Numeral Classifier Structures

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This monograph, ***Numeral Classifier Structures***, addresses the fundamental syntactic issues of numeral classifier constructions within the framework of generative grammar, based on a thorough study of a typical classifier language, Mandarin Chinese. It aims to clarify three major issues: the relationship between classifiers and the count-mass contrast, the relationship between classifiers and plural markers, and the constituency and thus the syntactic structures of numeral classifier constructions. First, the book shows that the contrast between count and mass is not binary. Instead, there are two independently attested features: numerability, the ability of a noun to combine with a numeral directly, and delimitability, the ability of a noun to be modified by a delimitive (size, shape, or boundary) modifier. The positive value of numerability alone indicates the count status of a nominal, but it is the combination of the negative values of both features that indicates the mass status of a nominal. The theory proposed in this book enables us to identify count and mass nominals in any language that has attributive numerals and delimitive modifiers. Although all nouns in Chinese are non-count nouns, there is still a mass/non-mass contrast, with mass nouns selected by individuating classifiers and non-mass nouns selected by individual classifiers. Second, it is possible to express number features by morphological forms of classifiers in a classifier language. Third, while individual, individuating, and kind classifier constructions are right-branching, partitive and collective classifier constructions are left-branching.

Acknowledgment (to be added later. This manuscript has received comments from many people. The author is very grateful. YOUR further comments are always welcome. Please write to Lngnz@ccu.edu.tw) Word count: 81946

Chapter 1 Introduction

Three kinds of new knowledge are offered to you in this book: new observations, new generalizations, and new analyses.

The facts discussed in this book are about a kind of formatives, numeral classifiers. The word *zhi* in the Mandarin Chinese example in (1a) is a numeral classifier (I will simply call it CL henceforth). A CL occurs with a numeral and an NP, such as, respectively, *san* 'three' and *bi* 'pen' in (1a). In (1b), *di* is also a CL.

(1) a. Yaoyao kanjian-le san zhi bi.
Yaoyao see-PRF three CL pen
'Yaoyao saw three pens.
b. Yaoyao kanjian-le san di you.
Yaoyao see-PRF three CL oil
'Yaoyao saw three drops of oil'.

Some languages have CLs and some do not. Some languages have the counterpart of the CL in (1b), but not that in (1a). From the English translations of the two examples we can see that English has the word *drop* to correlate with the CL *di* in (1b), but does not have a counterpart to the CL *zhi* in (1a).[1] CLs like *zhi* are called individual measures in Chao (1968: 585). I call such CLs individual CLs. CLs like *di* are called individuating CLs in this book (they are grouped into partitive measures in Chao 1968). Languages that have both types of CLs, such as Mandarin Chinese, Japanese, and Mayan languages, are called CL languages.

Mandarin Chinese is a typical CL language. This is because, first, in this language, the occurrence of a CL in a numeral expression is obligatory (except in idiomatic expressions or compounds), whereas in some other CL languages such as Indonesian, the occurrence of a CL in numeral expressions can be optional in certain constructions. Scond, the word order of a numeral expression is consistent in this language: the CL follows the numeral and precedes the noun, and there is no other order variant for the three elements. This is different from Japanese and Korean. Third, the three elements are next to each other, and thus no other functional elements such as case markers intervene in the numeral expression. This is different from languages such as Japanese. These characteristics of Mandarin Chinese represent a simple pattern of numeral expressions. In this book, we try to give a thorough syntactic analysis of CL constructions of this simple pattern.

One hypothesis about the contrast between CL languages and other languages is that nouns like *bi* 'pen' in Chinese are mass nouns, therefore, like the word *oil* in English, such nouns also require CLs. Accordingly the function of individual CLs like *zhi* in (1a) is to individuate mass. Such a hypothesis is falsified in this book. While falsifying problematic hypotheses like this, we have developed a new understanding of the relation between mass nouns and other types of nouns. The traditional binary count-mass division is shown to be not fine-grained enough to reach an acceptable level of descriptive adequacy. Instead, we have identified two new properties (or called features, in a technical way) to capture the contrasts among four basic types of nominals, represented by the English words *pen, oil, belief*, and *furniture*. We argue that Chinese *bi* 'pen' correlates with the *furniture*-type only. There are also languages in which neither of the two types of CLs occurs in numeral expressions, in

[1] The word *head* in the English example (i), and the word *Stück* in the German example (ii) function as a CL. (i) means the same as *four cattles*. But such examples are not systematic in the languages.

(i) four head cattle (ii) vier Stück Vieh
four piece cattle
'four cattles'

contrast to both English and Chinese. For instance, it is perfect to say *txabïa apeta* 'three blood' in Yudja (an indigenous language spoken in Brazil; Lima 2010; 2011). This type of languages has been generally ignored in the literature, although their existence has been noted since early fourties (Whorf 1941). While introducing and discussing examples of these under-studied languages, we are informed that the shape of an elephant is not only look or feel like a pillar and a fan, but also a rope!

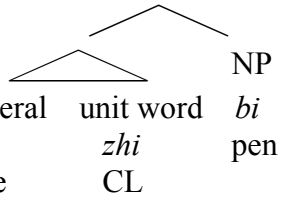
Another influential hypthesis regarding the contrast between CL languages and other languages is that the CL *zhi* in (1a) is required to correlate with the plural makre *s* in the English word *pens*. It has been declared that CL languages have no way to encode the contrast between singularity and plurality. This generalization is shown to be wrong. In this book, we report the fact that Mandarin Chinese does have a systematic way to encode the contrast. In (2a), the reduplicate CL *pian-pian* introduces an exclusive plural reading, and in (2b), the plain form of the CL *pian*, in the absence of any numeral, introduces an exclusive singular reading.

(2) a. He-li piao-zhe pian-pian shuye.
river-in float-PRG CL-RED leaf
'There are many leaves floating on the river.'
Not: 'There is a leaf floating on the river.'
b. He-li piao-zhe pian shuye.
river-in float-PRG CL leaf
'There is a leaf floating on the river.'
Not 'There are leaves floating on the river.'

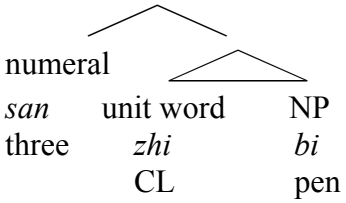
We show that all CLs can be reduplicated to encode unit-plurality. The semantic type of the encoded plural is abundant plural, which is attested widely, including in non-CL languages such as English. We also provide a series of arguments to falsify the traditional assumption that constructions like (2b) are derived by a numeral-deletion operation. Cross-linguisticlly, this book also investigates the interactions between plural markers and numerals, the structural relation between plural markers and CLs, and the correlation between semantic and morphological markedness of plural markings.

As we have seen, numeral expressions in CL languages are composed of three basic elements: a numeral, a CL, and an NP. It has long been unclear how these three elements are organized in the structure. Which two of them are combined first before the third element is integrated? Some propose the structure in (3a), and others propose the structure in (3b), for the numeral expression in (1a), for example.

(3) a.



b.



Not many arguments can be found to support either proposal, although this is a basic issue of the syntax of numeral expressions. In this book, all arguments that we can find are shown to be problematic. New arguments are looked for. Considering a large range of numeral expressions, and investigating the formal properties that are directly relevant to constituency, we reach a non-unified analysis: although CLs like those in (1) exhibit the right-branching structure, as in (3b), some other types of CLs exhibit the left-branching structure, as in (3a).

One more fresh set of facts explored in this book is a special type of compound, which has not been seriously discussed in any morphology book: the one that is composed of a noun and a CL, such as *hua-duo* 'flower' in (4).

(4) Yaoyao na-le san ge hua-duo.
Yaoyao take-PRF three CL flower-CL
'Yaoyao took three flowers.'

In (4), the CL *ge* is still necessary to occur between the numeral and the compound. The syntax and semantics of this kind of compound confirm that the existence of individual CLs with numerals in CL languages is syntactic, and that the position of such CLs is a functional head position, which may be taken by a place-holder, a semantically vacuous element.

Although we are not boasting that we have got the whole shape and structure of an elephant, I mean, numeral CL structures in human language, we are confident in the progress of our understanding of the empirical issues, and to some extend, the understanding of the natural laws beneath the facts.

The theoretical framework of this book is generative grammar. We discuss numeral CLs only, not other types of CLs such as possessive CLs and noun CLs (Aikenvald 2003). We also restrict our research to numeral CLs in nominal constructions, not including numeral CLs in verbal constructions.

In Chapter 2, the issue of countability is investigated. In Chapter 3, the number markers of Mandarin Chinese are probed. Then in Chapter 4, the constituency of numeral constructions in this language is studied. The constituency patterns reached are then spelled out into inriched syntactic structures in Chapter 5. In this chapter, relevant functional projections are also established with empirical considerations. Meanwhile, typological patterns of the properties of the functional categories are discussed. In Chapter 6, noun-CL compounds are analyzed, and thus one more new dimension of knowledge is added. Chapter 7 concludes the book.

Chapter 2 Classifiers and Countability

2.1. Introduction

Why does a numeral expression need a CL in CL languages such as Mandarin Chinese?[2] It has been widely assumed that the obligatory occurrence of a CL with a numeral and a noun in CL languages is related to the contrast between count and mass nominals. The goal of this chapter is to show that this traditional assumption is not fine-grained enough to cover the systematic contrasts of various types of nominals in either Mandarin Chinese or other languages. Instead, I argue that two syntagmatic properties of nominals are syntactically significant: the ability of a noun to combine with a numeral directly, and the ability of a noun to be modified by a delimitable (size, shape, or boundary) modifier. The two newly recognized properties or features can be attested in the co-occurrence restrictions of articles, quantifiers, adverbs, prepostions, and CLs, in pronominalization, and in certain context-triggered shifts. It is the combination of the different values of the two features, rather than the alleged binary contrast between count and mass, that explain various syntactic contrasts of countability, cross-linguistically. I argue that although the positive value of the first feature alone is enough to define the count status of a nominal, it is the combination of the negative values of both features that defines the mass status of a nominal. This chapter shows that the popular assertion that all nouns in Chinese are mass nouns is not accurate. Instead, all nouns in Chinese are non-count nouns, but they are further divided into mass and non-mass ones.

The chapter also falsifies the generally believed entailment relation between plurality and countability. Furthermore, it also identifies the distinctive function of CLs of CL languages that separates them from non-CL languages.

The two features argued for in this chapter, numerability and delimitability, also set the scene for the analysis of other syntactic issues to be discussed in this book. They are encoded in functional categories, to be shown in later chapters.

In addition to this introduction section and the last summary section, this chapter is composed of six substantial parts. Section 2.2 proposes my new theory of the count-mass contrast, based on the two features. Section 2.3 and Section 2.4 are investigations of the features in Chinese nouns and unit words, respectively. Section 2.5 presents how quantifiers in Chinese are sensitive to numerability. Section 2.6 compares this new analysis of the count-mass contrast with other approaches in the literature. Section 2.7 further argues that the count and non-count contrast is syntactic, and shows the problems of certain current syntactic analyses of CLs.

2.2. Decomposing countability

2.2.1 Identifying two new features syntagmatically

Since De Saussure (1916), two kinds of relationship between linguistic elements are recognized: paradigmatic and syntagmatic. A paradigmatic relationship is established by a substitution test. For instance, the three words *of, by* and *for* establish a paradigmatic relation in forming the string *government {of/by/for} the people***,** since each of them can substitute another. They may occur in the same syntactic position. A syntagmatic relationship, however, is defined by the compatibility of co-occurring elements in the same construction, e.g., the relationship between *the* and *people* in the string *the people*. Paradigmatic and syntagmatic relationships have been metaphorically viewed as vertical and horizontal ones, respectively.

Many formal features such as tense and aspect of verbal expressions, gender and person

[2] CLs in general are called *liang-ci* 'quantity-word' in Li (1924), *danwei-ci* 'unit-word' in Lü (1942: Ch. 11.72), *fu-mingci* 'auxiliary noun' in Gao (1948: Ch. 4), and measures in Chao (1968).

of nominal expressions are defined paradigmatically. Selection features are typically syntagmatic features. For instance, the transitive verb *drink* c-selects a nominal, because it needs to occur with a nominal; and it s-selects a liquid-denoting nominal, because it needs to combine with this type of nominal.

Different kinds of syntagmatic relations exhibit different properties. In selection, the occurrence of the selected element is obligatory. But there are other syntagmatic relations that do not exhibit this kind of obligatariness. For instance, gradability of adjectival expressions is defined by the possibility to occur with a degree word (e.g., Sapir 1944; Bolinger 1972). In (5a), the adjective *nice* is gradable since it may occur with the degree word *quite*. In contrast, the adjective *next* is not gradable, since it may not occur with any degree word, such as *quite*, as shown in (5b).[3]

(5) a. the quite nice book b. the (*quite) next book

Another example of non-obligatory co-occurrence relation is seen in the feature of agentivity. Agentivity of a verbal expression is defined by the possibility to be modified by an agent-oriented adverb. For instance, the VP *shouted* in (6a) is agentive since it may occur with the agent-oriented adverb *deliberately*, and the VP *arrived* in (6b) is not agentive, since it may not occur with *deliberately*.

(6) a. Kim shouted deliberately. b. Kim arrived (*deliberately).

In defining gradability and agentivity, a feature is identified simply in the way that it allows X. Allowing does not mean requiring. Therefore the presence of X is not obligatory.

With this background in mind, I now introduce two features which are also defined syntagmatically, in order to analyze the count-mass contrast of nominals.

Some nominals may combine with a cardinal numeral directly, and some may not. In (7a), for instance, the noun *apple* combines with the numeral *one* directly. In (8a), however, the noun *oil* may not do so.

(7) a. one apple b. five apples c. zero apples
d. 0.5 apples e. 1.0 apples f. five beliefs
(8) a. (*one) oil b. (*one) furniture

The contrast can also be seen in predication (the examples in (9) are adapted from Chierchia 2010: 104):

(9) a. The boys are at least thirty. b. *The gold is at least thirty.
c. The gold is at least thirty pounds.

The numeral *thirty* is the predicate of the nominal *the boys* in (9a), whereas it may not be a predicate of the nominal *the gold* in (9b). Comparing (9b) and (9c), we see that the numeral needs the support of the measure word *pounds* to function as the predicate of the string *the gold*. Following the assumption that the copula in a nominal predicate construction in English is a tense-bearer and the surface order of the subject-copula string is derived by the raising of the subject from its base-position, I assume that the combination of the subject with the numeral predicate in their base-position is possible in (9a), but not possible in (9b). The

[3] The word *very* may occur with non-gradable adjectives such as *next*. However, in addition to being a degree word, *very* also means actual or precise, used to emphasize the exact identity of a particular person or thing, according to *The New Oxford American Dictionary* (Second Edition 2005, Oxford University Press).

contrast is related to the type of the nominal *boy* and that of *gold*.

The contrast is also seen between Argument Structure Nominals and their correlated simple nominals. According to Grimshaw (1990) and Alexiadou (2011: 34), in both English and Greek, Argument Structure Nominals, such as *jumping of the cow* in (10a), may not occur with a numeral, whereas their correlated simple nominals may, as shown by *jump* in (10b) and (10c):

(10) a. *One jumping of the cow was interruptee by the fireworks.
b. One jump was disqualified.
c. two jumps

I use the feature numerability to represent the contrast between nominals that may combine with a numeral directly and nominals that may not do so. Accordingly, [+Numerable] means ALLOWING A NUMERAL, and [-Numerable] means DISALLOWING A NUMERAL. Therefore, the nominals in (7), (9a), and (10b/c) are [+Numerable] and those in (8), (9b/c), and (10a) are [-Numerable].

The numerals in the nominals in (7), which are all [+Numerable], are different. In this analysis, numerability cares about the ability to occur with a numeral only, and no special status is given to the contrast between singularity and plurality, or among integer, zero, and other numerals.

The feature of numerability is attested in the fact that certain elements intrinsically bring about a relevant effect. For instance, the occurrence of English suffixes such as *–er, -ee –ant/-ent,* and *–ist* makes a noun able to occur with a numeral. In (11a), the noun *advice* has [-Numerable], since it may not occur with the numeral *one*. In (11b), however, when the suffix *–er* occurs with the noun, the numeral may occur. The acceptability contrast in (11) indicates that it is the suffix that brings about the feature [+Numerable] to the nominal.

(11) a. *one advice b. one adviser

On the other hand, in Dutch, the presence of a collective affix such as *-werk* makes the noun unable to occur with any numeral (de Belder 2010; 2011a: 218) and thus the affix is a marker of [-Numerable] in my analysis. In (12a), the nominal *suiker* ‘sugar’ has [+Numerable], since it occurs with the numeral *drie* ‘three’. In both (12b) and (12c), *-werk* occurs. In the presence of the numeral *drie* ‘three’, (12b) is not acceptable. The acceptability contrast indicates that it is the suffix that brings about the feature [-Numerable] to the nominal (COL = COLLECTIVE).

(12) a. drie suiker-en
three sugar-PL
‘three sugars’

b. *drie suiker-werk-en
three sugar-COL-PL

c. suiker-werk [Dutch]
sugar-COL
‘confectionery’

In addition to numerability, we also identify the feature delimitability. Some words may be modified by a size-denoting expression (e.g., *big, small*), shape-denoting expression (e.g., *long, round, square, thin*), or boundary expression (e.g., *whole*), and some may not. In (13a), (13b), and (13c), the delimitive adjectives *big, large* and *square* modify the concrete nouns *apple, furniture*, and *watermelon*, respectively. In (13d), (13e), (13f), and (13g), however, the three adjective may not modify *oil*, *music*, *belief,* and *wine* (see Jespersen 1924: 198, Quine 1960: 104, McCawley 1979 [1975]: 170, Bunt 1985: 199). In (14a), the abstract noun *story*

may be modified by *whole*, but in (14b), the abstract noun *leisure* may not.[4]

(13) a. a big apple b. large furniture c. square watermelon
d. *large oil e. *large music f. *huge belief g. *square wine
(14) a. whole story b. *whole leisure

The contrast is also found in predication, as seen in (15) (from Chierchia 2010: 110):

(15) a. The violets are small. b. The furniture is small. c. *The snow is small.

