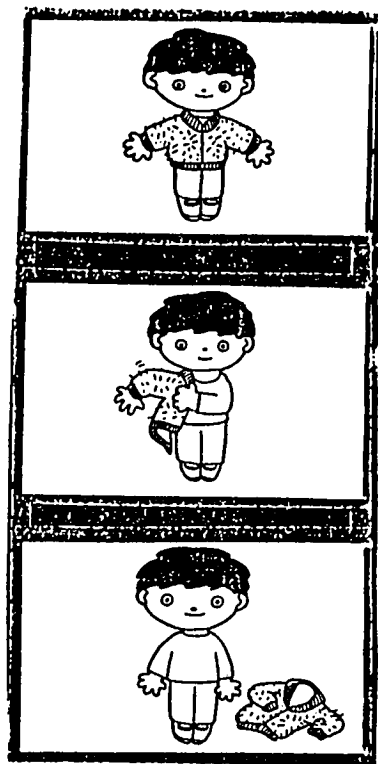


Fig. 6

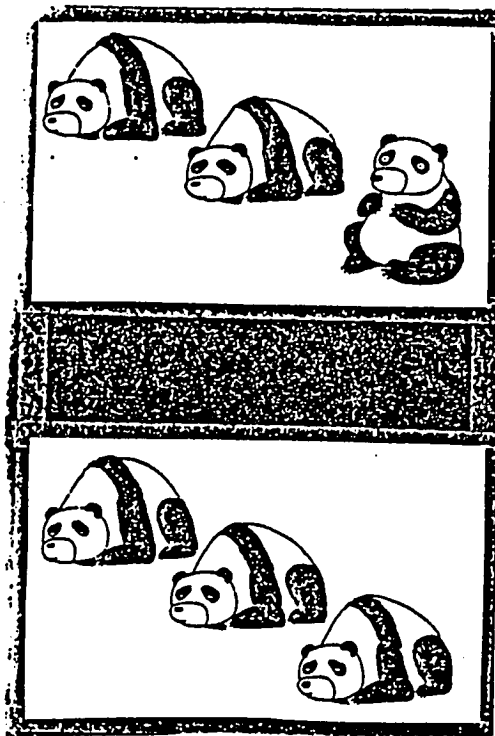


Fig. 7

Table 4. Acquisition of dou in Mandarin Chinese  
(picture-identification)

test sentences: (i) [xiaogou] dou zuo xialai le  
doggie all sit down asp./part.  
"(the) dogs have all sat down"

(ii) [xiongmao] dou shuijiao le  
panda all sleep asp./part.  
"(the) pandas have all fallen asleep"

Age (years)	<u>No. of Subjects</u> <u>correct on both</u> <u>sentences</u>	<u>No. of Subjects</u> <u>correct on one</u> <u>sentence</u>	<u>No. of Subjects</u> <u>incorrect on</u> <u>both sentences</u>	<u>Total</u>
3	11 (58%)	5 (26%)	3 (16%)	19
4	20 (91%)	1 (4.5%)	1 (4.5%)	22
5	20 (100%)	0	0	20
6	24 (100%)	0	0	24
7	23 (100%)	0	0	23
8	12 (92%)	0	0	13

The act-out tasks exploring the child's understanding of mei...dou revealed basically the same pattern of responses. In these tasks, the child was asked to take out all the objects in a plastic box containing six objects. Only if the child took out all the objects would the response be counted as correct. As shown in Table 5, only 60% of the three year-olds were able to respond correctly, whereas by four the accuracy rate had reached 100%.<sup>21</sup>

Table 5. Acquisition of mei...dou in Mandarin Chinese  
(Act out)

test sentences: (i) [mei ke tang] dou na chu lai  
every CL candy all take out  
"Take every candy out"

(ii) [mei ge tanqiu] dou na chulai  
 every CL marble all take out  
 "Take every marble out"

Age (years)	<u>No. of Subjects</u> <u>correct on both</u> <u>sentences</u>	<u>No. of Subjects</u> <u>correct on one</u> <u>sentence</u>	<u>No. of Subjects</u> <u>incorrect on</u> <u>both sentences</u>	<u>Total</u>
3	12 (60%)	0	8 (40%)	20
4	22 (100%)	0	0	22
5	20 (100%)	0	0	20
6	24 (100%)	0	0	24
7	23 (100%)	0	0	23
8	13 (100%)	0	0	13

Our experimental findings accord with existing data on child language acquisition in Mandarin. The earliest record reflecting the child's use of dou is found in Erbaugh (1983:367), where a child aged 2;6 uttered:

(90) \*dou bian  
 all side  
 'every side'

referring to the fact that the toys were all over the place. It is interesting to note that here the quantificational adverb dou was used in prenominal position as a determiner, as the child probably had not mastered the distributional properties of the word. Another instance of dou in naturalistic data was used by a child aged 3;2 (Erbaugh: 410), where a conjoined NP was quantified<sup>22</sup>.

(91) you gen wasi dou zhangjia le  
 oil and gas all rise-price asp.  
 "the price of oil and gas has risen"

Thus, appropriate use of dou is documented in naturalistic studies at approximately the point of acquisition we are suggesting.



Three points are worth noting in the above tables. One is that the adverb dou and the quantificational expression mei...dou had both been acquired by four. This shows that the addition of the determiner mei 'every' did not seem to make it easier for the young child to understand universal quantification. Another way of viewing this is to suggest that the information load of universal quantification is carried by dou rather than by mei, the former being the more important element in universal quantifier expressions. If each correct response on a test sentence is given a score of 1 and an incorrect response a score of zero, each subject would receive a summative score of 0, 1, or 2 points for each testing point with two sentence tokens. A crosstab of the summative results on dou (based on Table 4) and those on mei...dou (based on Table 5) showed significant interaction between the two testing points ( $p < .02$ ), supporting the observation that acquisition of the two expressions was concurrent. A second point worth noting about the data in Table 5 is that of the eight three-year-olds who failed to interpret mei...dou on both sentences, five of them consistently interpreted mei...dou as 'one', taking only one of the six objects from the box, one of these children consistently interpreted mei...dou as 'two', while the remaining two interpreted the expression as 'one' on one sentence and as 'two' on another. It appears that the universal quantifier may be interpreted as singularity or duality at the early stages of the child's language development. A final point worth noting about Tables 4 and 5 is that if one compares the middle columns of the two tables, one will find

a higher level of consistency in the act-out tasks (Table 5) than in the picture identification tasks (Table 4), a difference we will also observe in the results on the other test items.

Summarizing the data on the Type I items, the Mandarin-speaking child had acquired yi 'one' before three, and by four had also mastered the durative aspect marker zai, the quantificational adverb dou 'all' and the expression mei...dou 'every...all'.

Results on Type II items: Part I (sentences containing a universal quantifier preceding an existential quantifier)

With regard to test sentences involving two Q-NPs, let us first

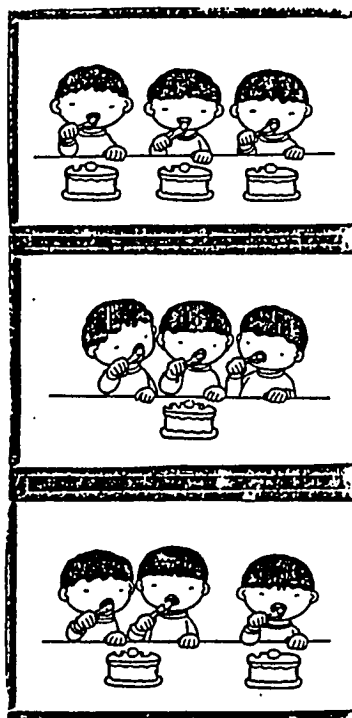


Fig. 8

examine the case where a universal quantifier phrase meige N 'every N' precedes an existential quantifier yige N 'a N'. Here the findings from the picture identification tasks and act out tasks differ considerably. On the picture identification item, the child had to select from three pictures (as shown in Fig. 8) the one that corresponded to the test sentence. Selection of the uppermost picture, where the three children are each eating a different cake, was labelled as a wide scope interpretation of the subject universal quantifier; selection of the middle picture was considered a narrow scope interpretation of the subject NP; and a choice of the bottom picture was counted as a non-scope reading.

A few remarks are in order regarding the interpretation of the children's responses. As discussed in Section 2.1, in theory, while the topmost picture unequivocally reflects a wide scope reading of the universal quantifier, the middle picture is subject to two interpretations, since it is consistent with both a wide scope and a narrow scope interpretation of the universal quantifier. Granting the fact that selection of the middle picture is no sufficient indication of a narrow scope reading, we assume nonetheless that it corresponds to a canonical narrow scope interpretation of the universal quantifier. In principle, we could also argue that the bottommost picture is also consistent with a wide scope reading of the universal quantifier, one in which the cakes being eaten by two of the children happen to be the same. Here, we have labelled the choice of the bottom picture as a non-scope reading to distinguish it from the clear wide scope reading and the canonical narrow scope

reading.22a

As is evident from the figures in Table 6, the data from these picture identification tasks do not show at first sight a pattern as clear as that in preceding tables. In general, the developmental path fluctuates and does not seem to follow a steady decline or incline.

Table 6. Acquisition of mei...yi 'every...a' in Mandarin Chinese (picture-identification)

test sentences: (i) [meige xiaopengyou] dou zai chi [yige dangao]  
 every child all DUR eat one cake  
 "every child is eating a cake"

(ii) [meige xiaopengyou] dou zai he [yibei shui]  
 every child all DUR drink one-CL water  
 "every child is drinking a glass of water"

(wide scope=wide scope reading of the universal quantifier)

Age (years)	<u>Subjects</u> <u>with wide</u> <u>scope on</u> <u>both</u> <u>sentences</u>	<u>Subjects</u> <u>with wide</u> <u>scope on one</u> <u>sentence,</u> <u>narrow scope</u> <u>on another</u>	<u>Subjects</u> <u>with narrow</u> <u>scope on</u> <u>both</u> <u>sentences</u>	<u>Subjects</u> <u>with at least</u> <u>one non-scope</u> <u>reading</u>	<u>Total</u>
3	4 (21%)	9 (47%)	1 (5%)	5 (26%)	19
4	2 (9%)	10 (45%)	9 (41%)	1 (6%)	22
5	3 (15%)	3 (15%)	14 (70%)	0	20
6	3 (12.5%)	9 (38%)	12 (50%)	0	24
7	8 (35%)	3 (13%)	12 (52%)	0	23
8	3 (23%)	6 (46%)	4 (31%)	0	13
Adult	16 (80%)	4 (20%)	0	0	20

In spite of the apparent irregularities, a number of interesting tendencies can still be observed. Note first the high level of

inconsistency between a wide and narrow scope interpretation of the test sentences reflected in the third column of the table. Looking at the three, four, six, and eight year-olds, we see that between 38% and 47% of the subjects gave a wide scope interpretation of the universal quantifier on one sentence and a narrow scope interpretation on the other. In fact, of all the age groups only the five and seven year-olds showed a significant level of consistency. A crosstab of their responses on the two test items showed chi-square significance ( $p < .05$ ,  $p < .002$  respectively).<sup>23</sup> The overall high level of inconsistency may be due to the fact that the children did not find a strong difference between the wide and narrow scope interpretations, so that they selected as correct the first picture that seemed to them to represent the meaning of the sentence.<sup>24</sup> A second tendency that should be noted is that there is a general increase in consistent narrow scope readings between the age of 3 and 5, followed by a steady decline after 5. Concurrent with this development is a tendency for consistent wide scope readings to rise although the slope of the increase here is not well-defined, showing some degree of fluctuation. This can be seen from Fig. 9, where the figures in the second and fourth columns of Table 6 were plotted.

The graphs also show that in all but the youngest age group, there is a bias toward the narrow scope interpretation of the universal quantifier. In the four, five and six year-olds, the percentage of subjects showing a consistent narrow scope interpretation was more than 4 times that of subjects showing a wide scope interpretation. A further point that should be mentioned about

Table 6 is the existence of non-scope readings only among the three and four year-olds and their complete absence after 4. Comparing the results of the children and the adult groups in Table 6, we see a sharp contrast between the two sets of data. The fact that 80% of the adults responded consistently with a wide scope reading and that none of them gave consistent narrow-scope interpretations showed that the predominant adult reading of these test sentences was indeed one in which the subject NP has scope over the object NP. However, the fact that 20% of the adult subjects fluctuated between a wide and narrow scope interpretation shows that a narrow scope interpretation of the universal quantifier is possible. This can be understood in light of the entailment relationship between the wide and narrow scope readings of the sentence. Even with a wide scope reading of the subject NP, it is possible to have an interpretation that happens to be identical with a narrow scope reading.

Turning to the children's comprehension of similar sentences in act-out tasks (cf. Fig. 4), we observe some differences as well as a

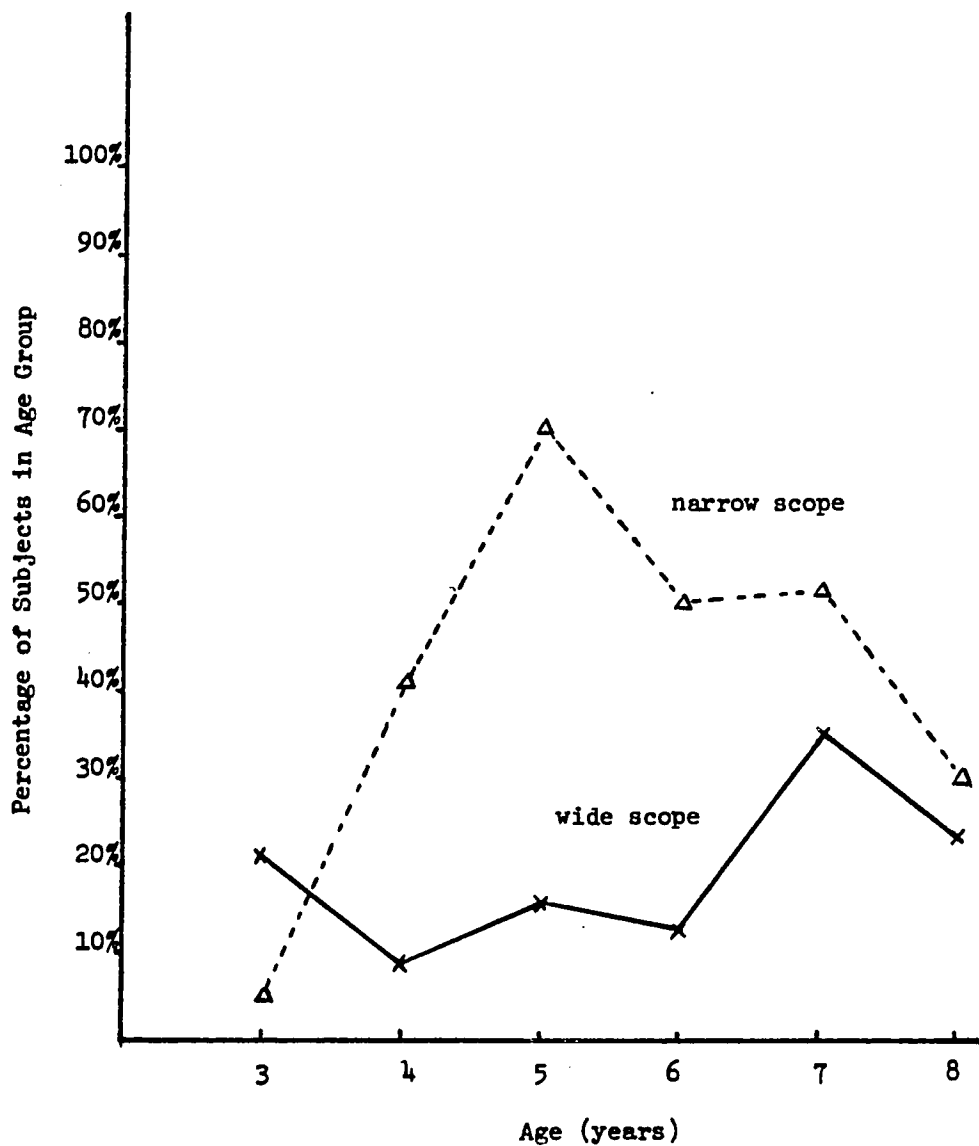


Fig. 9. Consistent wide scope vs narrow scope readings of the universal quantifier in mei..yi 'every..a' sentences in Chinese (picture identification)

number of parallels to the findings in the picture identification tasks. In the two act-out tasks reported in Table 7, in which children were asked to arrange four objects with respect to four boxes stacked in a pile, one possible structure corresponding to a wide scope reading of the subject NP would be one where each of the four objects was placed in a separate box. A narrow scope interpretation would be one where all the four objects were placed in the same box. A non-scope response would be one where other responses were given: either only a total of one object was placed in one of the boxes, or a total of two objects were each placed in a box.

A sharp contrast between Table 7 and Table 6 is the high level of consistency exhibited by the subjects on the act-out tasks, as can be seen by comparing the third columns of the tables. The proportion of subjects fluctuating between a wide scope and a narrow scope reading never exceeded 16% of the age group. If we assign a score of 1 for every wide scope response and a score of 0 for every non-wide scope response, and obtain a summative score (ranging from 0 to 2) for each subject for the mei...yi picture identification tasks and another summative score for the mei...yi act-out tasks, the summative results for the two sets of data do not show statistical interaction for any of the age groups.<sup>25</sup>



Table 7. Acquisition of mei...yi 'every..a' in Mandarin Chinese (Act out)

test sentences: (i) [meige xiaomao] dou zuo zai [yige hezi] li  
every kitten all sit at one box in  
"every kitten sits in a box"

(ii) [meige taikongren/]dou shui zai [yige hezi] li  
jiqiren  
every spaceman all sleep at one box in  
"every spaceman sleeps in a box"

(wide scope=wide scope reading of the universal quantifier)

Age (years)	<u>Subjects</u> <u>with wide</u> <u>scope on</u> <u>both</u> <u>sentences</u>	<u>Subjects</u> <u>with wide</u> <u>scope on one</u> <u>sentence,</u> <u>narrow scope</u> <u>on another</u>	<u>Subjects</u> <u>with narrow</u> <u>scope on</u> <u>both</u> <u>sentences</u>	<u>Subjects</u> <u>with at least</u> <u>one non-scope</u> <u>reading</u>	<u>Total</u>
3	5 (25%)	1 (5%)	9 (45%)	5 (25%)	20
4	7 (32%)	0	15 (68%)	0	22
5	6 (30%)	1 (5%)	13 (65%)	0	20
6	11 (46%)	4 (16%)	9 (38%)	0	24
7	11 (48%)	3 (13%)	9 (39%)	0	23
8	8 (62%)	1 (7%)	4 (31%)	0	13
Adult	19 (95%)		1 ( 5%)		20

(Note: adult subjects had only one test sentence)

The highly consistent response of the subjects on the act-out task is supported by the fact that the performance of the subjects on the two test sentences of the act-out task showed strong statistical interaction ( $p < .01$ ) for all six age groups. Going beyond the apparent differences between the two tables, we observe two significant parallels between them. One is that as in Table 6, an

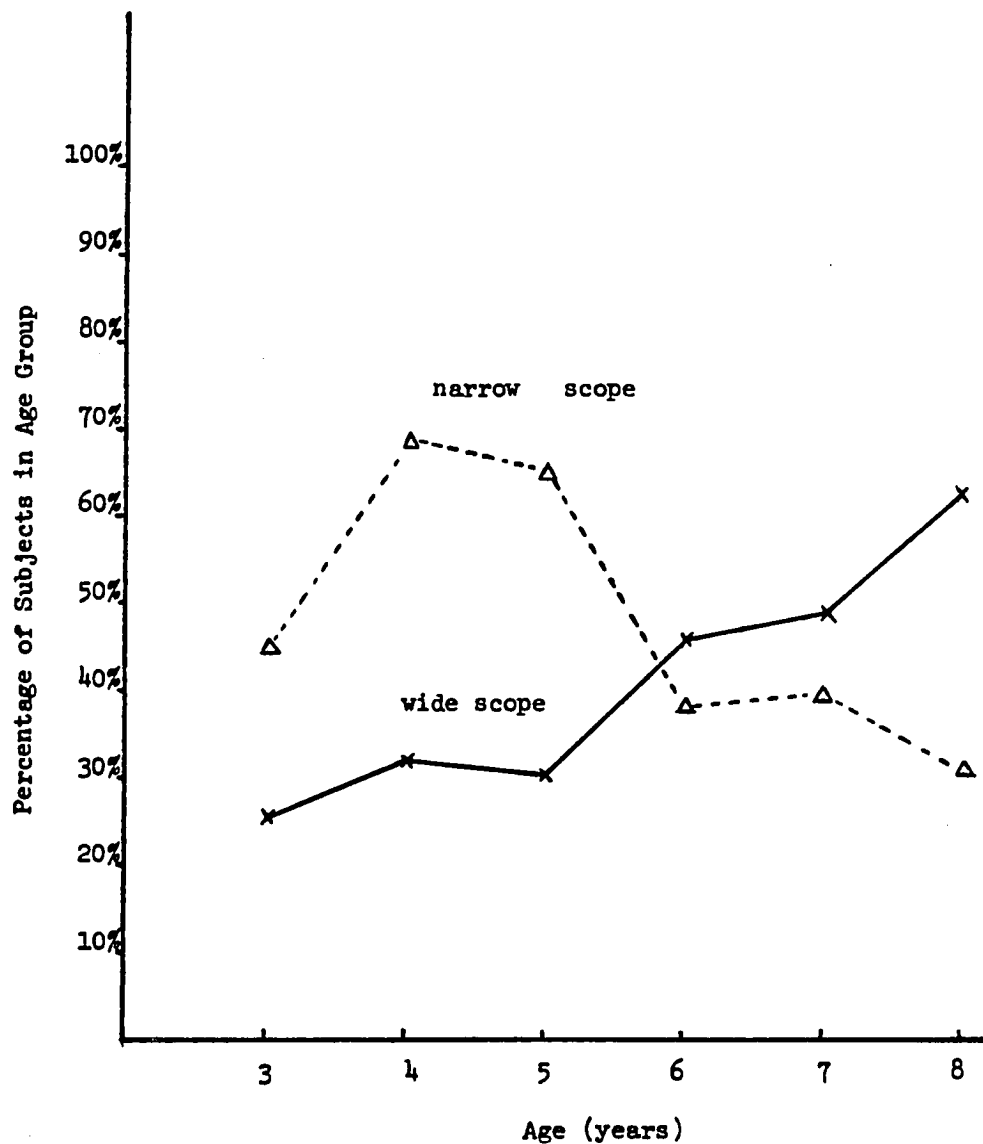


Fig. 10. Consistent wide scope vs narrow scope readings of the universal quantifier in mei...yi 'every...a' sentences in Chinese (Act out)

increasing tendency toward narrow scope interpretation is observed among the younger age groups, followed by a decline in such interpretations after five. Concurrent with this is also a tendency for consistent wide scope interpretations to rise as the age increases. These similarities can be seen clearly if we compare Fig. 9 with Fig. 10, in which the figures in the second and fourth columns of Table 7 are plotted.

Fig. 10 shows that as in Fig. 9, a narrow scope bias is prominent among the four and five year olds. The proportion of four to five year-olds giving a consistent narrow scope reading was approximately twice that giving a consistent wide scope response. However, after six, the reverse pattern holds so that by age eight, the percentage of children assigning consistent wide scope interpretation was twice that assigning consistent narrow scope interpretations. In both figures, the two line graphs display quite similar slopes, the major difference between them being the much higher level of wide scope interpretations on the act-out tasks than on the picture identification tasks. A final parallel between the figures in the two tables is the occurrence of non-scope interpretations only in the youngest age group and their disappearance after three. It is worthy of note that the five subjects who failed to give a scope dependent reading of the test sentence (cf. the fifth column of Table 7) were precisely those who did not comprehend mei...dou 'every..all'; all of them consistently dropped only one object in one of the boxes, reflecting their inability to handle the relationship between two Q-NPs, as they

understood only one of them.

Recall that the prop arrangement for the act-out items just reported was one that did not facilitate a wide scope reading of the universal quantifier (see Fig. 4). To see whether a difference in prop arrangement would affect the children's performance, let us consider the results of the act-out item based on the layout in Fig. 5, which presumably would facilitate a wide scope reading of the subject. The results are given in Table 8.

