

A NUMBER PROJECTION*

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1. Introduction

Indefinite NPs,¹ NPs with weak determiners such as those containing numeral expressions *three people*, *two children*, have been analyzed either as quantificational expressions which need to undergo a quantifier raising process (QR, May 1977, 1985) or as variables which need to be bound (Kemp 1981, Heim 1982). Diesing (1992), on the other hand, argues that such NPs should have both possibilities: they can be quantificational expressions or variables according to structures and interpretations. If undergoing QR, these expressions have a presuppositional interpretation; if they are variables, they are interpreted as cardinal expressions, bound by an existential operator (the existential closure adjoined to VP).

This paper attempts to show that it is not sufficient, at least for numeral expressions, to be recognized as two-way ambiguous, as a quantifier (quantificational presuppositional interpretation) or a variable (cardinal interpretation). It is necessary to recognize the existence of a third type of numeral expressions which behaves like a definite NP with respect to its structural positions in a sentence but is not referential or allows a coreferential pronoun as a definite NP. It is not like a variable indefinite NP with respect to distribution or interpretation possibilities. It also is not like a quantificational expression with respect to properties of scope and binding pronouns. It will be shown that only by recognizing the existence of this additional type of numeral expressions will it be possible to capture more adequately the relation between the distribution of different types of NPs and their corresponding interpretations. The existence of this type of numeral expressions provides the only adequate account

*This work has benefited greatly from the help with data by Andrew Chang, Sumei Ho, Miaoling Hsieh, Fang Li, Grace Li, Bingfu Lu, Shu-ing Shyu and Zoe Wu, and very helpful discussions with them. I am also grateful to Joseph Aoun, James Huang and Patricia Schneider-Zioga for their comments on earlier drafts of this paper.

¹ It is not the concern of this paper to distinguish NPs and DPs.

for an indefinite subject constraint in Chinese which has been observed and debated in the literature. Most importantly, the analysis proposed here provides clear evidence that there indeed exists in the grammar a Number projection, distinct from NP or DP.

This paper will begin with the generalization that a subject in Chinese cannot be indefinite (section 1), and then discuss a cluster of sentence patterns that seems to violate this generalization (section 2). It will be proposed that a numeral expression can simply refer to a specified, identifiable quantity denoted by the numeral, rather than an individual denoted by the noun (or classifier) (section 3). Recognizing the existence of such a numeral expression provides a more adequate account for the prohibition against indefinite subject NPs in Chinese, including the cases containing indefinite bare NPs and numeral phrases (section 4). Finally, in section (5), we investigate further the properties and structures of numeral expressions. It will be shown that this type of expressions has unique properties not accommodated by the distinction of different interpretations of NPs (presuppositional and cardinal) embedded under the distinction between quantifier and variable status of weak NPs. Many unique properties of such expressions concerning scope, pronominal coreference and binding etc. will follow from their structure: a structure headed by Number. Such a number phrase also has its place in other languages, such as those illustrated by the apparent exceptions to agreement rules in English.

2. Definiteness² requirement on a preverbal subject

It has often been observed in the literature that a preverbal subject NP tends to be definite and a postverbal NP tends to be indefinite in Mandarin Chinese. A definite NP is generally represented by a bare NP (interpreted as definite), an NP with a demonstrative, or a proper name. An indefinite NP is generally represented by a bare NP (with an indefinite interpretation) or a numeral expression [Number + Classifier + N]. These facts are illustrated below.

² "Definiteness" is replaced by "specificity" in some literature (Lee 1986, Tsai 1994 for the discussion of "specific" subject NP constraint).

(1) *keren laile.*

guest came

'The guest(s) came'

(2) *laile keren le.*

came guest

'There came (some) guest(s)'

keren 'guest' in (1) is interpreted as definite and that in (2) interpreted as indefinite. When a demonstrative (such as 'that' indicating definiteness) cooccurs with 'guest', only a preverbal position is possible (because the presentational sentence as in (2) requires its postverbal NP to be indefinite); when a numeral phrase such as 'one' cooccurs with 'guest' (indicating indefiniteness), only a postverbal position is possible.

(3) a. *nage keren laile*

that guest came

b. *??yige keren laile*

one guest came

'There came a guest.'

(4) a. **laile nage keren le.*

came that guest

b. *laile yige keren le.*

came one guest

An existential *you* 'exist' is added for the sentence like (3b) to be acceptable:

(5) *you yige keren laile.*

have one guest came

Even though the general prohibition against an indefinite subject illustrated in (1-5) has been more or less regarded as standard in the literature, there is, however, a set of data that systematically presents counterexamples to the said subject constraint, which forces us to recognize the existence of a quantity expression that is independent of the presuppositional or cardinal interpretations of numeral expressions.

3. Exceptions

In contrast to the generalization for a subject not to be indefinite, there are several specific sentence patterns that seem to allow a subject NP to be indefinite, as observed by Tsai (1996):³

(6) V-*de/bu*-V Constructions (potential form)

wuge ren chi-de-wan shiwan fan.

five person eat-can-finish ten-bowl rice

'Five people can finish ten bowls of rice.'