In (15a), the delimitive adjective *small* is the predicate of *the violets*. Similarly, in (15b), the adjective is the predicate of *the furniture*. In (15c), however, the adjective may not be the predicate of *the snow*.

I use the feature delimitability to represent the contrast between nominals that may be modified by a delimitive modifier and nominals that may not be. Thus, [+Delimitable] means ALLOWING A DELIMITIVE MODIFIER, and [-Delimitable] means DISALLOWING A DELIMITIVE MODIFIER. The nominals in (13a), (13b), (13c), (15a), and (15b) are [+Delimitable] and other nominals in (13) and (15) are [-Delimitable].

When a nominal has [+Delimitable], we know that its denotation must have "a certain shape or precise limits" (Jespersen 1924: 198). The shape or limits are delimitable in certain dimensions (e.g., length, size, volume, shape, and time), and therefore, atomicity is exhibited. In contrast, a nominal with [-Delimitable] denotes either material, which in itself independent of shape or size, such as *silver, water, butter, gas, air*, or immaterial notions that have no intrinsic boundaries, such as *leisure, music, traffic, success, tact, commonsense* (cf. Jespersen 1924: 198). In my understanding, the former group of nouns can occur with a standard or container measure, as seen in (16a) and (17a), whereas the latter group cannot, as seen in the rest of the examples in (16) and (17).[5]

(16) a. a kilo of butter b. *a kilo of leisure c. *a kilo of beliefs
(17) a. a bowl of butter b. *a bowl of leisure c. *a bowl of beliefs

Note that immaterial nouns such as *belief* can be [+Numerable], as seen in (7f), although they are [-Delimitable], as seen in (13f).

Similar to numerability, delimitability is also attested in the fact that certain elements intrinsically bring about a relevant effect. For instance, *shui* 'water' alone may not be modified by *xiao* 'small', as seen in (18a); but if it is followed by a CL such as *di*, the whole compound *shui-di* can be modified by *xiao*, as seen in (18a'). Similarly, *ni* 'mud' alone may not be modified by *xiao*, as seen in (18b); but if it is followed by a CL such as *kuai*, the whole compound *ni-kuai* can be modified by *xiao*, as seen in (18b'). The examples in (18c) and (18c') show the same point (This issue is further discussed in 6.3.1).

(18) a. *xiao shui a'. xiao shui-di
small water small water-CL
'small drop(s) of water'

[4] Dixon (1982) calls shape and size modifiers dimension modifiers. Tang (2005: 456) mentions that "m-feature" refers to [+/-bound], but she does not discuss the feature. The term m-feature occurs only once in the whole paper.

[5] In idiomatic expressions, *ton* can occur with any noun. Thus *tons of leisure* is acceptable. But *ton* may not be replaced by other standard measures such as *pound* and *kilo* in such expressions. I thank Audrey Li for pushing me to clarify this.

b. *xiao ni
small mud

b'. xiao ni-kuai
small mud-CL
'small chunk(s) of mud'

c. *da yun
big cloud

c'. da yun-duo
big cloud-CL
'big piece(s) of cloud'

On the other hand, English words such as *woman, brother*, and *child* may be modified by a delimitive adjective such as *tall*, but if the suffix *–hood* or *–ship* occurs with a noun, no delimitive adjective may occur, as seen in (19). Therefore, the suffixes *–hood* and *–ship* are markers of [-Delimitable].

(19) a. tall {woman/brother/child}
b. *tall {womanhood/brotherhood/childhood}
c. tall {lady/friend/priest}
d. *tall {ladyship/friendship/priestship}

It is important to be pointed out that words such as *big*, *small*, *enormous, huge*, and their Chinese counterparts have an intensifier usage. As stated in Morzyski (2009: 176), "an adjective that normally expresses size characterizes the degree to which the gradable predicate holds", as shown in the examples in (20) (also see Constantinescu 2011: 35). In such a use of the adjectives, *big* can be replaced by *real*, *da* 'big' can be replaced by *zhenzhengde* 'real' or *qiang* 'strong', and *xiao* 'small' can be replaced by *shaowei* 'moderately' in certain contexts.

(20) a. big idiot
b. big smoker
c. big idea
d. da bendan
big fool
'big fool'
e. da hao xingshi
big good situation
'very good situation'
f. xiao xian shenshou
small show skill
'show the skill a little bit'
g. da huo
bg fire
'strong fire'
h. da feng
big wind
'strong wind'

The intensifying readings are not size readings, and thus the adjectives in such a use are not delimitive adjectives. Similar intensifying reading is also found in other adjectives such as *good*, as in (21) (Levinson 2010: 150; Kayne 2005: 195):[6]

(21) a. He braided her hair good and tight.
b. A good many linguists went to the conference.

2.2.2 Defining count and mass by the two features

Traditionally, the notion of count is in direct contrast to the notion of mass. Different from this binary analysis, I use the two values of the two features, numerability and delimitability, to make a more fine-grained classification.

The feature numerability alone may distinguish a count noun from a non-count noun. If

[6] A related issue to be clarified is that the retroflection suffix *–r* in Mandarin Chinese encodes endearment, as well as diminutiveness. In the former reading, no size meaning is expressed, as seen in (i).

(i) a. da-men-r
big-door-RETRO
'big door'
b. qi-shui-r
air-water-RETRO
'soda water'

In Cinque (2011: 6), the functional projection to host an endearment element is ranked lower than the one for a diminutive element. Also see Fortin (2011: 3) for an analysis to distinguish the two readings of diminutives.

a nominal may combine with a numeral directly in the context, it has [+Numerable] and thus is a count nominal in that context. Otherwise, it is a non-count one. According to Chierchia (1998: 353; 2010: 104), being able to combine with a numeral is the signature property of a count nominal.

But numerability alone is not enough to identify whether a noun is a mass noun. A non-count noun is not necessarily a mass noun. On the one hand, well-recognized mass nouns, such as the word *oil*, may be neither combined with a numeral directly (see (8a)), nor modified by a delimitive adjective (see (13d)). On the other hand, words such as *furniture* may be modified by a delimitive modifier (see (13b)), although they may not combine with a numeral directly (see (8b)). Such nouns are non-count and non-mass. I claim that although the feature [+Numerable] alone is enough to define the count status of a nominal, it is the combination of both [-Numerable] and [-Delimitable] that defines the mass status of a nominal.

Moreover, [+Delimitable] is not part of the defining property of a count element. Words such as *belief* may combine with a numeral, as seen in (7f), and thus are count nouns, but they may not be modified by a delimitive adjective, as seen in (13f). In order to distinguish different types of count nouns, I call the *apple*-type nouns count with a delimitable feature and the *belief*-type nouns count without a delimitable feature. The four possible combinations of the two values of the features are summarized in (22):

(22)

	[Numerable]	[Delimitable]	example	countability status
a.	+	+	*apple* in (7a), (13a)	count with a delimitable feature
b.	+	-	*belief* in (7f), (13f)	count without a delimitable feature
c.	-	+	*furniture* in (8b), (13b)	non-count, non-mass
d.	-	-	*oil* in (8a), (13d)	mass

Among the four possibilities: (22a) and (22b) are both count, (22d) is mass, and (22c) is non-count and non-mass. Although count is not mass and mass is not count, the independent status of (22c) is important. The existence of this group of nominals indicates that non-count nominals do not have to be mass ones. Also, from a different perspective, having the feature [+Delimitable] means that the noun is not a mass noun, but it does not mean that the noun must be a count noun (contra Wiltschko 2005, among others). *Duckling* and the German word *Eichhörnchen* 'squirrel' can occur as non-count nouns, in addition to count nouns (see de Belder 2011b: 181, fn. 12), although they can be modified by delimitive modifiers (e.g., *small duckling*). Moreover, the independent status of (22b) indicates that not all count nouns may be modified by a delimitive modifier.

In my approach, like the feature of gradability for APs and the feature agentivity for VPs, the features related to the count-mass contrast for NPs can also be defined syntagmatically.

I claim that the two features, numerability and delimitability, are universal in identifying count and mass nouns, assuming attributive numerals (Rijkhoff 2002: Ch. 5) and delimitive modifiers are available in all languages. Also, the two features are the only criteria to be considered in analyzing the count-mass contrast. The relationship between plural markers and the count-mass contrast will be discussed in 2.2.6 and 2.6.3.

2.2.3 Attesting the two features in co-occurrence restrictions

The linguistic reality of numerability and delimitability is independently attested in co-occurrence restrictions of articles, quantifiers, adverbs, prepositions, and CLs.

It is well-known that indefinite articles and some quantifiers occur with count nouns in English. For instance, *every*, *many, several,* and *another* occur with nouns that have [+Numerable], and *much* occurs with nouns that have [-Numerable].

(23) a. {every} apple b. {many/*much} apples
(24) a. *{every} oil b. {*many/much} oil c. {*many/much} furniture

In 2.5, we will see that certain quantifiers in Chinese have similar co-occurrence restrictions with respect to numerability, after we introduce the bearers of the feature in the language.

Prepositions can also select numerability. For instance, the Dutch preposition *per* 'by' takes count nouns only, whereas *vol* 'full of' takes non-count nouns only (de Swart et al. 2010: 6-7).

(25) a. per {bus/trein/bootje/*zand/*steenkool} [Dutch]
by bus/train/boat.DIM/sand/coal
b. vol {modder/zand/*auto/*koe}
full.of mud/sand/car/cow

The feature delimitability is also attested in the same way. In Japanese, the quantifiers *tasuu* 'many' and *shoosuu* 'a few' may occur with words such as *isha* 'doctor' or *hon* 'book', but not words like *inku* 'ink' or *gyunyu* 'milk'. This contrast is shown in (26a) and (26b). The word *isha* or *hon*, but not *inku* or *gyunyu,* can be modified by a delimitive adjective. Therefore, the quantifiers occur with [+Delimitable] nominals. However, the opposite pattern is seen in the quantifiers *taryoo* 'much' and *shooryoo* 'a little'. They may occur with words such as *inku* or *gyunyu*, but not words like *isha* or *hon*, as shown in (27a) and (27b), and therefore, they occur with [-Delimitable] nominals (Kobuchi-Philip 2011: 307; similar examples have also been provided to me by Yukari Kurita, p.c., Sept. 23, 2010).

(26) a. {tasuu/shoosuu}-no isha b. *{tasuu/shoosuu}-no inku
many/a few -GEN doctor many/a few -GEN ink
(27) a. *{taryoo/shoorryoo}-no isha b. {taryoo/shooryoo}-no inku
much/a little -GEN doctor much/a little -GEN ink

The Korean counterparts of the examples show the same contrast (Yi 2010, Sec. 4.4.1).

Adverbs such as *each* may not be in construal with nouns that have [-Delimitable], as shown by the contrast between (28a) and (28b). Mandarin Chinese adverb *zuge* 'each' is subject to the same constraint, as seen in the contrast in (29).

(28) a. The balls each fell down off the table. b. *The oil each fell down off the table.
(29) a. Qiqiu zuge xiaoshi-le.
ballon each disappear-PRF
'The ballons disappeared one by one.'
b. *Zhima-you zuge xiaoshi-le.
sesame-oil each disappear-PRF

In Chinese, some CLs are sensitive to the delimitable feature of the noun. For instance, no liquid-denoting noun may be modified by a delimitive adjective, as seen in (30a). Such a noun is [-Delimitable]. It can occur with the CL *di*, as seen in (30b). *Di* takes nouns with [-Delimitable] only.

(30) a. *chang {you/shui/xue/niao/yanlei/mo-shui}
long oil/water/blood/urine/tear/ink-water
b. san di {you/shui/xue/niao/yanlei/mo-shui/*putao}
three CL oil/water/blood/urine/tear/ink-water/grape
'three drops of {oil/water/blood/urine/tear/ink/*grape}'

In contrast, *putao* 'grape' can be modified by a delimitive adjective, as seen in (31a) below. Such a noun is [+Delimitable]. It may not occur with *di*, as seen in (30b) above. Other CLs that reject nominals with [+Delimitable] include *ji* (for liquid medicine), *pao* (for urine), *tan* (for any liquid). I call such CLs (part of Chao's 1968 partitive measures) individuating CLs, which select [-Delimitable].

(31) a. da putao
big grape
'big grape'
b. san ke {putao/*you/*zhi/*zheng-qi/*xue/*rou/*bu/*qian/*yanlei}
three CL grape/oil/paper/steam-air/blood/meat/cloth/money/tear

Words like *putao* can be selected by another kind of CLs, individual CLs (called individual measures in Chao 1968: 585). The CL *ke* in (31b) is such a CL. It selects nouns with [+Delimitable]. Other CLs such as *ben* (for books), *tou* (for animals such as cows), and *zhi* (for animals such as chickens) are also individual CLs. Moreover, collective CLs, such as *zu* 'group', *qun* 'crowd', *da* 'dozen', *shuang* 'pair', *dui* 'pair', and partitive CLs, such as *ye* 'page', *duan* 'paragraph', and *zhang* 'chapter' (they all belong to Chao's 1968 partitive measures), also occur with nouns with [+Delimitable] only.

2.2.4 Attesting the two features in pronominalization

The English proform *one* can only take a count noun as its antecedent (Schütze 2001; Barbiers 2005; Ojeda 2005: 404). The same constraint is also seen in the Afrikaans proform *een* 'one' (Corver & van Koppen 2011: 376). This constraint indicates that such pronominalization is sensitive to the feature numerability.

(32) a. Would you like a red bike or a white one?
b. *Would you like red wine or white one?

In Mandarin Chinese, the word *liaoliaowuji* 'few' can be used as a pronoun. Like other pronouns, it can function as an argument independently, taking another nominal as its antecedent. The antecedent of the pronoun *liaoliaowuji* must be a noun that is able to be modified by a delimitive adjective. In (33a), the antecedent of *liaoliaowuji* is *mao-bi* 'brush-pen', which can be modified by a delimitive adjective such as *chang* 'long'. In contrast, in (33b), the antecedent of *liaoliaowuji* is *mo-shui* 'ink-water', which, as shown in (30a) above, cannot be modified by a delimitive adjective. The pronominalization fails. The acceptability contrast in (34) exhibits the same pronominalization constraint.

(33) a. Wo yiqian mai-guo henduo mao-pi, xianzai shengxia liaoliaowuji.
I before buy-PRF many brush-pen now remain few
'I bought many brush-pens before, but few of them remain now.'

b. Wo yiqian mai-guo henduo mo-shui, *xianzai sheng-xia liaoliaowuji.
I before buy-PRF many ink-water now remain few
'I bought much ink before, *but few of them remain now.'

(34) a. Women guji daliang youke hui lai zheli, keshi zhi jin zhi
we estimate a.lot tourist will come here but up.to now only
lai-le liaoliaowuji.
come-PRF few
'We estimated that a lot of tourists would come here, but up to now only a few have came.'

b. Women guji daliang zheng-qi hui cong zhe ge kung mao-chulai,
we estimate a.lot steam-air will from this CL hole rise-out come
*keshi zhi mao-chulai-le liaoliaowuji.
but only rise-out-PRF few
Intended: 'We estimated that a lot of steam would come out of this hole, but only little came out.'

The contrast between (33a) and (33b) and the one between (34a) and (34b) indicate that pronominalization of *liaoliaowuji* is sensitive to the feature delimitability.

2.2.5 Attesting the two features in shifts

In this subsection, I argue that the two features are also attested in the input and output of three shifts: Universal Grinder, Universal Packager, and Universal Sorter.[7]

Universal Grinder

Imagine we have a big grinder. We can put things in and what we get is a massive object, which does not have a shape intrinsic to the property of the input. This is the so-called effect of Universal Grinder (Pelletier 1979 [1975]: 6). Compared with the word *apple* in (35a), the word *apple* in (35b) denotes a massive object.

(35) a. There is an apple on the table. b. There is apple in the salad.

Universal Grinder has been viewed as an effect of changing a "count" noun into a "mass" noun. I claim that it is an effect of blocking the projection of the feature [+Delimitable], in a specific context. In other words, the output of the shift must be [-Delimitable]. For instance, the word *apple* in (35b) may not be modified by the delimitive adjective *small*, as shown in (36) (Bunt 1985: 207).

(36) There is (*small) apple in the salad.

The effect of the Universal Grinder is also seen in Chinese:

(37) a. Wo yu bu chi-le.
I fish not eat-PRF
A: 'I will not eat the whole fish anymore.'
B: 'I will not eat the fish meat anymore.'

[7] I disregard the formal machanisms of the shifts here, since they are not relevant to the point I intend to make (see Wyngaerd 2009 for an analysis of semantic shifts). See 5.6.1 for syntactic representations of the outputs of the shifts.

b. Wo da de yu bu chi-le.
I big DE fish not eat-PRF
A: 'I will not eat the whole big fish anymore.'
*B: 'I will not eat the (big) fish meat anymore.'

The word *yu* 'fish' in (37a) is ambiguous. Reading A is attested when the speaker is with a plate of whole fish, and Reading B is attested when the speaker is with a plate of processed fish meat (e.g., fish slices or chunks). The meat reading is an effect of Universal Grinder. However, in (37b), the adjective *da* 'big' occurs, and then *yu* must have the whole fish reading. The meat reading disappears. Note that only delimitive modifiers can bring about the blocking effect. In (38), the modifier is not a delimitable one and thus the ambiguity remains (in this case, the Universal Grinder effect is observed even in a complex nominal. Cf. Acquaviva 2010: 9).

(38) Zuotian mai de yu wo bu chi-le.
yesterday buy DE fish I not eat-PRF
A: 'I will not eat the whole fish that {was/were} bought yesterday.'
B: 'I will not eat the fish meat that was bought yesterday.'

We can see that the presence of the delimitive adjective correlates with the atomicity reading. The fact that the output of the Universal Grinder may not allow a delimitive adjective means that the output of the shift is not only [-Numerable], but also [-Delimitable].