Table 8. Acquisition of mei...yi in Mandarin Chinese  
(Act out, with configuration favoring wide scope reading)

test sentence: [meike tang] dou fang zai [yige hezi] li  
(one token) every-CL candy all put at one box in  
"Put every candy in a box"

(wide scope=wide scope reading of the universal quantifier)

Age (years)	<u>No. of Subjects</u> <u>with wide scope</u> <u>reading</u>	<u>No. of Subjects</u> <u>with narrow</u> <u>scope reading</u>	<u>No. of Subjects</u> <u>with non-scope</u> <u>reading</u>	<u>Total</u>
3	6 (30%)	9 (45%)	5 (25%)	20
4	9 (41%)	12 (55%)	1 (4%)	22
5	8 (40%)	12 (60%)	0	20
6	17 (71%)	7 (29%)	0	24
7	18 (78%)	5 (22%)	0	23
8	9 (69%)	4 (31%)	0	13

The above figures reflect basically the same generalizations that hold of Table 7: first of all, an increasing narrow scope bias in the youngest three age groups and a subsequent decline after six. At the same time, a steady increase toward wide scope readings across

the age groups could also be seen. As in the preceding tables, non-scope responses were recorded only among the three and four-year-olds and were not found after four. The major difference between Table 7 and Table 8 lies in a relatively higher percentage of wide scope readings across all age groups in the act out task with a prop configuration that favored a wide scope interpretation.

The major findings of the preceding Type II items can be summarized as follows: (a) in picture identification tasks, Chinese children tended to interpret the subject quantifier as having narrow scope in all but the youngest age group, (b) in act-out tasks, Chinese children five and under showed a bias toward interpreting the subject universal quantifier as having narrow scope; six to eight year-olds, however, tended to interpret the universal quantifier as having wide scope; (c) in both picture identification and act-out items, one observes an increasing trend toward consistent narrow scope readings in the younger groups and a decline in such readings after five; at the same time, one also observes a tendency for consistent wide scope readings to rise with age; (d) in the picture identification and act-out items, non-scope interpretations were found only among the three and four year-olds, disappearing after four.

#### Discussion of Results of Type I and Type II items

Our findings confirm the earlier studies of Donaldson and Lloyd (1974) and Roeper and Matthei (1975) in revealing that acquisition of single quantifiers precedes acquisition of the relative scope of two quantifiers. In our data, the universal quantifier dou 'all' and

mei...dou 'every..all' were acquired by four, whereas the adult norms for wide scope interpretation of the universal quantifier were not mastered even at the age of eight. The fact that five of the eight subjects that failed to understand mei...dou could not assign a mapping relationship between the two sets of entities represented by meige N and yige N suggests that a minimum prerequisite for scope acquisition is the assignment of [+quantifier] feature to all the Q-NPs concerned.<sup>26</sup>

Recall also from our earlier discussion that given a universal Q-NP  $\alpha$  and an existential Q-NP  $\beta$ , if either one of the two or both are regarded as non-operators, we predicted that an equivalent of a narrow scope interpretation of  $\alpha$  will result in the early stages of the development. The only situation where  $\alpha$  will have wide scope over  $\beta$  is when both are understood as operators and the c-command unmarked option of the scope parameter will instruct the child to assign wide scope to the hierarchically more prominent  $\alpha$ . Our predictions are borne out by the clear narrow scope bias among the three, four and five year-olds, and the tendency for wide scope bias after five. The transition point coincides with the stage at which the notion of c-command takes root, as Chien and Wexler (in preparation) have found that Mandarin-speaking four-year-olds show clear grasp of the c-command condition on antecedents to anaphors. It thus appears that Chinese children before 6 have probably not analyzed both the universal quantifier and the singular NP as operators. This receives support from the fact that in the picture identification tasks, a non-scope choice (where one of the children

is eating a cake while the other two are sharing one) was found only among the three and four year-olds. Such an incomplete group reading is a clear indication that the two Q-NPs were taken separately as referring to distinct sets of entities with no mutual dependence. Of the two Q-NPs meige N 'every N' and yige N 'a N', which of the two was interpreted as nonoperator? There is indication that the singular numeral phrase was interpreted referentially by Chinese children from Type II items involving two singular numeral phrases.

Results of Type II items: Part II (existential quantifier precedes existential quantifier; existential quantifier precedes universal quantifier)

The test sentences at issue are the following:

- (92) [yige houzi dai zhe yingding maozi] hen haowanr  
 one monkey wear asp one hat very funny  
 "that each monkey is wearing a hat is funny"
- (93) [you yige houzi dai zhe yingding maozi] hen haowanr  
 have one monkey wear asp one hat very funny  
 "that a (certain) monkey is wearing a hat is funny"
- (94) you yige xiaopengyou bao zhe yige wawa  
 have one child hug asp one doll  
 "A child is hugging a doll"
- (95) you yige dangao [meige xiaopengyou dou zai chi e ]  
 have one cake every child all DUR eat  
 "there is a cake (which) every child is eating"

In both (93-94) where the first singular NP is introduced by you, it receives a specific reading, whether it is found within an embedded clause (as in 93) or in the matrix clause (as in 94). In (92), however, the first singular NP within the sentential subject receives a universal reading (cf. Ch.1.2). If the singular numeral

NP is always interpreted as a non-operator in early stages of acquisition, we would expect that first of all, the child would not note the distinction between (92) and (93) and s/he would interpret the former exactly as an adult would interpret (93), assigning a specific reading to the first singular NP. In the same manner, the young child would at a very early point show adult norms in his/her comprehension of (94), with a specific reading of yige xiaopengyou 'a child', irrespective of whether s/he understood the function of you as a marker of specificity.<sup>26a</sup> In (95), we have an existential quantifier preceding a universal quantifier, and the adult interpretation of the sentence is unambiguously one where the existential quantifier has scope over the universal quantifier. Analogous to the mei...yi 'every...a' test sentences of Table 6, two Q-NPs are involved in (95), but (95) is syntactically more complex than the mei...yi sentences as the object of the embedded verb chi 'eat' is an empty category coindexed with the existential quantifier phrase. However, if the child interprets the singular numeral phrase yige dangao 'a cake' in (95) referentially at a very early stage, s/he could show adult norms much earlier than is the case with the sentences where the universal quantifier precedes the existential Q-NP, since a scope independent reading is identical to a wide scope reading of the existential quantifier. These predictions are confirmed by the experimental data.

The test pictures used for both (92) and (93) are given in Fig. 3. Selection of the lower picture would be considered a referential reading of the embedded subject while a choice of the upper picture



would be construed as a non-referential reading. The results on (92) are shown in Table 9. It is clear that the vast majority of the children interpreted the embedded singular subject referentially for all age groups. The proportion of subjects giving non-referential readings showed some fluctuation but never exceeded 26% of the age group. Compared to the more or less even distribution of referential

Table 9. Chinese Children's Interpretation of Singular NPs in Subject Position of Embedded Clause (picture-identification)

test sentence: [[yige houzi dai zhe yiding maozi] hen haowanr]  
 one-CL monkey wear asp. one hat very funny  
 "(that) each monkey is wearing a hat is funny"

Age (years)	<u>No. of Subjects</u> <u>with non-</u> <u>referential</u> <u>reading</u>	<u>No. of Subjects</u> <u>with referential</u> <u>reading</u>	<u>Total</u>
3	5 (26%)	14 (74%)	19
4	4 (18%)	18 (82%)	22
5	4 (20%)	16 (80%)	20
6	1 (4%)	23 (96%)	24
7	3 (13%)	20 (87%)	23
8	2 (15%)	11 (85%)	13
Adult	9 (45%)	11 (55%)	20

and non-referential interpretations in the adult group, the predominant referential interpretation of the children indicates that universal generalization of the singular numeral phrase is a very late acquisition for Chinese children.<sup>27</sup> If we compare Table 9 with Table 10, which provides the data on (93), it appears that the young child did not rely solely on the existential verb you as a cue

for a referential reading; the child's treatment of singular numeral phrases as non-operators is in fact the more important underlying factor.

Table 10. Chinese Children's Interpretation of Singular NPs  
Introduced by the Existential verb in Embedded Position  
(picture-identification)

test sentence: [you yige houzi dai zhe yiding maozi] hen haowanr]  
have one monkey wear asp. one hat very funny  
"(that) a (certain) monkey is wearing a hat is funny"

Age (years)	<u>No. of Subjects</u> <u>with non-</u> <u>referential</u> <u>reading</u>	<u>No. of Subjects</u> <u>with referential</u> <u>reading</u>	<u>Total</u>
3	5 (26%)	14 (74%)	19
4	1 (5%)	21 (95%)	22
5	0	20 (100%)	20
6	0	24 (100%)	24
7	1 (4%)	22 (96%)	23
8	0	13 (100%)	13
Adult	0	12	12

Table 10 shows that the adult norms for (93) were acquired before four. As in Table 9, we see an overwhelming bias toward a referential reading of the object of you, the only difference between the two tables being reflected in the relatively higher percentage of referential readings in the case where the first singular NP is introduced by you. This suggests that while the child's interpretation of referentiality of singular NPs does not crucially depend on you, the addition of this existential verb would

nonetheless reinforce the referential interpretation. This point is further confirmed by data on sentences such as (94), where the singular NP following you is found in matrix position rather than in a sentential subject.

Table 11. Acquisition of you....yi in Mandarin Chinese (picture-identification)

- test sentences: (i) you [yige xiaopengyou] bao zhe [yige wawa]  
have one-CL child hug asp. one doll  
"A child is hugging a doll"  
(ii) you [yige xiaopengyou] dai zhe [yiding maozi]  
have one child wear asp. one hat  
"A child is wearing a hat"

Age (years)	<u>No. of Subjects</u> <u>correct on both</u> <u>sentences</u> (referential reading on both sentences)	<u>No. of Subjects</u> <u>correct on one</u> <u>sentence</u> (referential reading on one sentence)	<u>No. of Subjects</u> <u>incorrect on</u> <u>both sentences</u> (non-referential on both sentences)	<u>Total</u>
3	15 (79%)	1 (5%)	3 (16%)	19
4	21 (95%)	0	1 (5%)	22
5	20 (100%)	0	0	20
6	24 (100%)	0	0	24
7	22 (96%)	0	1 (4%)	23
8	13 (100%)	0	0	13

The pictures used for the pair of test sentences here are similar but not identical to those in Fig. 3 (see Appendix 3 for details). It is striking that the figures of Table 11 are identical to those in Table 10 for the age groups four through eight, with only a slight difference in the youngest age group.

The last set of Chinese data we report in this section concerns sentences such as (95), where the existential quantifier precedes

the universal quantifier. The test pictures used were similar to those used for the sentences in Table 6 (cf. Fig. 2 and Fig. 8).

Table 12. Acquisition of you...mei 'a..every' in Mandarin Chinese (Picture Identification)

test sentences: (i) you [yige dangao] [meige xiaopengyou] dou zai chi  
have one cake every child all DUR eat  
"There is a cake (which) every child is eating"

(ii) you [yibei shui] [meige xiaopengyou] dou zai he  
have one-CL water every child all DUR drink  
"There is a glass of water (which) every child is drinking"

(narrow scope=narrow scope of the universal quantifier)

Age (years)	<u>Subjects</u> <u>with narrow</u> <u>scope on</u> <u>both</u> <u>sentences</u>	<u>Subjects</u> <u>with narrow</u> <u>scope on one</u> <u>sentence,</u> <u>wide scope</u> <u>on another</u>	<u>Subjects</u> <u>with wide</u> <u>scope on</u> <u>both</u> <u>sentences</u>	<u>Subjects</u> <u>with at least</u> <u>one non-scope</u> <u>reading</u>	<u>Total</u>
3	5 (26%)	4 (21%)	6 (32%)	4 (21%)	19
4	14 (64%)	1 (4%)	3 (14%)	4 (18%)	22
5	16 (80%)	2 (10%)	2 (10%)	0	20
6	19 (79%)	3 (13%)	1 (4%)	1 (4%)	24
7	21 (91%)	2 (9%)	0	0	23
8	12 (92%)	1 (8%)	0	0	13
Adult	18 (90%)		1 (5%)	1 (5%)	20

(Note: adult subjects had only one test sentence)

A comparison of Table 12 with Table 6 shows two sharp contrasts. One contrast is that while both were picture identification tasks, a much higher level of self consistency is seen in the former table: the proportion of subjects giving consistent readings (either wide scope or narrow scope, obtained by adding the figures in the second

and fourth columns) was 58% in the youngest age group, climbing to 78% by four, and reaching 90% at five. This differs significantly from Table 6, where the proportion of subjects giving consistent readings was 26% in the 3 year-olds and 50% in the 4 year-olds. While this figure reached 85% in the 5 year-olds, it showed fluctuation and dropped back to 62.5% in the 6 year-olds. The child's performance on both sentences of the you...mei task, where the existential quantifier precedes the universal quantifier, shows highly significant interaction among the three and six year-olds ( $p < .01$ ) and significant interaction among the four, five and seven year-olds ( $p < .05$ ). Another difference is that we see a steady progress in the child's mastery of the adult norms. Thus the percentage of subjects giving consistent narrow scope readings of the existential NP dropped steadily from 32% to 0% while at the same time a well-defined steady increase of wide scope readings was manifested. Except for the youngest age group, over 60% of the children responded with a consistent wide scope reading of the singular NP. The clearcut pattern of responses exhibited in this picture identification task, whose test sentence exceeds the mei...yi 'every...a' sentences in terms of syntactic complexity, provides strong confirmation of our hypotheses that the early child is interpreting singular NPs referentially. Once s/he has identified both the universal quantifier and the singular NP as operators, the structural configuration of the sentences will lead him/her to assign wide scope to the structurally more prominent singular NP. A comparison of Table 11 and 12 shows that in order for the child to

correctly interpret sentences with an existential Q-NP preceding a universal Q-NP, it is not enough if s/he regards the existential verb you as a marker of specificity. A crosstab of the summative results of the two tables failed to show significant interaction except for the four year-old group ( $p < .01$ ), indicating that the child cannot simply be relying on the semantics of you but needs to rely on structural relations to make correct decisions on relative scope.

## 2.2 Experiments with English-speaking Children

### Method

A total of 123 English-speaking children aged between three and eight were studied in Hong Kong. Each age group consisted of between 20 and 22 subjects. The three and four year-olds ( $N=40$ ) were drawn from one nursery while the five to eight year-olds ( $N=83$ ) all came from a primary school. All of the children spoke English as their first language and used the language at home with their parents. The overwhelming majority of them were speakers of British English, while a very small number were speakers of Australian English or North American English. As shown in Table 13 below, a fairly even distribution of male and female subjects was found in the five, seven and eight year-olds, although a slight male or female bias could be observed in the three, four and six year-olds. Among the five-to-eight year-old groups, each half age was represented by at least nine subjects, whereas in the younger group, each half age was represented by between six and 14 subjects.

Table 13. Age and Number of English-speaking Subjects

<u>Age</u>	<u>Number of Subjects</u>		<u>Total</u>
	<u>Male</u>	<u>Female</u>	
3 year-old	14	6	20
4 year-old	6	14	20
5 year-old	10	12	22
6 year-old	13	8	21
7 year-old	9	11	20
8 year-old	10	10	<u>20</u>
		Total=	123
Adult	8	13	21

In addition, a group of 21 Grade 13 students, all native speakers of British English, were asked to fill out a questionnaire which contained a portion of the test items administered to the children group (see Appendix 5 for details).

The procedure for this set of experiments followed that of the experiments with Chinese children. Each subject was interviewed for 10-15 minutes by two experimenters, one of whom was the author. The other experimenter was a native speaker of British English who had extensive experience in testing children as a speech therapist. The procedure for testing the adult subjects was essentially the same as that for Chinese adults, except that the subjects were interviewed all in one group.

#### Test Items

The experiments carried out on English children made use of the

same set of test pictures and props as those employed in the experiments for Chinese children. The main difference between the two in terms of content is that the English experiment included far less test items, only a total of 15. There were eight picture identification tasks, three serving as training tasks and one used as a distractor, and seven act out tasks. The sequence in which the items were administered was given as follows.

(Training session: three picture identification items)

- A. two picture identification items followed by three act-out tasks
- B. two picture identification items followed by three act-out tasks
- C. one picture identification task, followed by one act-out item

Block A is parallel to Block B, with a sentence token of every testing point located in each of these two blocks. Block C begins with a picture identification tasks which is a repeat of one of the training picture sets to distract the subject in order that the effects of the children's earlier responses on the last item (the configuration control item) could be minimized. The English counterparts of Type I and Type II items were the following:

(96) Take every sweet out

(97) Every child is eating a cake

(98) Every spaceman sleeps in a box

Results: Type I and Type II items

The first item we examined was the child's conception of every in an



act-out task. As in the design for the Chinese experiments, the child was asked to take out every one of the six objects placed in a lidded plastic box. Given the fact that the Chinese universal quantifier expression mei...dou was acquired before 4, one would assume that the acquisition of every should occur at approximately the same stage, since the semantics of the two expressions is highly similar. This is in fact what we observe in the performance of the English children.

Table 14. Acquisition of every by English-speaking Children  
(Act-out)

test sentences: (i) Take every sweet out  
(ii) Take every marble out

<u>Age</u> (years)	<u>No. of Subjects</u> <u>correct on</u> <u>both sentences</u>	<u>No. of Subjects</u> <u>correct on</u> <u>one sentence</u>	<u>No. of Subjects</u> <u>incorrect on</u> <u>both sentences</u>	<u>Total</u>
3	17 (85%)	0	3 (15%)	20
4	20 (100%)	0	0	20
5	22 (100%)	0	0	22
6	21 (100%)	0	0	21
7	20 (100%)	0	0	20
8	20 (100%)	0	0	20

Table 14 shows that only 15% of the 3 year-old subjects failed to interpret every correctly. It is interesting to note that like the Chinese children, these subjects who failed the task took out only one or two of the objects from the box, suggesting that they were probably interpreting every as singularity or duality. Thus the English-speaking child had acquired every by three. From

naturalistic studies (cf. Macnamara 1982:180; Brown 1973), we know that some children begin to use a N to refer to single objects before they turned two, and the use of singular NPs with a as article is common among three year-olds. Thus we can assume that the three year-old English child is able to understand a N as denoting singularity. In other words, most English children will have been able to identify every N and a N as [+quantifier] by four. If that is the case, we would expect to see (as in the Chinese results) a stage where in a sentence such as (97-98) one or both of the Q-NPs are interpreted as non-operators, i.e. a stage during which the equivalent of a narrow scope reading of the universal quantifier can be observed. Let us first examine the extent to which our prediction is corroborated by the findings in the picture identification tasks. These results are provided in Table 15 above. A number of gross similarities can be seen between the patterns in Table 15 and those in Table 6. First of all, the children exhibited a fair amount of inconsistency in their responses; their responses on the two test sentences showed significant interaction only for the seven year-olds ( $p < .05$ ). Secondly, as expected we do see a narrow scope bias (20% vs 5%) in the children's interpretation of every N among the three year-olds. Thirdly, as in the Chinese data, a general increase in consistent wide scope readings with age could be noted, rising from 5% to 95% of the age group. This was accompanied by a general decline in consistent narrow scope readings of the universal quantifier from 20% to 0% (except for an irregularity among the seven year-olds).

Table 15. Acquisition of Every....a  
in English (Picture-identification)

test sentences: (i) [Every child] is eating [a cake]  
(ii) [Every child] is drinking [a glass of water]

(wide scope=wide scope reading of the universal quantifier)

<u>Age</u> (years)	<u>Subjects</u> <u>with wide</u> <u>scope on</u> <u>both</u> <u>sentences</u>	<u>Subjects</u> <u>with wide</u> <u>scope on one</u> <u>sentence,</u> <u>narrow scope</u> <u>on another</u>	<u>Subjects</u> <u>with narrow</u> <u>scope on</u> <u>both</u> <u>sentences</u>	<u>Subjects</u> <u>with at least</u> <u>one non-scope</u> <u>reading</u>	<u>Total</u>
3	1 (5%)	11 (55%)	4 (20%)	4 (20%)	20
4	9 (45%)	6 (30%)	3 (15%)	2 (10%)	20
5	11 (50%)	3 (13.6%)	3 (13.6%)	5 (22.8%)	22
6	12 (57%)	6 (28%)	1 (5%)	2 (10%)	21
7	11 (55%)	4 (20%)	5 (25%)	0	20
8	19 (95%)	1 (5%)	0	0	20
Adult	14 (67%)	6 (28%)	1 (5%)	0	21

Finally, the appearance of non-scope readings was restricted to the younger age groups, as was the case with the Chinese data. The figures representing the consistent wide and narrow scope readings are plotted in Fig. 11 below.

If we compare this figure with Fig. 9, the differences are striking. Although the solid lines in the two figures (representing the consistent wide scope readings) both show a climbing slope, the one in Fig. 11 displayed a very steep ascent, rising to about four times the value of the solid graph in Fig. 9 by age 8.

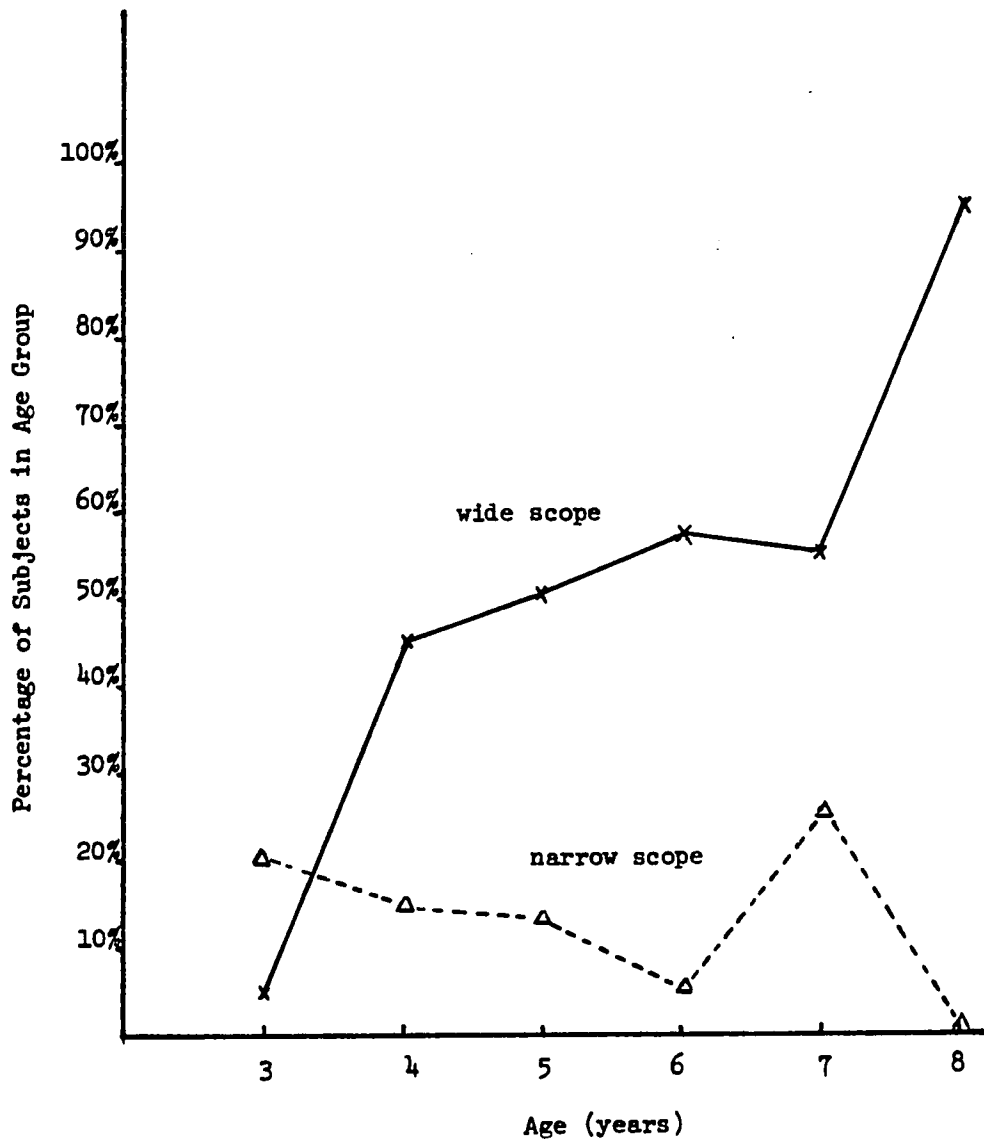


Fig. 11. Consistent wide scope vs narrow scope readings of the universal quantifier in every...a sentences in English (picture identification)

In other words, contrary to what we have observed in the Chinese data, we see here a wide scope bias instead of a narrow scope bias beginning with age 4. While a narrow scope bias was present in the English subjects at age three, it did not show any increase in the early ages but instead showed a general decline. A further difference between the Chinese and English data in this picture identification task concerns the number of subjects choosing the non-scope readings, which corresponded to the bottom picture in Fig. 8. Our interpretation of the non-scope reading has been that it originated in a group reading of both Q-NPs (i.e. both regarded as non-operators). If that is the case, the figures in the fifth column of Table 15 can be treated on a par with the figures for consistent narrow scope readings, both stemming from a failure to assign [+operator] status to the Q-NPs. In other words, among the children who gave a group interpretation to the quantifiers, some opted for a complete group reading (equivalent to a narrow scope reading of every N) while others opted for an incomplete group reading (equivalent to a non-scope reading).<sup>28</sup> One last difference between Table 6 and Table 15 is that while most of the adult subjects consistently responded with a wide scope reading of every N, about one third of them gave a narrow scope response in at least one of the sentences, which is a higher percentage than that for the Chinese adults.