(7) Modal Constructions

sange bubing keyi/neng/yinggai/bixu dai jiufen kouliang.

three foot-soldier may/can/should/must carry nine-ration

'Three foot soldiers may/can/should/must carry nine rations.'

(8) *Gou*-sentences

a. *yizhang chuang gou shui sange tongzi-jun*

one bed enough sleep-in three boy-scout

'One bed is enough for three boy scouts to sleep in.'

b. *yizhang chuang gou sange tongzi-jun shui.*

one bed enough three boy-scout sleep-in

'One bed is enough for three boy scouts to sleep in.'

(9) Flip-flop Constructions⁴

³ There are many other interesting works discussing the cases where an indefinite NP is possible in subject position, such as Fan (1985), Lee (1986), Liu (1990), Shyu (1995), Xu (1996), among others. See Li (1996) for a discussion of such works. Such cases, including those of contrastive usage and of the type of sentences expressingthetic judgment (Kuroda 1992, Shyu 1995) do not affect the points made in this paper.

⁴ Such flip-flop sentences must have the interpretation of capacity/amount of accommodation. For instance, the room/capacity of a bed is to hold three scouts, the amount of three scouts takes up the space of a bed. The following sentences cannot be a "flip-flop" pair because one story normally is not exhausted by three people's telling it.

(i) a. *sange ren shuo yige gushi.* b. **yige gushi shuo sange ren.*
 three persons say one story one story say three persons

However, (ib) can be acceptable in a certain context where "exhausting a story by three people" makes sense. Imagine a situation at a campfire where each kid must

- a. *sange tongzijun shui yizhang chuang.*
 three boy-scout sleep-in one bed
 'Three boy scouts should sleep in one bed.'
- b. *yizhang chuang shui sange tongzi-jun.*
 one bed sleep-in three boy-scout
 'One bed should hold three boy scouts in sleeping.'

However, these four structures are not identical in their acceptance of an indefinite subject NP: (8) and (9) seem to be exceptionless. They accept an indefinite subject easily. (6) and (7), on the other hand, are not as consistent. Even though the sentences given above allow an indefinite subject, there are instances like them but disallowing an indefinite subject. Take (7) for instance, if we retain the relevant models but change the verb phrases, the sentences can become unacceptable.⁵

- (10) a. **sange bubing keyi/neng/yinggai/bixu hen yonggan.*⁶
 three foot-soldier may/can/should/must very brave
 'Three foot soldiers may/can/should/must be brave.'
- b. **sange bubing keyi/neng/yinggai/bixu lai/hui jia.*
 three foot-soldier may/can/should/must come/return home
 'Three foot soldiers may/can/should/must come/return home.'

The following sentences are additional examples, which show that the presence/absence of models does not always affect the acceptability of an indefinite subject:

tell part of a story for the night. The counselor needs to prepare enough stories so that each kid can have his turn. There is a book collection of stories. The stories are almost of equal length. The counselor estimates that the length of a story will be enough for three kids. He can then say *yige gushi shuo sange ren, wuge gushi jiu keyi shuo shiwuge ren le.* 'one story tells three persons (is (enough) for three persons to tell), five stories can tell 15 persons.' or *sange ren shuo yige gushi, shiwuge ren jiu shuo wuge gushi* 'three people tell one story, 15 people will tell five stories.'

⁵ All the unacceptable sentences are good if *you* 'have' precedes the subject.

⁶ We include both stage-level and individual-level verbs (Carlson 1977, Diesing 1992 and others) in these examples in order to show that the types of verbs are not the relevant factor here.

- (11) a. **liangge ren (hui/keneng) kan tade dianying/hen yonggan.*
 two man will/may see his movie/very brave
 'Two people will/may see his movie/be brave.'
 b. **sange xuesheng (yinggai) qu ken Wang laoshi.*
 three student should go see Wang teacher
 c. **wuge xiaohai (keneng) zuowan gongke le.*
 five children may do-finish homework

Similarly, the pattern illustrated in (6) does not always allow an indefinite subject (even with further addition of modals), illustrated here:

- (12) a. **wuge xuesheng (keneng) zuo-de-wan gongke.*
 five student may do-De-finish homework
 'Five students (possibly) can finish homework.'
 b. **wuge ren (keneng) chi-bu-bao fan.*
 five person may eat-not-full rice
 'Five persons possibly cannot get full from eating rice.'
 c. **wuge difang (keneng) shou-bu-dao womende xin.*
 five place may receive-not-arrive our letter
 'Five places (possibly) fail to receive our letter.'

An indefinite subject NP in all these examples is much less acceptable than in (6-7).

4. Quantity expressions

What, then, is the difference between the two sets of acceptable and unacceptable sentences that governs the distribution of an indefinite subject? Note, first, that the unacceptable sentences above in fact improve greatly if they are direct answers to questions of *how many*. In fact, as answers to quantity questions, even the sentences in (6) without *de/bu*, sentences in (7) without modals and sentences in (8) without *gou* all become non-distinguishable from those with *de/bu*, modals or *gou*. Even though answers to questions may be regarded as a particular type of sentences which may or may not fall within a certain syntactic account, it does give us a clue to possible answers to the question raised from the facts discussed in the previous section.