If the shift is understood as a simple change of the choice between a binary count-mass system, one cannot explain the acceptability contrast in (36) and the reading contrast in (37). The two features proposed in this book can give a more precise description of the output of the shift: it must be [-Delimitable], as well as [-Numerable].

Examples of the effect of the Universal Grinder in Chinese, such as (37), are easy to find (contra Cheng et al. 2008; and Cheng 2012; See de Belder 2011a: 91, or 2011b: 198, for a discussion of the markedness of data like *There is dog all over the wall*, and her pragmatic account). The experimental studies in Huang (2009) and Huang & Lee (2009) also show that Chinese has Universal Grinder effect. (39) gives us another pair of such examples (if we change *jidan* 'egg' in (39) into *pingguo* 'apple', we get a parallel effect).

(39) a. Panzi-li you jidan.
plate-in have egg
A: 'There are whole eggs in the plate.'
B: 'There is scrambled egg in the plate.'
b. Panzi-li you da jidan.
plate-in have big egg
A: 'There are big whole eggs in the plate.'
*B: 'There is big scrambled egg in the plate.'

Now let us turn to the input of the shift. The word *furniture* is [-Numerable] (see (8b)). After an earthquake, for example, when pieces of furniture pieces such as legs of chairs and tops of tables are all over a place, one can say (40), and thus the Universal Grinder effect is also available.

(40) There is furniture all over the place.

In Chinese, no noun may combine with a numeral directly and thus all nouns are

[-Numerable] (2.3.1), but the Universal Grinder effect is still available. Considering both the Chinese examples in (37a), (38), (39a), and the English example in (40), we can see that the input of the shift is not restricted to [+Numerable]. So the shift is not a shift from a count noun to something else, since the input can be a non-count noun.

The above discussion shows that the input of Universal Grinder is specified with [+Delimitable] only, but the output is the negative values of both features.

(41) Universal Grinder: [α Numerable, +Delimitable] → [-Numerable, -Delimitable]

The two features are thus attested in a more precise description of the shift.

Universal Packager

In a perspective different from the Universal Grinder, all kinds of the material type of massive objects can be put in containers or be apportioned in a certain way, and after doing so, the massive objects become discrete portions and thus can be counted. For instance, the word *water* and *beer* in (42a) each occur with a numeral and are thus [+Numerable], i.e., countable.

(42) a. Give me two waters and one beer.
b. I'll have another {beer/wine/whiskey}.
b. I had too many {beers/wines/whiskeys} already.

This is the so-called effect of Universal Packager (Bach 1986: 10; Jackendoff 1991; 1997: 53). It has been viewed as an effect of changing a "mass" noun into a "count" noun, since the massive objects become "the individuations based on the glasses or servings thereof" (Ojeda 2005: 405). This conventional unit or portion reading is commonly found (Corbett 2000: 37). In fact, it is a contextually induced numerability effect. The denoted entity must be quantized in a certain way in the context. The discourse context specifies the exact unit of counting. The feature [+Numerable] emerges in the context where the noun occurs with a numeral, as in (42a), or with a determiner or quantifier that occurs with a noun that exibits [+Numerable] e.g., *another*, *many* (see 2.2.3), as in (42b) and (42c) (cited from Ojeda 2005: 404).

The effect of Universal Packager is seen in nouns with [-Delimitable] only, but not [+Delimitable] words such as *furniture* and *cutlery*. For instance, (43) does not mean three packages of cutleries (Borer 2005: 103, fn. 14; Acquaviva 2010: 3).

(43) *three cutleries

If the shift is understood as a simple change of the choice between count and mass nouns, one cannot explain why certain "mass" nouns reject the shift consistently. The two features proposed in this book can give a more precise description of the input of the shift. The packager effect applies to [-Numerable, -Delimitable] nouns only, but not [-Numerable, +Delimitable] nouns.[8]

[8] Comparative constructions have a similar effect as Universal Packager (Bale & Barner 2009; 2012: Sec. 2.1 & 2.3.1). In (ia) the noun *water* is typically used as a mass noun, but in (ib) *waters* denotes portions of water. The decision of "who has more" is based on volume for the mass usage in (ia), but on number (e.g., number of portions) for the non-mass usage in (ib). In (iia), the decision of "who has more" is based on number (e.g, number of the furniture pieces), as in (ib). (iib) is not acceptable.

(i) a. Mary has more water than Jane does. b. Mary has more waters than Jane does.
(ii) a. Mary has more furniture than Jane does b. ??Mary has more furnitures than Jane does.

(44) Universal Packager: [-Delimitable, -Numerable] → [+Numerable]

No noun in Chinese can be preceded by a numeral directly, even for non-mass nouns (2.3.1). So no result of the shift is observed in the language, although the language has [-Delimitable, -Numerable] (i.e., mass) nouns. However, the shift seems to be attested in an indirect way in the language, and it is subject to the same input condition. In (45a) (Yu Hong, p.c., Dec. 3, 2010; Jane Tang, p.c., Jan. 17, 2011) and (45b) (Doetjes 1997: 33), the liquid-denoting nouns *guozhi* 'juice' and *pijiu* 'beer' are interpreted as packages of juice and beer. But importantly, first, the package interpretations emerge only when such a noun follows a unit word, such as the collective CL *da* 'dozen' in (45a) and the individual CL *ge* in (45b) (Persian examples similar to (45b) are seen in Ghomeshi 2003: 55 (25c) and Cowper & Hall 2012: (48b); see (135c,d) later). This is different from examples such as (42). Second, the package interpretation is not observed if the noun following a CL has [+Delimitable]. In (45c), *pingguo* 'apple', which can be modified by a delimitive adjective such as *xiao* 'small' and thus has [+Delimitable], does not have a packager reading. Thus we see the same constraint on the same type of nouns, (43) in English and (45c) in Chinese.

(45) a. yi da {guozhi/pijiu}
one dozen juice/beer
'a dozen packages of {juice/beer}'

b. Gei wo liang ge pijiu.
give I two CL beer
'Give me two units of beer.'

c. yi da pingguo
one dozen apple
'a dozen (*packages of) apples'

Universal Sorter

Counting kinds is to count abstract units. Examples like (46) (Chierchai 2010: 106) are discussed in Lyons (1977: 463), Allan (1977: 294), and Bunt (1985: 11). The word *wines* in (46) follows a numeral and thus behaves like a count noun. Allan calls nouns in such a use pseudo-uncountable nouns, and Bunt calls this phenomenon the effect of Universal Sorter.

(46) I like only three wines: chardonnay, pinot, and chianti.

Like in the case of the Universal Packager, the denoted entity in the output of Universal Sorter is also quantized. But the quantization is accomplished in an abstract sense. In both cases, a noun combines with a numeral, and it thus exhibits [+Numerable] feature. Therefore, like the words *water* and *beer* in (42), the word *wine* in (46) also behaves like a count noun.

As pointed out by Cowper & Hall (2012: Sec. 1.2), the Universal Sorter effect is not seen in words such as *furniture*. We have seen above that the Universal Packager effect is also absent in *furniture*-type of words. In my feature analysis, we can make a precise description that like the shift of Universal Packager, the shift of Universal Sorter applies to [-Numerable, -Delimitable] nouns only, but not [-Numerable, +Delimitable] nouns. So we get the same shift rule as the one for the Universal Packager:

(47) Universal Sorter: [-Delimitable, -Numerable] → [+Numerable]

Like Universal Packager, no direct effect of Universal Sorter is seen in Chinese.

The three shifts, Universal Grinder, Packager, and Sorter, have been found in various languages, and their existance is independent of morphological number marking (Wiese 2012: Sec. 4.3.2). In all of the three shifts, the two features, delimitability and numerability, are attested in either their input or output.

2.2.6 Numerability and number

I have decomposed countability into two features, [Numerable] and [Delimitable], and have argued that [+Numerable] alone can distinguish count nouns from non-count nouns. Numerability is different from the notion of number. The former is concerned with the possibility to combine with a numeral, but does not have to be sensitive to the contrast between singular and plural markers. However, the latter is concerned with the contrast between singular and plural in morphology, but does not have to be sensitive to the occurrence of a numeral. When we consider the two values of numerability and the two values of number, we see four possible patterns. All of them are attested.

First, a nominal can be both [+Numerable] and [+Plural], as seen in (48) (see Krifka 1998: Ch. 7, fn. 1; Borer 2009: Sec. 1.1 for such examples).

(48) a. 1.0 apples b. two apples c. zero apples

In (48a) and (48c), the denoted referent is not a plural object, but the plural marker is required. Moreover, words such as *scissors*, *trousers*, or *glasses* (in the sense of "binoculars") appear only in their plural form, even though they might refer to single objects (they are called defectives in Corbett 2000: 174).

Second, a nominal can be [+Numerable] but [-Plural], as seen in (49).

(49) one apple

In languages such as Yudja (Lima 2010; 2011), there are neither CLs nor plural markers, but all nouns can combine with a numeral directly. (50) is an example (Lima 2010: 7).

(50) txabïa apeta [Yudja]
three blood
'three units of blood'
(the unit is identified in the context: drops, puddles, or containers)

In Yudja, when a numeral and a noun are combined, the exact unit of counting depends on the discourse context (Lima 2010: 13). Lima reports the naturalness of data like (50) in the absence of either Universal Sorter or Universal Packager effects.

Third, a nominal can be [-Numerable] but [+Plural]. McClawley (1979 [1975]: 172) shows that the word *clothes* is plural, since it takes plural agreement in (51a), but it may not combine with a numeral, as seen in (51b). He also notes that words such as *guts* and *intestines* behave the same. We can add *outskirks, oats, grits,* and *masses* to this group. Jespersen (1961 [1909]) gives dozens of such words in English (also see Huddleston & Pullum 2002: 342; Acquaviva 2010: 2).

(51) a. My clothes {are/*is} in this locker. b. *I've just bought five clothes.

Similarly, although mass nouns such as *water* have been found in a plural form in a non-shift context, as in (52a) (Krifka 2008: Sec. 7.1), they may not occur with a numeral, as shown by (52b). This is different from the effects of Universal Packager and Universal Packager (2.2.5). When mass nouns are pluralized in such a case, there is no conventionalized counting unit in the context (see Mathieu 2012: Sec. 10.3.1). We will say more about this kind of plural in Chapter 3 (3.1.3).

(52) the waters of the Nile b. *the three waters of the Nile

In the above two cases, the values of numerality and plurality are different. The contrastive values of the two features are also seen in the fact that some nouns may occur with a numeral, and thus have [+Numerable], but they reject a plural marker when they do so. For some languages, this is a consistent pattern, a well-known fact stated in textbooks such as Booij (2007: 127). In the Hungarian examples in (53), the plural marker *–k* may not occur with the numeral (Csirmaz & Dekany 2010: (88)). The same constraint is also found in Bangla (Dayal 2011: 4), Turkish, Western Armenian, and some other languages (See Bale et al. 2011b; see our 3.2.5 for further discussion of the interaction).

(53)a. három takaró-(*k) b. három kutyá-(*k) [Hungarian]
three blanket-PL five dog-PL
'three blankets' 'five dogs'

Fourth, a nominal can be both [-Numerable] and [-Plural]. One example is *furniture*. Also, the nominals after the prepositions in (54) occur with neither a plural marker nor a numeral. The English examples are from Kiss (2010) and de Swart et al. (2010), and the Catalan and Spanish examples are from Espinal (2010: 985).

(54) a. at school b. in prison
c. Van anar a escola. [Catalan]
PAST go to school
'They went to school.' (It could be one, or more than one)
d. Estuvieron en prisión. [Spanish]
were in prison
'They spent time in prison.' (It may have been more than one prison)

Not only prepositions, but also transitive verbs can take such bare complements, in a language that has plural morphology, as seen in (55) (Espinal 2010: 985):

(55) a. Has portat samarreta. [Catalan]
have worn T-shirt
'You have worn a T-shirt.' (It could be one, or more than one)
b. Comprará cochel. [Spanish]
buy-FUT car
'(S)he will buy a car.' (It could be one, or more than one)

Examples like those in (54) and (55) have been labeled as number neutrality in languages that usually express number in morphology (Espinal 2010: 985).

Moreover, some nouns are found in singular, since they are preceded by the indefinite singular article *a*, but they never occur with a numeral, including *one*. The word *shortage* in (56a) and the nominal *good knowledge of Greek* in (56b) may not be preceded by the numeral *one*. In my analysis, the nominals here do not have [+Numerable] and thus they are not count ones.

(56) a. {a/*one} shortage of engineers
b. Jill has {a/*one} good knowledge of Greek.

All of the cross-linguistic facts discussed in this section indicate that numerability and

number are two different grammatical notions, although they may interact in a certain language-specific way. This is similar to the situation that modality and tense may interact closely, but they are recognized as two different notions. The possible interactions also do not mean that one is a sub-type of the other. Unfortunately, it is still widely believed that plurality is an issue of the count-mass contrast, assuming only count nouns may be plural.

Syntactic features are distributed in different types of elements cross-linguistically and within the same language. In the following three sections, we discuss the two features with respect to different types of elements in Chinese, a CL language, compared with non-CL languages, such as English.

2.3. The two features in nouns

2.3.1 Numerability of nouns

Occasionally, we see people claim that numeral CL languages do have count nouns, or people feel reluctant to admit that there is no count noun in such languages. However, we still need to consider "[i]f we assume that classifier languages have count nouns (similar to English *silverware*, cf. constructions like *three pieces of silverware*), then it is unclear what necessitates the use of classifiers." (Krifka 2008: 5)

If we put unit words such as *dui* 'pile' aside, it is undeniable that no noun in Chinese may combine with a numeral directly, regardless of whether the nominal is an argument or predicate, and whether it is concret or abstract (cf. Muromatsu 2003: 79, 85), as shown in (57). Therefore, all nouns in the language have the feature [-Numerable]. This means that no noun in the language is a count noun.

(57) a. Nali you san *(ge) xianglian
there have three CL necklace
'There are three necklaces.'

b. Nali you san *(di) you
there have three CL oil
'There are three drops of oil.'

c. Baoyu gen Daiyu shi liang *(ge) gudian xiaoshuo-zhong de renwu.
Baoyu and Daiyu be two CL classic novel-in DE character
'Baoyu and Daiyu are two characters in a classic novel,'

d. Shijie-shang you liang *(zhong) heping: zhuanzhi-xia de gen
world-on have two CL peace dictator-under DE and
mingzhu-zhidu-xia de.
democratic-system-under DE
'There are two kinds of peace: the one under a dictatorship and the one under a democratic system.'

The occurrence of a unit word such as a CL is obligatory between a numeral and a noun in Chinese. It has been noted that a CL can be optional after the numeral *yi* 'one' in colloquial Beijing dialect of Mandarin Chinese, in examples such as (58a), (58b) (H. Huang 1981), and (58c) (Lü et al. 1999 [1980]: 599).

(58) a. chi yi mantou
eat one steamed.bread
'eat one steamed-bread'

b. bei yi shu-bao shangxue qu
carry one book-bag go-school go
'carry one school bag and go to school'

c. zhe yi {qingkuang/shigu/banfa}
this one situation/accident/method
'this situation/accident/method'

However, Du (1993) and Jing (1995) find that the omission of a CL in such data must satisfy two conditions. First, the noun must be a "count noun". More precisely speaking, the

noun must be the one that may occur with the CL *ge*. This can be seen in (59a). Some other nouns may not occur with *ge*, as seen in (59b). (60) shows that those nouns in (59b) may not follow *yi* directly (see 2.4.1 for more discussion of *ge*).

(59) a. yi ge {mantou/shu-bao/qingkuang/shigu/banfa}
one CL steamed.bread/book-bag/situation/accident/method
b. *yi ge {you/zhi/zheng-qi/xie/rou/bu/qian/yanlei}
one CL oil/paper/steam-air/blood/meat/cloth/money/tear
(60) *yi {you/zhi/zheng-qi/xie/rou/bu/qian/yanlei}
one oil/paper/steam-air/blood/meat/cloth/money/tear

Second, the tone of the numeral *yi* 'one' consistently undergoes the tone sandhi as though it is followed by a fourth tone syllable (Jin 1979), i.e., the tone is changed from the first tone to the second tone. Importantly, the CL *ge* has the fourth tone. In all of the examples like (58a, b, c), the CL *ge* may show up. The syllable *man* in (58a), which follows *yi*, has the second tone, and the syllable *shu* in (58b), which also follows *yi*, has the first tone. Neither is able to trigger the tone sandhi of *yi*. Jing (1995: 14) thus correctly points out that in data like (58), an implicit version of the CL *ge* actually occurs between *yi* and the noun, and that is why *yi* undergoes the tone sandhi. The tone sandhi fact clearly shows that the CL *ge* occurs in the syntax and even the phonological structure of the apparent CL-less examples like those in (58). Thus, there is always a unit word between a numeral and a noun in Mandarin Chinese. Since it is the unit word that is next to a numeral, it is the unit word, rather than the associated noun, that exhibits [+Numerable].

In contrast to Chinese, "there are a considerable number of Amerind languages as well as some elsewhere, for example, in New Guinea which do not have measure constructions. Numerals occur directly both with nouns designating mass as well as countable objects." (Greenberg 1972:16) In Hopi (Whorf 1956 [1941]: 141; Greenberg 1972: 16), Karitiana (Müller et al. 2006), Halkomelem Salish (Wilhelm 2008: 64), and Yudja (Lima 2011), all nouns can combine with a numeral unconditionally. The Yudja example in (50) is repeated here as (61). We can see that all nouns in such languages may have the feature [+Numerable].

(61) txabïa apeta [Yudja]
three blood
'three units of blood'
(the unit is identified in the context: drops, puddles, or containers)

Between the above two extreme patterns of Modern Mandarin Chinese and Yudja, in languages such as English and Dëne, some nouns may combine with numerals directly and some may not. We have seen the contrast between *apple* in (7) and *oil* in *furniture* in (8). The following are Dëne examples from Wilhelm (*ibid.*). Karitiana behaves the same as Dëne in this aspect (Müller et al. 2006).