Our findings so far are contrary to our expectations in two important ways: first we witness in the English subjects a rapid transition to wide scope interpretation at a very early age;

secondly, since c-command and linear order are not relevant factors for determining scope order in English, one would have expected a more even distribution of wide and narrow scope readings as the child grows older and learns that c-command and linear order are not restrictions on scope interpretation. Let us see if these tendencies also hold of the act-out tasks. The same prop setting as that in Fig. 4 was used for this pair of items.

Table 16. Acquisition of Every...a  
in English (Act-out)

test sentences: (i) [Every spaceman] sleeps in [a box]

(ii) [Every kitten] sits in [a box]

(wide scope=wide scope of the universal quantifier)

<u>Age</u> (years)	<u>Subjects</u> <u>with wide</u> <u>scope on</u> <u>both</u> <u>sentences</u>	<u>Subjects</u> <u>with wide</u> <u>scope on one</u> <u>sentence,</u> <u>narrow scope</u> <u>on another</u>	<u>Subjects</u> <u>with narrow</u> <u>scope on</u> <u>both</u> <u>sentences</u>	<u>Subjects</u> <u>with at least</u> <u>one non-scope</u> <u>reading</u>	<u>Total</u>
3	3 (15%)	0	17 (85%)	0	20
4	6 (30%)	0	13 (65%)	1 (5%)	20
5	15 (68%)	1 (5%)	6 (27%)	0	22
6	15 (71%)	0	5 (29%)	0	21
7	20 (100%)	0	0	0	20
8	18 (90%)	0	2 (10%)	0	20
Adult	20 (95%)		1 (5%)	0	21

(Note: adult subjects had only one test sentence)

Comparing the figures in Table 16 to those in Table 7, we find again similar patterns of responses: (a) a much higher degree of self consistency in contrast to the corresponding picture identification items; (b) a general increase in consistent wide scope readings with age; (c) a narrow scope bias in the younger age groups (three and four year-olds) followed by a reversal after five; (d) the paucity of non-scope readings and their subsequent disappearance after four. The percentages of subjects with consistent wide and narrow scope interpretations are plotted in Fig. 12 below.

The similarity between the slopes of the solid lines in Fig. 12 and Fig. 10 cannot escape notice. The main difference between the two figures has to do with the absence of an upward initial contour of the dotted line (representing the narrow scope readings) in Fig. 12 and the earlier occurrence of the point at which the reversal in scope bias occurs (between age four and five in Fig. 12 vs between five and six in Fig. 10).

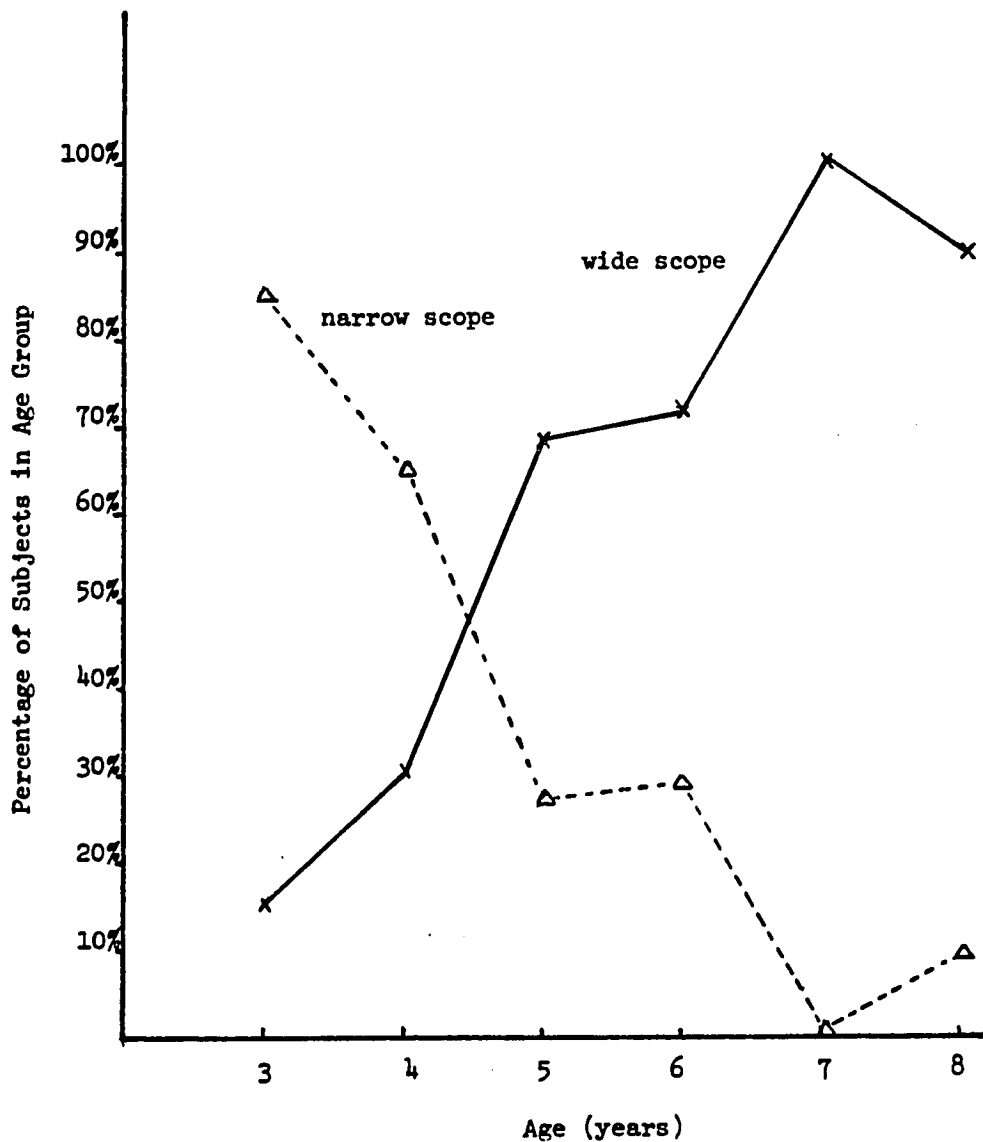


Fig. 12. Consistent wide scope vs narrow scope readings of the universal quantifier in every...a sentences in English (Act out)



The act-out task with a prop configuration favoring a wide scope reading (cf. Fig. 5) revealed a still higher percentage of wide scope readings, as shown in Table 17 and Fig. 12a.

Table 17. Acquisition of Every...a in English  
(Act-out, with prop configuration favoring  
wide-scope reading)  
test sentence: Put [every sweet] in [a box]  
(1 token)

(wide scope=wide scope reading of the universal quantifier)

<u>Age</u> (years)	<u>Subjects with</u> <u>wide scope</u> <u>reading</u>	<u>Subjects with</u> <u>narrow scope</u> <u>reading</u>	<u>Subjects with</u> <u>non-scope</u> <u>reading</u>	<u>Total</u>
3	11 (55%)	6 (30%)	3 (15%)	20
4	16 (80%)	4 (20%)	0	20
5	15 (68%)	7 (32%)	0	22
6	13 (62%)	8 (38%)	0	21
7	18 (90%)	2 (10%)	0	20
8	15 (75%)	5 (25%)	0	20
Adult	17 (81%)	4 (19%)	0	21

With this type of prop setting, a narrow scope bias was not observed at all in any age group. It should be noted that the test sentence was not syntactically identical to that in the preceding two items. However, the hierarchical relationship between the two Q-NPs concerned remains the same, with the first Q-NP c-commanding the second. The fact that a much higher percentage of wide scope readings emerged in the three and four year-olds might be due to the influence of visual cues.

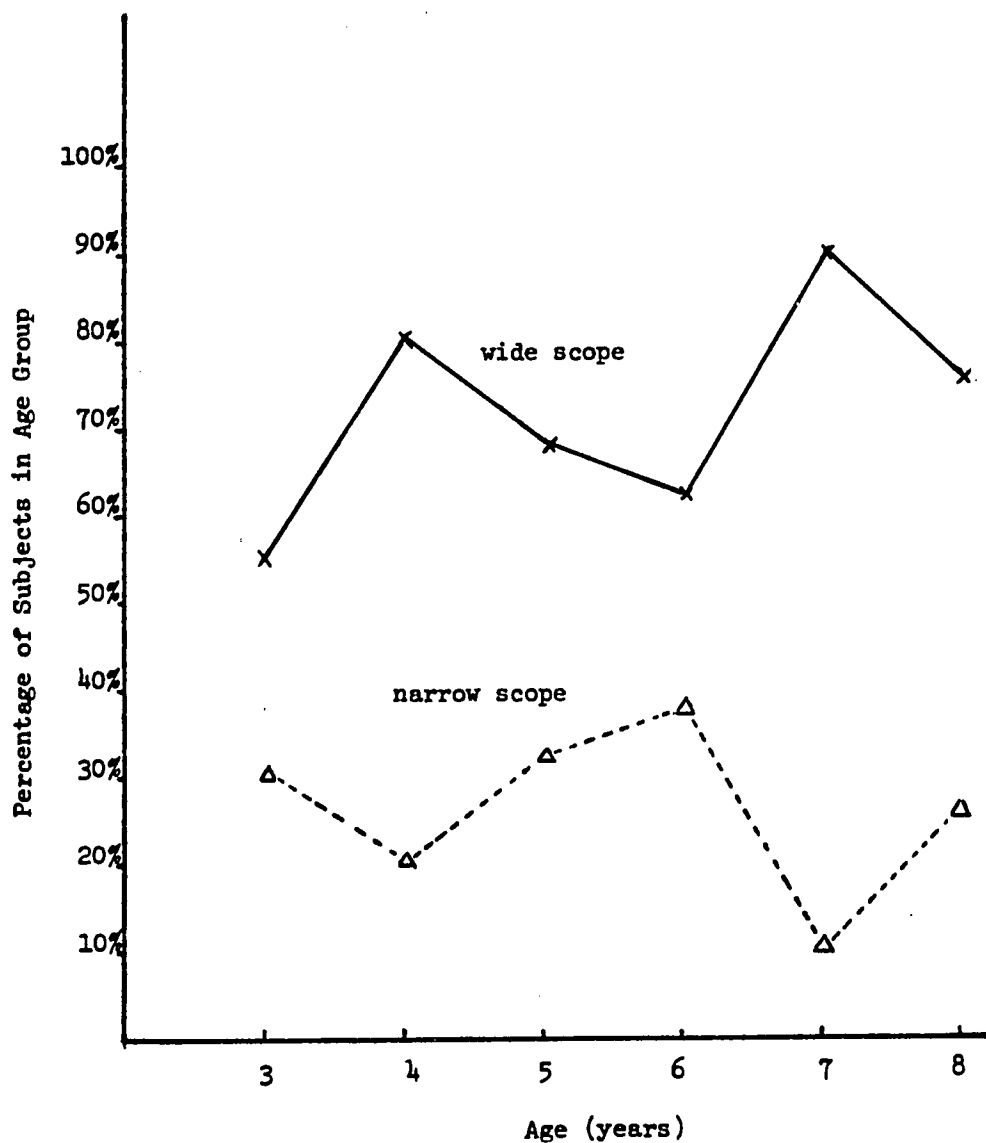


Fig. 12a. Wide scope vs narrow scope readings of the universal quantifier in every...a sentences in English (Act out, with prop configuration favoring wide scope reading)

Summarizing the two salient features of the English data, English children showed consistent wide scope interpretations of every N at five -earlier than their Chinese counterparts, and that their wide scope readings became dominant by 7. In contrast, Chinese children acquired a wide scope bias only after five and that this wide scope reading did not gain dominance until after eight. In the next section, we offer a number of suggestions as to why such cross-linguistic differences are manifested in the findings.

### 2.2.3 Cross-linguistic Comparison

Below we consider three linguistic factors that may account for the prevalence of wide scope readings among English children and the lack of such a tendency in Chinese children. Before we consider these factors, we would like to point out that it is highly unlikely that the cross-linguistic differences were due to perceptual factors arising from the test situation itself. This is because the Chinese children were performing a host of other items in the same experiment, for which the development trend as well as the points of acquisition were very well-defined, e.g. the child's mastery of yi 'one', dou 'all', mei...dou 'every...all', the durative aspect zai, the relative scope of an existential quantifier with respect to a following universal quantifier (the you...mei items). It does not seem plausible that while for the other test items the child was registering linguistic input, the child was tuning in to perceptual factors primarily for the mei...yi 'every...a' sentences. On the other hand, there is strong evidence for the child registering linguistic input from the parallels we have observed between the picture

identification tasks and the act-out tasks. In the Chinese case, a narrow-scope bias for mei...yi was clear in both the picture identification and act-out tasks(cf. Fig. 9 and Fig. 10); likewise, in the English data, the preference for a wide scope interpretation was found in both types of tasks (cf. Fig. 11 and Fig. 12). The common factor underlying the two tasks was clearly the linguistic input and not the perceptual dimensions of the test situation. Nor does it seem reasonable to attribute the cross-linguistic difference to cultural differences: one may conjecture, for example, that given the fact that the prop arrangement disfavors a wide scope reading, the Chinese children may have been more disciplined than their English counterparts and therefore did not feel like disturbing the prop configuration they were presented with in the act-out tasks. It is the impression of the experimenters that both groups of children were equally alert and energetic and neither seemed to be on the whole more restrained than the other. Even if one accepts the relevance of possible cultural divergences, which seem prima facie contrary to fact, one would still be hard pressed to explain why these cultural differences did not extend to other act-out tasks such as mei...dou 'every', and why similarities between the picture identification and the act-out items were manifested in spite of differences in the test situation.

Having rejected the significance of perceptual or cultural factors that may have played a role in the children's responses, we would like to propose the first linguistic factor that could contribute to the pattern of responses of the English child. The

preference for wide scope readings may be due to the distribution of the universal quantifier to the direct object or prepositional object positions. In earlier acquisition studies of quantification, Donaldson and Lloyd (1974) observed that 3-5 year-olds had the tendency to interpret sentences such as "Each car is in a garage" or "all the cars are in the garages" as "all the cars are in all the garages", so that if a total of three toy cars were each placed in a toy garage, with a fourth garage remaining empty, the child would not interpret the first two of the preceding sentences as being true of the situation. Roeper and Matthei (1975) also report similar findings; they observed that the majority of their three to nine year-old subjects showed a tendency to interpret "all the circles are black" as "all the circles are all black", and the majority of the preschoolers in their sample understood "some of the circles are black" as "some of the circles are some black". Roeper and Matthei thus proposed the following hypothesis:

- (99) "all children will pass through a phase where they will interpret a single quantifier as if it occurred in two positions with the scope unique to each position

If indeed young children have the tendency to spread the universal quantifier to all possible determiner positions, one would expect them to interpret "Every child is eating a cake" as "Every child is eating every cake", with a one-one correspondence between the children and the cakes. This would result in a wide scope interpretation of the subject NP in the test sentences at an early

age, which is exactly what we saw in the English data.

The next question we need to address is why such a spreading phenomenon did not occur in the Chinese sample. On this issue, we need to recall our earlier discussion in Ch. 1.3.2 about the distribution of universal quantifiers in Chinese. It was noted that while universal quantifiers like mei 'every' and suoyou 'all' can occur in object position, the quantifier renhe 'any' and reduplicative classifiers cannot occur in object position to signal universal quantification. This restriction was attributed to the strong tendency for isomorphism between SS and LF in Chinese. It was further observed that the most natural position for universal quantifiers to occupy was the preverbal position supported by dou. The implication of this syntactic property of Chinese for our present discussion is that if the object position disfavors universal quantifiers, the early child would not realize that this position is a possible slot for universal quantification, so that the general tendency stated in (99) would not apply even if it also holds for the Chinese child.

A second factor that may underlie the difference between our Chinese and English findings is related to the referential properties of yi-CL-N vs a N. In Section 1.2, we saw that the two exhibited a number of parallels. Both have a numerical reading 'one'; both can display a generic reading in subject position; when occupying object position, the two can function non-referentially in want-contexts or as predicate nominals. Despite these similarities, an important difference exists between these singular indefinite

NPs: the Chinese yi-CL-N tends to be more restricted in its non-referential role than the English a N. This can be seen from the fact that yi-CL-N requires a modal context to take on a generic meaning in subject position. In addition, while the singular indefinite NP in Chinese can function as a predicate nominal, we noted that the most common form of the predicative nominal in the language is one with zero determiner. Thirdly, while in English a N can occur non-referentially within the scope of not, yi-CL-N cannot fall within the scope of bu 'not'. The overall difference between the singular indefinite NP in English and Chinese thus lies in the stronger propensity of a N for non-referential use than its Chinese counterpart yi-CL-N, the latter appearing to be in some sense more concrete in reference.

The above linguistic difference between the two languages is reflected in early child language. In the case of English, we know that the semantics of a vs that of the is acquired by three and a half years old, both in comprehension and production. When an object is specified for the child speaker and for the listener, the child will use the; when the object is not specified either for the child speaker or for the listener, the child will use a (cf. McNamara 1982, Brown, 1973, Maratsos 1974). Brown (1973:352-3) gives examples of a N used as a generic and a N used nonreferentially in want-contexts as well as in scope of negation, as the following illustrate.

(100) Put a band-aid on it (Eve, 2;2)

(101) A wheel looks like a Q (Adam, 3;2)

(102) This don't have a wheel on it (Adam, 3;2)

(103) I need a clothespin (Adam 3;2)

(104) Make a B (Sarah, 3;8)

MacNamara (1982:119,180) observed in his child Kieran instances of a N used both referentially and non-referentially by the 20th month. In the following examples (105-106), a N is used referentially, whereas in (107-110) it is used predicatively.

(105) See a bus

(106) See a car

(107) You're a girl

(108) It's a car

(109) like a crab

(110) like a boat on water

In Bloom (1970), many instances of a N used within the scope of negation can be found in the spontaneous utterances of her three subjects.

(111) that not ∅ doughnut (Kathryn 24;2) (Bloom:195-6)

(112) ∅ can't find ∅ saucer (Kathryn 24;2)

(113) Eric couldn't see ∅ duck (Eric 26;3) (Bloom:207)

(114) don't take ∅ choochoo train home (Eric, 26;3)

(115) it's not ∅ big spoon (Gia 27;1)

Abundance evidence is therefore available in child language records attesting to the English child's use of non-referential use of a N. As we suggested in section 1 of this chapter, while non-referentiality does not warrant [+operator] status, it may well be a useful clue for the child to sort out likely candidate



operators. The early acquisition of the referential properties of a<sub>N</sub> could have helped the child to identify a<sub>N</sub> as [+operator] at a very early stage.

In existing studies of acquisition of Mandarin, the naturalistic data is not rich enough for a scrutiny of the referentiality of numeral phrases. However, based on Lee (1981,1985) and Erbaugh (1982), several observations can still be made about the child's use of yi-CL-N. First of all, referential use of numeral phrases is attested in Lee (1985): the two-year-old child studied used the NP liangge ren 'two persons' to refer to two toy spacemen emerging from hiding in a play situation, as (116) shows. (117) gives another instance of a numeral phrase used referentially.

(116) liangge ren chulai le (Xiaomin 2;0)  
two-CL person come-out asp./part.  
"(the) Two men came out"

(117) liangge jiqi ren dajia (pitting one spaceman against another)  
two-CL spaceman fight  
"Two spacemen are fighting"

Similar sentences involving numeral phrases can also be found in the records of Erbaugh (1982), as shown in (118).

(118) peng dao yige kaishui (2;11) (Erbaugh:451)  
touch compl. one-CL boiled-water  
"child talking about an animal falling into a pot of  
boiling water"

In both studies, there is some evidence that the child could also use the numeral phrase non-referentially, referring to any member of a class of objects. However, since the children were describing objects in their presence, it is not totally clear whether they were in fact using the sentences without specific reference.

- (119) yao liangge zhege (2;0 the child wants two Lego blocks  
 want two-CL this-CL with rounded tops as houses)  
 "want two of this" (Lee 1985)
- (120) wo hui yige xiao wuzi (2;5; the child is building blocks)  
 I will one-CL small house (Erbaugh 1982)  
 "I will (build) a small house"
- (121) zhege shi yige menmen (between 2 and 3;labelling an object)  
 this-CL be one-CL door  
 "this is a door"

In the above sentences containing the verb yao 'want', the modal hui 'will' and the copula shi 'be', the numeral phrases in normal use do not denote a specific referent. But these sentences (cf. 119,121) are also compatible with the situations where the children had already decided on some object(s) which for them were unique.

One clear contrast between the naturalistic records in the two languages is that there is not a single instance of yi-CL-N used as a generic NP in the Chinese data (cf. English data (101)). In addition, in the 132 negative utterances of the child reported in Lee (1981) (17 months to 23 months 2 weeks), there was not a single instance of yi-CL-N occurring in the utterances. This observation is also true of Erbaugh (1982) where negative sentences such as (122) never contain a singular indefinite NP within the scope of negation.

- (122) neige bu menmen (3;2; referring to a toy garage that  
 that-CL not door has no door) (Erbaugh:522)  
 "that is not a door"

Based on these naturalistic findings and our earlier analysis of adult use of numeral phrases in Mandarin, it does appear that non-referential use of yi-CL-N is much more restricted in Chinese than it is in English. This could have delayed the Chinese child's perception of the singular indefinite NP as an operator capable of

scope dependence, leading to what seems to be a narrow scope interpretation of the universal quantifier at the initial stages.

A third linguistic factor that may contribute to the divergence between English and Chinese is the fact that there is number agreement in English but not in Chinese. It is well known that number morphology is acquired early in English: of the three children studied by Brown (1973:271), all of them had acquired number agreement between the determiner and the head noun (e.g. two blocks) as well as the number agreement between the subject of a sentence and a predicative nominal (they blocks) by 2;10. Number agreement between the present tense third person singular morpheme and the subject NP was acquired later; the earliest point of acquisition reported was around 2;3 and the latest around 3;10. Thus number agreement within the NP and between subject and predicate was understood before four. Now in English the universal quantifier determiner every selects singular morphology, as in every boy, and everybody is waiting. This could serve as a cue signalling to the child that the entities denoted by the NP should not be taken as a set but should rather be taken individually.<sup>29</sup> In other words, number agreement informs the child of the distributive nature of every so that a wide scope interpretation of the quantifier results.<sup>30</sup>

One may ask if something comparable to number agreement exists in Chinese which would provide a similar clue to the Chinese child. A possible type of cue that might suggest singularity is the fact that the universal quantifier mei 'every' can cooccur with

classifiers, whether individual or collective. The individual classifier ge is a general classifier that cooccurs with a large number of nouns capable of being interpreted as an individual.

- (123) yige ren / fangzi/ beizi / guojia/ shou  
 one-CL person/house/ cup/ country/ hand  
 "a person/a house/ a cup/ a country/ a hand"
- (124) yizhu fangzi/ yiqun ren/ yidui dongxi/yishuan wazi  
 one-set house /one-group person/one-pile thing/one-pair sock  
 "a set of houses/ a group of people/ a pile of things/  
 pair of socks"
- (125) yijian yifu / yizhang zhi/ yitiao yu/ yili mi  
 one-piece clothes/one-sheet paper/one-CL fish/one-grain rice  
 "a piece of clothing/ a sheet of paper/ a fish/a grain of rice"

The individual classifier ge is contrasted with aggregate classifiers such as zhu, qun, dui, shuan as illustrated in (124), which denote a collective. Other examples of individual classifiers are given in (125). Now mei 'every' and renhe 'any' are the only two universal quantifier determiners that can precede a singular numeral phrase whereas none of the other universal quantifiers can if the numeral yi 'one' is retained.