If we compare the two sets of sentences (10-12) and (6-7), with identical or similar subjects and modals (including the potential form *de/bu*), we find that the interpretation of the latter, but not the former, concerns the notion of quantity. The sentences in (6-7) mainly express quantity: the capacity of five people's eating rice is ten bowls, carrying the amount of nine rations is a task possible/desirable concerning the capacity of three soldiers. By contrast, the sentences in (10-12) do not suggest immediately that the quantity interpretation is the concern. If there is a clear linguistic context indicating a quantity interpretation, such as answers to questions of how many, the sentences in (10-12) become acceptable, with or without modals or other key expressions, as just mentioned. In other words, an indefinite subject NP in such cases is acceptable only when it is clearly indicated that the NP is interpreted as denoting a quantity, rather than referring to some individuals.

The sentence patterns in (6-9) play an important role in allowing an indefinite subject NP. However, it is important to point out that it is not because of the working of a certain syntactic process or structure that licenses an indefinite NP here. Crucially, the said indefinite subject NP is acceptable because it is interpreted as a quantity NP, rather than an individual-denoting NP. The possibility of a quantity NP interpretation is intimately tied to these special sentence patterns. First consider the patterns in (8) and (9), which, unlike (6-7), do not have exceptions. This is so because these structures are bona fide patterns expressing quantity. This is obvious with the pattern in (8) which crucially relies on the word *gou* 'enough, sufficient': the notion of quantity must be involved when 'sufficient' or 'enough' is the concern. So is the pattern in (9), which is a pattern

specifically used to express the quantity necessary/possible/sufficient to fill/take up something. The patterns in (6-7) often express quantity as well, though not always. The potential form in (6), together with the other elements in the predicate, can indicate how much/many is desired/necessary/sufficient to finish/consume certain amount of things. The modals in (7), together with the predicate, also contribute to the quantity reading (how much can/may/need to complete a certain task). That the meaning of modals contributes to the quantity interpretation is especially clear if we compare the sentences in (7)

(repeated here) and (13)⁷ (again, as answers to questions about quantity, (13) is acceptable):

(7) *sange bubing keyi/neng/yinggai/bixu dai jiufen kouliang.*
three foot-soldier may/can/should/must carry nine ration
'Three foot soldiers may/can/should/must carry nine rations.'

(13)**sange bubing gan/ken/xiang dai jiu-fen kouliang.*
three foot-soldier dare/willing/want carry nine ration
'Three foot soldiers dare/are willing to/want to carry nine rations.'

The modality in (7) indicates the possibility, or the expected/desired capacity of the amount of three soldiers for the task of carrying certain amount of rations. By contrast, the modality in (7) indicates the daring, willingness, or desire, which is of individuals to carry out the task. That the quantity interpretation is the concern, rather than some specific structural factors, can be further illustrated by the following instances. The sentences in (14a-b) involve an adverb *zhunneng* 'definitely' as suggested in Lee (1986) (though it is possible to assume that the adverb *zhunneng* in fact contains a modal *neng*) and (15) contains the adverb *jiu/cai* '(reaching a certain standard (in terms of quantity, for example) then...':

(14) a. *wuge ren zhunneng gai wan zhejian fangzi/zuo wan zhejian shi.*
five person definitely build complete this house/do finish this matter
'Five persons can definitely complete building the house/doing this work.'

b. **wuge ren zhunneng gai zhejian fangzi/zuo zhejian shi.*
five person definitely build this house/do this matter
'Five persons (are such that they) can definitely build the house/do this work.'

⁷ Tsai (1996) notes the unacceptability of (13) and relates the difference in acceptability to the difference in the types of models involved: deontic or epistemic. This distinction does not capture the unacceptability of (10-12), however. Indeed, it is not the distinction of deontic vs. epistemic models that accounts for the difference. It is the quantity interpretation of the patterns that matters.

- (15) *sange ren jiu/cai zou.*⁸
 three person then go
 'three people then go (when the number of people reaches three,
 three leave)

The contrast between (14a) and (14b) is not expected at all without the notion of quantity. The minimal difference between the two sentences is the word *wan* 'finish'. The occurrence of this word, however, makes it much easier for (14a) to have a quantity interpretation: the task of building the house or doing this work can be completed by the effort of 5 people. (14b), on the other hand, is not concerned with the manpower needed to complete the construction or do the work. It is concerned with the possibility or ability of individuals for the work of constructing the house/doing the work.

The quantity indicators do not even have to be in the same clause as the numeral expression:

- (16) a. *sange ren zuo yijian shi, tai shao/qingsong le ba!*
 three people do one thing, too little/easy
 'Three people do one thing, (it is) too little/easy.'
 b. *sange ren zhi jiaolai yipian wenzhang, tai duo ren zuo tai shao shi le ba.*
 three people only hand-in one article, too many people do too few thing Par
 'Three people only handed in one article. Too many people did too little, isn't it?'
 c. *sange ren zhaogu yige haizi, tai chong le ba!*
 three person care one child. too spoil Par.
 'Three people take care of one child. (that is) spoiling (the child) too much.'

Typical math contexts provide many examples of quantity interpretation of the numeral expressions.

⁸ The elements before *jiu/cai* possibly may be analyzed as reduced conditional clauses (given that a conditional clause often cooccurs with *jiu* or *cai*): (when it reaches) three people, then (three people) go.