(62)a. solághe dzól b. *solághe bër [Dëne]
five ball five meat
'five balls'

The variation among different types of languages, represented by Modern Mandarin Chinese, Yudja, and Dëne, clearly shows that numerability is a notion of grammar (see 5.6 for my syntactic analysis of the variation).

In some languages, there is an optionality with respect to the occurrence of a CL

between a numeral and a non-mass NP. In Jingpo (Dai 1991) and Indonesian (Sato 2009: 15; Dalrymple & Mofu, to appear), a CL is optional in such a position, as seen in (63).

(63) a. tiga orang siswa
three CL student
Both: 'three students'

b. tiga siswa
three student
[Indonesian]

The optionality is also seen in certain semantic types of nominals in other CL languages (see Tang 2004 for a discussion). Tang calls languages that require a CL or measure word to occur with a numeral "rich" CL languages, whereas CL languages that do not have this requirement "poor" CL languages.

As in Yudja, in Indonesian, a CL language, a numeral may also be directly follwed by a liquid or material-denoting noun, as seen in (64) (Dalrymple & Mofu, to appear: sec. 4.3).

(64) a. duo air laut
two water sea
'two (areas of) sea water'

b. sepuluh kayu
ten wood
'ten (pieces of) wood'
[Indonesian]

In fact, the apparent cross-linguistic variation is also found within the same language. In Mandarin Chinese, in a normal phrasal nominal, a unit word is obligatory between a numeral and a noun; but in idiomatic expressions or compounds, the language patterns with Yudja: no unit word appears in this position. In the examples in (65a, b), a kind CL is implied, and in (65c, d, e, f), an individual CL is implied. Note that there is no fourth-tone-triggered tone sandhi of *yi* in (65d), so such examples are different from those in (58).

(65) a. wu-xiang-fen
five-spice-powder
'five-spice-power'

b. wu-du-ju-quan
five-poison-all-complete
'all five kinds of sins'

c. san-jiao-guanxi
three-angle-relation
'triangle relation'

d. yi xin bu neng er yong
one heart not able two use
'don't be absent-minded'

e. San ren xing bi you wo shi.
three person walk must have my teacher
'One can always find a teacher around.'

f. san fang liang ting
three room two sitting.room
'3 bedrooms & 2 sitting room'

The frequent occurrence of such expressions does not mean they are productive. One cannot replace a component of such an expression with another element of the same type freely. For instance, compared with (65a), neither of the two examples in (66) is acceptable. So we need to distinguish the productivity of types of construals from frequency rate of tokens (similar idiomatic expressions or compounds in which no CL occurs with a numeral and a noun are also found in other CL languages such as Thai; see Hundius & Kölver 1983: 209, fn. 5).

(66) a. *liu-xiang-fen
six-spice-powder

b. *wu-chou-fen
five-stink-powder
(cf. (65a))

Moreover, if a numeral denotes a very high round number, a CL is optional for a non-mass noun, as seen in (67a) and (67b) (cited from Xing 1997: 191). Aikhenvald (2003: 100) reports that several languages have the same pattern. She observes that for numeral CLs, "[I]n many languages, they are obligatory with smaller numbers, and optional with larger

ones."

(67) a. Liu-yi (ge) funü cheng ban-bian tian.
six-billion CL woman support half-part heaven
'Six billion women can take half of the responsibilities of the world.'
b. Wu-qian-wan (ge) jiaoshou touzi gupiao.
five-thousand-ten.thousand CL professor invest stock
'Fifty million professors invest in stocks.'
c. Liu-yi ling san *(ge) funü
six-billion plus three CL woman
'six billion and three women'

It is possible that when no CL shows up between a complex numeral and a noun in data like (67), the last morpheme of the numeral, i.e., *yi* 'billion' in (67a) or *wan* 'ten.thousand' in (67b), functions as a collective CL, like *shuang* 'pair' or *da* 'dozen'. In (67c), the morpheme left-adjacent to the CL is *san* 'three', which may not function as a collective CL, and therefore, the CL *ge* is obligatory.

The complexity does not affect the establishment of the two values of numerability. We will give our syntactic representations of the variations in 5.6.

2.3.2 Delimitability of nouns

Although all nouns in Chinese are non-count nouns, they are not the same, with respect to delimitability. In 2.2.3, we see that nouns with [+Delimitable] are selected by individual CLs, and nouns with [-Delimitable] are selected by individuating CLs. As shown in (68), nouns like *he* 'river' can be modified by a delimitive adjective such as *changchang* 'long'. In contrast, material nouns such as *you* 'oil' in (69a) (putting aside the intensifying reading of such adjectives; see the discussion of (20); also ignoring the occurrence of *de*).

(68) a. changchang de he
long DE river
'long river'
b. da (de) qi-qiu
big DE air-ball
'big balloon'
c. fang (de) xigua
square DE watermelon
'square watermelon'

(69) a. *changchang (de) you
long DE oil
b. *da (de) zheng-qi
big DE steam-air
c. *fang (de) mianfen
square DE flour

The contrast is shown not only in modification, but also in predication. The string *hen chang* 'very long' may not be the predicate of the mass noun *you* 'oil' in (70a), but it can be the predicate of the non-mass noun *he* 'river' in (71a). The string *hen da* 'very big' may not be the predicate of the mass noun *zheng-qi* 'steam-air' in (70b), but it can be the predicate of the non-mass noun *qi-qiu* 'ballon' in (71b).[9]

[9] Audrey Li mentions to me an asymmetry in the word *tiankong* 'sky'. It may not be directly modified by *da* 'big', but can take *hen da* 'very big' as its predicate.

(i) a. *da tiankong
big sky
b. Tiankong hen da.
sky very big
'The sky is very big.'

The acceptability of (ib) can be accounted for by the traditional understanding that the sky has a certain shape (as in the expression *tian fang di yuan* 'the sky is square and the earth is round', and *tiankong da-bu-da* 'Is the sky big?'). The unacceptability of (ia) shows the idiosyncratic property of certain nouns that reject modifiers that denote the (assumed) intrinsic properties of their denotation (e.g., **tian fengmi* 'sweet honey'; see Paul 2010). Note that such rejection is not a general property of nouns (e.g., *ku kafei*, 'bitter coffee', *re huoguo* 'hot hotpot', *xiao mayi* 'small ant').

(70) a. *You hen chang.
oil very long
b. *Zheng-qi hen da.
steam-air very big

(71) a. He hen chang.
river very long
'The river is very long.'
b. Qi-qiu hen da.
air-ball very big
'The balloon is very big.'

Abstract or immaterial nouns are never modified by physical shape or size modifiers. However, some abstract nouns may, and some may not, be modified by boundary modifiers such as *wanzheng* 'complete', which are also delimitive modifiers. Nouns such as *xiaohua* 'joke' can be modified by *wanzheng,* as in (14a), whereas nouns such as *chouhen* 'hatred' reject the modifier, as seen in (14b).

(72) a. wanzheng de {xiaohua/jianyi/gushi/jihua}
complete DE joke/suggestion/story/plan
'a complete {joke/suggestion/story/plan}'
b. *wanzheng de {chouhen/kongju/heping/youxian/pinqiong/pingjing}
complete DE hatred/fear/peace/leisure/poverty/stillness

This contrast shows that the feature delimitability can divide Chinese nouns, which are all non-count ones, into the mass-type, which has [-Delimitable], and the non-mass-type, which has [+Delimitable].

Greenberg (1972: 26) claims that nouns in CL languages have the characteristics of a mass noun. The idea is also seen in Hansen (1972), Graham (1989), Krifka (1995), Doetjes (1996, 1997), Chierchia (1998), among many others. According to our new analysis of the count-mass contrast, however, not all nouns in Chinese are mass nouns.

2.4. The two features in unit words

2.4.1 Classification of unit words

Following Li (1924 [1992: 81]), we assume that in a numeral expression, a CL expresses the unit for counting. The CLs in (1), repeated here as (73), can be compared with other types of unit words. According to Croft (1994: 151-152), standard measures such as *liter* in (74a), container measures such as *bottle* in (74b), kind CLs such as *kind* in (74c), partitive CLs such as *section* in (74d), and collective CLs such as *group* in (74e) are universally available.

(73) a. Yaoyao kanjian-le san zhi bi. [Individual CL]
Yaoyao see-PRF three CL pen
'Yaoyao saw three pens.
b. Yaoyao kanjian-le san di you. [Individuating CL]
Yaoyao see-PRF three CL oil
'Yaoyao saw three drops of oil'.

(74) a. Kim bought three liters of milk. [Standard measure]
b. Kim bought three bottles of milk. [Container measure]
c. three kinds of chocolate [Kind CL]
d. three sections of orange [Partitive CL]
e. three groups of students [Collective CL]

Greenberg (1972: 10) points out that "all the classifiers are from the referential point of view merely so many ways of saying ... 'times one'." This is also true of all measure words. All types of CLs and measure words are used in counting, telling us what counts as one in the context, i.e., the unit of counting (see Croft 1994: 152 and Allan 1977: 293). Both CLs and

measure words have the so-called additive measure function, or have a monotonic interpretation (Schwarzschild 2006), which means that if we add m units of x and n units of x together, we get the sum (superset) of the two quantities; and if we divide m units, we get the subpart of the m units.

I thus treat all types of CLs and measure words as unit words. In Haas (1942), all unit words in Thai are given the label of "classifier", while in Chao (1968), all unit words in Mandarin Chinese are given the label of "measure".

Semantically, counting with either a CL or a measure word is a process of cardinal number assignment (Wiese 2003: 18). But the two kinds of cardinal number assigments are different. For instance, cardinal number assignments with CLs are about cardinality, excluding properties like weight or volume. This is different form cardinal number assigment with measure words (see Wiese 2003: 21). This difference correlates with the fact that immaterial abstract notions such as *suggestion* and *joke* are never counted by measure words. Another difference is that cardinal number assignments with CLs are based on absolute scales. These scales generally do not allow transformation. Accordingly, there is only one number that applies to a given set. In contrast, 2 kilos of beef means the same as 2000 grams of beef. This kind of transformation between two different units and thus two different numbers are not seen in the cardinal number assigments with CLs.[10]

In this section, we will see the differences among different types of unit words with respect to the feature of [Delimitable] of the noun.

In counting, there is no restriction to numerals. In my study of unit words, I do not consider words that may not be preceded by any numeral other than *yi* 'one', such as *shen* 'body' in (75a) and *lian* 'face' in (75b) (Chao 1968: 603, Li & Thompson 1981: 111). In such constructions, the word *yi* is probably not a numeral, since it can be replaced by the adjective *man* 'full' (Y. M. Li 2000: 54), whereas real numerals cannot. The element following such a use of *yi* is analyzed as a noun instead of a CL in B. Li (2009). Therefore, such examples are not numeral expressions and thus are beyond the scope of the discussion here.

(75) a. {yi/*san} shen nitu
one/three body mud
'a body covered all over in mud'

b. {yi/*san} lian you
one/three face oil
'a face covered all over in oil'

2.4.1.1 Unit words that occur with [-Delimitable]

Unit words that exclusively select [-Delimitable] nouns are individuating CLs (2.2.3), as shown in (76).

(76) a. shi dui tu
ten CL earth
'ten heaps of earth'

b. wu gu zheng-qi
five CL steam-air
'five puffs of steam'

d. wu di you
five CL oil
'five drops of oil'

e. wu tan you
five CL oil
'five puddles of oil'

f. wu pao niao
five CL urine
'five units of urine'

g. liu ji yao-shui
six CL medicine-liquid
'six units of liquid medicine'

h. liang gu sichao
two CL thought
'two schools of thought'

[10] The only two exceptions are dual collective CLs such as *shuang* 'pair', *dui* 'pair', and the loan CL *da* 'dozen'. *San shuang kuaizi* 'three pair chopsticks' gives the same counting result as *liu gen kuizi* 'six CL chopsticks' and *san da jidan* '3 dozen egg' gives the same counting result as *36 ge jiadan* '36 CL egg'. But unlike standard measure, such transformations are not systematic between collective and individual CLs.

Recall that all nouns in Mandarin Chinese are [-Numerable]. Therefore, such CLs occur with [-Delimitable, -Numerable] nouns, which are mass nouns. Such CLs are called "Partitive Measures" in Chao (1968), and "Classifiers for massive objects" in Gerner & Bisang (2010: 606) (also see, e.g., Croft 1994: 162). Semantically, individuating CLs are associated with the idea that "the noun refers to some kind of mass and the classifier gives a unit of this mass" (Denny 1986: 298, cited in Aikhenvald 2003: 318).

Individuating CLs divide massive objects into units, but not necessarily the minimal units (contra Wilhelm *ibid.*: 49). Both *di* in (77a) and *tan* in (77b) are individuating CLs. The unit encoded by the latter is bigger than that by the former. Moreover, a chunk of mud or meat can be big or small, and such chunks are not the minimal units of mud or meat.

(77) a. san di shui
three CL water
'three drops of water'

b. san tan shui
three CL water
'three puddles of water'

2.4.1.2 Unit words that occur with [+Delimitable]

A noun with [+Delimitable] refers to an entity that has its natural unit. Unit words that occur with [+Delimitable] nouns are divided into three types.

A. What counts as one is bigger than the natural unit of the element denoted by a non-mass noun. In this case, a collective CL occurs, as in (78). A collective CL expresses a unit for counting sets of elements that are encoded by a noun with the feature of [+Delimitable]. In (78a), *dui* expresses a unit that covers a group of entities that are called *luobo* 'carrot', and the noun *luobo* can be modified by a delimitive adjective such as *da* 'big'. In (78b), *zu* also expresses a unit that covers a group of concepts encoded by *xiaohua* 'joke', and the this noun can be modified by a delimitive adjective such as *wanzheng* 'complete'.

(78) a. shi dui luobo
ten CL carrot
'ten piles of carrots'

b. san zu xiaohua [Collective CL]
three CL joke
'three groups of jokes'

Collective CLs (called Group Measures in Chao 1968: 595, and Aggregate Measure in Li & Thompson 1981: 107) include the so-called multiplying or number set type, such as *shuang* 'pair', *dui* 'pair', and *da* 'dozen' (cf. Bender & Beller 2006: 397), and the so-called blurring type, which includes *qun* 'crowd', *zu* 'set, group', and arrangement CLs, such as *pai* 'row' and *luo* 'stack'.

B. What counts as one is smaller than the natural unit of the element denoted by the non-mass noun. In this case, a partitive CL occurs, as in (79). In (79), *pian* expresses a unit that represents a part of an entity encoded by *luobo*, which is [+Delimitable], as shown above.[11]

[11] Partitive CL is one of the various types of unit words for pseudo-partitive constructions. Such constructions denote the quantity of entities (e.g., *three kilos of tea*), whereas partitive constructions (e.g., Fodor & Sag 1982, Jackendoff 1977) denote a part-whole relation within a definite domain (e.g., *three kilos of the tea*). The numeral expressions discussed here, including those contain a partitive CL, are all pseudo-partitive constructions. The fractional unit word *cheng* 'one tenth' in Chinese is used in partitive constructions only. I do not discuss this unit word in this book.

(i) Ba cheng xuesheng yijing kao-le Tuofu.
eight 1/10 student already test-PRF TOEFL
'80% of the students have taken the TOEFL test.'

Liao and Wang (2011: 150) claim that in a partitive construction, an individual CL or a measure word precedes a kind CL, as in (ia). Their discussion does not cover partitive CLs. In data like (ib), a partitive CL precedes an individual CL.

(79) shi pian luobo [Partitive CL]
ten CL carrot
'ten slices of carrot'

C. What counts as one matches the natural unit of the element denoted by the non-mass noun. In this case, an individual CL is used, as in (80a) and (80b). In other words, an individual CL expresses the natural unit of an element that is encoded by a noun with the feature of [+Delimitable].

(80) a. shi gen luobo
ten CL carrot
'ten carrots'

b. shi ze xiaohua [Individual CL]
ten CL joke
'ten jokes'

Individual CLs can be recognized as elements encoding intrinsic units of atomic elements, whereas other types of unit words encode provided units of various kinds of elements (cf. Hundius & Kölver 1983: 169). The three types of CLs can be distinguised each other from the following two tests.

The semantic differences between collective and the other two types of CLs can be seen in (81), where the nominal following the CL is the coordinate nominal *fanqie gen pinguo* 'tomato and apple'. Only the collective CL *dui* allows the cardinal number to be assigned to the combination of the two kinds of entities, labelled as reading B. This is seen in the acceptability contrast between (81a) and the other two examples, (81b) and (81c).

(81) a. liang dui fanqie gen pinguo [Collective CL]
two CL tomato and apple
A: 'two piles: one pile of tomatos and one pile of apples'
B: 'two piles: each pile has both tomatos and apples'

b. liang kuai fanqie gen pingguo [Partitive CL]
two CL tomato and apple
A: 'two chunks: one chunk of tomato and one chunk of apple'
B: *'two chunks: each chunk has both tomatos and apples'

c. liang ge fanqie gen pingguo [Individual CL]
two CL tomato and apple
A: 'two individuals: one tomato and one apple'
B: *'two individuals: each individual has both a tomato and an apple'

We can assume that in Reading B of (81), what is counted is the combination of tomoatos and apples, whereas in Reading A, there is no such a combination in counting. In other words, the unit for Reading B is a complex unit. This reading is available for collective CLs, but absent for partitive and individual CLs.

The semantic differences between individual CLs and the other two types of CLs can be seen in (82), where each CL is modified by the adjective *da* 'big'. Only the individal CL construction in (82c) expresses the meaing that *xigua* 'watermelon' is big. This reading is labelled as reading A. The other two constructions in (82a) and (82b) do not express such an assertaion. The meaning of *da* is applied to the counting unit only in these two constructions, as seen in Reading B.