- (125a) mei (yi)ge ren/ mei (yi)zhang zhi / mei (yi)li mi  
 every (one)-CL person/every (one)-CL paper/every (one)-grain  
 rice  
 "every person/every sheet of paper/ every grain of rice"
- (125b) renhe \*(yi) ge ren/ renhe \*(yi)zhang zhi  
 any one CL person /any one sheet paper  
 "any person/ any sheet of paper"
- (125c) quan li mi / \*quan yi li mi  
 all/entire grain rice/ all/entire one grain rice  
 "the entire grain of rice/ \*the entire one grain of rice"
- (125d) \* suoyou zhang zhi / \* suoyou yi zhang zhi  
 all sheet paper /all one sheet paper  
 "all sheets of paper/\* all one sheet of paper"

As we have seen from our discussion in Ch. 1.1, suoyou 'all' cannot cooccur with any classifiers and as shown in (125d), it cannot precede the singular numeral ; quan 'all/entire' can occur with classifiers that can be interpreted as having extent, but as shown in (125c), it cannot precede yi 'one'; renhe 'any' cannot precede a classifier directly but may precede the singular numeral phrase, as (125b) demonstrates. Thus one important distributional difference between quantifiers like mei and renhe vs quantifiers like suoyou and quan is that the former can precede yi-CL-N , while the latter cannot. Would this be a kind of clue informing the child of the distributive nature of quantifiers like mei?

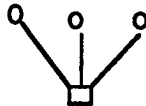
While this may well be a clue leading the child to the distributive properties of mei, it does not seem likely that the child can make use of it at an early stage for the simple reason that compared to articles in English, classifiers are in general a late acquisition. For example, longitudinal and cross-sectional studies have shown that the aggregate classifiers are acquired much later than the individual classifiers. In Lee (1985), the three classifiers most frequently used by the child subject at 2;0 were the general classifier ge, and two other individual classifiers, tiao 'classifier for long slender objects', and ben 'text' (as in yitiao yu 'a fish', yiben shu 'a book'). The classifiers used most frequently by two of the children studied by Erbaugh (1982:447) were zhi 'individual classifier for animal', zhang 'sheet', ben 'text', duo 'classifier for flower/cloud', tiao 'classifier for long slender object' and kuai 'lump', all of which were individual classifiers.<sup>31</sup>

Ying et al (1983), in a survey of 179 Mandarin-speaking children between five and seven years old, found that four year-olds had only acquired two individual classifiers ge and zhi 'individual classifier for animal', and five-year-olds had only expanded the inventory by adding two more individual classifiers, tiao 'classifier for long, slender object' and ben 'text'. They further demonstrated that aggregate classifiers were acquired very late, as only one of these- shuan 'pair' was mastered by seven. Fang (1985) reports similar findings among four to six year-old Mandarin-speaking subjects (N=36): on average, four year-olds could use only four of the 12 commonly used classifiers,<sup>32</sup> and six year-olds had an average classifier inventory size of nine. It was also found that four year-olds could not use any of the individual classifiers zhang 'sheet', li 'grain', tiao 'classifier for long, slender object' and kuai 'lump' appropriately to describe clay objects moulded into the relevant shapes, indicating that they had not acquired the semantics of these classifiers. The fact that the classifier system is an essential ingredient of the numeral phrase and that it is acquired relatively late could be an inhibiting factor in the child's exploitation of relevant distributional cues having to do with cooccurrence of quantifier determiners with numeral phrases.

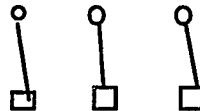
So far we have proposed three linguistic factors to account for why the early emergence of wide scope interpretations' of every is found in the English data and not in the Chinese data. The other finding that turned out to be contrary to our expectation and needs to be explained is the lack of narrow-scope readings among older

English children. One would have expected the older children to learn at some point that c-command and linear order are not absolute factors for scope interpretation for English, and thus also allow a narrow scope interpretation of every N. The absence of a tendency in this direction cannot be attributed to the poverty of relevant triggers for resetting the parameter of scope order, since simple sentences such as 'put a book on every shelf' can inform the child of the irrelevance of c-command. The more plausible view is to ascribe this to the operation of discourse principles such as the Gricean Maxim of Quantity. This maxim requires the speaker to make his/her contribution as informative as is required for the current purpose of the exchange and no more. In the test pictures on the relative scope of universal and existential quantifiers,

Situation A



Situation B



(126) Every child is eating a cake

(127) There is a cake (which) every child is eating

Situation B can only be described by (126) whereas Situation A can be described by (126) and (127). Since (126) has been used to describe a unique situation, the child will assume that if Situation A is referred to, a separate sentence like that of (127) would be used instead, in accordance with the maxim of Quantity. Thus even if the English child detects scope ambiguity, s/he may still select Situation B rather than A. That conversational maxims like the maxim

of Quantity are relevant to children's decoding of ambiguous messages have been demonstrated by Jackson and Jacobs (1981).<sup>33</sup> The use of the same discourse strategy by the Chinese children would, of course, reinforce the move toward adult norms (i.e. a wide scope reading of the universal quantifier), which is the trend we observe. It appears that a combination of structural constraints, language specific syntactic properties and discourse principles combine to shape the responses of the child in the interpretation of quantified sentences.



#### 2.2.4 Acquisition of Marked Scope Order

##### Chinese

In this section we examine experimental findings on how Chinese and English children interpret the relative scope of certain Q-NPs which are in some sense marked. In the Chinese case, the test sentences concern the quantificational adverb quan 'all/entire', introduced in 1.1, which has somewhat similar properties to dou.

(128) xiongmao quan shui le  
panda all/entire sleep asp./part.  
"the pandas are all asleep"

(129) wo shenme quan bu yao  
I what all/entire not want  
"I don't want anything" (cf. Lu 1980)

(130)a. \*meige ren/\*renhe ren/\*gege ren quan qu le  
every person/any person/CL-CL person all go asp.  
"everyone has left"

b. suoyou ren quan qu le  
all person all/entire go asp.  
"All went"

c. tamen quan qu le  
they all go asp.  
"they have all left"

(131)a. zhetao shu quan bu quan?  
this-set book complete not complete  
"is this set of book complete?"

b. zhetao shu hen quan  
this-set book very complete  
"this set of books is very complete"

c. zhetao shu bu quan  
this-set book not complete  
"this set of books is not complete"

(132) qizi quan/dou fang t zai yige pingzi li  
 chess- all put at one bottle in  
 piece

"Put all the chesspieces in a bottle"

(128) is synonymous with a sentence where quan is replaced by dou, meaning all of the pandas have fallen asleep. In Beijing Mandarin, it is reported (Lu 1980) that quan can also interact with wh-words to form expressions equivalent to 'every/any', as illustrated in (129).<sup>34</sup> Like dou, quan quantifies plural NPs preceding it, as in (130c). However, quan differs from dou in that it cannot cooccur with the determiners mei, renhe and the reduplicative classifiers in the same way that dou can, the only universal quantifier determiner that it can cooccur with being suoyou 'all', as illustrated in (130a-b). In addition, unlike dou, quan can serve as the center of a predication having the meaning 'complete', as it can be modified by the intensifier hen 'very', can be negated, and can assume A-not-A form in yes-no questions, as evidenced in (131). In terms of quantifier scope, quan exhibits similar properties to dou in a sentence like (132), where a bare NP is quantified by quan and a singular indefinite NP is found elsewhere in the sentence. Recall that in Ch.1.1.6 we observed that dou marks a NP with no overt quantifier determiners as Q-NP and licences it to play a role in scope relations at LF. Recall also that when such a dou-marked NP is topicalized from direct object position, an anomaly results in the sense that the scope relations do not follow the scope

interpretation principle for Chinese. In other words, in (132) the NP qizi 'chesspiece', which occurs earlier in the sentence, in fact has narrow scope with respect to the singular NP in prepositional object position. If quan replaces dou in (132), the sentence is even more clearly unambiguous having only a narrow scope reading of the topicalized NP.

How would children interpret sentences such as (132) which is marked in deviating from the scope interpretation principle for Chinese? As marked properties of the language tend to be acquired later than the regular pattern of the language, one would expect that the child would analyze (132) exactly on a par with sentences like (133) consisting of meige N and yige N using the same set of principles.

(133) meige xiaopengyou dou zai chi yige dangao  
 every child all DUR eat one cake  
 "every child is eating a cake"

If that is the case, we would expect the Chinese child to show a narrow scope reading of the topicalized NP in the younger age groups, as the young child is likely to interpret yige N as a non-operator, leading to a complete group reading of the sentence. This would give the false impression that the child starts at a point very close to adult norms. Among older children, however, we expect the child to show different responses to the test sentences involving quan and those involving dou. There will be a continued progression toward narrow scope interpretation of the topicalized NP in (132) as the child learns the marked scope properties of such

constructions. On the other hand, for sentence (133) the child will move toward a wide scope reading of the subject NP as s/he discovers the scope dependent properties of the Q-NPs. This is precisely what we found in the test items on quan. First of all, let us note that the quantifier quan, like dou, was acquired by four years of age. This picture identification item used exactly the same picture as one of the items for dou. Table 18 gives the results.

Table 18. Acquisition of Quan 'all/entire' in Mandarin  
(Picture-identification)

test sentence: [xiongmao] quan shui le  
(1 token) panda all/entire sleep asp./part.  
"All the pandas are asleep"

Age (years)	<u>No. of Subjects</u> <u>correct</u>	<u>No. of Subjects</u> <u>incorrect</u>	<u>Total</u>
3	15 (79%)	4 (21%)	19
4	21 (95%)	1 (5%)	22
5	20 (100%)	0	22
6	24 (100%)	0	24
7	23 (100%)	0	23
8	13 (100%)	0	13

The test items for (132) were act-out tasks that used a prop arrangement similar to that for the configuration control item for mei..yi 'every..a', as shown in Fig. 13. The child was instructed to arrange the counters (chesspieces) with respect to the four bottles. Note that the test design here is based on the same assumption we have been adopting for the act-out tasks, i.e the prop setting

should not facilitate the interpretations corresponding to the adult norms. Since in (132) the adult interpretation is one where all the counters would be placed in the same bottle, the prop arrangement here disfavors the adult interpretation. It should be emphasized that this act-out task was the first act-out item performed by the child in the experiment, so the results obtained on this item could not be due to influence from the child's performance on other act-out items testing quantificational scope. The results are given in Table 19.



Fig. 13

In this item, if the child put all the objects in the same container, it would be counted as a narrow scope reading; if the

objects were each placed in a different container, it would be considered a wide scope reading; if one or two of the objects were placed in the containers, the response was regarded as a non-scope reading.

Table 19. Acquisition of marked scope order (Quan...yi)  
'all...a' in Mandarin (Act-out)

test sentence: (i) [xiaomao] quan fang zai [yige hezi] li  
kitten all/entire put at one box in  
"Put all the kittens in a box"

(ii) [qizi] quan fang zai [yige pingzi] li  
chesspiece all/entire put at one bottle in  
"Put all the chesspieces in a bottle"

(narrow scope=narrow scope reading of the NP quantified by  
quan)

Age (years)	<u>Subjects</u> <u>with narrow</u> <u>scope on</u> <u>both</u> <u>sentences</u>	<u>Subjects</u> <u>with narrow</u> <u>scope on one</u> <u>sentence,</u> <u>wide scope</u> <u>on another</u>	<u>Subjects</u> <u>with wide</u> <u>scope on</u> <u>both</u> <u>sentences</u>	<u>Subjects</u> <u>with at least</u> <u>one non-scope</u> <u>reading</u>	<u>Total</u>
3	8 (40%)	2 (10%)	5 (25%)	5 (25%)	20
4	11 (50%)	4 (18%)	6 (27%)	1 (5%)	22
5	13 (65%)	3 (15%)	4 (20%)	0	20
6	13 (54%)	5 (21%)	6 (25%)	0	24
7	16 (70%)	3 (13%)	4 (17%)	0	23
8	12 (92%)	1 (8%)	0	0	13

Here, we see again a high level of self-consistency in the

children's performance on the two sentence tokens, a feature characteristic of their responses in the act-out tasks. As in the act-out tasks of the mei...yi 'every...a' sentences, the occurrence of non-scope readings was only found in the three and four year-olds, disappearing after four. In fact, the five subjects that gave non-scope responses were precisely those who failed to understand the meaning of the universal quantifier. As expected, we observe the narrow scope bias beginning with the three year-olds, which follows a gradual increase, reaching adult norms (92%) by eight years of age. If we compare the narrow scope figures in Table 19 and Table 8 (the configuration control test for the mei...yi 'every...a' sentences), we see almost identical figures among the three, four and five year-olds. This does not come as a surprise because in both sentences, a universal quantifier and an existential Q-NP are involved and the children were tested with essentially the same type of prop arrangement.

Further, the contrast between the two tables found among the six and seven year-olds is striking. While continued progression toward increased narrow scope readings is found in Table 19, a sharp drop in narrow scope readings was seen in Table 8. These similarities between the act out tasks of mei...yi and guan...yi can also be seen by comparing Fig. 10 with Fig. 14 below. As can be seen the narrow scope bias in both figures starts at roughly the same level and a narrow scope bias is seen in 3-5 year olds. After five years of age, a reversal can be discerned in Fig.

10 but not in Fig. 14.<sup>34a</sup> The interaction between the configuration control task for mei..yi and quan..yi is supported by the fact that a crosstab of the results in the mei..yi control test and either of the quan..yi items shows statistical significance for three to five year-olds ( $p < .05$ ). The findings are thus consistent with our account of early acquisition of quantifier scope.



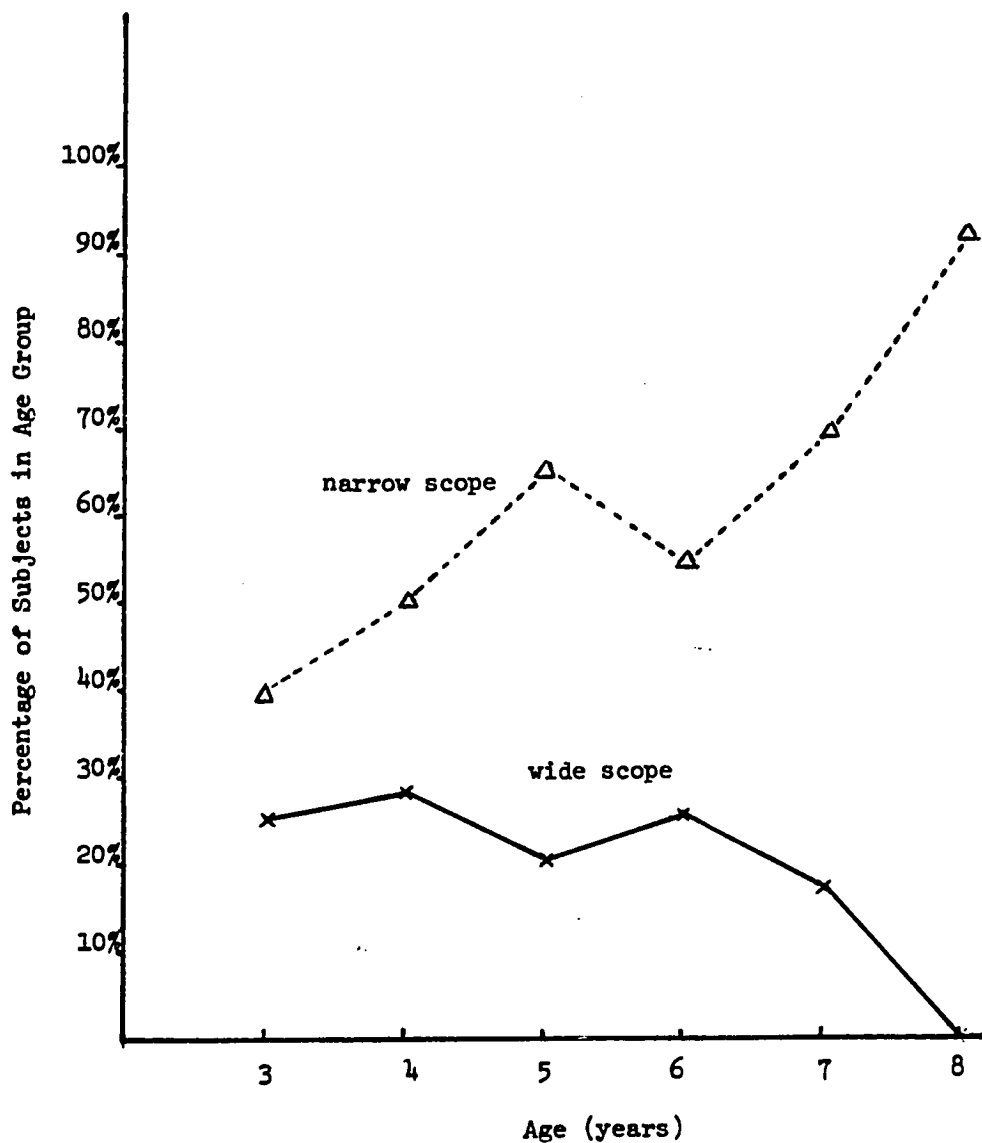


Fig. 14. Acquisition of marked scope order in Chinese. Consistent wide scope vs narrow scope readings of quan...yi 'all...a' sentences in Chinese (Act out)

### English

The marked instances of scope order we are interested in involve the universal quantifier all in relation to a singular numeral NP, as in (134) below. In the normal adult interpretation, narrow scope is assigned to all the N. As discussed earlier, scope order in English is basically free within the clause, so that in principle both scope orders are possible. The fact that the dominant reading is one with all having narrow scope is due to the idiosyncracies of all. In (135), where every N is used in place of all the N, a wide scope reading of every is easily available.

(134) Put [all the counters] [in a bottle]

(135) Put [every sweet] [in a box]

(136) Every child is eating a cake

The English subjects were tested in similar fashion using the toy arrangement as in Fig. 13. Since we know that English children interpret (136) somewhat differently from their Chinese counterparts, the prediction for the English child would be different. Recall that with (135-136), an early preference for wide scope readings of the universal quantifier was noted. This was attributed to the tendency to distribute universal quantifiers to object position, the availability of additional cues in number morphology, and to the early comprehension of the referential properties of a N. Since all the counters in (134) c-commands a bottle, we would predict that the English child will follow the unmarked option of the scope order parameter and assign wide scope

to all the N. Thus we expect the English child to behave very much unlike the Chinese child in showing a very weak tendency toward a narrow scope reading of all, but the narrow scope reading of all will grow stronger with age.

Before reporting the data on (134), let us first note that the quantifier all was acquired by four years of age, if we take 85% as a criterion for point of acquisition. The two picture sets used for this testing point were the same as those for the dou items (cf. Fig. 7).

Table 20. Acquisition of All in English  
(Picture-identification)

test sentences: (i) The pandas are all asleep

(ii) The dogs are all sitting down

Age (years)	No. of Subjects <u>correct on</u> <u>both sentences</u>	No. of Subjects <u>correct on</u> <u>one sentence</u>	No. of Subjects <u>incorrect on</u> <u>both sentences</u>	Total
3	10 (50%)	8 (40%)	2 (10%)	20
4	17 (85%)	2 (10%)	1 (5%)	20
5	19 (86.4%)	0	3 (13.6%)	22
6	18 (85.7%)	1 (40.8%)	2 (9.5%)	21
7	18 (90%)	1 (5%)	1 (5%)	20
8	19 (95%)	1 (5%)	0	20
Adult	21 (100%)		0	21

(Adult subjects had only one test sentence)

It is interesting to observe that after four, there were subjects who were incorrect on both test sentences or correct on just one of

the test sentences. This could be due to the fact that all, unlike the Chinese dou or quan, can quantify both subject and predicate so that the test sentence could also be understood as "the pandas are fully asleep". This latter interpretation is also consistent with the incorrect picture choice, in which only two of the pandas are asleep.<sup>35</sup>

Table 21. Acquisition of marked scope order (All....a)  
in English (Act-out)

test sentences: (i) Put [all the kittens] in [a box]  
(ii) Put [all the counters] in [a bottle]

(narrow scope=narrow scope of the universal quantifier)

<u>Age</u> (years)	<u>Subjects</u> <u>with narrow</u> <u>scope on</u> <u>both</u> <u>sentences</u>	<u>Subjects</u> <u>with narrow</u> <u>scope on one</u> <u>sentence,</u> <u>wide scope</u> <u>on another</u>	<u>Subjects</u> <u>with wide</u> <u>scope on</u> <u>both</u> <u>sentences</u>	<u>Subjects</u> <u>with at least</u> <u>one non-scope</u> <u>reading</u>	<u>Total</u>
3	1 (5%)	5 (25%)	11 (55%)	3 (15%)	20
4	2 (10%)	2 (10%)	13 (65%)	3 (15%)	20
5	4 (18%)	4 (18%)	14 (64%)	0	22
6	8 (38%)	5 (24%)	7 (33%)	1 (5%)	21
7	4 (20%)	2 (10%)	14 (70%)	0	20
8	8 (40%)	4 (20%)	8 (40%)	0	20
Adult	13 (62%)		8 (38%)	0	21

(Note: adult subjects had only one test sentence)

As for the act-out item on marked quantificational scope, Table 21 indicates that three year-old children did begin with a very

high percentage of wide scope readings of all, which remained at a plateau, only to decline after seven. This can be seen clearly from the graphs in Fig. 15 below.<sup>36</sup>

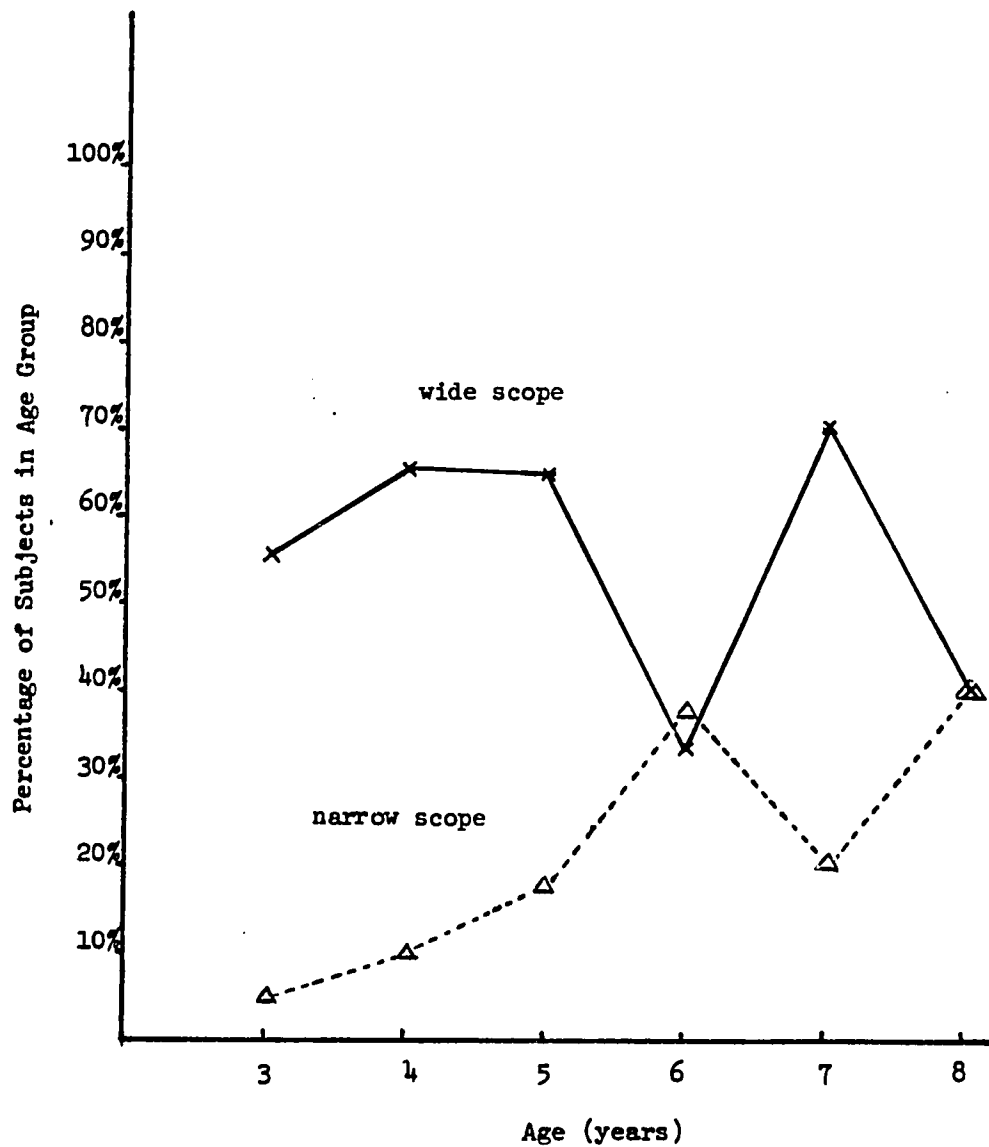


Fig. 15. Acquisition of marked scope order in English. Consistent wide and narrow scope readings of the universal quantifier in All...a sentences (Act-out)

At the same time, we see that the percentage of narrow scope interpretations of all the N started near the zero point, slowly climbing to around 40% at eight. If we compare this task to the item testing every...a with a configuration favoring wide scope interpretation (see Fig. 12a), we perceive some gross similarities between the two figures in terms of the percentage of wide scope interpretations. The wide scope graphs in both cases started at around 55% and were maintained at over 60% in the four and five year-olds. After seven, the wide scope readings were kept at over 70% in the case of every but dropped to 40% in the case of all. As Fig. 12a shows, the wide scope reading for every was clearly dominant across all age groups. In Fig. 15, it appears that children after six were beginning to learn the lexical properties of all, as a result of which the percentage of subjects giving wide and narrow scope readings of all was about the same by eight. The interaction between the configuration control test for every...a sentences and these sentences of marked scope order is further supported by statistical analysis. A crosstab of the results on either of the all...a sentences with the results on the configuration test for mei...yi shows statistical significance for the three, four and five year-olds ( $p < .05$ ).