(17) a. *sange ren zuo yijian shi, jiuge ren zuo jijian shi?*⁹
 three people do one thing nine people do how-many thing
 'Three people do one thing, how many things do nine people do?'

b. *sange ren shui yizhang chuang, women shierge ren yao duoshao chuang?*

three people sleep-in one bed we twelve people need
 how-many bed

'Three people sleep in one bed, how many beds do we twelve people need?'

c. *yizhang chuang shui sange ren, liangzhang chuang keyi shui jige ren?*

One bed sleep three people two bed can sleep how-many people

'One bed sleeps three people, how many people can two beds sleep (accommodate)?'

5. Relevance of the definite subject constraint

As mentioned at the beginning, a subject in Chinese cannot be indefinite. That is, a bare NP in the subject position must be interpreted as definite and a numeral NP is not acceptable in this position. This observation has often been made in contrast with English which allows a subject to be indefinite. Since it has been proposed (as in Diesing 1992) that an indefinite subject in English is possible because it can be licensed by an existential operator adjoined to VP, assuming a subject in English to be originated from a VP-internal position (the Internal Subject Hypothesis, see Koopman and Sportiche 1988,

⁹ All of these sentences have an 'every' interpretation for the first numeral NP: *every three people do one thing*..., *every three people sleep in one bed*, *every bed sleeps three people*. (See Linding Li, 1986)

Furthermore, note that the various so-called universal quantifiers have different interpretations in such patterns (the cooccurrence of *dou* 'all' in such cases is not necessary). *mei* 'every' must have a distributive interpretation but *suoyou quanbu* 'all' can only have a collective interpretation (when *dou* is added, distributive reading is possible).

(i) *meige ren zuo yijian shi, jiu keyi wancheng henduo shi.*
 every one do one thing then can complete many things
 'Everyone does one thing, many things can be completed.'

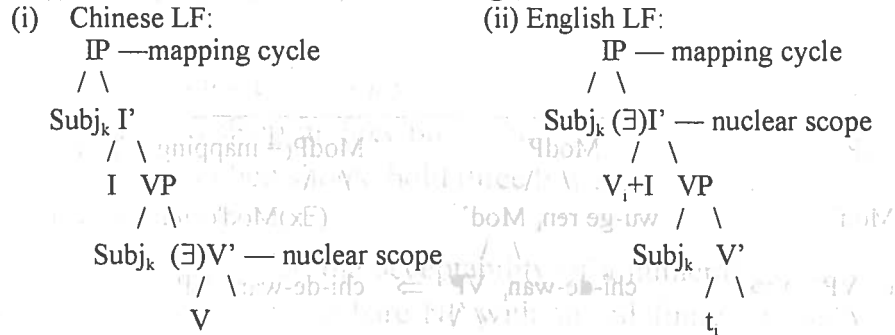
(ii) *suoyou/quanbu de ren zuo yijian shi, jiu keyi wancheng henduo shi.*
 all De person do one thing then can complete many things
 'All of the people do one thing, many things can be completed.'

among many others),¹⁰ it is possible to claim that a subject in Chinese cannot be an indefinite NP because the existential closure is not high enough to license this indefinite NP. Somehow, Chinese phrase structures do not have an existential closure that is high enough to c-command the subject NP; a subject indefinite NP therefore does not have an existential operator to license it unless *you* ‘exist, have’ occurs before the subject NP, taking you to be equivalent of an existential operator.¹¹

This line of pursuit may be supported by the fact that (6-9) are acceptable, if we follow Tsai in assuming that the presence of *de/bu* (6), modals (7), *gou* (8) and an empty modal in the flip-flop construction (9) make it possible for an existential closure to c-command the subject and therefore license an indefinite subject.¹² However, we

¹⁰ Diesing (1992) proposes a Mapping Hypothesis, which, briefly put, has an existential closure adjoined to VP. VP is mapped into the nuclear scope of a tripartite structure. An indefinite NP inside a VP can be licensed by this existential closure; whereas an indefinite NP outside of VP cannot be licensed by such an existential closure because it is not within its domain. A subject can be indefinite only because it can be reconstructed to (base generated at the beginning) the VP internal position.

¹¹ In order to capture the fact that a subject NP in English, but not in Chinese, can be indefinite, Tsai (1996) suggests that the existential closure is inside VP (as in (i)) in Chinese but is outside VP in English because of the V-to-I movement:

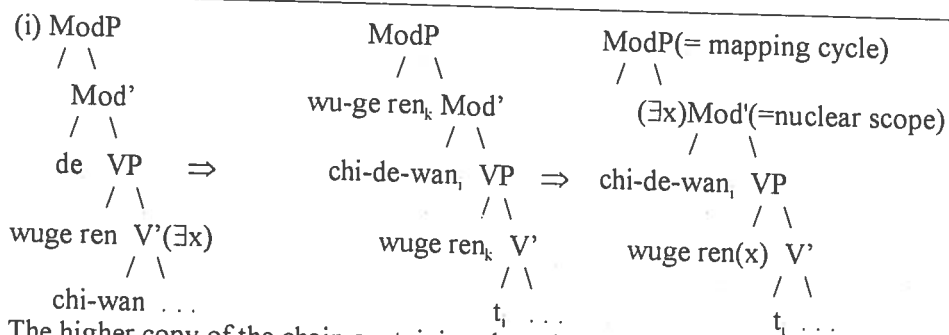


A subject in English therefore can be bound by the existential closure, but not in Chinese.