(ii) a. san zhi zhe liang zhong gou
three CL this two kind dog
'three of these two kinds of dog'

b. san pian zhe liang ge xigua
three CL this two CL watermelon
'three slices of these two watermelons'

(82) a. liang da dui xigua [Collective CL]
two big CL watermelon
A: *‘two piles of big watermelons’
B: ‘two big piles of watermelons’

b. liang da pian xigua [Partitive CL]
two big CL watermelon
A: *‘two slices of big watermelons’
B: ‘two big slices of watermelons’

c. liang da ke xigua [Individual CL]
two big CL watermelon
A: ‘two big watermelons’
B: *‘two big units of watermelons’

In (82), the meaning of the adjective *da* ‘big’ seems to be lowered to the noun *xigua* ‘watermelon’ in Reading A, but not in Reading B. The reading contrasts tell us that this lowering is possible for individual CLs, but not for collective and partitive CLs.

We summarize the contrasts in (83):

(83)

	complex unit	Adjective-lowering
Collective CL	✓	*
Partitive CL	*	*
Individual CL	*	✓

Generally speaking, the same form of a unit word can belong to different types, depending on the type of the associated noun, and the semantic function of the unit. In (76a), the CL *dui* occurs with the mass noun *tu* ‘earth’, and it is thus an individuating CL. However, in (78), *dui* occurs with the non-mass noun *luobo* ‘carrot’, and it is thus a collective CL. Similarly, when the CL *pian* occurs with different kinds of non-mass nouns, it may have different status. When it occurs with *luobo* ‘carrot’ in (79), it denotes a part of a carrot and thus it is a partitive CL. When it occurs with *qiche* ‘car’, as in (84a) below, it is a collective CL. When it occurs with *shuye* ‘leaf’, as in (84b), it represents the natural unit of a leaf, and therefore it is an individual CL. Moreover, if the CL *pian* occurs with the mass noun *moutou* ‘wood’, as in (84c), it apportions the mass of wood, therefore it is an individuating CL. The two examples of the CL *duo* in (85) also show the ambiguity of the CL.

(84) a. Shan-jiao-xia ting-zhe yi pian qiche. [Collective CL]
mountain-foot-below park-PRG one CL car
‘At the foot of the mountain was an area of cars’

b. san pian shuye [Individual CL]
three CL leaf
‘three leaves’

c. san pian mutou [Individuating CL]
three CL wood
‘three pieces of wood’

(85)a. san duo hua [Individual CL]
three CL flower
‘three flowers’

b. san duo yun [Individuating CL]
three CL cloud
‘three pieces of cloud’

In English, unit words may also be ambiguous. The unit word *piece* is an individuating CL in (86a), but a partitive CL in (86b) (see Lehrer 1986: 115). Moreover, the unit word *heap* is an individuating CL in (87a), but a collective CL in (87b).

(86) a. two pieces of paper b. two pieces of celery
(87) a. three heaps of sand b. three heaps of books

2.4.1.3 Unit words that have no occurrence restriction with the value of [Delimitable]

Kind CLs have no occurrence restrictions with respect to the value of [Delimitable] of the noun. They occur with all types of nouns. Standard and container measures occur with either [+Delimitable] nouns or material type of [-Delimitable] nouns, but reject nouns denoting immaterial notions (see (16) and (17)).[12] So in general, these three types of unit words are not sensitive to the contrast between [+Delimitable] and [-Delimitable]. In the following data, the nouns in the a-examples are [+Delimitable] and those in the b-examples are [-Delimitable].

(88) a.	shi zhong luobo Ten kind carrot 'ten types of carrot'	b.	shi zhong mianfen ten kind flour 'ten types of flour'	[Kind CL]
(89) a.	shi gongjin luobo ten kilo carrot 'ten kilos of carrots'	b.	shi gongjin mianfen ten kilo flour 'ten kilos of flour'	[Standard measure]
(90) a.	shi xiang luobo ten box carrot 'ten boxes of carrots'	b.	shi xiang mianfen ten box flour 'ten boxes of flour'	[Container measure]

When standard and container measures occur with nouns of [+Delimitable], they do not have to represent the natural units of the elements encoded by the nouns. For instance, *shi gongjin luobo* 'ten kilos of carrots' can be more or less than ten carrots, and it can also be the weight of ten carrots coincidentally. If each carrot is exactly one kilo, ten kilos of carrots have ten carrots. In this special case, the standard measure *gongjin* happens to denote the natural unit of carrots. Moreover, if each kilo of carrots has multiple carrots in the discourse context, the standard measure unit happens to get the same interpretation as a collective CL; and if each kilo has less than one carrot in the context, the standard unit happens to get the same interpretation as a partitive CL. The same is true of container measures. For instance, *san xiang dian-shan* 'three box electric-fan' may mean either three boxes of fans and each box contains several fans, or three boxes and each contains one fan. In the latter reading, the container measure *xiang* happens to denote the natural unit of fans. So the functions of a container measure may also overlap with those of other unit words. Since measure words are not, but other unit words are, specified with the value of [Delimitable], it is not surprising that the former may have function-overlap with the latter.

[12] Standard measures should also include units for measuring time (e.g., *yue* 'month'), money (e.g., *yuan*), and electricity (e.g., *wa* 'watt), etc. (see Cheng 1973: 286).

The words *nian* 'year', *yue* 'month', *ri* 'day', and *xiaoshi* 'hour' may be ambiguous between unit words and regular nouns (T'sou 1976: 1239; J. Tang 2005: 457). When such words are preceded by a CL, as in (i), they are nouns; but when they are preceded by a numeral, as in (ii), as pointed out by T'sou (*ibid*.), Li & Thompson (1981: 105), and Cinque (2011: 3), they occur in the position of a unit word, and what is missing is the noun *shijian* 'time'.

(i) san ge xiaoshi
three CL hour
'three hours'

(ii) san xiaoshi
three hour
'three hours'

2.4.1.4 Summary and the general function of unit words

The classification of various unit words is summarized in (91):

(91)	N
Individuating CLs	[-Delimitable]
Collective/Partitive/Individual CLs	[+Delimitable]
Kind CLs/Container measures/Standard measures	[+/-Delimitable] (underspecified)

The basic function of all types of unit words in numeral expressions is to tell us what counts as one. In (92) and (93), the nouns are the same, *xigua* 'watermelon', but the counting units are different.

(92)a. san ke xigua [Individual CL]
three CL watermelon
'three watermelons'

b. san zhu xigua [Individual CL]
three CL watermelon
'three watermelon plants'

c. san dui xigua [Collective CL]
three CL watermelon
'three piles of watermelons'

d. san pian xigua [Partitive CL]
three CL watermelon
'three slices of watermelons'

e. san zhong xigua [Kind CL]
three CL watermelon
'three kinds of watermelons'

(93)a. san boung xigua [Standard measure]
three pound watermelon
'three pounds of watermelons'

b. san gongjin xigua [Standard measure]
three kilo watermelon
'three kilos of watermelons'

c. san xiang xigua [Container measure]
three box watermelon
'three boxes of watermelons'

d. san dai xigua [Container measure]
three bag watermelon
'three bags of watermelons'

2.4.1.5 The CL *ge*

The CL *ge* in Mandarin Chinese is special. Generally speaking, when it occurs, it can be replaced by an individual CL, if such a CL is available, as seen in the alternations in the three examples in (94), or by a kind CL, as seen in the three examples in (95), or an individuating CL, as seen in the two examples in (96).

(94) a. san {ge/ke} xigua
three CL/CL watermelon
three watermelons'

b. san {ge/tiao} jianyi
three CL/CL suggestion
'three suggestions'

c. san {ge/chang} shigu
three CL/CL accident
'three accidents'

(95) a. Yani you san {ge/zhong} xinnian.
Yani have three CL/CL belief
'Yani has three kinds of beliefs.'

b. Yani you san {ge/zhong} xin-tai.
Yani have three CL/CL mind-state
'Yani has three kinds of states of mind.'

c. Mei ge cunzi dou faxian-le zhe liang {ge/zhong} bingdu.
every CL village all find-PRF this two CL/CL virus
'These two kinds of virus have been found in every village.'

(96)a. Yani faxian-le san {ge/tiao} cuowu.
Yani find-PRF three CL/CL error
'Yani found three errors.'

b. Ni zheyang zuo you san {ge/dian} haochu.
you so do have three CL/CL benefit
'Your so doing has three benefits.'

However, the replacement in the other direction is not alway possible. For instance, the individual CLs in (97) and the kind CLs in (98) may not be replaced with *ge*, without changing their intended meanings (see Loke 1994).

(97) a.	san ke shu	b.	san tiao daolu	c.	san zhi bi
	three CL tree		three CL road		three CL pen
	'three trees'		'three roads'		'three pens'
(98) a.	san zhong shu	b.	san zhong xiaohua	c.	san kuan maozi
	three kind book		three kind joke		three style hat
	'three kinds of books'		'three kinds of jokes'		'three styles of hats'

Moreover, no alternation between *ge* and an individuating CL that occur with a concrete noun in either direction is possible. The individuating CLs in the three examples in (99a,b,c) may not be replaced by *ge*, and *ge* may not occur with any non-abstract mass noun, as shown in (99d). Thus Chao's (1968: 508-509) generalization that "[M]ass nouns do not take the individual classifier g" (sic) is right for non-abstract mass nouns.[13]

(99) a.	san di you	b.	san zhang zhi	c.	san gu zhengqi
	three CL oil		three CL paper		three CL steam-air
	'three drops of oil'		'three pieces of paper'		'three puffs of steam'

d. *san ge {you/zhi/zheng-qi/xie/rou/bu/qian/yanlei}
three CL oil/paper/steam-air/blood/meat/cloth/money/tear

[13] Many papers have been published on *ge*. See Myers (2000) for a review. The word *ge* in data like the following is also a CL, followed by a nominalized element (Ōta 2003 [1958]: 363, Chao 1968: 320). The word *ta* here has been analyzed as an indefinite D-element in Lin & Zhang (2006):

(i) Zanmen wan ta (yi) ge tongkuai!
we play it one CL satisfaction
'Let's play as much as we like.'

Ge may also occur in other contexts in which no numeral may occur. *Ge* in such uses is thus not a unit word. For instance, it can occur to the left of an adjective, as in (ii-a); or to the left of negation, as in (ii-b) (Ōta 1958: sec 21.4, Zhu 1982: 49):

(ii) a. Akiu pao-le *(ge) kuai.
Akiu run-PRF GE fast
'Akiu ran fast.'

b. Akiu xiao *(ge) bu-ting.
Akiu laugh GE not-stop
'Akiu laughed endlessly.'

No other CL can occur in such contexts. Lü (1983: 131) claims that in certain cases, *ge* is used for prosodic reasons (cf. W. Zhang 1991: 266).

In (iii), *ge* also rejects a numeral. In (iv), *ge* precedes a proper name (Lü 1990 [1944]: 159; Ōta 2003 [1958]: 75; Cheng & Sybesma 1999: 523). *Ge* can also precedes a pronoun (Cheng & Sybesma 1999: 538).

(iii) Wo he (*yi) ge shui jiu lai.
I drink one GE water then come
'I'll come after I drink some water.'

(iv) Na *(ge) Hufei zhen bu xianghua.
that CL Hufei truly not decent
'That Hufei is really unreasonable.'

However, examples like (iv) may show that the uses of pronouns and proper names have the syntax of common nouns (Ōta 2003 [1958]: 75; X. F. Zhang 2008: 413; De Clercq 2008).

When *ge* occurs in the position of an individual CL, the noun can be of various semantic type (e.g., *ren* 'person', *guojia* 'country', *xigua* 'watermelon', *taiyang* 'sun'), as pointed out by Myers (2000). Thus, *ge* has no semantic sorting function at all. Historically speaking, *ge* emerged quite late (see 2.7.3), but it is the most frequently used CL, and many nouns, especially abstract nouns and nouns denoting new concepts, occur with *ge* only. Myers call *ge* default CL.

One issue that needs to be clarified is the following. It has also been assumed that individual CLs typically mark the first mention of a new item; they occur with indefinite nouns rather than definite ones and the CL *ge* may take a sortal CL as an antecedent (Erbaugh 1986: 408, Aikhenvald 2003: 324, 328). The example in (100a) is used to show this belief. However, there is no problem if we exchange the positions of the two CLs in this example, as seen in (100b). Our (100c) is another example in which it is the CL *ge* that occurs first, and another CL occurs later in describing the same entity.

(100)a. Cong neibian guolai yi ge xiaohaizi, uh…qi, qí, qí-zhe yi liang jiaotache
from there come one CL child uh ride ride ride-PRG one CL bike
uh shi yi ge hen ke'ai de xiao de jiaotache.
uh be one CL very cute DE little DE bike

b. …, qi-zhe yi ge jiaotache, shì yi liang hen ke'ai de xiao de jiaotache.
ride-PRG one CL bike be one CL very cute DE little DE bike
Both: 'From there comes a child, riding a bike, (it) is a very cute little bike.'

c. Yuanyuan de lai-le yí ge ren, yuanlai shi yí wei lao jiaoshou.
far DE come-PRF one CL person in.fact be one CL old professor
'A person came from far away. It turned out to be an old professor.'

2.4.2 Unit words as the unique numerability bearers in Chinese

All unit words may combine with a numeral directly. Therefore all unit words have the feature [+Numerable], and thus countable.

English unit words are also countable. As stated in Grimshaw (2007: 204 fn. 6), unit words in English can never be mass nouns. For instance, Chierchia (2010: 103) claims that in (101), the unit word *quantities* is countable, and thus the whole NP *quantities of water* is countable, although *water* is not countable. In my analysis, unit words may combine with a numeral directly and thus they are [+Numerable], i.e., they are countable.

(101) I am going to spill three quantities of water on your floor.

Since no noun in Chinese has the feature [+Numerable] and all unit words have the feature, the latter are the unique numerability bearer in numeral expressions of the language. We can see that numerability does not have to be anchored to lexical or root elements. In Chinese, unit words are analyzed as nominal auxiliaries in Chao (1948, 1968: 584) and Z. Lu (1951: 42), as numeral auxiliaries in Ōta (2003 [1958]: 146), and as light nouns in Huang (2009). I claim that such auxiliaries or light nouns are numerability bearers in CL languages. The analytical realization of numerability is parallel to the situation that tense information can be realized by either verbs or auxiliaries in English. Formal features in general can be distributed in various types of elements.

2.4.3 Delimitability of unit words

In 2.4.1, we show that unit words may have different co-occurrence restrictions with the nouns following them, but they are also different with respect to whether they themselves are

able to be modified by a delimitive modifier. Modifiers of unit words vary cross-linguistically. In this section, I discuss delimitive modifiers of unit words in Mandarin Chinese only.

Kind CLs may not be modified by any delimitive modifier:

(102)a. san zhong qianbi
three kind pencil
'three kinds of pencil'

b. *san {chang/da/zheng} zhong qianbi [Kind CL]
three long/big/whole kind pencil

Standard measure words may not be modified by shape and size modifiers (Liu 1980: 10; cf. Lu 1987: fn. 3), but they can be modified by boundary modifers:[14]

(103)a. san sheng you
three liter oil
'three liters of oil'

b. *san {chang/da} sheng you [Standard Measure]
three long/big liter oil

c. san zheng dun you
three whole ton oil
'three whole tons of oil'

d. san zheng bang yingtao
three whole pound cherry
'three whole pounds of cherries'

Note that the adjectives *da* 'big' and *xiao* 'small' may mean 'significant' and 'insignificant', respectively (see the discussion of (20) above). Such readings are not delimitable readings, and thus the two adjectives in these readings may modify abstract nouns (cf. English *big idea, big chance*), abstract units in (104a,b), and standard measures in (104c,d):

(104)a. si da bi jiaoyi
four big CL transaction
'four significant transactions'

b. si xiao tiao jianyi
four small CL suggestion
'four minor suggestions'

c. Zuowei dui wo de jiangli, ni gei wo mai yi da jin putao!
as to I DE award yu for me buy one big jin grape
'As an award, you should buys two big jins of grapes for me!'

d. Ta zuzu fei-le liang da bang.
he as-much-as fat-PRF two big pound
'He has gained weight as much as two big pounds.'

All other types of unit words may be modified by a shape or size adjective in Chinese (Lu 1987, Luo 1988, among others), and thus have the feature [+Delimitable] (Note that Cheng & Sybesma 1998: 390 claim that individual CLs may not be modified and only the numeral *yi* 'one' may be followed by an adjective; but our data in (105) show that the two restrictions assumed in their theory cannot be maintained).

(105)a. san tiao xianglian
three CL necklace
'three necklaces'

b. san chang tiao xianglian [Individual CL]
three long CL necklace
'three long necklaces'

(106)a. san di you
three CL oil
'three drops of oil'

b. san da di you [Individuating CL]
three big CL oil
'three big drops of oil'

[14] In expressions such as *yi zheng-nian* 'one whole year', *yi zheng-yue* 'one whole month', the last morpheme can be a CL, which is followed by a deleted *shijian* 'time' or a null noun meaning time (see footnote 12).

(107)a. san pian xigua
three CL watermelon
'three slices of watermelon'

b. san da pian xigua [Partitive CL]
three big CL watermelon
'three big slices of watermelon'

(108)a. san qun yang
three CL sheep
'three flocks of sheep'

b. san da qun yang [Collective CL]
three big CL sheep
'three big flocks of sheep'

(109)a. san xiang xianglian
three box necklace
'three boxes of necklaces'

b. san da xiang xianglian [Container measure]
three big box necklace
'three big boxes of necklaces'

c. san ping you
three bottle oil
'three bottles of oil'

d. san da ping you
three big bottle oil
'three big bottles of oil'

Individual CLs in other languages such as Thai (Hundius & Kölver 1983: 169-171), Kiriwina (Croft 1994: 150), and Hungarian (Csirmaz & Dékány 2010: e.g., (36)) may also be modified by delimitive adjectives. CLs in Korean however may not be modified (Byeong Yi, p.c., Sept. 16, 2010). Since kind CLs may not be modified, the feature is not a defining property of CLs.

I leave to Chapter 5 the discussion of the morphological constraints on such modification in Chinese and possible derivation of the constructions.