To summarize our discussion on the acquisition of marked scope order, the evidence from Chinese and English suggests that sentences involving Q-NPs displaying marked scope order are interpreted in essentially the same way as the sentences conforming to regular

scope interpretation principles. It is only among the older age groups that we perceive a difference between their interpretation of unmarked and marked scope orders.

### 2.3 Possible Triggers for the Scope Interpretation in Chinese

In our earlier discussion, we have seen that the scope interpretation principles are different for English and Chinese. The relevant notions for Chinese are g-command and linear order, whereas the relevant factor for English is g-command. These language-specific principles have to be learned by the child on the basis of positive evidence by fixing the values of the parameter of scope order. The issue we would like to explore in this section is whether other types of evidence besides the behavior of quantifier phrases may also trigger the values of the parameters. Two additional sources are considered here: one is the relative scope of modals and negation, and the other is topic-subject and topicalization structures. It is suggested here that since the scope interpretation principle in Chinese applies not only to Q-NPs but pervades the entire system of quantification, information on the relative scope of other logical operators may also provide a clue for acquiring the scope interpretation principle of the language. It is hypothesized that there may be a correlation between the Chinese child's understanding of the contrast in (137-138) and his grasp of

- (137) ni bu keyi qu  
you not may go  
"you may not leave/you are not permitted to leave"



(138) ni keyi bu qu  
 you may not go  
 "you have permission not to leave"

the linearity condition for scope interpretation in Chinese. In (137), bu 'not' precedes the modal keyi 'may' and has the latter within its scope, so the sentence has the scope order 'Neg (may)'; in (138) since the modal precedes the negative, the interpretation is one where the modal has scope over negation, i.e. 'may (Neg)'. The contrast between sentences such as these is a plausible source for fixing scope order, because these sentences where modals are used in the deontic sense presumably occur frequently in parental speech to regulate the child's behavior. Another possible source of information for deciding on scope order is the acquisition of topic structures as exemplified in (139-140).

(139) [zhege xiaopengyou a, [baba zai chi dangao]]  
 this child part. dad DUR eat cake  
 "As for this child, (his) dad is eating a cake"

(140) [zhege xiongmao a, [xiaogou zai bei she e]]  
 this panda part. doggie DUR carry-on-back asp  
 "As for this panda, the doggie is carrying it on its back"

In (139), zhege xiaopengyou 'this child', marked by the pause particle a, serves as the topic of the sentence, and the comment is the proposition [baba zai chi dangao] 'dad is eating a cake'. In order to understand topic-comment structures of this kind, the child needs to understand that the topic position does not have to relate thematically to the verb in S. In other words, s/he needs to understand that (139) should not be interpreted as both the child

and his father eating a cake. (140) illustrates a topicalization structure where the empty category in S is bound by the topic. In acquiring topicalization structures, the child needs to understand that if there is a gap in S, then the topic should coindex with the gap. The relevance of topic structures for acquisition of quantifier scope is based on the following considerations. As we observed in Ch. 1.2, the topic in topic-prominent languages such as Chinese restricts the domain of quantification of a sentence, and serves as a point of reference for the remainder of the sentence. In other words, in a topic-comment structure, the remainder of the sentence has to be interpreted as a function of the initial constituent of the sentence, and not vice versa. It is thus conjectured that in a similar vein, in a sentence of the form  $[Q-NP_1 \text{ dou } [V \text{ } Q-NP_2]]$  the VP has to be interpretively dependent on the initial Q-NP, and not vice versa. This implies, of course, that the  $Q-NP_2$  contained within VP must be interpretively dependent on  $Q-NP_1$ .<sup>37</sup> We hypothesize therefore that the topic prominent nature of the language may be related to the linearity condition for scope interpretation. If that is the case we would expect the acquisition of topic structures to go hand in hand with that of the isomorphic scope principle. Another parallel that can be drawn between topic structures and quantificational structures is that both involve empty categories bound from A' positions at LF; in the case of Q-NPs there is evidence that they behave like A'-anaphors; in the case of topicalization in Chinese, there is also evidence that topic traces

should be analyzed as A' anaphors (cf. Liu 1986). If it indeed turns out that a correlation exists between topic structures and quantified sentences, it would mean the child will have a rich source of data for setting the values of the Scope parameter, since topic-prominence is a core property of the language and a very salient feature distinguishing subject-prominent languages such as English from Chinese.

### 2.3.1 Acquisition of the relative scope of modals and negation

There were two test items relevant to the relative scope of modals and negation in the test battery, both of which were act-out tasks. For the test sentence (141) below, a cardboard on which were drawn four square boxes was placed in front of the child; two of the boxes were yellow in color and two were black. A row of three black circular counters of about the same size as the squares were placed on one side of the cardboard adjacent to the square boxes, as in Fig. 16.

(141) hese qizi bu keyi fang zai huangse gezi li  
 black chess- not may put at yellow square in  
 piece  
 "Black chesspieces may not be placed in yellow squares"

(142) qizi fang zai fangge li. hese qizi bu keyi fang zai  
 chess-piece put at square box-in black chess-piece not may put at  
 huangse gezi li  
 yellow box in  
 "Put the chesspieces in the boxes. Black chesspieces may not  
 be placed in the yellow boxes."

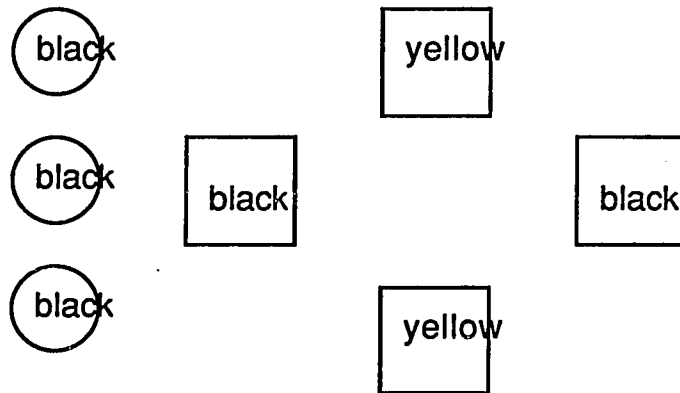


Fig. 16

The child was first asked about the colors of the square boxes and of the chesspieces. If they were not familiar with the color names, they were told the names of the colors of the objects. They were then instructed to place the chesspieces in the square boxes, as in (142). If the child placed two or all of the black counters in the black square boxes (with one in one of the two black boxes, and one or two in the other black box) the response would be counted as correct. If a black chesspiece was laid in any of the yellow boxes, the response was counted as incorrect. The results of this item are given in Table 22.

Table 22. Acquisition of Bu...keyi (not..may)  
in Mandarin-Chinese (Act-out)

test sentence: [hesē qizi] bu keyi fāng zài [huángsè gezi] lǐ  
(1 token)    black chess- not may    put    at    yellow square in  
   piece  
   "Black chesspieces may not be placed in yellow  
   squares"

<u>Age</u> (years)	<u>No. of Subjects</u> <u>with correct</u> <u>choice</u>	<u>No. of Subjects</u> <u>with incorrect</u> <u>choice</u>	<u>Total</u>
3	15 (75%)	5 (25%)	20
4	19 (86%)	3 (14%)	22
5	20 (100%)	0	20
6	24 (100%)	0	24
7	23 (100%)	0	23
8	13 (100%)	0	13
Adult	12 (100%)	0	12

As the figures demonstrate, the child by four had comprehended the scope relation of bu and keyi, when the former preceded that latter. It may be suggested that perhaps the child had learned bu keyi as a single lexical item rather than paying attention to the order of the logical operators. This view does not seem plausible because we know from studies of acquisition of negation (cf. Lee 1981) that the Mandarin-speaking child by two had grasped the major semantic categories of negation (rejection, non-existence, denial) both in comprehension and in production. There is therefore no reason to suppose that the negator here is part of a lexical item rather than

a lexical item in its own right. It seems also clear that the child has to fix the relative order of the negative with respect to a large number of verbs, including modal verbs, and that the acquisition of governing principles for this cannot be a lexical process. This is supported by the presence of errors of scope order found in acquisition records, an example being the following.

(143) a. \* wo dang bu jiejie (2;8) (Erbaugh:226)

I act-as not sister

"I don't want to act as sister"

b. wo bu dang jiejie

I not act-as sister

"I don't want to act as sister"

The child used (143a) when the correct ordering of the negator and the verb should be as in (143b).

In the next test item, the child was presented with another cardboard on which were drawn four square boxes, two red and two green. Three red chesspieces (counters) were placed next to the square boxes as in Fig. 17. The child was then asked about the colors of the boxes and counters; they were told the respective color names if they did not show knowledge of them. The experimenters then gave the instruction as in (143). If the child placed two or all of the red chesspieces in the green square boxes and none in the red boxes, a zero score would be given, since the child was clearly not differentiating the cases where the modal precedes the Neg from the case where the reverse obtains. It is also possible that a child responding in such a way may have ignored the modal verb and tuned in only to the negator. If the

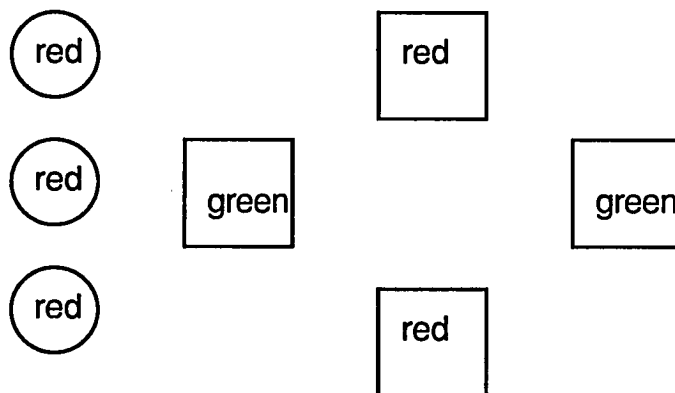


Fig. 17

(143) qizi            fang zai fangge li.  
 chess-piece put at square-box in

hongse qizi      keyi bu fang zai hongse gezi li  
 red chess-piece may not put at red box in

"Put the chesspieces in the square boxes. It is  
 permissible for the red chesspieces not to be placed  
 in red boxes"

child put two or all of the red chesspieces in the red square boxes,  
 the child would be assigned a score of 1, since the response would  
 not indicate a clear understanding of the fact that two  
 possibilities are allowed by the sequence keyi bu. The child was  
 allowed to place the red chesspieces in either of the red boxes or  
 in the green boxes. It may be that a child responding in the second  
 manner had already acquired some notion of the meaning of the  
 sequence keyi bu 'may (Neg)', but the contrast between the two scope  
 orders was not yet firmly established. A third type of response,  
 where the child distributed the red chesspieces in boxes of two  
 different colors, would receive the highest score 2. In such a

response, the child typically put two red chesspieces, both or each in a red box and the remaining red chesspiece in a green box, or the child may simply put one chesspiece in a red box and one in a green box.<sup>38</sup> The results are shown in Table 23.

Table 23. Acquisition of Keyi...bu 'may..not'  
in Mandarin-Chinese (Act-out)

test sentence: [hongse qizi] keyi bu fang zai [hongse gezi] li  
red chess- may not put at red square in  
piece

"it is permissible for red chesspieces not to  
be placed in red squares"

Age (yrs)	<u>Subjects placing objects in boxes of different colors(score=2)</u>	<u>Subjects placing objects only in red squares (score=1)</u>	<u>Subjects placing objects only in green squares (score=0)</u>	<u>Total</u>
3	0	6 (30%)	14 (70%)	20
4	1 (5%)	11 (50%)	10 (45%)	22
5	2 (10%)	16 (80%)	2 (10%)	20
6	3 (13%)	19 (79%)	2 (8%)	24
7	4 (17%)	17 (74%)	2 (9%)	23
8	7 (54%)	5 (38%)	1 (8%)	13
Adult	11 (92%)	1 (8%)	0	12



The first point to note is that the adult subjects performed in a way consistent with the test design, since with only one exception, all adult subjects placed the counters in boxes of different colors. We also found that children before five seemed incapable of contrasting the two scope orders, so that 70% of the three year-olds and 45% of the four year-olds interpreted 'may (Neg)' as if it were 'Neg (may)'. five, six and seven year-olds seem to be able to distinguish the two scope orders, but did not show full understanding of the scope order keyi bu 'may not', since between 70% and 80% of them placed the red counters in the red boxes. In fact, quite a number of the six and seven year-old subjects showed some hesitation upon hearing the experimenter's instruction, but then decided to go ahead with a more conservative response. The facts indicate that a firm grasp of the meaning of keyi bu did not take root until eight. If we had collapsed the results in the first and second columns of the table, the point of acquisition would have been pushed back to a much earlier age, but as we explained earlier, the response of a child receiving a score of 1 point can be subject to various interpretations, but if a child received a score of 2, we are fairly certain that the child had understood the contrast between the two scope orders. Thus while our response categorization may have compelled us to underestimate the child's acquisition of the scope order of modals and negation, we feel confident that our results provide clear evidence for the upper bound of the point of acquisition.

The question we started out with was whether the child's performance on the preceding items would show any interaction with their performance in the sentences involving quantificational scope, specifically the mei...yi 'every..a' sentences. Since the scope order neg (may) was acquired by four and that we know there was a narrow scope bias of the universal subject quantifier among three and four year-olds, there clearly would not be a parallel between wide scope interpretation of mei...yi 'every..a' and the child's understanding of 'Neg (may)'. Thus, a crosstab was only carried out between the results of the scope order 'may (Neg)' and the summative results of the mei...yi 'every..a' act-out tasks. Recall that in the former tasks, a child assigning wide scope interpretation in both test sentences would receive a score of 2, a child assigning wide scope on only one of the test sentences would receive a score of 1, and a child who did not show any wide scope response would be given a score of zero. The crosstab failed to show any significant interaction between the two factors for any of the age groups. A similar crosstab for the results of the mei...yi 'every...a' picture identification tasks likewise revealed a negative finding. It thus appears that the relative scope of Q-NPs does not show a clear link with the relative scope of modals and negation.

#### 2.4.2 Acquisition of Topic Structures

The topic structures we investigated were of two types: the first type, which we will refer to as topic-subject structures, examined whether the child understood that the topic need not be thematically related to the verb if there is no empty category in S for it to coindex with. The two test sentences and the corresponding pictures differed somewhat in complexity, so we will consider the results for each of the items separately. The first test sentence was (144), the test pictures given in Fig. 18.

- (144) [Zhege xiaopengyou a, [ baba zai chi dangao ]]  
this child part. dad DUR eat cake  
"As for this child, (his) dad is eating a cake"



Fig. 18

The correct choice for the test sentence should be the bottommost picture, where only the child's father is eating the cake. Here the pragmatic relationship between the child and the adult in the picture is a fairly simple one, so it should be easy for the child to infer that baba 'dad' refers to the dad of the child in the picture.

The results shown in Table 24 reveal two interesting facts. One is that none of the subjects interpreted the topic instead of the subject as the agent, as the topmost picture was never given as a response. Secondly, it is clear that the adult norms for this topic-subject sentence was acquired by five, as 85% of this age

Table 24. Acquisition of Topic-Subject Structures  
in Mandarin Chinese (Picture-identification) (I)

test sentence: [Zhege xiaopengyou a, [ baba zai chi dangao]]  
this child part. dad DUR eat cake  
"As for this child, (his) father is eating  
a cake"

<u>Age</u> (yrs)	<u>No. of Subjects</u> <u>choosing the</u> <u>bottom picture</u>	<u>No. of Subjects</u> <u>choosing the</u> <u>middle picture</u>	<u>No. of Subjects</u> <u>choosing the</u> <u>topmost picture</u>	<u>Total</u>
3	9 (47%)	10 (53%)	0	19
4	13 (59%)	9 (41%)	0	22
5	17 (85%)	3 (15%)	0	20
6	21 (88%)	3 (12%)	0	24
7	21 (91%)	2 (9%)	0	23
8	12 (92%)	1 (8%)	0	13
Adult	19 (95%)	1 (5%)	0	20

group correctly chose the bottom picture. Among the three and four year-olds, between 41% and 53% of the children interpreted the sentences as if the topic and subject functioned as a conjoined NP. This shows that the child in early stages may interpret the topic as thematically related to the verb, the A' nature of the topic position to be understood in later development. This is consistent with longitudinal and cross-sectional acquisition data on Mandarin so far reported in the literature. Chien (1983) has provided strong evidence showing that children as young as two and three were sensitive to the distinction between topic and subject, and that the category of subject as part of UG was accessible early to the child. Erbaugh (1982) has observed that the basic sentence type in the data she collected was what she called the referential order: the order of who did what to whom, while the topic-comment structures were acquired later.

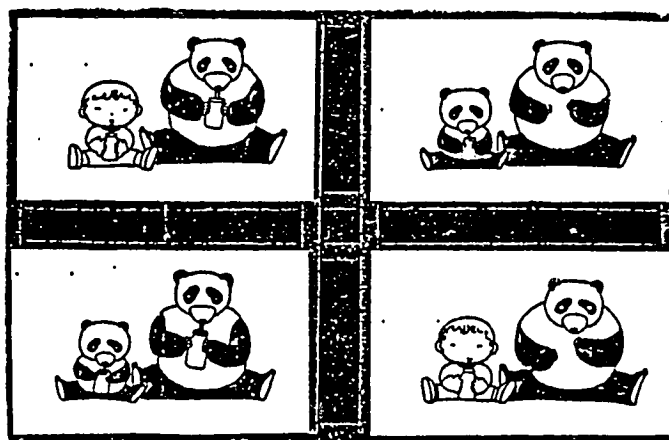


Fig. 19

The fact that the three and four year-olds in our data interpreted the topic as a subject and that the topic-subject structures were not acquired until five is indicative of the primacy of the category of grammatical subject. The second test sentence ran parallel to the first except that the test pictures were more complicated. The child was presented with four pictures, as shown above. In order to make the correct choice, the child would not only need to know that the topic should not be thematically linked to the verb, but also that the subject is pragmatically related to the panda so that the baby should not be understood as the human baby but as the baby panda. In other words, the top right picture should be selected.

**Table 25.** Acquisition of Topic-Subject Structures  
in Mandarin Chinese (picture-identification) (II)

test sentence: [ zhege xiongmao a [xiaobaobao zai he niunai]]  
this panda part. baby DUR drink milk  
"As for this panda, (its) baby is drinking milk"

Age (yrs)	<u>Subjects</u> <u>choosing</u> <u>the top</u> <u>right</u> <u>picture</u>	<u>Subjects</u> <u>choosing</u> <u>the lower</u> <u>left</u> <u>picture</u>	<u>Subjects</u> <u>choosing</u> <u>the lower</u> <u>right</u> <u>picture</u>	<u>Subjects</u> <u>choosing</u> <u>the top</u> <u>left</u> <u>picture</u>	<u>Total</u>
3	4 (22%)	5 (26%)	5 (26%)	5 (26%)	19
4	10 (45%)	1 (5%)	6 (27%)	5 (23%)	22
5	6 (30%)	1 (5%)	8 (40%)	5 (25%)	20
6	10 (41%)	3 (13%)	8 (33%)	3 (13%)	24
7	10 (43%)	2 (9%)	8 (35%)	3 (13%)	23
8	4 (31%)	0	6 (46%)	3 (23%)	13
Adult	10 (50%)	1 (5%)	9 (45%)	0	20

The fact that more pictures and a higher degree of pragmatic complexity are involved here made this item more difficult than the preceding one. This is borne out by the data in Table 25, as even at age eight, less than 50% of the age group selected the correct picture. A very clear pattern that can be discerned in the figure is that very few of the subjects selected the lower left picture, where both the big panda and the human child are drinking a bottle of milk. The second least favored choice was the picture in which both the mother panda and the baby panda are drinking a bottle of milk. Both the picture where only the baby panda is drinking a glass of

milk (the top right picture) and the one where only the human baby is drinking milk (lower right picture) were the most popular choices, with a slight preference for the former among four, six and seven year-olds and a slight preference for the latter among the three, five and eight year-olds. The picture that emerges is a clear demarcation between choices with the topic interpreted as a subject vs choices with the topic interpreted as distinct from the subject, with the child preferring the latter category. If we add up the numbers in the first and third columns of the table, the percentages yielded in ascending order of age would be 48%, 97%, 70%, 74%, 78% and 77%. This shows that over 70% of the four to eight year-olds could correctly interpret the topic-subject structures: the problem for them was that the ability to identify the pragmatic relationship between the topic and the subject had not been mastered. The relatively low percentage of these summative percentages (compared to Table 24) could be due to the relatively higher processing complexity of the test items compared to the first topic-subject test sentence. If we acknowledge the role of these additional factors, our findings on the two topic-subject items are compatible with each other.

As regards the test sentences for topicalization structures, one item involves a dog carrying a panda on its back, and the other describes the act of a child chasing another. To understand a topicalization structure of the form  $[NP_1 \ [NP_2 \ V \ e]_S]_S$ , the child



needs to realize that the topic is coreferential with the empty category in S and that the latter is not a phonologically null pronoun that can pick up its reference from entities other than that denoted by NP<sub>1</sub>. In the first test sentence for topicalization structure, given below as (147) (see Fig. 20)

- (147) [zhege jiejie a [gege zai zhui zhe e]]  
this sister part. brother DUR chase asp.  
"As for this girl, the boy is chasing (her)"

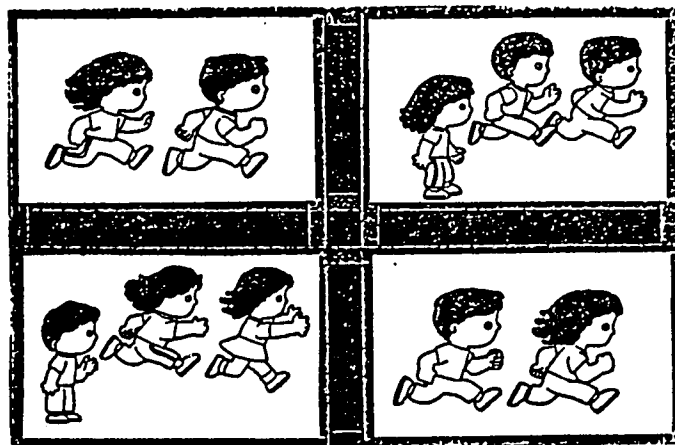


Fig. 20

, the correct choice should be the lower right picture where the boy is chasing the girl. The top left picture, where the girl is chasing the boy, corresponds to a reading where both NPs are interpreted as topics, having the structure  $[NP_1 [NP_2 [e_1 V e_2]_S]_S]_S$ <sup>39</sup>. The lower left and the top right pictures represent interpretations where the empty category is treated as a null pronoun, referring to another entity in the context.