¹² Tsai (1996) suggests that the verb in these sentences undergoes movement to a higher position c-commanding the internal subject position (Specifier of VP), assuming the Internal Subject Hypothesis. Take the potential construction in (6) for instance, the verb moves up to the modality projection *de/bu*, as in (i). This verb movement makes it possible for the existential closure to occur higher, rather than lower, than the VP node, adopting a version of the Mapping Hypothesis (Diesing 1992, Tsai 1994). (i) shows that the subject NP in (6) *wuge ren* ‘five people’ moves into [ModP, Spec], forming a chain and leaving a copy in [VP, Spec], while the verb complex *chi-wan* raises to wrap around the infixal modal *de*:

have seen instances where the same modals or *de/bu* (potential morphemes) may or may not help make a numeral subject NP possible. In fact, we have tried to show that it is not solely because of the presence of modals and other similar elements that makes an indefinite subject NP possible. Rather, it is the quantity interpretation contributed by the overt linguistic contexts that distinguishes the (un)acceptability of an 'indefinite' NP in a subject position. The supporting evidence lies in the fact that there are instances with the 'right modals' (and others such as *de/bu*) not allowing an indefinite subject and there are instances without the modals that accept an indefinite subject.

There is a further piece of evidence that it is the quantity reading that makes a numeral NP in subject position acceptable, rather than the particular structures in (6-9). Recall that an indefinite NP can be represented by a bare NP or a numeral NP in Chinese. The account based on treating an indefinite NP (indefinite bare NP and numeral NP) as a variable requiring an existential operator as licensor would predict that a bare NP also can occur in the patterns in (6-9) and receive an indefinite interpretation, just like numeral NPs. This prediction, however, is not born out. The subjects in (6-9) replaced by a bare NP must be interpreted as definite or generic. The subject bare NPs cannot be interpreted as indefinite.



The higher copy of the chain containing the subject NP *wuge ren* can be deleted, leaving a copy of the subject NP that is within the scope of the Existential closure. The indefinite NP is therefore acceptable in such structures. Sentences in (7-9) are analyzed in the same way: (7) has an overt modal, (9) is assumed to contain an empty modal. The V moves up to modal to extend the chain as in (10). *gou* in (8) is assumed to be a light raising verb. The subject NP is raised from within the *gou* projection to outside it (the existential closure will be attached to the projection of *gou*). This account of an indefinite subject NP predicts that any sentence with the relevant modals or with a *V-de/bu-V* form should allow an indefinite subject.

- (18) V-*de/bu*-V Constructions (potential form)
ren/xiaohai chi-de-wan shiwan fen.
person/child eat-can-finish ten-bowl rice
'People/Children can finish ten bowls of rice.'
- (19) Modal Constructions
bubing keyi/neng/yinggai/bixu dai jiufen kouliang.
foot-soldier may/can/should/must carry nine ration
'Foot soldiers may/can/should/must carry nine rations.'
- (20) *Gou*-sentences
a. *chuang gou shui sange tongzi-jun*
bed enough sleep-in three boy-scout
'The bed is enough for three boy scouts to sleep in.'
b. *chuang gou sange tongzi-jun shui.*
bed enough three boy-scout sleep-in
'The bed is enough for three boy scouts to sleep in.'
- (21) Flip-flop Constructions
a. *tongzi-jun shui yizhang chuang.*
boy-scout sleep-in one bed
'The boy scouts sleep in one bed.'
b. (*da*) *chuang shui sange tongzi-jun.*
big bed sleep-in three boy-scout
'The big bed should hold three boy scouts in sleeping.'

The contrast between the acceptability of a numeral expression and the unacceptability of a bare NP with an indefinite interpretation in these instances ((6-9) vs. (18-21)), nevertheless, is expected if it is the presence of a quantity interpretation that allows a numeral NP in the subject position of (6-9). Since what is accepted in the subject position of these sentences is a quantity-denoting expression and since a bare NP does not denote a quantity, it is expected that the subject bare NP in (18-21) is interpreted as definite or generic, following the general constraint on the subject NPs in Chinese.

An implicit assumption so far is that a subject NP in Chinese cannot be indefinite and this constraint does not allow exceptions, as

we have seen in cases with bare NPs (18-21). A quantity denoting numeral NP, however, is exempt from this constraint.^{13,14} Questions thus arise as to why quantity denoting numeral expressions are exempt from the constraint. We turn to this issue and the relevant properties of quantity denoting numeral expressions next.

6. Structures and properties

We start with a peculiarity in interpreting quantity denoting numeral expressions that has not been discussed so far. The peculiarity can be first illustrated by an acceptable English sentence with a numeral expression in the subject position. Take an English sentence *Two teachers interviewed five students* for instance. The

¹³ But this is not the only exception. See note (3).