2.5 Numerability and quantifiers in Chinese

It is well-known that quantifiers have co-occurrence restrictions with respect to countability in English, as seen in section 2.2.3. In this section, we show that some quantifiers also exhibit the similar co-occurrence restrictions in Chinese.

Recall that it is unit words, rather than nouns, that can be count elements in Chinese. So if a quantifier has to occur with a count element in Chinese, it must combine with a unit word.

According to Cardinaletti & Giusti (2006), quantifying elements can be modifiers or non-modifiers, cross-linguistically, and they are syntactically different (also see de Belder 2011a: 105). In Chinese, modifiers can be followed by the functional word *de*. Quantifying elements such as *daliang* 'a lot', *suoyou* 'all', *quanbu* 'all', *daduoshu* 'most', *dabufen* 'most' can be followed by *de*, and thus they should be quantifying modifiers. They modify NPs directly, and thus may not be followed by a CL, as seen in (110) (see Tang 2007: 984; Hsieh 2008: 61; X. P. Li 2011: 6):[15]

(110)a. suoyou (de) (*duo) hua
all DE CL flower
'all of the flowers'

b. daliang (de) (*ping) shui
a.lot DE bottle water
'a lot of water'

Putting such modifiers aside, I consider quantifiers that may not be followed by *de*.

2.5.1 Quantifiers that occur with [+Numerable]

Cardinal numerals, ordinal numerals, and quantifiers such as *ji* 'how many'(Chao 1968: 580; it is called "unknown figure" in Iljic 1994: 107, and "vagur number" in Hsieh 2008: 62), *ji* 'a few, several, several', *haoji* 'several', *ruogan* 'several', the paucal quantifier *liang-san* 'two-three => a few' (Ōta (2003 [1958]: 134), *ge* 'each', and the dual quantifier *liang* must be

[15] Note that the position of *de* is to the left of the unit word in (110) and (115) in 2.5.3. Thus the issue is different from the one in 2.6.4, where whether *de* may follow a unit word is discussed.

followed by a unit word, as seen in (111).[16] Moreover, the quantifiers *man* 'all' must be followed by a unit word of an appropriate type in counting, as seen in (111g). Such quantifiers occur with elements that have [+Numerable].[17]

(111)a. san *(duo) hua
three CL flower
'three flowers'

b. di san *(duo) hua
ORD three CL flower
'the third flower'

c. Ni you ji *(duo) hua?
you have how.many CL flower
'How many flowers do you have?'

d. haoji *(duo) hua
several CL flower
'several flowers'

e. liang-san *(duo) hua
two-three CL flower
'a few flowers'

f. liang *(duo) hua
dual CL flower
'two flowers'

g. man *(ben) riji dou xie-zhe liang ge zi: jian fei
whole CL diary all write-PRG two CL word lose fat
'The whole diary is full of two words: lose weight.'

But these quantifiers have no restriction on the delimitability feature of the element following them. In (112a), the quantifier *ji* 'how many' precedes the CL *di*, which is modified by the delimitive adjective *da* 'big'. In (112b), *ji* precedes the standard measure *sheng* 'liter', which rejects a delimitive adjective. *Ji* may occur with either of them, indicating that it is not sensitive to the delimitable feature of the unit words.

(112)a. Yigong you ji da di you?
total have how.many big CL oil
'How many big drops of oil are there in total?'

b. Yigong you ji (*da) sheng you?
total have how.many big liter oil
'How many (*big) liters of oil are there in total?'

2.5.2 Quantifiers that occur with [-Numerable]

Quantifiers such as (*yi*)-*dian* (or (*yi*)-*dianr*) 'some, a little', and *henshao* 'little' may not be followed by any unit word, as shown in (113).[18]

(113)a. Nali you (yi)-dian (*ping/*di) niunai.
there have some bottle/CL milk
'There is a little milk.'

b. Duo xue yi-dian (*ge) Ma-Lie!
more study some CL Marx-Lenin
'Study more of Marxism and Leninism!'

---

[16] In Thai, ordinal numerals must also be next to a CL (Haas 1942: 204).

[17] Persin quantifier *čænd* 'several; how many', like Mandarin Chinese *ji* 'several; how many', is also followed by a CL, such as the general CL *ta* (see Cowper & Hall 2012: Sec. 7.1).

[18] If *yi* to the left of *dian* is in contrastive to another numeral, as shown in (i), *dian* can always be replaced by the CL *ge*. In such an example, *dian* is a CL. (i) and (ii) mean the same.

(i) Wo you liang dian {jianyi/yiwen}, bu shi yi dian {jianyi/yiwen}
I have two CL suggestion/question not be one CL suggestion/question
'I have two suggestions/quesitons rather than one.'

(ii) Wo you liang ge {jianyi/yiwen}, bu shi yi ge {jianyi/yiwen}.
I have two CL suggestion/question not be one CL suggestion/question

c. Nali you yi-dian (*ke) xiao xigua.
there have some CL small watermelon
'There are a few small watermelons.' (e.g., in the context of talking about the quantity of the storage in a certain place)

d. Henshao (*ge) xuesheng neng zai 20 fenzhong-nei gei-chu huida.
few CL student can at 20 minute-in give-out answer
'Very few students can give an answer in 20 minutes.'

Iljic (1994: 107) claims that such quantifiers are for mass or abstract nouns only. Precisely speaking, it is a unit word, rather than a non-mass noun, that may not follow such quantifiers. In (113c), *xigua* 'watermelon' is not a mass noun, but it follows *yi-dian* 'a little' (See Lien 2011 for a discussion of similar quantifiers in Southern Min).

The rejection of unit words, which are the only count elements in the language, indicates the rejection of [+Numerable]. Therefore, quantifiers such as (*yi*) *dianr* 'some, a little' and *hen shao* 'very little' can be regarded as quantifiers that occur with [-Numerable] expressions, similar to *much* and *little* in English. Semantically, since such quantifiers reject unit words, which encode what counts as one in counting, they are not used for counting. Similarly, the quantifiers in (110), which also reject unit words, are not for counting, either. If counting and measuring are two different types of quantification, those reject unit words must be for measuring (the contrast identified here is different from the one assumed in Rothstein 2009; see Zhang 2012a for my critical comments on Rothstein's analysis).

Note that words such as *renhe* 'any' and *mei* 'each' are D-elements, base-generated higher than a numeral, since they may precede a numeral (e.g., {*renhe/mei*} *san ba san* '{any/every} three unbrella(s)').

2.5.3 The ambiguous cases

In addition to the two types of quantifiers introduced in the above subsections, quantifiers such as *henduo, haoduo,* or *haoxie,* which all mean 'many, much', may occur with any type of nouns or unit words (Tang 2007: 984, Hsieh 2008: 61) (the same is true of *takusan* 'many, much' in Japanese, another CL language; see Iida 1998: 4; Kobuchi-Philip 2011: 307).

(114)a. henduo (ben) shu
many CL book
'many books'

b. henduo (di) shui
many CL water
'a lot of {water/drops of water}'

However, when *henduo* occurs with a unit word, e.g., a CL, it may not be followed by *de*, as in (115a), patterning with a quantifier that occurs with [+Numerable], such as a numeral, as seen in (115b); whereas when it occurs without a unit word, it may be followed by *de*, as in (116a), patterning with a quantifying modifier such as *suoyou*, as seen in (116b) (see (110a)) (Hsieh 2008: 61).

(115)a. henduo (*de) ben shu
many DE CL book
'many books'

b. san (*de) ben shu
three DE CL book
'three books'

(116)a. henduo (de) shu
many DE book
'many books'

b. suoyou (de) shu
all DE book
'all items of the books'

Such quantifiers are thus ambiguous in their status.

The fact that certain quantifiers are sensitive to numerability further indicates that

nominal constructions in Chinese exhibit the contrast between count and non-count elements.

2.6. Reflections on the theories of countability

2.6.1 What's new

The study of the contrast between count and mass nouns dates back to Aristotle. Developing the insights of many previous studies, I have made the following three main claims with respect to the contrast.

First, a count noun is defined exclusively by [+Numerable], i.e., the possibility to combine with a numeral directly. It has been generally recognized that such a combination possibility is the "signature" grammatical property of count nouns (e.g., Chierchia 2010: 104). I have now further argued that this is the only defining grammatical property of a count noun, cross-linguistically. This syntagmatic definition means that the count/non-count distinction is clearly linguistic, rather than extra-linguistic. It is thus not surprising that countability is expressed in various ways, cross-linguistically and within the same language. In Chinese, generally speaking, no noun may combine with a numeral directly, and therefore, no noun is a count noun. Numerability is instead represented exclusively by unit words, including CLs and measure words. In languages such as Yudja (Lima 2010, 2011) and Halkomelem Salish (Wilhelm *ibid.*: 64), no individual or individuating CL exists in the language, and every noun can combine with a numeral directly. Thus every noun can be a count noun. Between these two patterns, in languages such as English, Karitiana (Müller et al. 2006), and Dëne (Wilhelm *ibid.*), in an unmarked situation (i.e., without a shift), some words are [+Numerable], and others are [-Numerable] (see 2.3.1).

Second, the notion of mass is not the direct negation of count. Instead, it is the combination of the two syntagmatic properties: [-Numerable] and [-Delimitable]. Words such as *oil* in English and their counterparts in Chinese are mass nouns. This refined analysis makes it possible to precisely identify elements that may not combine with a numeral directly but allow a delimitive adjective, e.g., *furniture* in English and *pingguo* 'apple' in Chinese. Such words do not denote massive objects. As Chierchia (2010: 144) put it, "we know right off the bat that *furniture* cannot be treated on a par with *water*." Such words have been called "count mass nouns" (Doetjes 1996: 44, 2010: 44), "object mass nouns" (Barner & Snedeker 2005; Bale & Bartner 2009: 229; 2012), "fake mass nouns" (Chierchia 2010: 110), and "collectives" in Wiese (2012). The similarity between such words and the Chinese counterparts of English count nouns has also been discussed in Doetjes (1996: 35), Portner (2005: 98), Krifka (2008: Sec. 6.5), Chierchia (2010: 111, fn. 12), Bale & Barner (2012: Sec. 2.3), Cowper & Hall (2012: Sec. 3.1), Wiese (2012), among others. In Doetjes (1996: 34), "count mass nouns" are for the words which are semantically count but behave like a mass noun syntactically. The generally recognized special properties of the *furniture*-type of nouns are represented by the features [-Numerable] and [+Demimitable] in our analysis.

Although it has been widely believed that all nouns are mass nouns in Chinese, the difference between English mass nouns and Chinese non-mass nouns, with respect to delimitability, has been noted in Gil (2008: 8). He finds that unlike the former, the latter can be modified by "size and shape adjectives". Explicitly, he states:

> . . . whereas in English, constructions such as *big water* are bizarre, in Mandarin, constructions such as *da pingguo* 'big apple' are syntactically well-formed, and understood in the same way as their English counterparts.

In my analysis, both *furniture* and *pingguo* are [-Numerable] and [+Delimitable]. Therefore, *da pinguo* 'big apple' is as natural as *big furniture*. Consequently, CL languages like Chinese are able to distinguish mass and non-mass nouns. Our identification of the

location of [+Numerable] in CLs rather than in nouns for CL languages is one step forward than the vague statement that such languages do not have count syntax.

The close interaction between the notions countability and delimitability has long been realized in the literature, but the nature of the relation has not been clarified. Jespersen (1924: 198) makes the following statement:

> There are a great many words which do not call up the idea of some definite thing with a certain shape or precise limits. I call these "mass-words"; they may be either material, in which case they denote some substance in itself independent of form, such as *silver, quicksilver, water, butter, gas, air*, etc., or else immaterial, such as *leisure, music, traffic, success, tact, commonsense*

Quine (1960: 104) also notes that the unacceptability of **spherical water* and **spherical wine*. On the other hand, it is obvious that count nouns such as *suggestion* also reject *spherical*. Bunt (1985: 199) also points out that mass nouns such as *water* may not be modified by adjectives such as *large*. Krifka (2008: Sec. 1) states that mass nouns such as *water, milk,* and *gold* denote liquids and substances that lack of defined boundary. However, McCawley (1975: 170) finds that *furniture* and *footwear*, which have also been treated as "mass" nouns, and admit size modification "much more readily than hard-core mass nouns such as *rice*". Bunt also mentions the acceptability of examples such as '*There is small furniture in the doll's house*' (1985, 200 & 207ff). In Ojeda (2005: 404), "modification in terms of size and shape" is mentioned as one of the "well-known differences between count and mass nouns". In Svenonius (2008), to capture the incompatibility between delimitive adjectives and mass nouns, such adjectives are assumed to be in the Specifier of SortP, which is the locus of count nominals, rather than mass ones.

The most recent and thorough discussion of the relation between the count-mass contrast and size adjectives is de Belder (2011b). Her discussion does not cover other delimitive modifiers such as *thick, thin*, *round, complete*, though. Crucially, she claims that "if something acquires the [Size] feature, it automatically becomes countable." (p. 183) So for her analysis, size features entail the count status. This is different from my analysis, which gives an equal status to numerability and delimitability: neither entails the other, and thus there are four possibilities. One empirical consequence of her analysis is that it is not able to capture the fact that non-count nouns such as *furniture* may have size feature. This kind of nouns are predicted to be "illicit" in her theory (de Belder 2011a: 83 (34); 2011b: 180), contrary to the fact.

The proposed two features, numerability and delimitability, are both related to the countability of nominals. This is parallel to our understanding that tense and viewpoint aspect features are different, but they are both related to the temporal properties of linguistic elements.

We have claimed that all nouns in Mandarin Chinese are non-count nouns. In languages such as Yudjia, since every noun may combine with a numeral directly, all nouns are count nouns. Then, there could still be a contrast with the different values of [Delimitable], the contrast parrellel to that between the English word *belief*, which is [-Delimitable], and *table*, which is [+Delimitable].

Third, numerability, which is one of the two features for the mass-count contrast, is different from morphological number, as shown in 2.2.6. I will say more about this issue in 2.6.3.

In 2.6.2 through 2.6.5, I will discuss some alternatives to identify the count-mass contrast: the semantic approach, the morphological approach, the multiple-criteria approach, and some other non-binary analyses.

2.6.2 The semantic approach to the count-mass contrast

In a pure semantic approach, only count nouns are assumed to denote elements that show natural atomicity. Whorf (1956 [1941]: 140) states that "[I]ndividual nouns denote bodies with definite outlines: 'a tree, a stick, a man, a hill.' Mass nouns denote homogeneous continuance without implied boundaries". Quine (1960), Goodman (1966), Cheng (1973), McCawley (1979 [1975]), Wierzbicka (1985), among others (see Joosten 2003 for a survey) all try a semantic approach to the count-mass contrast. For a brief review of the semantic studies of the issue, from the perspectives of cumulativeness, divisiveness, to the homogeneousness of the referent, see Doetjes (to appear, Section 2.1). Recently, the atomicity approach is defended in Wilhelm (*ibid.*). The semantic critera are also taken for granted in works such as de Belder (2011a: 73). However, Rothstein's (2010: 14) following statement clearly tells us why this approach is inadequate:

> "inherent, or natural, atomicity is neither a necessary nor a sufficient criterion for count noun predicates, and homogeneity v. non-homogeneity cannot be at the root of the mass/count distinction. *Furniture* is mass but naturally atomic and non-homogeneous since it denotes sets of individual units and *fence* is count but homogeneous and not naturally atomic. This means that a theory of count nouns cannot rely on presuppositions of atomicity." [sic.]

In addition to *fence*, nouns such as *segment* and *line* are also count but denote homogeneous entities, like mass nouns (Aquaviva 2010: 4).

As pointed by Rothstein (2010: 19), "the mass/count distinction can only be explained in terms of how the expressions refer, and not in terms of the things they refer to. This means it is a grammatical and not an ontological distinction." Doetjes (2010: 10) also points out that "meaning does not determine whether a noun is mass or count in an unambiguous way" (similar idea is seen in Chierchia 2010: 103). The problems of semantic approaches are also discussed in Bale & Barner (2009: 230). As frequently noted in the literature, the same type of notions can be expressed by both count and non-count words in the same language, and by count words in one language but non-count ones in another language. Some well-known examples can be found in McCawley (1975: 165). The following examples in (117a, a', b, b') are cited from Kiss (2010) and the rest in (117) are from Chierchia (2010: 101, 110).

	Count		Non-Count	
(117)a.	vegetable	a'.	fruit	
b.	Obst fruit	b'.	Gemüse vegetable	[German]
c.	mobile/mobili furniture.SG/furniture.PL	c'.	mobilia furniture	[Italian]
d.	virtue	d'.	beauty	
e.	belief	e'.	knowledge	
f.	jump	f'.	jumping (see (10))	

Theoretically, our approach defines grammatical notions in a system syntagmatically. Instead of stipulating various semantic features for nouns directly, such as [+/-Shape] (Rijkhoff 2002: 51) or [+/-Concrete] (Muromatsu 2003), or [+/-Size] (de Belder 2011b), or [+/-Individuated] (Bobyleva 2011: 58), we examine the compatibility between different types of elements in syntactic structures. Linguistic categories are defined by the relations of elements in the language system, rather than by the properties of the denoted referents. The

latter approach fails to account for cross-linguistic variations (see 2.6.5.2 and 2.6.5.3 for our further comments on Rijkhoff 2002 and Muromatsu 2003).

In Wilhelm's (*ibid.*: 64) semantic approach, examples like *furniture* are treated as semantics-syntax mismatches. Since all non-mass nouns in Chinese behave like *furniture*, as recognized by many scholars, one would claim that Chinese is a typically mismatched language. However, as correctly pointed out by Wiese (2012: abstract), nouns like *furniture* are "a general, systematic option for nouns, rather than an idiosyncratic phenomenon". Chierchia (2010: 103) has this to say, "the existence of the mass/count distinction in grammar is neither a logical nor, perhaps, a communicative necessity." "Language, viewed as specifically human aggregate of cognitive capacities, must have developed an autonomous apparatus responsible for the mass/count system." In this book, we have identified two linguistic features of the apparatus, and therefore, hopefully, the system of the count-mass contrast is less vague to us now.