As can be seen from Table 26, the topicalization structure was acquired at around the same time as the topic-subject structures, the percentage of subjects giving the correct response reaching 90% by five years of age. Note that none of the 122 subjects chose the

Table 26. Acquisition of Topicalization Structure  
in Mandarin-Chinese (picture-identification) (I)

test sentence: [zhege jiejie a [gege zai zhui zhe e]]  
this sister part. brother DUR chase asp.  
"As for this girl, the boy is chasing (her)"

Age (yrs)	<u>Subjects</u> <u>choosing</u> <u>the lower</u> <u>right</u> <u>picture</u>	<u>Subjects</u> <u>choosing</u> <u>the upper</u> <u>left</u> <u>picture</u>	<u>Subjects</u> <u>choosing</u> <u>the upper</u> <u>right</u> <u>picture</u>	<u>Subjects</u> <u>choosing</u> <u>the lower</u> <u>left</u> <u>picture</u>	<u>Total</u>
3	12 (63%)	2 (11%)	5 (26%)	0	19
4	12 (55%)	7 (32%)	3 (13%)	0	22
5	18 (90%)	2 (10%)	0	0	20
6	22 (92%)	2 (8%)	0	0	24
7	21 (91%)	2 (9%)	0	0	23
8	13 (100%)	0	0	0	13
Adult	19 (95%)	0	1 (5%)	0	20

bottom left picture where the first NP was interpreted as subject and the second NP interpreted as topic, and the empty category understood as a pronoun. It is also noteworthy that the top right picture corresponding to the reading where the first NP was understood as a topic, the second NP as a subject and the empty category as a pronoun, was also not a favored choice. Across all age groups the most favored interpretation is the correct one, and a couple of subjects assigning an interpretation where both NPs are interpreted as topicalized.

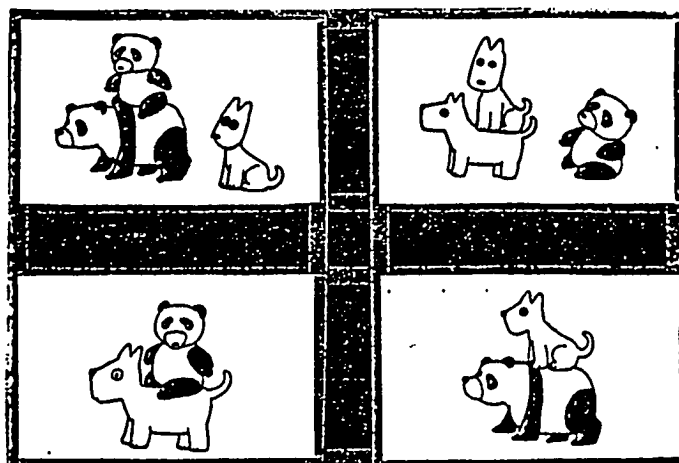


Fig. 21

The second test sentence for topicalization structures is (148), with the test pictures given in Fig. 21 above.

- (148) [zhege xiongmao a [xiaogou zai bei zhe e]]  
 this panda part. doggie DUR carry-on-back asp  
 "As for this panda, the doggie is carrying it on its back"

This test sentence parallels the first in that two of the choices require the empty category to coindex with the topic (the lower left and lower right pictures), while the remaining two are interpretable only with the empty category understood as a pronoun (the top pictures). The correct response is represented by the lower left picture where the dog is carrying the panda on its back. The results are shown in Table 27.

Table 27. Acquisition of Topicalization Structure  
in Mandarin-Chinese (picture identification) (II)

test sentence: [zhege xiongmao a [xiaogou zai bei zhe e]]  
this panda part. doggie DUR carry asp.  
on-back  
"As for this panda, the dog is carrying (it)  
on its back"

<u>Age</u> (yrs)	<u>Subjects</u> <u>choosing</u> <u>the lower</u> <u>left</u> <u>picture</u>	<u>Subjects</u> <u>choosing</u> <u>the lower</u> <u>right</u> <u>picture</u>	<u>Subjects</u> <u>choosing</u> <u>the upper</u> <u>right</u> <u>picture</u>	<u>Subjects</u> <u>choosing</u> <u>the upper</u> <u>left</u> <u>picture</u>	<u>Total</u>
3	10 (53%)	4 (21%)	2 (10%)	3 (16%)	19
4	5 (23%)	11 (50%)	5 (23%)	1 (1%)	22
5	9 (45%)	10 (50%)	0	1 (5%)	20
6	20 (83%)	4 (17%)	0	0	24
7	20 (87%)	3 (13%)	0	0	23
8	13 (100%)	0	0	0	13
Adult	19 (95%)	0	1 (5%)	0	20

We observe basically similar results to those of the first test item on the topicalization structures. Over 70% of the subjects of every age group opted for the reading where the empty category is interpreted as a trace of the topic (the percentages of the second and third columns of the table added). In fact, after the age of five, no subject chose any of the top pictures. The proportion of subjects giving the correct response reached 83% by six and 100% by eight, showing clearly that as in the preceding test item, the topicalization structures had definitely been acquired by six. The

main difference between Tables 26 and 27 lies in the slightly lower percentage of correct choices in the second test sentence. If we examine the figures of the second and third columns of the two tables, we find that the relatively low percentage of correct values in Table 27 is due to a corresponding increase in the numbers in column 2. In other words, in the second test item, more subjects selected the reading where the first NP is interpreted as the DS subject of the sentence and the second NP as the DS object of the sentence. This may be due to the fact that the panda is generally of bigger size than the dog, and the child's knowledge of the world might have biased him/her toward this reading. Despite the possible influence of this pragmatic factor, the overall tendencies in the findings of the two test sentences closely match each other.

How is the child's performance on the topic-subject and topicalization sentences related to his/her interpretation of mei...yi 'every...a' sentences? A crosstab of the summative results of the mei...yi items (picture identification as well as act-out) with the results on each of the topic structures failed to establish significant interaction. It thus appears that there may not be any straightforward relationship between the child's acquisition of the scope interpretation principle specific to Chinese and his/her acquisition of topic structures.

#### 2.4 Conclusion

This exploratory study of the acquisition of quantificational

scope has yielded five major findings:

- (i) Children understood single quantifiers such as dou 'all', quan 'all/entire', every, all long before they developed a firm grasp of the adult norms for quantifier scope. In both English and Chinese, the universal quantifiers were mastered before four (cf. Tables 2, 4, 14, 18, 20). However, children did not interpret sentences where a universal quantifier preceded an existential quantifier in the same way as adults until after six. This fact was clearly demonstrated by the Chinese data. As we saw from Table 6 and Table 7, while 80% of Chinese adults consistently gave a wide scope response in the picture identification tasks of the mei...yi 'every..a' sentences, less than 40% of the seven and eight year-olds assigned wide scope interpretations consistently on these items. In the corresponding act-out tasks, only less than 62% of the seven and eight year-olds gave consistent wide scope responses, compared to 95% of the adults. As regards sentences where an existential quantifier preceded a universal quantifier, i.e. the you...mei 'a..every' sentences, while 90% of the adults correctly gave a narrow scope reading of the universal quantifier, the percentage of children producing consistent correct responses reached over 80% only in the seven and eight year-old groups.<sup>40</sup> Our findings thus provide additional evidence supporting the earlier observations of Donaldson and

Lloyd (1974) and Roeper and Matthei (1975).

Further, our data indicate that children's understanding of the semantics of quantifiers is a prerequisite for their understanding of quantifier scope. The responses of the small number of children who did not comprehend dou, mei...dou, every suggests that many of them did not realize sentences containing two quantifiers entailed a mapping relationship between two sets of entities denoted by the Q-NPs.

- (ii) A second major finding of our study based on the act-out tasks (Tables 6 and 16, and Fig. 10, Fig. 12) is that the initial phase of the child's development was dominated by what appears to be a narrow scope interpretation of the universal quantifier in mei...yi 'every...a' sentences. We take this to be evidence that the existential quantifier yige N 'a N' was initially interpreted referentially, as a non-operator, thus leading to a scope independent reading of the sentences, which is equivalent to a narrow scope reading of the universal quantifier. The crucial data supporting our analysis is the interpretation of singular numeral phrases in embedded subject position by Chinese children. These singular numeral phrases, which received a universal reading in about half of the adult subjects, were interpreted referentially by the vast majority of the children across all age groups (cf. Table 9). With



regard to the unmarked option of the [+/-operator] parameter proposed in Hornstein (1984), our experimental data points to [-operator] as the unmarked value of the parameter. This agrees with the view that referentiality is the unmarked status of noun phrases, including numeral phrases (cf. Jackendoff 1982).

- (iii) A third generalization derivable from the Chinese data is that the ease with which children acquire scope order depends on the sequence in which the Q-NPs are ordered as well as on the syntactic properties of the quantifiers in the language concerned. Comparing the sentences where the universal quantifier precedes the existential quantifier and those where the existential quantifier precedes the universal quantifier, we find a sharp contrast between the two sets of data (cf. Table 6 and Table 12). Where an existential quantifier precedes a universal quantifier, the children's responses showed steady progress with age and were highly consistent across all age groups even in a picture identification task. On the other hand, where a universal quantifier precedes an existential quantifier, we perceive a high level of inconsistency in the picture-identification tasks. In addition, the development of the children's interpretations of such sentences showed some degree of fluctuation over age (cf. Fig. 9). A clear difference between the two quantifier orderings is that if the existential quantifier precedes,

the interpretation is always unambiguously one where the existential quantifier takes wide scope, regardless of whether one assigns the sentence a scope-dependent or scope-independent reading. In contrast, if the universal quantifier precedes, different interpretations will result depending on whether a scope-dependent or scope-independent reading is intended. This potential for ambiguity in the mei...yi 'every...a' sentences may account for the high degree of inconsistency among both English and Chinese subjects (cf Table 6 and Table 15) in the picture identification tasks for these sentences. We have also seen that where a universal quantifier precedes an existential quantifier, how early the child understood the scope dependence between the two quantifiers could depend on the syntactic properties of the quantifiers themselves. We have argued that yige N, the Chinese counterpart of a N, is more restricted in its non-referential function and that the universal quantifier phrase meige N does not provide early morphological clues to its distributivity as its English counterpart does. These differences may underlie the relatively lower tendency for wide scope readings of meige N observed among Chinese children.

- (iv) Our data also reveal that children interpreted marked scope order in much the same way they did unmarked scope order among the younger age groups, the difference between marked and

unmarked orders not acquired until after seven or eight. Thus Chinese children understood sentences of the form  $[NP_1 \text{ quan } .[yige N]_2]$ , where  $NP_1$  is normally understood as having narrow scope (contrary to the scope interpretation principles for Chinese), in a way parallel to sentences of the form  $[[meige N]_1 \text{ dou } \dots [yige N]_2]$ . In both sentences, scope-independent readings were given at first, and the adult norms of the marked scope order were not acquired until eight (cf. Table 19). Similarly, English children interpreted  $[\dots [all \text{ the } N] \dots [a N]]$  sentences in the same way as they did  $[[Every N] \dots [a N]]$  sentences given the same prop arrangement, with a wide scope bias in the younger groups, the narrow scope interpretation of all the N not acquired until after eight (cf. Fig. 12a and Fig. 15).

- (v) Our final result is that the acquisition of the relative scope of Q-NPs in Chinese 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. In our Chinese experiments, 'Neg (modal)' was acquired by four, whereas clear understanding of 'Modal (neg)' was demonstrated by only slightly over 50% of the eight-year-olds. The topic structures in Chinese were clearly acquired by five, but the children's performance on the topic structure items did not allow us to predict their interpretation of quantifier scope.

In many ways, this study has been exploratory in character and the results we have obtained have contributed perhaps more to a clarification of issues than to unequivocal answers on the question of acquisition of quantifier scope. A number of problems encountered in the course of our research suggest further areas of research.

- (i) A methodological difficulty we experienced in trying to observe crosslinguistic differences between Chinese children's interpretation of mei...yi sentences vs English children's interpretation of every...a sentences is that the adult responses turned out to be unexpected. We had expected Chinese adults to find these sentences unambiguous, with the universal quantifier taking wide scope, and the English adults to find these sentences ambiguous, with both scope orders possible. What we discovered was that while this prediction was true of Chinese, it failed to hold of the English adults, as 95% of both English and Chinese adults gave wide scope responses on the act-out tasks. It appears that even if the English adult had found these sentences unambiguous, they may have acted according to the preferred interpretation, which was the wide scope interpretation of every. To circumvent this problem, it would be fruitful in future research to examine sentences where the ambiguity is clearer in adult judgments, as in sentences such as (149).

(149) A picture was drawn by every child

As we have seen from the Chinese data, a clear progression toward adult norms was observed in the Chinese counterpart of these sentences (with the existential quantifier having wide scope). Based on the fact that (149) easily allows for a narrow scope interpretation of a picture, we would predict a consistent difference in the pattern of responses between Chinese and English children in the older age groups: a much higher percentage of narrow scope interpretation of a picture in the responses of the English children. Data on such sentences will furnish a clearer basis for cross-linguistic comparison.

- (ii) Another persistent problem that we encountered in our analysis concerns the difficulty in distinguishing scope-independent readings from scope-dependent readings. As we have seen, a scope-independent reading of 'every..a' sentences is tantamount to a wide scope reading of the existential quantifier in such sentences. How could we tell which interpretation was intended by the child if the two readings were confounded with each other? To have a more reliable assessment of when children understand the possibility for scope dependence between two Q-NPs, it would be worth investigating their interpretation of sentences such as (150), where two numeral phrases are involved.

(150) Two boys tied up three girls

In an act-out task with six male toys and six female toys provided, several possibilities can be envisaged: if the child is acting merely according to visual stimuli, s/he may use all twelve toys; if s/he gives a scope independent reading, a total of two boys will tie up a total of three girls; if, however, scope dependent readings are given, s/he may select two male toys, and have each of them tie up three girls, or vice versa, three girls may be chosen, each of whom will be tied up by two boys. Here the scope-dependent readings are sharply differentiated from the scope independent readings, and the children's responses can be more easily interpreted.

- (iii) Thirdly, one claim we have put forward to explain the Chinese findings is that referentiality is the unmarked status of numeral phrases. To subject this claim to further test, it appears that a closer English equivalent to the Chinese yige N should be investigated, as in (151).

(151) Every child is eating one cake

As one N is not used as a generic NP and cannot appear non-referentially in the scope of negation, it is more restricted in its non-referential role, as is the case with yige N.

If our claim is correct, we would expect a high percentage of English children giving a referential reading of one N in the younger age groups than we have observed with a N.

A further test of our hypothesis would be to examine sentences

like (152-153) where the object NP is not a Q-NP.

(152) Every child is eating cakes

(153) meige xiaopengyou dou zai chi dangao  
every child all DUR eat cake

Our prediction will be that, since only one Q-NP is involved, even the young Chinese child, who showed scope independent readings because of the referentiality of yige N, will give a much higher percentage of wide scope responses in his/her interpretations of these sentences.

- (iv) Finally, it should be noted that the mei...yi /'every...a' sentences included in our experiment for English and Chinese children only covered instances where both Q-NPs g-command each other, since the g-command domain is where cross linguistic differences between English and Chinese are manifested. However, it would be of great interest from the standpoint of Universal Grammar to see how children interpret sentences such as (154-155).

(154) A child was bitten by every dog

(155) A child told me [that every dog was jumping up and down]

Since g-command is a necessary ingredient of the scope interpretation principles for both English and Chinese, and presumably for all languages, we would predict that the g-command condition is adhered to in all stages of the child's development. Thus we would expect a contrast to be observed in the responses to the two sentences among older English

children, who have learned that linear order is not relevant to scope interpretation in the language. A narrow scope of a child would not be possible in (155) at any age but would be available for (154) in older English children. We would also expect that Chinese children at all ages find the Chinese counterparts of (154) and (155) unambiguous: the existential quantifier has to take wide scope, due to the g-command condition in the case of (155) and due to the linearity condition in the case of (154).



## Notes to Chapter Two

<sup>1</sup>We are assuming that bare plurals functioning as predicative nominals (as in All the red ones squares?) are not Q-NPs that undergo QR at LF. One reason for assuming this is that as Carlson (1977) has observed, bare plurals always take narrow scope in relation to other quantifiers:

- (a) Everyone read a book on Shakespeare
  - (b) Everyone read books on Shakespeare
- (a) is ambiguous with both scope possibilities, while (b) only has the reading where the universal quantifier takes wide scope. This suggests that bare plurals do not undergo QR at LF.

<sup>2</sup>Quine (1973) has suggested that the transformation of a sentence into a relative clause is in effect a process of substitutional quantification, whereby a term is substituted for by a variable.

- (i) I see the moon
- (ii) The moon is a thing that I see

Corresponding to every sentence such as (i) of the form F(a), we can always convert it into the form as in (ii) "a is a thing such that F(x)", where the expression "a is a thing such that" can be viewed as an operator. This may be a source of variables for acquisition (Quine:124). It is also suggested that interrogatives could be another source of the child's knowledge of substitutional quantification, as they also involve variables:

- (iii) John is the teacher
- (iv) who is John?

Quine's account is crucially based on the child's being able to observe the interchangeability of sentences like (i) and (ii). Whether these are always presented in pairs in language acquisition is questionable. Our objection to Quine's analysis is two-fold. On theoretical grounds, it seems that even if the child learns that relative pronouns and interrogative pronouns can be bound variables, how does s/he generalize this to quantifier phrases and how does he learn constraints such as the Condition on Proper Binding? If such constraints have to be a given, the notion of variable binding has to be also a given, as the constraints are stated in terms of variable binding. On empirical grounds, too, it seems that Quine's account of variable learning is debatable, since it links the learning of quantification to interrogatives and relative

clauses. There is evidence from our data that preschool children as late as 3 years old, who are competent in comprehending and asking questions, still did not understand the properties of quantifiers.

<sup>3</sup>One might raise the question as to whether "adjunction to maximal nodes" is a necessary UG principle. It does not seem to be one since the Condition on Proper Binding (assuming OB c-command) will ensure that QR can only adjoin a phrase  $\alpha$  to a node already dominating  $\alpha$  at SS. Whether the node  $\beta$  to which  $\alpha$  adjoins is maximal or not, as long as  $\alpha$  is within the maximal category of  $\beta$ ,  $\alpha$  will have scope internal to  $\beta$ . If  $\alpha$  is outside the  $\beta$  projection,  $\alpha$  has scope external to  $\beta$ . Not much seems to depend on the maximal projection requirement, except that it will prevent a proliferation of LF structures.

<sup>4</sup>Hornstein also proposes a third type of quantifiers which share some of the properties of Type I quantifiers and some of the properties of Type II quantifiers. An example of the third category of quantifiers is *wh* words in-situ. That *wh*-words in situ behave like names can be seen from the fact that *wh*-traces have to be A-free. Thus they can be classified as Type I quantifiers. The reason for positing a separate category is that *wh*-in-situ, unlike names, shows ECP effects.

- (a) \**who* believes that *who* left the party?
- (b) *who* said that John bought *what*?
- (c) *shei* zhidao [*neige ren* likai le]  
     who know      which person leave asp  
     "For which x, for which y, x knows y left"  
     "For which x, x knows for which y, y left"
- (d) *shei* shuo [Zhangsan mai le *shenme*]?  
     who say              buy asp. what  
     "for which x, for which y, x said Zhangsan bought y"

It is unclear how universal this classification is since the corresponding sentences in Chinese (c-d) do not show ECP effects. As the crucial distinction lies in the difference between Type I and Type II classifiers. We will leave the issue of Type III category aside and concentrate on the main classifications.

<sup>5</sup>As is clear from (16-19), the pronouns coindexed with quantifiers in these sentences may not be pronouns functioning as bound variables at all, but are what Evans (1980) has termed E-type pronouns. Whatever term we use to describe such pronouns, it remains the case that the quantifiers at issue can coindex with them, in the same way that Type I quantifiers like *any* can.

<sup>6</sup>We can of course impose the additional restriction that such pronoun coindexing must agree in number with the quantifier. However, this would not be a legitimate restriction for languages such as Chinese, which has no number agreement. In any case, even with a restriction of this sort, the child will not have negative data showing him that mei can bind singular pronouns but suoyou cannot, since both mei and suoyou have to coindex with plural pronouns.

<sup>7</sup>As Ladusaw (1980) has observed, any has to be licensed by a downward-entailing expression, of which the negator is only a special case. Informally, a downward-entailing expression has the property that if a predication holds of a NP denoting a superset modified by the expression, the predication will also hold of a NP denoted by a subordinate term. For example, no and at most are downward entailing expressions. "no student came" entails "no male student came"; "at most two students came" entails "at most two male students came".

<sup>8</sup>The facts are more complicated than I have been suggesting, since as proposed in Ladusaw (1980), any can also be analyzed as an existential quantifier having inherent narrow scope with respect to negation. Thus (28) can be analyzed as "-Ex, John knew x"; and (30) can be represented as "Ax=student, -Ey=homework, such that x did y". If any is analysed as an existential quantifier, then sentences such as (30) will inform the child that it shall be treated as an operator, as any will now fall within the scope of another quantifier. As we have seen, this may not be an undesirable consequence, because just like the singular NP a N, any can bind across discourse, and like a N, it is subject to locality conditions, as we have noted.

<sup>9</sup>Similarly, attributive use of definite NPs can also bias the child toward regarding them as operators, as in

(i) The child who sings the loudest will get a prize

(ii) The child who sings the loudest will be applauded  
by everyone

Again, as (ii) shows, these attributive definite descriptions behave like generic NPs in being scope independent. In (ii), every has to have narrow scope with respect to the subject NP. This also serves to show that non-referentiality is not a sufficient condition for operator status.

<sup>10</sup>The ease with which one could obtain the different scope order interpretations clearly depends on stress. As Ianucci and Dodd (1980) report, the reading where the universal quantifier has narrow scope with respect to negation can be obtained more easily if the quantifier is stressed. Despite the role of stress, the distinction between English and Chinese with respect to scope order still holds. No phonological marking can reverse the scope order dictated by linear precedence in Chinese.

<sup>11</sup>Ladusaw (1980:80) observes that although linear order fails to predict the scope order of Q-NPs and the relative scope of Q-NPs and negation, it seems that if we consider other operators such as sentence adverbs and modals, it is generally the case whichever element is on the left has the wider scope. This suggests that scope order may not be a monolithic phenomenon, and that Q-NPs, being operators in argument position, can behave differently than non-objectual operators such as modals and adverbs.

<sup>12</sup>It should be noted that in our examples (61a,c,d), c-command is confounded with linear order. Due to the distribution of quantifiers in Chinese, the only environment to isolate the effect of c-command will be a configuration such as

[ NP [ [V [...β...]<sub>NP</sub>] <sub>V</sub>, α ]<sub>VP</sub> ]<sub>S</sub>

where β is in a complex NP so that it precedes but is c-commanded by α, as in

(i) wo gei le [[meige pengyou] de xiaohai] [yige wanju]  
 I give asp every friend NOM child one toy  
 "I gave a toy to children of every friend "

Since this has only the reading where mei 'every' has wide scope, the evidence favors the view that c-command is not relevant to scope order determination in Chinese.

<sup>13</sup>Recall that in our earlier discussion, we have have assumed that the child is innately endowed with the ability to represent variable-binding relationships. While he is equipped with the vocabulary of first-order logic, he still needs to find out how quantifiers should be ordered syntactically to represent meanings in natural languages.

<sup>14</sup>The parameter of Scope order must be stated as a necessary condition rather than as a sufficient condition. If it were

stated as a sufficient condition, in cases where  $\alpha$  and  $\beta$  both satisfy the condition but where only one of the possible scope orders is available, the child will regard the hypothesis as failing to make the right predictions. For example, consider the condition " $\alpha$  g-commands  $\beta$ " as a sufficient condition. Now in a situation where  $\alpha$  and  $\beta$  g-command each other but where the latter has scope over the former, the child will infer that the hypothesis is not confirmed for  $\alpha$ . But if the parameter is stated as a necessary condition no such problem arises. In this situation,  $\beta$  has scope over  $\alpha$ , and since  $\beta$  g-commands  $\alpha$ , the condition is satisfied.