¹⁴ It should be clear by now that we cannot simply claim numeral NPs do not occur in subject position. In fact, it is in general not enough to rely on form to determine the types of NPs that can occur in subject position. This can be further illustrated: Liu (1990) observes that preverbal NPs (subject) are subject to a constraint of G-specificity. 'A basic NP can occur preverbally iff it is G(eneralized)-specific' (p. 115). According to Liu, nouns are categorized into G-specific and non-G-specific according to form: with or without determiners, and with what determiners. A non-G-specific NP depends on other NPs for scope interpretation and, when in object position, does not induce scope dependency (cannot have scope over the subject NP, i.e., does not have a subject-dependent on-object reading). Scope-independent reading is unavailable. The bracketed NPs in the following sentences are classified as non-G specific because they have the two characteristics just mentioned. Being a non-G-specific NP, they cannot occur in the subject position (p. 112):

- (i) a. **[shilaige xiaohai] xiao de zhibuqi yao*
 ten-about child laugh De straighten-not-up back
 'About ten children laughed so much they couldn't straighten their backs.'
 b. **[ba dao shige xuesheng] canjiale youxing.*
 eight to ten student joined parade
 'Between eight and ten students joined the parade.'

As expected from the discussions earlier, however, such non-G-specific NPs become acceptable when overt linguistic contexts are present to induce a quantity interpretation:

- (ii) a. *[shilaige xiaohai] ban-bu-dong yi-qian bang de dongxi.*
 ten-about child move-not-move one-thousand pound De thing
 'About ten children cannot move a one-thousand pound item.'
 b. *[ba dao shige xuesheng] zhu yijian fang.*
 eight to ten student live one room
 'Between eight and ten students stay in one room.'

It is clear that we cannot account for the distribution of indefinite NPs according to the form of NPs.

sentence has two scope dependent readings (subject having scope over object or object having scope over subject). Moreover, it can have an independent scope interpretation which can be roughly translated as ‘there existed a set of two teachers and a set of five students and the former set interviewed the latter.’ Such an existence interpretation, however, is not present in the ‘quantity’ interpretation sentences. (22), for instance, is not translated as ‘there exist two students and a room, the former (group) sleeps in the latter.’ (The individuals need not exist for the sentence to be true.) Rather, it is translated as ‘(the quantity of) two students stays in (the quantity of) one room (one room accommodates two students).’

(22) *liangge xuesheng shui yijian fang.*

two students sleep one room

‘Two students sleep in one room.’

The interpretation of quantity NPs can be further highlighted, if we compare the quantity NP cases with those containing *you* ‘have’.

(23) a. *wuge ren chi-de-wan shiwan fan*

five people eat-De-finish ten-bowl rice

‘Five people can finish ten bowls of rice.’

b. *you wuge ren chi-de-wan shiwan fan*

have five people eat-De-finish ten-bowl rice

‘There exist five people such that each of them can finish ten bowls of rice.’

The contrast between (23a) and (23b) shows two important differences between these two types: (i) the NP preceded by *you* denotes individuals and the existence of such individuals plays an important role in determining the truth value of the relevant sentences, but the quantity NP does not denote individuals (it expresses the capacity of the amount of five people in (23a)) (ii) the truth of the sentences (propositions) with *you* entails that the sentence (proposition) is true with each member of the set denoted by the *you* NP (i.e., if (23b) is true, it must be true that each of the five individuals can finish ten bowls of rice), but such an entailment is not true with quantity NPs (i.e., if (23a) is true, it does not mean (in fact it cannot mean) one

individual can finish ten bowls of rice).

A predicate calculus representation for an existential quantifier in the form of (24b) for (24a), for instance, cannot appropriately express the meaning of the quantity NP, *sange ren*, even though it can express the interpretation of sentences containing you NP quite accurately (*you sange ren ban-de-dong yijia gangqin* 'there exist three people who can move a piano', with the reading of the existence of a number of individuals who each can perform the task expressed by the VP).

(24) a. *sange ren ban-de-dong yijia gangqin.*

three person move-can-move one piano

'Three persons can move a piano.'

b. $\exists x_1 \exists x_2 \exists x_3 [x_1 \neq x_2 \wedge x_1 \neq x_3 \wedge x_2 \neq x_3 \wedge \text{person}(x_1) \wedge \text{person}(x_2) \wedge \text{person}(x_3) \exists y \{[\text{piano}(y)\dots] \wedge \text{move}(x_1,y) \wedge \text{move}(x_2,y) \wedge \text{move}(x_3,y)\}]$

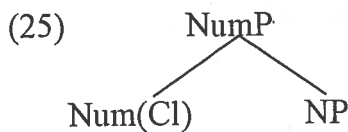
Even a generalized quantifier (Barwise and Cooper, 1981) treatment does not easily distinguish the two types of expressions, either.¹⁵ Specifically, the quantity NP is not to express the existence of a certain number of individuals denoted by the NP; rather, it expresses the quantity/capacity of a set. In other words, the quantity NP cannot be translated, in plain language, as 'there exists an X number of individuals such that these individuals....' Quantity denoting numeral expressions do not fall in line with individual-denoting NPs.