2.6.3 The morphological approach to the count-mass contrast

A pure morphological approach to the count-mass contrast would assume that count nouns are identified by their number markers, while mass nouns are signaled by the rejection of a number marker. Such an approach has been found in Link (1983: 306), Doetjet (1996, 1997), Chierchia (1998), among others. However, we have extensively discussed the differences between the count status and number in 2.2.6.

There are at least four problems in a number marking approach to the count-mass contrast.

First, the expectation of a "count" noun fails when we consider the so-called mass plural, seen in 2.2.6. More examples of mass plural are listed in (118) (Acquaviva 2010: 3, 8; see Ojeda 2005 for similar examples in Bantu languages), where the occurrence of the plural marker leads to a mass reading, instead of the expected count reading.

	Count	Mass	
(118)a.	brain	brains	
b.	fund	funds	
c.	ksilo	ksila	[Modern Greek]
	wood.SG	wood.PL	
	·piece of wood'	'wood'	

Huddleston & Pullum (2002: 343) state that *bushes* and *mountains* in *We should plant a few bushes* and *She climbed two mountains* in one day are regular count plurals; but "they have non-count interpretations in examples like [33]:" (Their [33] = (119) below)

(119)a. He threw it in the bushes. b. She lives in the mountains.

Corbett (2000: 173) reports that "In Manam (Lichenberk 1983: 269) *all* mass nouns are plural, (as marking on the verb shows). In Turkana, some are singular and some are plural (Dimmendall 1983: 224). In Bantu languages too, mass nouns are frequently split between singular and plural (Guthrie 1948: 851)." Similarly, both mass and non-mass nouns can occur with the plural clitic *mga* in Tagalog (Corbett 2000: 133-134). In languages such as St'at'imcets, all nouns, including those referring snow, honey, and water, may freely take plural determiners. Davis & Matthewson (1999: 60) report that "Nouns whose English counterparts are mass may freely take plural determiners in St'at'imcets."

As clearly stated in Mathieu (2012: Sec. 10.3.3), mass plural is "one of several plurals (plural of modesty, exaggerative plural, hyperbolic plural, approximative plural,

anti-associative plural, etc.) that has nothing to do with counting individuals."

Second, the expectation of a "mass" noun fails, when we consider the bare nouns in certain PPs and VPs, introduced in 2.2.6. For instance, the noun *prison* in the PP *in prison* neither has a plural form nor is preceded by any article. The absence of a number marker does not lead to a mass reading. The nouns in such constructions seem to have a singular form, but denote either one or more than one atom. They thus look like non-counting singulars.

Third, there also exist non-counting plurals. Plurality that is not for counting is seen in Acquaviva's (2010: 2) following examples (I thank Jonathan Evans for giving me more such examples to see the contrast):

(120)a. I saw you in my dreams ≠ several different dreams
b. a house in the woods ≠ in several different woods
c. I have plans for tonight ≠ I have a few plans for tonight

If a count noun is supposed to occur in the context of counting, the notion of non-counting plural is not compatible with this understanding.

Considering both the first and the third point above, what we see is that plural marking is not only "not interpreted uniformly across languages" (Bale & Khanjian 2008: 86), but also not interpreted uniformly in the same language such as English.

Fourth, mutual exclusiveness between a numeral and a plural marker is observed in certain constructions or certain languages (see the Hungarian examples in (53) before and more in 3.2.5). If the possibility to occur with a numeral is the signature property of a count noun (Chierchia 1998: 353), the conflict indicates that plural markers cannot be a reliable signal for count nouns.

Realizing the complexity of plural markers, different terms have been used in the literature, to cover the patterns unpredicted by the morphological approach. Doetjet (2010: 45) calls the plurals in *oats* and *grits*, which may not occur with a numeral, defective plural, and finds that they often correspond to mass nouns in other languages. Some researchers treat such plurals as idiosyncratic ones and still keep number marking as an effective way to distinguish count from mass nouns (e.g., de Belder 2011a: 72; 205). Some other researchers (e.g., Harbour 2008) distinguish morphological number from semantic number. Krifka (2008) distinguishes semantic plurals and agreement plurals. For a recent review of the problems of morphological approach to the count-mass contrast, see Schaden (2010). As stated in Wilhelm (*ibid.*: 47, also see 57), "number marking is not a necessary property of count nouns" (also see Wiese 2012: Sec. 4.5 for the same conclusion).

Also, the number marker approach might lead us to conclude that languages such as Karitiana (Müller et al. 2006), Yudja (Lima 2010, 2011), and Dëne (Wilhelm *ibid.*), and quite a lot of languages discussed in Rijkhoff (2002: 38-41) have no way to express any contrast with respect to countability, since in such languages there is no number markers (and no CL, either). On the other hand, in languages such as St'at'imcets, since all nouns may freely take plural deterniners (& Matthewson (1999: 60), there is no way to express any contrast with respect to countability, either.

Semantically, singular count nouns such as *scarf* refer to entities taken individually, and plural count nouns such as *scarfs* refer to entities taken in bulk. In addtion to these two types of nouns, Ojeda (2005) uses the term Cosingular to refer mass plurals such as *clothes* (see 2.2.6) and the term Coplural to refer to mass nouns such as *clothing*. He specifies that "cosingular nouns can refer to entities taken in bulk - but without having to refer, at the same time, to entities taken collectively" (p. 390), whereas "coplural nouns will be able to refer to entities taken in bulk, but without having to refer, at the same time, to entities taken individually" (p. 391). We can see that the new terms are intended to regulate the arbitrariness

of the mapping between morphological forms and the encoded meanings.

However, arbitrary mapping between form and meaning is seen beyond number morphology. It is well-known that the German noun *Mädchen* 'girl' is neuter instead of feminine, although the referent is feminine. We might also need a term "co-feminine" to cover this mismatch. Additing new terms shows that plural forms may encode different things. Similar "non-count plurals" in Arabic are discussed in Acquaviva (2008: 229). The existence of such "non-count plurals" challenges the claim that plural markers are markers of count nouns.

It is possible that the feature of number is encoded by a functional projection independent of the ones for countability. See Chapter 4 for a further discussion.

2.6.4 The multi-criteria approach

The multi-criteria approach (Allan 1980) puts various considerations together, including the possibility to occur with a numeral, semantic and morphological factors, and ranks the degree of countability for each noun. This approach is adopted in Joosten (2003) and Kuo & Wu (2010). However, I have shown that semantic and morphological approaches to the count-mass contrast are both problematic. Then, logically, if some of the individual factors are problematic, putting them together does not help.

Moreover, since some linguistic phenomena are not observed in certain languages, in order to measure the countability of words in different languages, different criteria are used in this approach. For instance, in Kuo & Wu (2010), in order to judge the countability of a noun, articles and plural markers are used for English, but individual CLs are used for Chinese. This consistency is not desirable, methodologically speaking.[19]

2.6.5 Other non-binary analyses of countability

The idea that the count-mass contrast is not a dichotomous contrast and thus we need more features to represent them is also seen in the literature. As I mentioned above, de Belder (2011a,b) proposes that the feature [Size] should be considered. I already compared her analysis with ours in 2.6.1. In this section, I briefly address the inadequacies of certain other non-binary analyses of countability.

2.6.5.1 T'sou's (1976) [Entity] and [Exact]

T'sou (1976) uses the positive, negative, and variable values of two features, [Entity] and [Exact], to classify nouns, and claims that "the semantic distinctions of such a system are supported as well by evidence from syntax." His three pieces of syntactic evidence in Mandarin Chinese are the co-occurrence restrictions of a unit word with other three elements: ordinal number, fractional number, and the functional particle *de* (his *de*-adjectival). His classification can be shown by the table in (121), and the examples of unit words for each type are in (122) through (125) (*ibid*. p. 1217).

(121)

	Exact	Entity	DE-adjectival	Ordinal number	Fractional number
I	+	+	*	✓	✓
II	+	-	✓	*	✓
III	-	+	✓	✓	✓
IV	-	-	✓	✓	*

[19] Other problems of Kuo & Wu (2010) include the claim that container measures are more countable than standard measures, and the absence of individuating CLs in their analysis of Chinese CLs. Neither is justified.

(122) Type I: [+Entity, +Exact], e.g. *zhi* 'CL for individual, non-human objects'

a. *san zhi de ji [DE: *]
three CL DE chicken

b. di san zhi ji [Ordinal number: OK]
ORD three CL chicken
'the third chicken'

c. ban zhi ji [Fractional number: OK]
half CL chicken
'a half chicken'

"In (I) the measure refers to an exact quantity and involves discrete physical entities. A parallel case in English would be *sheet* (in *two sheets of paper*), which characterizes certain physical dimensions of 'paper', the mass noun." (p. 1217) One can see that our individual and individuating CLs (2.4.1) are grouped together in T'sou's system, and all nouns in Mandarin Chinese are treated as mass nouns, a claim that is argued against in this book. Moreover, as will be shown in 2.7.4, the *de* criterion is not reliable, since all unit words may be followed by *de* in certain contexts.

(123) Type II: [+Entity, -Exact], e.g. *jin* 'cattie', unit of weight'

a. san jin de ji [DE: OK]
three cattie DE chicken
'three catties of chicken'

b. *di san jin ji [Ordinal number: *]
ORD three cattie chicken

c. ban jin ji [Fractional number: OK]
half CL chicken
'a half cattie of chicken'

"In (II) the measure is exact but it refers to no discrete physical entity." (p. 1217) It is true that the notion of *jin* 'cattie' does not refer to any discrete physical entity, although *ji* 'chicken' does. If we keep this distinction in mind, we will find that the CL *zhi* in (122) does not refer to any discrete physical entity, either. Then, it is not clear why *zhi* is [+Entity], whereas *jin* is [-Entity].

(124) Type III : [+Entity, -Exact], e.g. *qun* 'brood'

a. san qun de ji [DE: OK]
three CL DE chicken
'three broods of chickens'

b. di san qun ji [Ordinal number: OK]
ORD three CL chicken
'the third brood of chickens'

c. ban qun ji [Fractional number: OK]
halp CL chicken
'a half brood of chickens'

For this type of unit words, "In (III), there is a definite sense of a well-defined discrete entity or entities, but the quantity is not exact either by design or by convention. For example, *a brood of chicks* (or *a plate of chicken*) is not an exact measure but there is a definite sense of physical entity and it can be referred to as a unit." (p. 1218) Again, the positive value of [Entity] for *brood* is not justified. It seems that T'sou confuses the semantic contents of the

noun and those of the unit word.

(125) Type IV: [-Entity, -Exact], e.g. *zhong* 'kind/type'

a. san zhong de ji [DE: OK]
three CL DE chicken
'three kinds of chicken'

b. di san zhong ji [Ordinal number: OK]
ORD three CL chicken
'the third kind of chicken'

c. *ban zhong ji [Fractional number: *]
half CL chicken

"In (IV), which characterizes mainly abstract nouns, the measure is neither exact nor does it refer to a discrete physical entity." (p. 1218)

T'sou also applies his classification of unit words directly to nouns. In his system, mass nouns such as *water* are [αEntity, -αExact], "to capture the fact that the values of its feature specification will be opposite. This will account for *three cans of water* [+Entity, -Exact], *three gallons of water* [-Entity, +Exact] and **three pieces of water* [+Entity, +Exact], as well as *two kinds of water* (soft and hard): [-Entity, -Exact]" (p. 1222). Note that the acceptability of the last example, which has the same value for the two features, is not predicted by his theory. Putting this confusion aside, we still see that the word *water* belongs to type II, III, and IV. It is thus not clear whether it is the semantics of the noun or the semantics of whole numeral expression that is under the classification.

Abstract nouns in his system are [-Entity, -Exact], "so that they can only occur with classifiers such as *type* or *kind*". However, "[S]ince all nouns may be classified with *type* or *kind*, it may be stated as a meta rule that all nouns may be optionally specified as [-Entity, -Exact]." (p. 1222) Accordingly, "[A]n example such as *boy* will be marked [+Entity, αExact] to provide for *three boys* [+Entity, +Exact] and *three groups of boys* [+Entity, -Exact] (as well as *two kinds of boys* by the optional meta rule)." (p. 1222)

Thus, it is not clear to me how much this feature analysis helps us to analyze the countability of nouns. Moreover, on the same page, he also states that "[P]articular languages will require additional features." Since he does not mention what other featues are, it is hard to evaluate his analysis, and therefore, I do not consider his analysis as a plausible alternate to the proposal made in this book.

2.6.5.2 Rijkhoff's (2002) [Shape] and [Homogeneity]

Rijkhoff (2002) uses the positive, negative, and underspecified values of two features, [Shape] and [Homogeneity], to classify nouns with respect to countability. Although the goal of the classification is to capture syntagmatic patterns, e.g., whether the nouns in a language may combine with a numeral directly and whether they require a number marker, the two features themselves are defined semantically and paradigmatically (p. 53): "If the property designated by a noun is coded as having a shape (+Shape), this means that the property (and by extension, the referent of the NP) is characterized as having a definite outline in the spatial dimension"; "If the property designated by a noun is coded as being homogeneous (+Homogeneity), this means that the property (and by extension, the referent of the NP) is characterized as being agglomerative."

The main problems of this approach are the following. First, all nouns in Mandarin Chinese (also in other CL languages) are classified as [-Shape]. Rijkhoff explicitly claims that "as a rule the value –Shape correlates with the use of classifiers (or: individualizers), and, conversely, the value +Shape correlates with the absence of classifiers" (p. 51). But as shown

in our 2.3.2, many nouns in the language may be modified by a shape adjective, such as *chang* 'long' and *fang* 'square', and therefore, their referents do have shapes. Although real mass nouns are classified as [-Shape, +Homogeneity], and non-mass nouns such as *shu* 'book' in Mandarin Chinese are classified as [-Shape, -Homogeneity] in his system, the definition of the feature [Shape] is problematic. Second, languages such as Yudja have no CLs, and thus all nouns should be classified as +Shape, but it is obvious that the referent of the Yudja word *apeta* 'blood' in *txabïa apeta* 'three units of blood' (Lima 2010) has no shape. Third, all singular nouns that may directly combine with a numeral, such as *idea* and *suggestion* in English, are classified as [+Shape, -Homogeneity], but it is not clear what the shape of an idea or suggestion is.

2.6.5.3 Muromatsu's (2003) 3D analysis

Muromatsu (2003) proposes that abstract, mass, and count nouns are 1-, 2-, and 3-dimensional (-D) expressions, respectively. She further claims that either a plural marker or a CL marks a 3D noun. However, the theory is not convincing.

First, it is claimed that only count nouns may occur with plural markers, and thus if an abstract noun such as *idea* occurs with a plural marker, as in *two ideas*, it denotes a 3D notion, similar to that of *two apples* (p. 84). According to this 3D theory, abstract nouns may not occur with measure units such as *pound* (P. 68). But *ideas* behaves the same as *idea* in this respect (**two pounds of* {*idea*/*ideas*}).

Second, it is claimed that "[A] classifier works on the 2D space, individuateing the mass, rendering the space three-dimensional" (P. 72), however, in Mandarin Chinese examples like the following, the CLs do not create concrete notions, and thus do not render the space three-dimensional. Her claim that abstract nouns may not occur with CLs (p. 85) does not reflect the reality.

(126)a. san ge jianyi
three CL suggestion
'one suggestion'

b. san zhong taidu
three CL attitude
'three kinds of attitute'

Third, it is claimed that "*furniture* is conceptualized as 2D," as massive as *honey* (p. 71), however, the former may be modified by a delimitive adjective (13b), whereas the latter may not, and thus they are fundamentally different.

2.6.6 Experimental perspective

The decomposition of countability into the two features, [Delimitable] and [Numerable], is supported by experimental evidence.

The contrastive values of [Delimitable] correlate with the contrast between mass and non-mass entities, a contrast independent of the notion of quantity or counting with numerals. The referents of nouns with [+Delimitable] are discrete individuals, which have non-arbitrary shape, size, or boundaries. Infant research has demonstrated that infants as young as 4 months use spatio-temporal information to identify discrete individuals (Spelke 1985). "There is also a developmental progression of the perceptual dimensions that infants use in object individuation: by 4.5 months infants use shape and size as the basis for object individuation; but it is not until 7.5 months that infants use pattern, and 11.5 months that they use color and luminance information to do so" (Xu 2007: 402).

The contrastive values of [Numerable] are related to the knowledge of the combination of numerals with counting units, in counting. Such knowledge seems to be developed much later. For instance, Brooks et al.'s (2010) research shows that pre-schoolers tend to count each broken part of an object and to make quantity judgments on the basis of broken parts (i.e.,

one fork broken into three pieces is ‘‘more’’ than two forks. It has also been observed that three-year-olds and young four-year-olds do not make use of container units to compare quantities of mass substances. When the two amounts of sand were very close in volume, although children were able to judge which side had ‘‘more glasses’’ when comparing three identical glasses full of sand with two other identical glasses full of sand, they scored at chance when they were asked to determine which side had ‘‘more sand’’ for the same visual display. It is reported that it is not until children are four years old or older that they are able to compare quantities in such a task successfully (see Li et al. 2010: 225). Similarly, the acquisition studies in Huang (2009) and Huang & Lee (2009) also report that children before two years old did not understand the meaning of numerals. For instance, when they were asked how many eyes their aunt had, they answered three (Lee 2012: Sec. 3.1).

The earliness of the development of the ability to identify discrete individuals and the lateness of the development of the ability of counting or quantifying indicate the separation of the two learning processes. One is related to the acquisition of [Delimitable], and the other is related to the acquisition of [Numerable].