<sup>15</sup> Recall that  $\alpha$  OB c-commands  $\beta$  iff the first branching node dominating  $\alpha$  also dominates  $\beta$ ;  $\alpha$  AS c-commands  $\beta$  iff the first maximal projection dominating  $\alpha$  also dominates  $\beta$ . Clearly the first branching node dominating  $\alpha$  may or may not be an XP. But if the first branching node dominating  $\alpha$  also dominates  $\beta$ , clearly the first XP dominating the former will also dominate the latter. That is, if  $\alpha$  OB c-commands  $\beta$ , then  $\alpha$  will also AS c-command  $\beta$ .

<sup>16</sup> Experimental studies by Goodluck (1978) and Wexler and Chien (1985) have shown that c-command is not fully acquired until the child reaches four to four and a half.

<sup>17</sup> Strictly speaking, the distinction distributive/collective of Q-NPs is distinct from the issue of relative scope, as observed in Fauconnier (1975). But there is clearly some degree of interaction between the two factors. In a sentence such as

(i) All of the men saw a movie last night

if a movie has wide scope over all of the men, then on this scope reading, we can have both a distributive and collective reading of all; it could be that all the men saw the movie together or separately, although what they saw was the same movie. But if all the men has wide scope over a film, it has to be the case that all is distributive, or else scope dependency cannot be realized.

<sup>18</sup> In the preliminary trials with Mandarin-speaking children, the experimenter tried to speak through a muppet. But this was found to be confusing to the child, so a more direct approach such as the one adopted in the experiment was used. The experimenter spoke directly to the child rather than through a toy.

<sup>19</sup> Since it was evident that the children had grasped the

concept of yi 'one' before three, it was thought unnecessary to include the two test items on 'one' for the 6, 7 and 8 year-olds.

<sup>20</sup>The performance of one of the three year-olds on the picture-identification tasks was considered invalid because of extremely low self-consistency. Her performance on the act-out tasks was, however, consistent and therefore included in the data analysis.

<sup>21</sup>As explained in Ch. 1, the universal quantifier determiner mei requires the support of dou when in subject position, and that it occurs most naturally in preverbal rather than postverbal position. It is thus not possible to isolate the effect of mei alone without dou.

<sup>22</sup>Since the child most probably did not understand economical terms such as zhangjia 'price-rise', it is possible that this was an instance of delayed imitation.

<sup>22a</sup>As will be seen later, the Chinese and English data on the picture identification item mei...yi (every...a) differ in that Chinese children gave a far higher percentage of choices of the middle picture. If we assume that all three picture choices are regarded as a wide scope reading of the universal quantifier, it would be difficult to account for the experimental results. The data from the two languages also reveal that very few children chose the non-scope reading after four years old. If the non-scope reading is analyzed as a wide scope reading of the universal quantifier, again one would be obliged to explain why this selection disappeared after a certain age.

<sup>23</sup>A crosstab of the results of the 4 year-olds also showed statistical interaction ( $p < .001$ ), but as can be seen from the high level of inconsistent responses (45%) in that age group, a high chi-square probability value was due to the high level of inconsistency rather than a high level of consistency, and thus the significance result is spurious.

<sup>24</sup>It has been observed in studies of referential communication among children (Asher 1979) that when the message is ambiguous, the young child is likely to conduct an incomplete search that ends with the identification of the first apparent match. That the child may have selected the first acceptable stimulus they cast their eyes on is plausible. However, the consistent narrow scope bias of the children suggests that these perceptual factors played a minor role in the children's interpretation.

<sup>25</sup>The chi-square values thus obtained were the highest for the three and four year-olds, but these figures can be accepted only if  $p < .15$ .

<sup>26</sup>Two of the remaining three children who failed the mei...dou test gave a consistent narrow scope reading of the subject NP in the act-out tasks, i.e. putting all the objects in the same plastic box, while one of them gave a wide scope interpretation for one test sentence and a narrow scope interpretation for the other. It is possible that the three children based their decisions on an understanding of yi 'one' and visual cues.

<sup>26a</sup>Recall that the specificity effect of you can be derived from general principles. In a structure such as (94)

[e you NP<sub>1</sub> [e<sub>1</sub> V NP<sub>2</sub> ]<sub>S</sub> ]<sub>S</sub>

NP<sub>2</sub> has the embedded S as its governing category with e<sub>1</sub> as SUBJECT. Since NP<sub>1</sub> is not in the same governing category as NP<sub>2</sub>, NP<sub>2</sub> cannot take wide scope over NP<sub>1</sub>. In other words, NP<sub>1</sub> must have wide scope and be interpreted referentially. The same analysis will apply for (95).

<sup>27</sup>The fact that we do not see an overwhelming bias toward non-referential reading in the adult group echoes a point we made in Ch. 1.2.2, i.e. the fact that in some idiolects, S-adjunction is allowed, while in other idiolects S"-adjunction is required. In the former case, S-adjunction will result in a referential reading of the embedded singular subject. In the latter case, since S" is not available, only a referential reading is possible.

<sup>28</sup>We do not have an explanation for why more English children chose a non-scope reading than Chinese children. If we accept the hypothesis that the non-scope reading here in fact reflects a wide scope reading of every N, one in which two of the values of a N happen to be identical. If this is indeed the case, the percentage of subjects with wide scope interpretations has been slightly underestimated.

<sup>29</sup>I owe much to Ken Wexler for discussion of the relevance of number morphology to acquisition of quantificational scope.

<sup>30</sup>Brown (1973:292) observes that subject verb number agreement is in a sense redundant, since both the subject NP and the verb will be marked by number (as in "The two dogs are dancing), except for nouns like sheep, which does not take

plural marking. If, as we suggest, number agreement aids the child in his acquisition of scope, this redundancy is well-motivated.

<sup>31</sup>The fact that these classifiers were found in the production data does not necessarily mean that the children could use them correctly in every obligatory context. As we see presently, the experimental studies show a more conservative estimate of the child's mastery of classifiers.

<sup>32</sup>All but one of the 12 classifiers tested were individual classifiers; they were jian 'piece', ge , zuo 'block', kuai 'lump', tiao 'classifier for long, slender object', zhang 'sheet', ke 'classifier for tree', ben 'text', zhi 'classifier for animal', liang 'classifier for vehicle', shuan 'pair', pi 'classifier for horse'.

<sup>33</sup>In Jackson and Jacobs (1981), it was found that if the child was asked to select from a set of figures of clowns with happy faces given an ambiguous message such as "I am thinking of the happy one. Which one is that?", the child would pick the figure with no extraneous information (such as the clown having in addition a flower). The child assumed that if the happy clown with a flower had been intended, a more informative message would have been produced.

<sup>34</sup>Sentences like (129) are not commonly used in the written language and are rare in southern varieties of Mandarin.

<sup>34a</sup>It should be pointed out that in Fig. 14, there is a slight drop in the percentage of narrow scope readings among the five and six years olds. As we explained earlier, a seemingly correct response of the younger age groups is actually coincidental and reflects their analyzing yige N 'a N' as a non-operator. This slight drop might be a manifestation of an attempt to overgeneralize once the children realize that yige N 'a N' is an operator. According to either the c-command or linear precedence option of the parameter of Scope Order, the child would assign wide scope to the NP quantified by quan.

<sup>35</sup>I am indebted to Nina Hyams for this observation.

<sup>36</sup>As in the experiments with Chinese children, the all...a item was the first act-out task performed by the English children in the battery. This eliminates the possibility of influence of other act-out items in the experiment on the all...a task.



<sup>37</sup>This is basically the idea of the Functional principle in Keenan (1974). In a sentence of the form P(a), where a is an argument and P a predicate, the predicate maps the argument to a truth value. The Functional principle states that

(i) the reference of an argument position must be determined independently of the meaning or the reference of the function symbol

(ii) function symbols which apply to the argument, however, may vary with the choice of argument and so need not be independent of it

This explains the tendency for subject NPs to have scope over object NPs. In Chinese, it may be the case that the additional requirement of a topic serving as a reference frame for the interpretation of the sentence imposes a more stringent requirement, so the function symbols which apply to the argument must vary with the choice of the argument and so must not be independent of it.

<sup>38</sup>The instruction of the experimenter could have been made more precise if it were phrased as

(ii) quzi            dou fang zai fangge    li  
chess-piece all    put    at square-box in  
"Put all the chesspieces in the square boxes"

with dou added. But since the Neg/Aux test item was included in the same experiment as dou, it was thought undesirable to introduce an extraneous factor in a test of the relative scope of modal and negation.

<sup>39</sup>It is interesting to note that in sentences with perfective aspect, it is possible to get a reading of [NP<sub>1</sub> [NP<sub>2</sub> V]] where both NPs are interpreted as topicalized NPs (NP<sub>1</sub> being the topicalized subject and NP<sub>2</sub> the topicalized object). But in the present case with the durative aspect zai, this reading is clearly unavailable, for reasons that are unclear to me.

<sup>40</sup>It is difficult to do the same adult-child comparison for the English data in terms of acquisition of scope, because the relevant 'every..a' sentences are supposed to be ambiguous for adults. The ambiguity of sentences such as 'every spaceman sleeps in a box' was, however, not reflected in the findings of the act-out task, possibly because the preferred adult interpretation of such a sentence is one where the universal quantifier takes wide scope. Even so, if we

assume the adult responses to be the norm, the percentage of children giving wide scope readings did not match that of the adults (95%) until after six years of age (cf. Table 6).

## REFERENCES

- Aoun, J. (1985) A Grammar of Anaphora. Cambridge: MIT Press.
- Asher, S. (1979) "Referential Communication" in The Functions of Language and Cognition ed. by G. Whitehurst and B. Zimmermann New York: Academic Press.
- Bar-Hillel, Y. (1954) "Indexical Expressions" Mind vol. 63:359-379
- Barwise, J. (1979) "On Branching Quantifiers in English" Journal of Philosophical Logic 8: 47-80
- Barwise, J. and R. Cooper (1982) "Generalized Quantifiers and Natural Language" Linguistics and Philosophy 4: 159-219
- Bellert, I. (1977) "On Semantic and Distributional Properties of Sentential Adverbs" Linguistic Inquiry 8.2: 337-351
- Berwick, R. (1985) The Acquisition of Syntactic Knowledge. Cambridge: MIT Press.
- Bloom, L. (1970) Language Development: form and function in emerging grammars. Cambridge: MIT Press.
- Borer, H. and K. Wexler (1986) "The Maturation of Syntax" Studies in the Cognitive Sciences No. 39, School of Social Sciences, University of California, Irvine.
- Brown, R. (1973) A First Language. Cambridge: Harvard University Press.
- Brown, R. and C. Hanlon (1970) "Derivational Complexity and the Order of Acquisition in child speech" in R. Brown Psycholinguistics. New York: The Free Press.
- Burzio, L. (1981) Intransitive Verbs and Italian Auxiliaries. Doctoral dissertation. MIT.
- Carden, G. (1976) English Quantifiers. New York: Academic Press.
- Carlson, G. (1977) "A Unified Analysis of the English Bare Plural" Linguistics and Philosophy 1: 413-457.
- Carpenter, R. (1984) Linguistic Universals and the Acquisition of Quantifier Scope. Senior Honors Thesis. University of Massachusetts, Amherst.
- Chafte, W. (1976) "Givenness, Contrastiveness, Definiteness, Subjects, Topics and Points of View" in C. Li (ed) Subject and Topic. New York: Academic Press.

- Chao, Y. (1968) A Grammar of Spoken Chinese. Berkeley: University of California Press.
- Chien, Y. (1983) Topic-comment structure and Grammatical Subject in First Language Acquisition in Mandarin Chinese. Doctoral Dissertation, Cornell University.
- Chomsky, N. (1982) Lectures on Government and Binding. Dordrecht: Foris.
- Ding, S. (1961) Lectures on Modern Chinese Grammar (Xiandai Hanyu Yufa Jianghua) Beijing: Chinese Academy of Social Sciences Publishers.
- Donaldson, M. and L. Lloyd (1974) "Sentences and Situations: children's judgment of match and mismatch" in Current Problems in Psycholinguistics, ed. by F. Bresson. Paris: Centre Nationale de la Recherche Scientifique.
- Dougherty, R. (1972) Global Constraints on Quantifiers and Adverbs. Indiana University Linguistics Club.
- Dubois, J. (1980) "Beyond Definiteness: the trace of identity in Discourse" in W. Chafe (ed) The Pear Stories. Norwood, N.J.: Ablex.
- Erbaugh, M. (1982) Coming to Order: Natural Selection and the Origin of Syntax in the Mandarin-speaking child. Doctoral dissertation. University of California, Berkeley.
- Evans, G. (1980) "Pronouns" Linguistic Inquiry 11.2 :337-362
- Fan, J. (1985) "Sentences with Indefinite NP subjects" (Wuding NP zhuyu ju) in Zhongguo Yuwen (Chinese Language) 1985.5: 321-328.
- Fang, F. (1985) "An Experiment on the Use of Classifiers by 4- to 6-year-olds" Acta Psychologica Sinica 1985.4: 384-392.
- Fauconnier, G. (1975) "Do Quantifiers Branch" Linguistic Inquiry 6.4: 555-578.
- Fiengo, R. and J. Higginbotham (1980) "Opacity in NP" Linguistic Analysis 7: 395-421.
- Fodor, J. (1980) "On the Impossibility of Acquiring 'more powerful' structures" in M. Piattelli-Palmarini (ed) Language Learning: the debate between Jean Piaget and Noam Chomsky. Harvard University Press.

- Fodor, J. and I. Sag (1982) "Referential and Quantificational Indefinites" Linguistics and Philosophy 5: 355-398.
- Gil, D. (1982) "Quantifier Scope, Linguistic Variation, and Natural Language Semantics" Linguistics and Philosophy 5: 421-472.
- Givon, T. (1982) "Logic vs Pragmatics, with human language as the referee: toward an empirically viable epistemology" Journal of Pragmatics vol. 6, No.2:81-133.
- Goodluck, H. (1978) "Children's grammar of complement-subject interpretation" in S.Tavakolian (ed) Language Acquisition and Linguistic Theory. Cambridge: MIT Press.
- Grice, H. (1975) "Logic and Conversation" Syntax and Semantics 3. ed. by P. Cole and J. Morgan. New York: Academic Press.
- Heim, I. (1982) The Semantics of Definite and Indefinite Noun Phrases. Doctoral dissertation. University of Massachusetts, Amherst.
- Hornstein, N. (1984) Logic as Grammar. Cambridge: MIT Press.
- Hornstein, N. and D. Lightfoot (1981) Explanation in Linguistics London: Longman.
- Huang, J. (1982) Logical Relations in Chinese and the theory of Grammar. Doctoral dissertation. MIT.
- Huang, J. (1983) "On the representation of scope in Chinese" Journal of Chinese Linguistics 11.1
- Huang, S. (1981) "On the scope phenomenon of Chinese quantifiers" Journal of Chinese Linguistics 9.2
- Hyams, N. (1983) The Acquisition of Parameterized Grammars. Doctoral dissertation. CUNY.
- Ianucci, D. and D. Dodd (1980) "The development of some aspects of quantifier negation in Children" Papers and Reports on Child Language Development 19: 88-94.
- Inhelder, B. and J. Piaget (1964) The Early Growth of Logic in the Child. tr. by E. Lunzer and D. Papert. New York: Norton.
- Ioup, G. (1975) "Some Universals of Quantifier Scope" in Syntax and Semantics 4 ed. by J. Kimball. New York: Academic Press.

- Jackendoff, R. (1972) Semantic Interpretation and Generative Grammar. Cambridge: MIT Press.
- Jackendoff, R. (1983) Semantics and Cognition. Cambridge: MIT Press.
- Jackson, S. and S. Jacobs (1981) "Ambiguity and Implicature in children's discourse comprehension" Journal of Child Language 9: 209-216.
- Keenan, E. (1971) "Quantifier Structures in English" Foundations of Language 7: 255-284
- Keenan, E. (1974) "The Functional Principle: generalizing the notion of "subject of"" Chicago Linguistic Society Papers 10.
- Kempson, R. and A. Cormack (1981) "Ambiguity and Quantification" Linguistics and Philosophy 4: 259-309.
- Koster, J. (1978) "Why Subject Sentences don't exist" in S. Keyser (ed) Recent Transformational Studies in European Languages Cambridge: MIT Press.
- Kuno, S. (1970) "Some Properties of non-referential noun phrases" in Studies in General and Oriental Linguistics ed. by R. Jakobson and S. Kawamoto. Tokyo: T.E.C.
- Kuroda, S. (1979) Generative Grammatical Studies in the Japanese Language. New York: Garland.
- Ladusaw, W. (1980) Polarity Sensitivity as Inherent Scope Relations. New York: Garland.
- Langacker, R. (1963) "Pronominalization of the chain of command" in D. Reibel and S. Schane (eds) Modern Studies in English. Englewood Cliffs: Prentice Hall.
- Lasnik, H. (1975) "On the semantics of negation" in Hockney et al (ed) Contemporary Research in Philosophic Logic and Linguistic Semantics. Dordrecht: D.Reidel.
- Lee, T. (1981) Acquisition of Negation in a Mandarin-speaking child. M.A. thesis. University of Hong Kong.
- Lee, T. (1983) "Topic-binding and control in Chinese" UCLA ms.
- Lee, T. (in preparation) "Diary record of a Mandarin-speaking child from one-and-a-half to three"
- Lewis, D. (1973) "Adverbs of Quantification" in E. Keenan (ed) Formal Semantics of Natural Language London: Cambridge

University Press.

- Li, C. and S. Thompson (1981) Mandarin Chinese: a functional reference grammar. Los Angeles, University of California Press.
- Liu, F. (1984) "NIC in Chinese" UCLA ms.
- Liu, F. (1986) "On Topic-traces in Chinese" Proceedings of the West Coast Conference on Formal Linguistics 5
- Lee, H. (1982) "Asymmetry in island constraints in Korean" UCLA ms.
- Lu, S. (ed) 1980. Eight hundred words in Modern Chinese (Xiandai Hanyu babai ci) Beijing: Commercial Press.
- Macnamara, J. (1982) Names for Things. Cambridge: MIT Press.
- Maratsos, M. (1974) "Preschool children's use of definite and indefinite articles" Child Development 45: 446-455
- Marciszowski, W. (ed) 1981. Dictionary of Logic as applied in the study of language. The Hague: Martinus Nijhoff.
- Martin, J. (1985) "The ECP and Indeterminates in Japanese" Journal of Asian Culture vol. IX: 36-51.
- May, R. (1977) The Grammar of Quantification. Doctoral dissertation, MIT.
- May, R. (1985) Logical Form: its structure and derivation. Cambridge: MIT Press.
- Munro, P. (1984) "Floating Quantifiers in Pima" Syntax and Semantics 16: The Syntax of native American languages. New York: Academic Press.
- Nishigauchi, T. (1982) "A note on subadjacency" University of Massachusetts, Amherst, ms.
- Obenauer, H. (1985) "On the identification of empty categories" The Linguistic Review 4: 153-202.
- Pesetsky, D. (1982) Paths and Categories. Doctoral dissertation. MIT.
- Prior, A. (1976) "What do general statements refer to?" in Papers in Logic and Ethics. London: Duckworth.
- Quine, W. (1973) The Roots of Reference. La Salle, Illinois: Open Court.

- Roeper, T. and E. Matthei (1975) "On the acquisition of some and all" Papers and Reports on Child Language Development 9: 63-74.
- Scott, D. (1980) "Advice on Modal Logic" in K. Lambert (ed) Philosophical Problems in Logic. Dordrecht: D.Reidel.
- Smith, C. (1980) "Quantifiers and Question-answering in young children" Journal of Experimental Child Psychology 30: 191-205
- Su, P. (1984) "Two issues concerning the adverb dou" (you guan fuci dou de liangge wenti) Studies in Linguistics series, no. 13. Beijing: Commerical Press.
- Teng, S. (1975) A Semantic Study of Transitivity Relations in Chinese. University of California Publications in Linguistics vol. 80.
- Teng, S. (1983) "Quantifier Hierarchy in Chinese" in Studies in Chinese Syntax and Semantics: Universe and Scope: presupposition and quantification in Chinese ed. by T. Tang, R. Cheng and Y. Li. Taipei: Student Books.
- Thomson, R. and R. Stalnaker (1973) "A Semantic Theory of adverbs" Linguistic Inquiry 4.2: 195-220.
- Vendler, Z. (1967) "Each and every, any and all" in Linguistics in Philosophy. Ithaca: Cornell University Press.
- Wexler, K. and P. Culicover (1980) Formal Principles of Language Acquisition. Cambridge: MIT Press.
- Wexler, K. and R. Manzini (in press) "Parameters and Learnability in Binding theory" in T. Roeper and E. Williams (ed) Parameters and Linguistic Theory
- Wexler, K. and Y. Chien (1985) "The development of lexical anaphors and pronouns" Papers and Reports on Child Language Development 24: 138-149
- Ying, H. et al (1983) "The characteristics of the acquisition of classifiers by four-to-seven-year-olds" Bulletin of the Psychological Sciences (Xinli kexue tongxun):24-31
- Zwicky, A. and J. Sadock (1975) "Ambiguity tests and how to fail them" in J. Kimball (ed) Syntax and Semantics 4 New York: Academic Press.



## Appendix 1

### Test Material for Chinese Children

Below are the test sentences administered to Mandarin-speaking subjects, arranged in exactly the same order as they were given. The relevant lexical items are underlined in each test sentence. The corresponding picture/prop sets are illustrated in Appendix 3.

#### Training Tasks

1. xiaopengyou shua ya ' (Training set 1, Appendix 3)  
child brush teeth  
"The child is brushing (his) teeth"
2. xiaopengyou xie zi (Training set 2, Appendix 3)  
child write character  
"The child is writing"
3. you yige xiaopengyou zai li mian  
have one child at inside  
"There is a child inside (a ring)"  
  
(a picture where a child is standing inside a ring formed by children joining hands together, and another picture where a child is standing outside a similar ring)

#### Block A (Picture Identification)

4. xiaopengyou zai he shui (A 1)  
child DUR drink water  
"The child is drinking water"
5. xiaogou dou zuo xialai le (B 1)  
doggie all sit down asp.  
"The doggies have all sat down"
6. [yige houzi dai zhe yiding maozi] hen haowanr (C)  
one monkey wear asp. one hat very funny  
"That a/each monkey is wearing a hat is funny"
7. you yige dangao meige xiaopengyou dou zai chi (D 1)  
have one cake every child all DUR eat  
"There is a cake (which) every child is eating"
8. zhege xiaopengyou a, baba zai chi dangao (E 1)  
this child part. daddy DUR eat cake

- "(As for) this child, (his) daddy is eating a cake"
9. zhege jiejie a, gege zai zhui zhe (F 1)  
 this sister part., brother DUR chase asp  
 "(As for) this girl, the boy is chasing"
10. meige xiaopengyou dou zai chi yige dangao (G 1)  
 every child all DUR eat one cake  
 "Every child is eating a cake"
11. you yige xiaopengyou bao zhe yige wawa (H 1)  
 have one child hug asp. one doll  
 "A child is hugging a doll"

Block B (Act-Out Tasks)

12. xiaomao guan fang zai yige hezi li (I 1)  
 kitten all/entire put at one box inside  
 "Put all the kittens in a box"
13. na yike tang chulai (J 1)  
 take one candy out  
 "Take a candy out"
14. meike tang dou na chulai (K 1)  
 every candy all take out  
 "Take every candy out"
15. meige taikongren/jiqiren dou shui zai yige hezi li (L 1)  
 every spaceman/machine-man all sleep at one box inside  
 "Every spaceman sleeps in a box"
16. qizi fang zai fangge li. (M 1)  
 chesspiece put at square inside  
 "Put the chesspieces in the squares"
- hese qizi bu keyi fang zai huangse gezi li  
 black chesspiece not may put at yellow square inside  
 "Black chesspieces are not allowed to be placed in yellow squares"
17. qizi fang zai fangge li. (M 2)  
 chesspiece put at square inside  
 "Put the chesspieces in the squares"
- hongse qizi keyi bu fang zai hongse gezi li  
 red chesspiece may not put at red square inside  
 "it is permissible that red chesspieces not be placed in red squares"
18. meige xiaomao dou zuo zai yige hezi li (L 2)  
 every kitten all sit at one box inside  
 "Every kitten sits in a box"

19. na yike tanqiu chulai (J 2)  
take one marble out  
"take one marble out"

20. meike tanqiu dou na chulai (K 2)  
every marble all take out  
"take every marble out"

Block C (Picture Identification and Control Items)

21. meige xiaopengyou dou zai he yibei shui (G 2)  
every child all DUR drink one-glass water  
"Every child is drinking a glass of water"

22. you yige xiaopengyou dai zhe yiding maozi (H 2)  
have one child wear asp. one hat  
"A child is wearing a hat"

23. zhege xiongmao a, xiaogou zai bei zhe (F 2)  
this panda part., doggie DUR carry-on-back asp.  
"(as for) this panda, the doggie is carrying (it)  
on its back"

24. zhege xiongmao a, xiaobaobao zai he niunai (E 2)  
this panda part., baby DUR drink milk  
"(as for) this panda, (its) baby is drinking milk"

25. you yibei shui, meige xiaopengyou dou zai he (D 2)  
have one-glass water, every child all DUR drink  
"There is a glass of water (which) every child is  
drinking"

26. xiongmao dou shuijiao le (B 2)  
panda all sleep asp./part.  
"(the) pandas have all fallen asleep"

27. zhege xiaopengyou zai chuan yifu (A 2)  
this child DUR wear cloth  
"This child is wearing (a piece of) clothing"

28. (Act-out, Configuration Control)  
meike tang dou fang zai yige hezi li (L 3)  
every candy all put at one box inside  
"Put every candy in a box"

29. (Picture Identification)  
[you yige houzi dai zhe yiding maozi] hen haowanr (C)  
have one monkey wear asp. one hat very funny  
"That a monkey is wearing a hat is very funny"

30. (Picture Identification)

xiongmao guan shui le

(B 2)

panda all sleep asp.