Given the interpretation possibilities, it may be straightforward to simply analyze a quantity NP as an NP containing 'quantity' — *the quantity of NP*, which has a definite form (a definite quantity), thereby abiding by the constraint that a subject NP in Chinese is definite.¹⁶ To implement this, we can postulate an empty head denoting quantity, taking the overt numeral NP as the complement of the empty head. A quantity NP would then have the form [NP (*de*) e] where 'e' is an empty head denoting quantity. A concern for such a representation is that an empty nominal head is generally not possible without the occurrence of the modification marker *de*, the only

¹⁵ Such quantity NPs cannot be interpreted as variables, either, in the sense of Heim (1982). We return to the variable analysis in section 6.4.

¹⁶ This possibility was suggested by James Huang when part of this paper was presented at ICCL-5 at TsingHua University, 1996.

exception being a classifier phrase directly preceding the empty head. In the case of quantity NPs, however, it is not a classifier phrase that directly precedes the empty head. Nor does there exist the modification marker *de*. What, then, can be an appropriate representation for quantity NPs, which can at the same time be distinguished from an indefinite referential NP (those numeral NPs preceded by *you*, for instance)? I would like to suggest that a quantity NP in fact is a projection headed by the number (Num) expression (cf. Huang 1982, Tang 1990), whereas a referential NP is either a classifier (Cl) phrase or an NP.¹⁷



Such a distinction provides a plausible account for the interpretation and distribution of quantity expressions vs. the indefinite referential NPs (recall (23a) vs. (23b)). When an expression is a Number Phrase, it denotes quantity (which is the fundamental meaning of numbers) and does not denote individuals. When an expression is a Classifier Phrase or an NP, it can denote individuals (referential). The postulation of a Number Phrase captures the syntactic and semantic behavior of such phrases.

6.1. Not counterexamples to the subject constraint

First, it makes it possible to claim that the examples in (6-9) are not exceptions to the general observation that a subject in Chinese is generally definite. There are two possibilities. First, it can be claimed

¹⁷ It does not matter for our purpose here if a Classifier phrase or an NP (or even a DP) is chosen, keeping in mind languages without classifiers such as English which also distinguishes between quantity NPs and referential NPs. A related observation is that a Number Phrase dominated by a DP *zhe/na sange ren* 'these/those three people' will function like a DP and denote individuals, rather than a pure quantity expression.

With respect to the mechanism, if a Classifier Phrase is chosen, it can be suggested that Number and Cl form a double headed structure. If Number projects, it is a Number Phrase; if Classifier projects, it is a Classifier Phrase. If a Classifier projection does not exist, it will then be a question of whether a Number expression is in a head position or a Specifier of N/Adjoined to N position.

that a quantity expression is not an individual-denoting expression. The issue of definiteness is irrelevant. The second possibility is to claim that a quantity expression is inherently definite. Note that a quantity phrase in fact refers to a particular quantity. A quantity 'three people' denotes the quantity of three; a quantity 'one room' denotes the quantity of one. In this sense, a quantity expression is a definite expression because it refers to a specified, identifiable amount. Taking a quantity expression as a definite phrase also accounts for the fact that a true quantity expression cannot be preceded by *you*, the existential marker which requires its following NP to be indefinite (much like the existential *there* construction in English):

- (26) a. *you liang wan fan chi sange ren.*
 have two bowl rice eat three people
 *'Two bowls of rice (is sufficient) for three people to eat.'
- b. *you liangzhang chuang gou shui sange ren.*¹⁸
 have two bed enough sleep three person
 *'One bed is enough for three people to sleep in.'

6.2. Pronominal coreference/binding

The recognition of a Number Phrase also accounts for the lack of pronominal coreference or pronominal binding. In cases containing an indefinite NP, a pronoun, singular or plural, can be interpreted as coreferential with or bound to the indefinite NP:

- (27) *wo zhao-bu-dao yige ren, neng zhunshi wancheng wo gei ta, de gongzuo.*
 I find-not-succeed one person can punctually complete I give him
 De job
 'I cannot find a person that can punctually complete the job I give to him.'

¹⁸If the numeral NP is interpreted as an individual-denoting indefinite NP, the sentence is acceptable: in a room with a few beds, there are two bigger beds, each of which can accommodate three.

- (28) a. *ni ruguo neng zhaodao yige/shenme bangshou,, jiu gankuai ba ta, qing lai.*¹⁹
 you if can find one/what helper then hurry Ba him invite come
 'If you can find a helper, hurry and invite him over.'
- b. *ta mingtian hui kandao sange ren,, hai hui gen tamen, zuo pengyou.*
 he tomorrow will see three people and will with them make friends
 'He will meet three people tomorrow and will make friends with them.'

However, a quantity expression does not accept a coreferential or bound pronoun. (29a-b) are not acceptable; and if they are acceptable at all (disregarding the definiteness requirement on subject), the numeral expression must be interpreted as denoting individuals, rather than denoting quantity:

- (29) a. **sange ren, chi-bu-wan ni gei tamen, de wuwan fan.*
 three men eat-not-finish you give them De five-bowl rice
 'Three men cannot finish the five bowls of rice that you gave to them.'
- b. **ruguo yi-guo fan chi-de-wan sange ren,, wo jiu qing tamen, lai.*
 if one-pot rice eat-De finish three person I then invite them come
 'If a pot of rice can provide three people, I will invite them over.'

6.3. Scope

The behavior of Number Phrases is not like that of the quantificational expressions (QPs) in Chinese in general. A QP generally has scope over another QP in a canonical active sentence when the former c-commands the latter (see Huang 1982, Aoun and Li (1989, 1993), among others). However, a number phrase does not interact at all with another number phrase with respect to scope. (30), for instance, has only one reading: the amount of rice consumed by three people is five bowls:

¹⁹ cf. Cheng and Huang's (1996) discussion of two types of *donkey* sentences in Chinese containing the indefinite non-interrogative *wh*-words.

(30) *sange ren chi-de-wan wuwan fan.*

three people eat-can-finish five-bowl rice

'Three people can finish five bowls of rice.'

A subject QP or *wh*-element has scope over a modal or negation; however, a number phrase does not:

(31) a. *shei keyi/bu qu?*

who can/not go

'Who is it that he can/will not go?'

b. *da bufen de ren keyi/bu qu.*

big part De people can/not go

'Most people are such that they can/will not go.'

(32) a. *sange ren keneng chi-bu-wan wuwan fan.*

three people possible eat-not-finish five bowl rice

'It is possible that three people cannot finish five bowls of rice.'

*'Three people are such that they can finish five bowls of rice.'

b. *sange ren bu hui zhi chi wuwan fan.*

three people not will only eat five bowl rice

'It will not be the case that three people only eat five bowls of rice.'

*'Three people will not be such that they only eat five bowls of rice.'

The interpretation of sentences like (32a-b) further suggests that there cannot be an existential operator associated with the Number Phrase. Otherwise, it is inexplicable why there does not exist an interpretation of the existential operator having scope over the negation or modal.

6.4. vs. Indefinite *wh*-elements (*donkey* sentences)

Considering the scope properties, one may argue that there might not be a need to recognize the existence of a Number Phrase. It may be that it is simply an indefinite NP which always takes narrow scope with respect to other quantificational expressions. This line of pursuit, however, would wrongly place the Number Phrase in the same category as the indefinite non-interrogative *wh*-element as in (33a-b), even though they behave differently. For instance, they behave differently with respect to the possibility of coreferential pronouns, as indicated in section 6.2. and (33).

- (33) *ruguo ni kandao shenme ren, qing ba ta dai jinlai.*
if you see what person, please Ba him bring in
'If you see anyone, please bring him in.'

(34a-b) further show the contrast between the two: even though (34a) is perfect, (34b) is not quite acceptable unless there is some additional comment following the numer phrase (cf. Li 1996).

- (34) a. *wo mei kandao shenme ren.*
I not see what people
'I did not see any one.'
b. **wo mei kandao sange/yige ren.*
I not see three/one person
'I did not see three/one person(s).'

6.5. Agreement

The existence of a Number Phrase in fact is not an isolated fact in Chinese. There are some cross-linguistic facts, even though somewhat limited, that point to the necessity of recognizing such an element. For instance, the existence of a Number Phrase may account for some agreement facts in English, as illustrated below:

- (35) a. Three men is not enough/sufficient to handle this job.
b. *Three men is coming tomorrow.
c. Three men are coming tomorrow.

A numeral expression can have singular Agreement when it is interpreted as denoting quantity (enough or sufficient quantity). The head is a number; it does not matter what number it is. Since it is a number, the agreement can be singular.²⁰

Moreover, as in Chinese, such a quantity denoting expression does not allow a coreferential or bound pronoun:

- (36) a. If a man owns a donkey, he usually beats it.
b. He will meet three people tomorrow and he will make friends with them.

²⁰This does not rule out the possibility that three men is treated as an individual denoting nominal expressions, which can then take a plural agreement.

- (37) a. *Three people, is sufficient to move a piano you gave to them,
b. *If three people is sufficient to move a piano, I will invite them
over.

7. Conclusion

We have shown in this paper that a prohibition against an indefinite subject NP is valid only if the interpretation possibilities of numeral expressions are clarified. The fact that a bare NP cannot have an indefinite interpretation in subject position, including the patterns in (6-9), indicates that, generally, a subject NP in Chinese indeed cannot be indefinite. The distribution of numeral expressions can only be adequately captured by recognizing an additional type of interpretation, the quantity interpretation, which in fact behaves like a definite NP with respect to its distribution in a sentence. This quantity type of numeral expressions does not behave like a quantificational element or a variable with respect to the behavior in pronominal binding, scope, the contrast with the variable-like indefinite *wh*-elements etc. All these follow from the fact that the quantity expressions are Number phrases (phrases headed by Number), rather than a classifier phrase or an NP, DP. With the proliferation of functional categories in recent development of the theory, the independent existence of a number phrase is expected but has not been seriously argued for. Within the Minimalist framework, it also is not surprising that a number can project and be the head of a projection. This paper offers evidence that a number phrase indeed exists in the grammar and has its own characteristics distinct from a NP or a DP. It also suggests that a numeral expression has ambiguous structures: either a Number phrase headed by Number (quantity interpretation) or an indefinite referential phrase, which cannot be headed by Number. The question that follows is what structure such an indefinite referential numeral phrase is. This will be dealt with in a separate work.

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