"(the) pandas have all fallen asleep"

31. (Act-out)

qizi guan fang zai yige pingzi li

(I 2)

chesspiece all/entire put at one bottle in

"Put all the chesspieces/counters in a bottle"

## Appendix 2

### Test Material for Chinese Adults

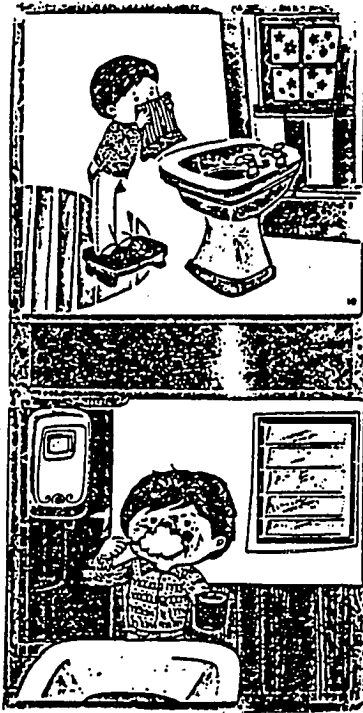
The test sentences below follow the exact order in which they were administered in the experiment. The relevant lexical items are underlined. Corresponding picture/prop sets can be found in Appendix 3. Items 1-9 are picture identification tasks whereas 10-12 are act-out tasks for which the subjects were asked to indicate on the questionnaire the way they would arrange the props in accordance with the meaning of the test sentence.

1. [yige houzi dai zhe yiding maozi] hen haowanr (C)  
 one monkey wear asp. one hat very funny  
 "That a/each monkey is wearing a hat is funny"
2. zhege xiaopengyou a, baba zai chi dangao (E 1)  
 this child part. daddy DUR eat cake  
 "(As for) this child, (his) daddy is eating a cake"
3. zhege jiejie a, gege zai zhui zhe (F 1)  
 this sister part., brother DUR chase asp  
 "(As for) this girl, the boy is chasing"
4. meige xiaopengyou dou zai chi yige dangao (G 1)  
 every child all DUR eat one cake  
 "Every child is eating a cake"
5. zhege xiongmao a, xiaobaobao zai he niunai (E 2)  
 this panda part., baby DUR drink milk  
 "(as for) this panda, (its) baby is drinking milk"
6. zhege xiongmao a, xiaogou zai bei zhe (F 2)  
 this panda part., doggie DUR carry-on-back asp.  
 "(as for) this panda, the doggie is carrying (it) on its back"
7. meige xiaopengyou dou zai he yibei shui (G 2)  
 every child all DUR drink one-glass water  
 "Every child is drinking a glass of water"
8. you yige dangao meige xiaopengyou dou zai chi (D 1)  
 have one cake every child all DUR eat  
 "There is a cake (which) every child is eating"

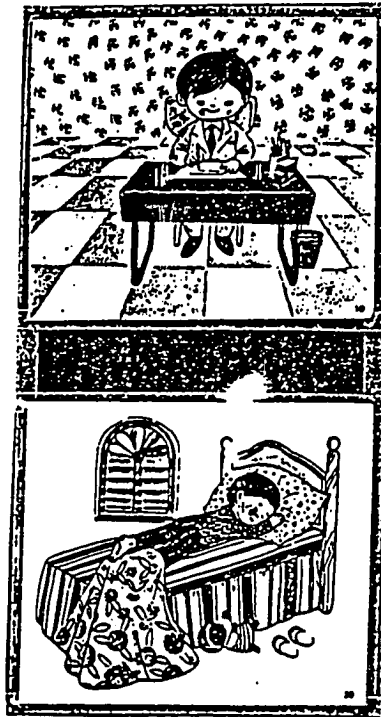
9. [you yige houzi dai zhe yiding maozi] hen haowanr (C)  
 have one monkey wear asp. one hat very funny  
 "That a monkey is wearing a hat is very funny"
10. qizi fang zai fangge li. (M 1)  
 chesspiece put at square inside  
 "Put the chesspieces in the squares"
- hese qizi bu keyi fang zai huangse gezi li  
 black chesspiece not may put at yellow square inside  
 "Black chesspieces are not allowed to be placed in yellow squares"
11. qizi fang zai fangge li. (M 2)  
 chesspiece put at square inside  
 "Put the chesspieces in the squares"
- hongse qizi keyi bu fang zai hongse gezi li  
 red chesspiece may not put at red square inside  
 "it is permissible that red chesspieces not be placed in red squares"
12. meige taikongren/jiqiren dou shui zai yige hezi li (L 1)  
 every spaceman/machine-man all sleep at one box inside  
 "Every spaceman sleeps in a box"

Appendix 3

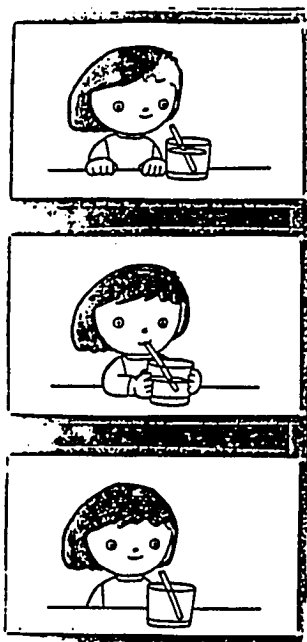
Test Pictures and Props



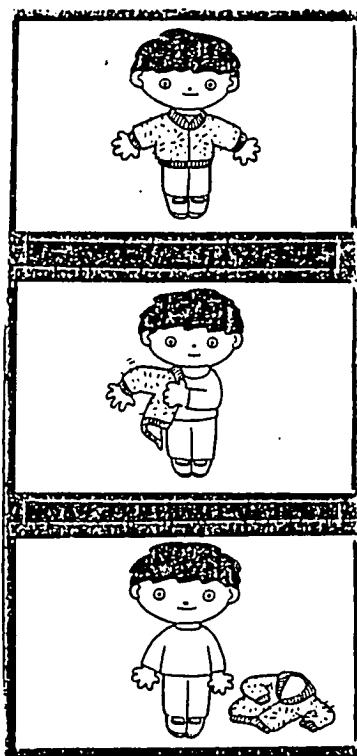
Training Set 1



Training Set 2

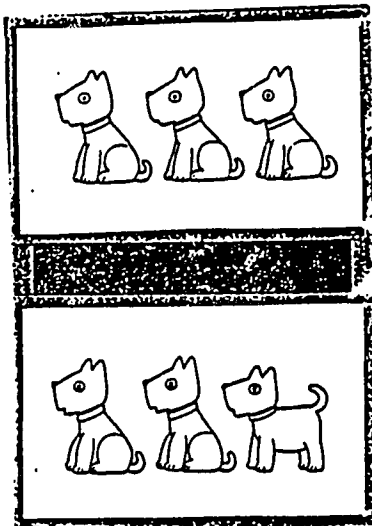


(A 1)

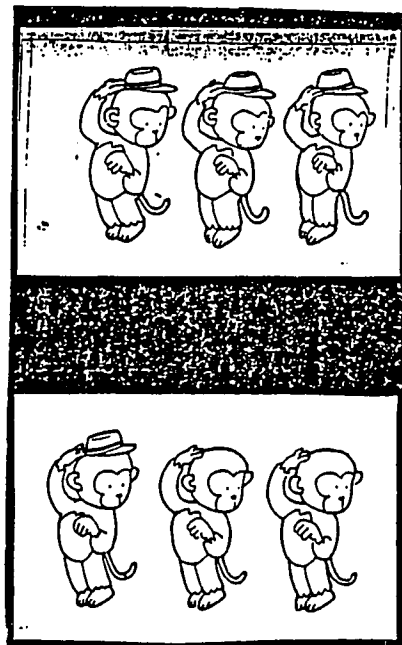


(A 2)



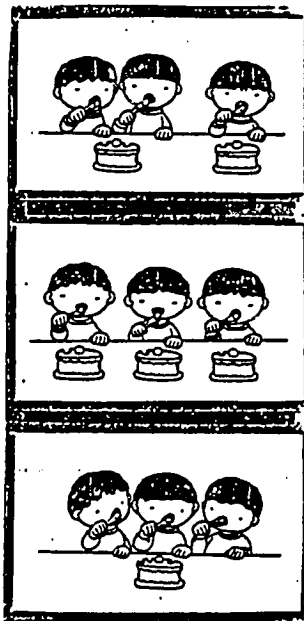


(B 1)

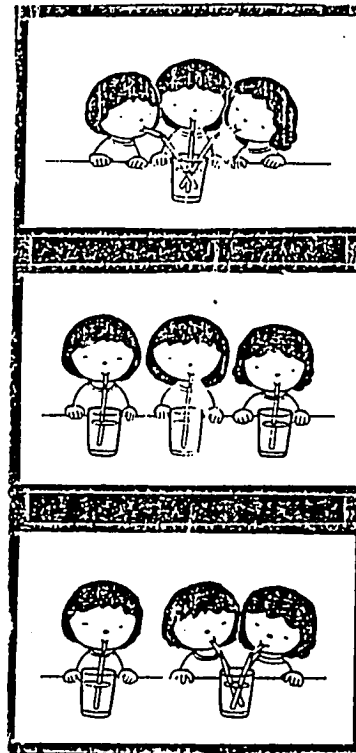


(B 2)

(C)



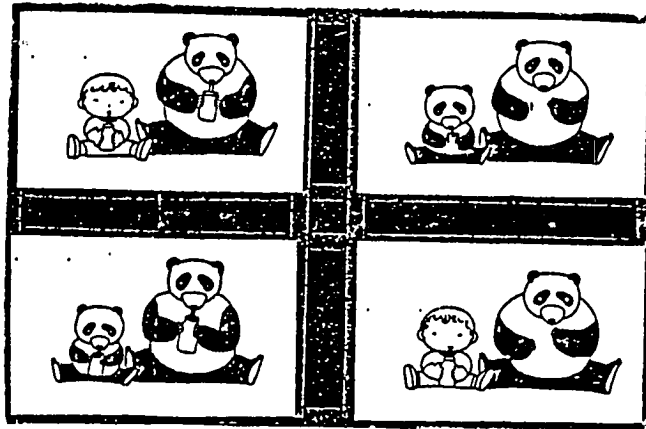
(D\_1)



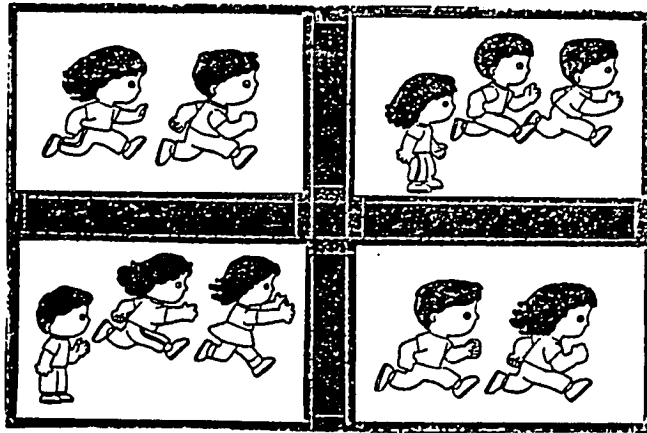
(D\_2)



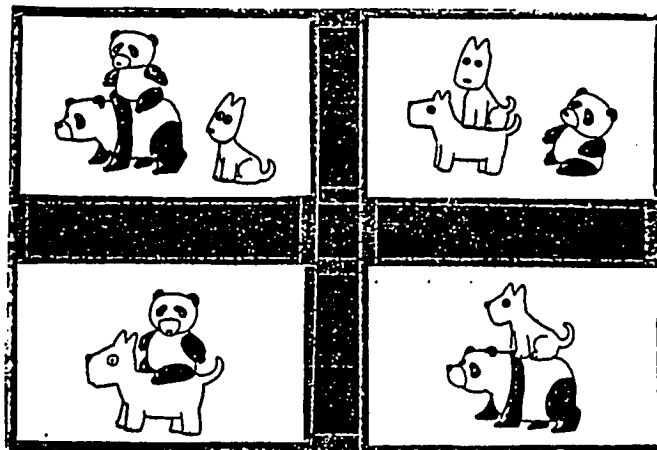
(E 1)



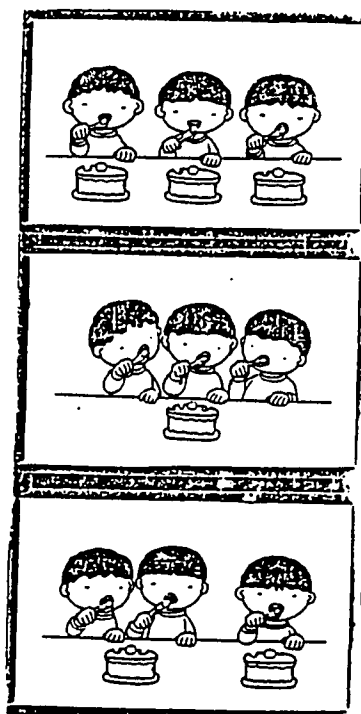
(E 2)



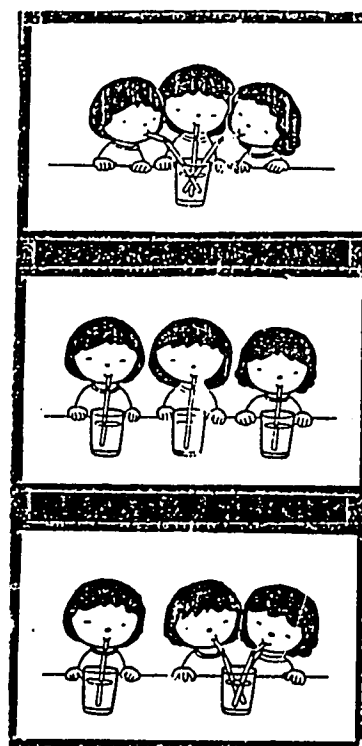
(F 1)



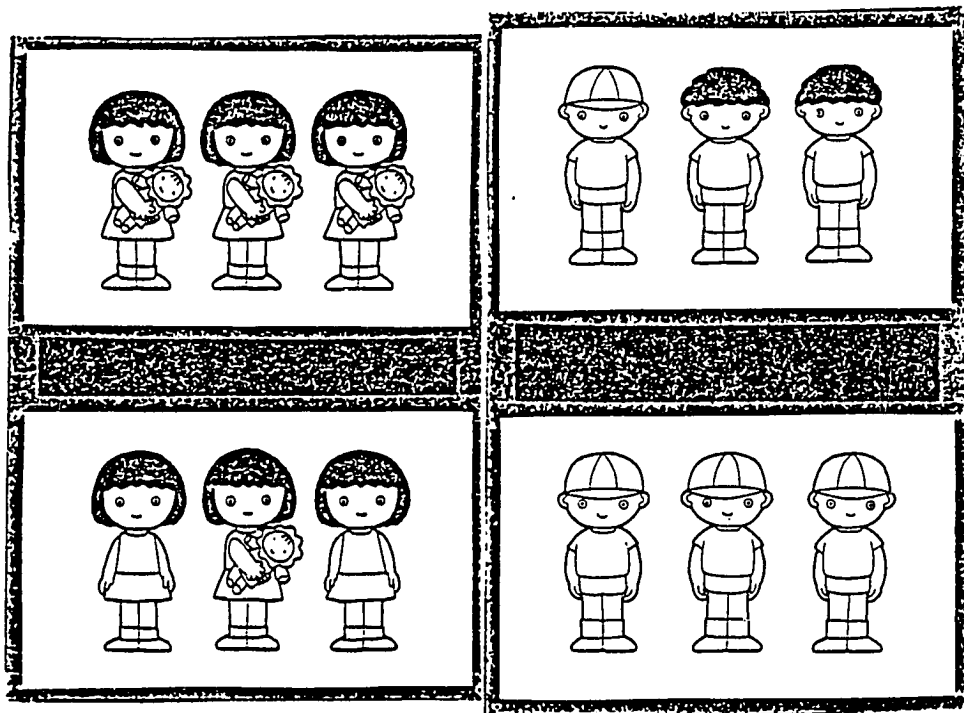
(F 2)



(G 1)

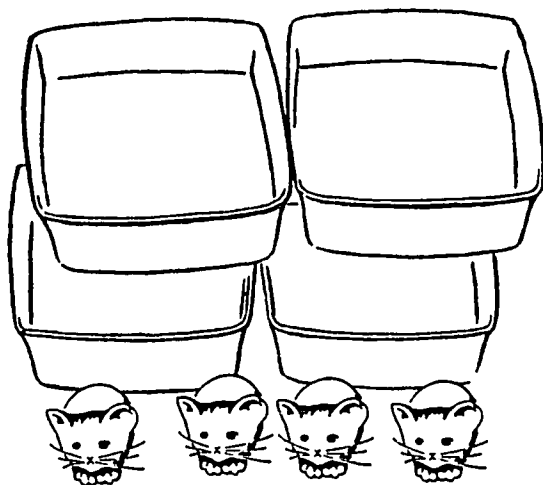


(G 2)



(H 1)

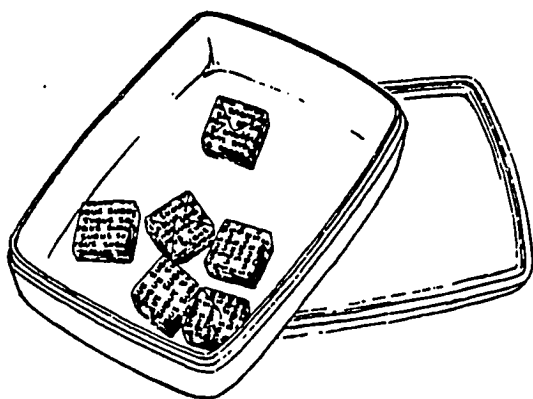
(H 2)



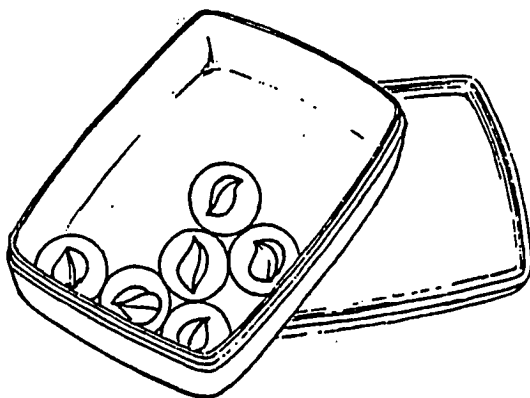
(I 1)



(I 2)

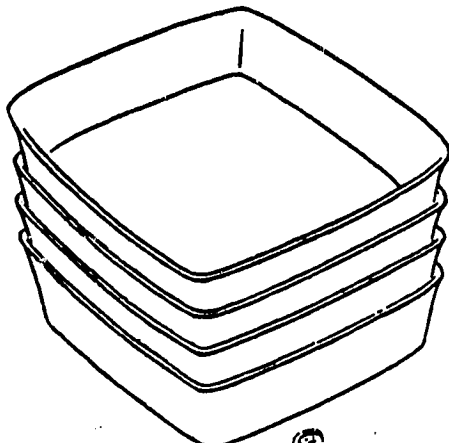


(J 1 = K 1)

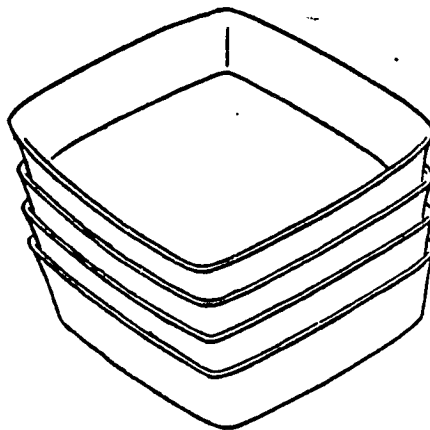


(J 2 = K 2)





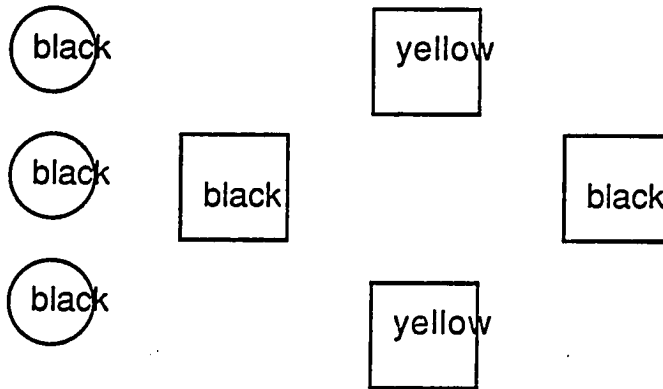
(L 1)



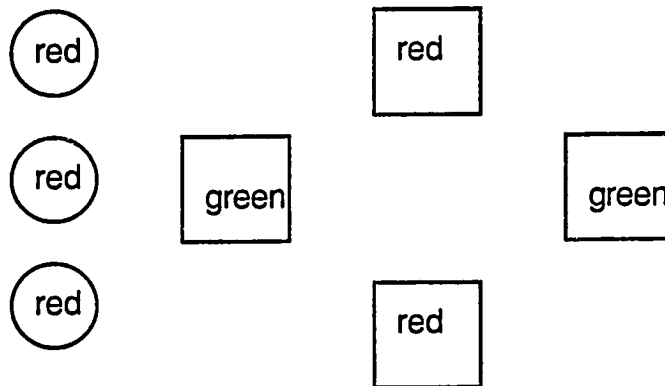
(L 2)



(L 3)



(M 1)



(M 2)

#### Appendix 4

##### Test Material for English Children

##### Training Tasks

1. The boy is brushing his teeth (Training Set 1)
2. The child is writing (Training Set 2)
3. There is a child inside a ring

(a picture where a child is standing inside the ring formed by a group of children joining hands together. Another picture shows a child standing outside a similar ring)

##### Block A

(Picture Identification)

4. The doggies are all sitting down (B 1)
  5. Every child is eating a cake (G 1)
- (Act- out)
6. Put all the kittens in a box (I 1)
  7. Take every sweet out (K 1)
  8. Every spaceman sleeps in a box (L 1)

##### Block B

(Picture Identification)

9. The pandas are all asleep (B 2)
  10. Every child is drinking a glass of water (G 2)
- (Act-out)
11. Put all the counters in a bottle (I 2)
  12. Take every marble out (K 2)
  13. Every kitten sits in a box (L 2)

##### Block C

14. (Distractor) The boy is brushing his teeth (Training set 1)
15. Put every sweet in a box (L 3)

## Appendix 5

### Test Material for English Adults

The test sentences below follow exactly the order in which they were presented.

1. The doggies are all sitting down (B 1)
2. Every child is eating a cake (G 1)
3. Every spaceman sleeps in a box (L 1)
4. Put all the counters in a bottle (I 2)
5. Put every sweet in a box (L 3)
6. Every child is drinking a glass of water (G 2)