Our more refined classification of nominals with respect to the two features is supported by the result of experimental research. In Barner & Snedeker (2005, 2006), based on an experimental study of both children and adults, the so-called mass nouns in English are divided into object-mass nouns (*furniture, jewelry*) and substance-mass nouns (*mustard, toothpaste*). They elicited quantity judgements for different types of nouns. Subjects were asked to compare scenes and answer “Who has more … e.g., *silverware* (object-mass noun), *shoes* (count noun), or *toothpaste* (mass noun)?” Each scene showed one large instance of the nominal referents, e.g., a large piece of silverware (e.g., a large fork), a large shoe, or a large glob of toothpaste, and one group of several small instances, that is, several small forks, shoes, or globs of toothpaste. Although the small instances were higher in number, the larger instances made up the bigger overall amount. Regardless of whether the subjects were children or adults, they chose the higher number of objects for both count nouns and object-mass nouns, but the larger overall amount for mass nouns. Thus, object-mass nouns show “number-based judgment,” patterning with count nouns, whereas the mass nouns show “quantity-based judgment”. Their classification correlates with our feature analysis, as shown in (127) (although their study does not cover nouns such as *belief*, which are [-Delimitable, +Numerable]). A parellel experimental study of Mandarin Chinese with a similar result is reported in Liu (2010), and a parellel experimental study of Japanese, also with a similar result, is reported in Inagaki & Barner (2009).

(127)	*shoes, candles*	*furniture, jewelry*	*mustard, toothpaste*
Barner & Snedeker (2005 2006)	Count nouns	object-mass noun	substance-mass noun
	Number-based judgment		Quantity-based judgment
Our analysis	[+Delimitable, +Numerable]	[+Delimitable, -Numerable]	[-Delimitable, -Numerable]

2.7. Reflections on the theories of CLs in numeral expressions

2.7.1 The syntactic foundations of the presence of CLs

The novel analysis of the count-mass contrast proposed in this book opens a new window to see the syntactic foundations of individual CLs in numeral expressions in CL languages.

Counting is possible in the presence of a unit. The unit tells us what counts as one in the context. The general function of a unit word in a numeral expression is to specify the unit for counting. Such a word is [+Numerable]. In Chinese, when a noun occurs with a CL, it is the CL rather than the noun that is the bearer of numerability.

Individual CLs are syntactically different from nouns. Thus the fact that numerability is

realized on CLs rather than nouns is a syntactic issue. The syntactic nature of the existence of individual CLs can be seen in another fact: the occurrence such CLs is sensitive to syntactic categories in English. Assuming that the word *times* in verbal numeral expressions such as (128a) is a CL (e.g., Landman 2004), we can see that in English verbal numeral expressions require the occurrence of CLs (Krifka 2007: 39), but nominal numeral expressions do not. There is no CL in the nominal numeral expression *three trips to Paris* in (128b), but the CL *times* is obligatory in the verbal numeral expression in (128a). Like nominals in Chinese, verbal phrases in English are not numerability bearers, and thus need CLs in counting. If we consider the representation of numerability in verbal phrases, English should be treated as a CL language.[20]

(128)a. Bill traveled to Paris three *(times). b. Bill made three trips to Paris.

This numerability-bearer analysis of CLs calls for a review of our current understanding of CLs in CL languages.

2.7.2 How special are the CLs of CL languages?

All seven types of unit words listed in 2.4.1 "are closely related in grammar and function" (Croft 1994: 152). Like measure words, CLs are also counting units or "unit counters" (Allan 1977: 293).

It has been widely believed that all nouns in CL languages are mass nouns, and therefore, the basic function of CLs is to divide mass into units (e.g., Thompson 1965; Greenberg 1972: 26; Link 1991; Senft 2000: 27; Grinevald 2000: 79, Krifka 2008: Sec. 6.3). For instance, Rijkhoff (2002: 162) claims that CLs exist because the properties that nouns in CL languages designate "are not characterized as having a boundary in the spatial dimension". Similary, Borer (2005: 101) claims that the main function of CLs "is that of dividing mass". Accordingly, the syntactic projection headed by a CL is called DivP. In the previous discussion, I have shown that CL languages can distinguish mass from non-mass nouns. As a consequence, the general function of CLs is not dividing or individuating.

Let us examine how the dividing assumption misrepresents the basic function of CLs. We have introduced five types of CLs in 2.4.1:

(129)a. san zhong yang [Kind CL]
three kind sheep
'three kinds of sheep'

b. san di shui [Individuating CL]
three CL water
'three drops of water'

c. san qun yang [Collective CL]
three CL sheep
'three flocks of sheep'

d. san pian xigua [Patitive CL]
three CL watermelon
'three slices of watermelon'

e. san ben shu [Individual CL]
three CL book
'three books'

[20] If we consider classification markers instead of numeral CLs, verbal classifiers are indeed not as widespread as nominal classifiers, as shown in Bisang (2011). Chinese, however, does have several verbal numeral classifiers, but not as many as nominal ones (see e.g., Zhang 2002).

From the translations of (129a), (129b), (129c) and (129d), we can see that English also has kind CLs such as *kind*, individuating CLs such as *di* 'drop', collective CLs such as *flock* and partitive CLs such as *slice*.

Among the five types of CLs, the individuating CL in (129b) indeed divides a massive object into units (also see the examples in (76)). Such CLs are also found in non-CL languages such as English, as seen in the word *drop* in the translation of (129b). Obviously, the availability of individuating CLs cannot distinguish CL languages from other languages.

What English does not have is individual CLs. There is no English counterpart for *ben* in (129e). It is this type of CLs that distinguishes CL languages from non-CL languages. In non-CL languages, generally speaking, individual CLs are not overtly represented by linguistic expressions. In such languages, it has been assumed (Quine 1969: 36) that the semantics of an individual CL is integrated either in the numeral (see Wilhelm *ibid.*: 55) or the noun (see Chierchia 1998; Rijkhoff 2002: 50) (see 5.6.3 for more discussion of these two approaches).

Crucially, individual CLs do not have the function of dividing or individuating. They do not occur with mass nouns. As pointed out by Bale & Barner (2012: Sec. 2.1), "default classifiers only specify that the noun can be counted, the method of individuation being determined by the content of the noun itself." The same idea is also seen in Wiese (2012: Sec. 4.2.2.4). Such CLs neither individuate anything nor create new units for the individuals any more, unlike collective or partitive CLs. Therefore, the popular belief that it is the individuating (discrete set-creating) function of CLs that is special in CL languages needs reconsideration.

A more accurate generalization is that in addition to the various ways of specifying a unit for counting, CLs in CL languages may also directly represent the natural unit of entities that show atomicity, whereas the CLs of other languages do not have this semantic function. In other words, CL languages have unit words to encode both intrinsic and provided units, whereas non-CL languages have units words for provided units only.

Based on the above discussion of the unified semantic property of all types of unit words in numeral expressions, i.e., to represent the unit for counting, I claim that if unit words project an independent functional projection, it should not be called DivP (Borer 2009). Instead, a label such as UnitP is more appropriate.

If the general function of CLs in numeral expressions is not dividing, we need to reconsider Borer's (2005) syntactic analysis of the count-mass contrast. In her analysis, the absence of dividing structure (DivP) derives "mass" reading, and the presence of dividing structure derives "count" reading. The two features proposed in this book calls for a richer structure to represent the count-mass contrast. This will be the topic of Chapter 5.

In Liao & Wang (2011), only two types of CLs are considered: individual and kind CLs. They (p. 148) thus claim that "the function of a classifier is to distinguish the ambiguous NP denotations by selecting a corresponding counting level (a KCL [= kind CL –NZ] selects a level which consists of kind terms, and an ICL [= individual CL –NZ] a level that consists of atomic individuals)." Considering the existance of collective, partitive, and individuating CLs, in addition to individual and kind CLs, we think Liao & Wang's claim does not capture the general function of CLs. In numeral expressions, the general function of CLs, like that of measure words, is simply to tell us what counts as one in counting, beyond distinguishing the denotations of NPs.

2.7.3 The sortal-mensural contrast and CLs that do not classify

Some scholars divide CLs into sortal CLs and mensual CLs. Tang (2005: 453) uses s(ortal)-feature to label the former. However, neither the definitions of the notions are clear

nor the classifications are consistent in the literature. This confusion affects our understang of the properties of CLs.

2.7.3.1 The inconsistency in the classification

According to Lyons (1977: 463), "A sortal classifier . . . individuates whatever it refers to in terms of the kind of entity it is", whereas "A mensural classifier . . . individuates in terms of quantity." Lyons (1977: 464) also mentions that CLs such as *kuai* 'chunk' can be both sortal and mensural. In this definition, both types of CLs individuate, and they are different only in the way of individuating. I have just claimed that not all CLs have the function of individuating, since not all nouns in Chinese are mass nouns.

In Aikhenvald (2006: 466), the two types are: "sortal classifiers, which just characterize a referent, and mensural classifiers, which contain information about how the referent is measured." This definition is vague in describing the alleged contrast. Does the assumed distinction mean that sortal CLs do not contain information about how the referent is measured? In fact, like measure words, CLs are also unit words, "[T]heir use is generally associated with the quantification of objects or nouns" (T'sou 1976: 1215; also see Paris 1981; Wiebusch 1995). If CLs are used for counting, their primary function is uniformally to tell us what counts as one in the context. Thus, all of them contain information about how the referent is measured. Accordingly, the so-called sortal CLs are not in contrast to the so-called mensural CL in this basic function. The alleged contrast has been cast doubt in the literature (see Aikhenvald & Dixon 2011: 410 fn. 18, and the literature cited there).

There seems to be no general agreement with respect to whether certain types of CLs are sortal or not, although individual CLs are generally treated as sortal ones. For Grinvald (2002: 261), only individual CLs are sortal ones and all other types of CLs are mensural. The same contrast is used in Li et al. (2008: Methods of Experiment 2), although they call sortal CLs count CLs.[21] In Rijkhoff (2002: 48), individual and collective CLs are sortal, but individuating CLs are mensural (he also has a general type, which does not belong to either sortal or mensual CLs). In Gerner & Bisang (2010), sortal CLs include individual and individuating CLs, whereas mensural CLs include collective CLs, and partitive CLs. In Li et al. (2012: 209, 217), individual, individuating and partitive CLs are sortal but collective CLs are mensural. The disagreement among the above mentioned publications is summarized in (130) (S = sortal CL; M = mensural CL):

(130)	Individual CL	Individuating CL	Partitive CL	Collective CL	Kind CL
Grinvald (2002: 261), Li et al. (2008)	S	M	M	M	
Rijkhoff (2002: 48)	S	M		S	
Gerner & Bisang (2010)	S	S	M	M	
Li et al. (2010: 209, 217)	S	S	S	M	

The alleged two types are usually defined by listing the subtypes, which themselves are described by examples, without any formal criterion. If the alleged division between sortal and mensural CLs is not formally defined, it is not surprising that the groupings are different for different scholars. Also note that in these works, it is not clear whether kind CLs are sortal or mensural.

[21] Hsieh (2008: 36) states that "If the partitioning involves natural singularities based on the inherent properties of the nouns, what is involved is a sortal classifier. If the divider imposes an arbitrary division, it is a massifier." Her definitions seems to separate individual CLs from other unit words, although she does not specifically discuss various types of other unit words.

2.7.3.2 The dual-functions of some CLs

In addtion to the primary function of CLs, i.e., to tell us the unit of counting, "[I]n some instances the size, shape, or function of the object referred to serves as a partial guide in determining which classifier should be used" (Haas 1942: 202). Thus some CLs may have semantic contents (Allan 1977: 285; Tai & Wang 1990). Consider the examples in (131). The first two pairs have individuating CLs and the rest three pairs have individual CLs. All of the CLs there both contain the information about how the referent is measured and, to a certain degree, also characterize the referent (the translations of the d- and e-pair in (131) come from Ōta 2003 [1958]: 151).

(131)a. yi dui {yan/tang}
one CL salt/sugar
'one pile of {salt/sugar}'

a'. yi kuai {yan/tang} [Individuating CL]
one CL salt/sugar
'one chunk of {salt/sugar (candy)}'

b. liang zhang zhi
two CL paper
'two sheets of paper'

b'. liang juan zhi
two CL paper
'two rolls of paper'

c. liang zhi hua
two CL flower
'two flowers on their stalks'

c'. liang duo hua [Individual CL]
two CL flower
'two flowers (not focusing on the stalks)'

d. san ben shu
three CL book
'three books (in regular shapes)'

d' san juan shu
three CL book
'three books (in the ancient roll form)'

e. san jia qiao
three CL bridge
'three frame-like bridges'

e' san zuo qiao
three CL bridge
'three hill-like stone bridges'

Moreover, different individual CLs for a noun with the same denotation may be contrastive in the different foci of the perspectives of the same entity (Her 2011), as seen in (132) below.

(132)a. liang mian qiang
two CL wall
'two walls (2-dimension perspective)'

a'. liang du qiang
two CL wall
'two walls (3-dimension perspective)'

b. san tiao yu
three CL fish
'three fish (focusing on body shape)'

b'. san wei yu
three CL fish
'three fish (focusing on the tails)'

Thus, even if the two functions, sorting and measuring, are available to some CLs, they are not exclusive each other. The possible sorting function never occurs independently of the measuring function.

2.7.3.3 The absence of the sorting function in some individual CLs

Collective, partitive, and kind CLs generally do not classify the semantic types of the associated nouns. It is not surprising that they are not generally treated as sortal ones (see (130)). So in this section, we discuss individual CLs only, which have been regarded as sortal CLs, consistently.

However, first, many individual CLs do not classify the semantic types of the associated nouns in all constructions. "In a number of other instances, however, the choice of classifier is entirely arbitrary." (Haas 1942: 203) For instance, the two uses of the individual CL *zhang*

in (133a) and (133b) do not exhibit semantic similarity (also see Myers 2000: 193; H. Zhang 2007).

(133)a. san zhang zui
three CL mouth
'three mouths'

b. san zhang chuang
three CL bed
'three beds'

This kind of variation is seen not only in the same language, but also cross-linguistically. The word *head* in (134a) is used as a CL for *cattle* in English, but its counterpart in German, *Kopt*, is not used as a CL for *Vieh* 'cattle'. Instead, it is used for *Salad* 'lettuce', and the CL for *Vieh* is *Stück* 'piece', as seen in (134b) and (134c) (Wiese 2012: Sec. 4.2.2.4).

(134)a. four head of cattle

b. vier Kopf Salad
four head lettuce
'four heads of lettuce'

c. vier Stück Vieh
four piece cattle
'four head of cattle'

[German]

Second, the same noun may occur with different individual CLs. For example, *mousha-an* 'murder-case' can be counted by the CLs *zong, qi, jian, chu, zhuang*, and *chang*, but *qiangdao-an* 'robbery-case' can be counted by the same set of CLs except the last two (*zhuang* and *chang*) (Ansel Liu p.c., Feb. 24, 2012). More such examples can be found in H. Zhang (2007: 53) (The arbitrariness of the selection of CLs is also seen later in examples in (238) and (239)).

Third, the most frequently used individual CL is the default one *ge*, which obviously do not classify the semantic types of nouns (Myers 2000, among others) (see our 2.4.1.4; see 2.7.5 for further discussion). However, no one treats *ge* as a mensural CL. If CLs are disjunctively either sortal or mensural, the status of *ge* is not clear. If the most frequently used CL has no place in a theory of CLs, the theory does not seem to be convinsing.

The existance of general or default CLs is also found in Persian. Like Mandarin Chinese, "numerals must be accompanied by a classifier even if the nominal is a count noun" (Ghomeshi 2003: 55). In this language, the CL *ta* may occur with a noun of any type. Since this CL does not classify semantic types of nouns and may occur with mass nouns, Cowper & Hall (2012: Sec. 7.1) claim that it is not a CL. In our opinion, it simply shows the basic properties of CLs, i.e., a counting unit. In (135a) and (135b), it occurs with a non-mass noun, and thus functions as an individual CL; and in (135c) and (135d), it occurs with a mass noun, and thus funcitons as an individuating CL (or introduces the effect of Universal Packager). The examples in (136) show that in this language, non-general CLs also exist (Cowper & Hall *ibid*.: Sec. 7.3; all of the examples in (135) and (136) are cited from Ghomeshi *ibid*. and Cowper & Hall *ibid*.).

(135)a. se-ta ketab
three-CL book
'three books'

b. do-ta deræt
two-CL tree
'two trees'

[Persian]

c. se-ta næmæk
three-CL salt
'three salts'

d. se-ta čai
three-CL tea
'three teas'

(136)a. se næfær kargær
three CL^{person} worker
'three workers'

b. se jeld ketab
three CL^{volume} book
'three books'

2.7.3.4 The source of the non-systematic sorting functions of some CLs

All CLs are the result of the grammaticalization of substantive categories such as nouns or verbs (e.g., Li 1924; Loke 1997). Chinese CLs started to grow in about 1324-1066 BC (Huang 1964: 441; Liu 1965: Ch. 1; see Loke 1997: 1). According to Ōta (1958 [2003: 149]), this historical process can be divided into five stages (also see Huang 1964: 440, Peyraube 1998, among others): (A) a noun functions as a unit word, and the former was a reduplicant of the latter, as in (137a). The unit word is also called 'echo-classifier'. In this case, one can assume that there was a total sharing of the semantic features between the two words. (B) a noun functions as a unit word, and the two nouns are different, as in (137b). In this case, the two nouns must be semantically compatible, and thus there was a partial sharing of the semantic features between them. In (137b), both *luan-chen* 'rebellious official' and *ren* 'person' are human being. (C) the unit word was not a noun any more, but it had been developed from a noun that had a meaning similar to that of the co-occurring noun. Therefore, the unit word was specific for the particular type of the noun. In (137c), the CL *liang* had been developed from the noun *liang* 'carridge'. As a CL, *liang* started to function as a unit word for any ground transportation veicles, but not for anything else. In this case, we can assume that there was a partial sharing of the semantic features between the unit word and the noun. (D) everything is the same as in stage C, except that the word order has been changed: the noun follows the CL, as in (137d). (E) the unit word has no semantic sharing with the noun, as the general CL *ge* in (137e).

(137)a. ren shi ren
person ten person
'ten persons'

b. luan-chen shi ren
choas-official ten person
'ten rebellious officials'

c. che shi liang
carridge ten CL
'ten carridges'

d. shi liang che
ten CL carridge
'ten carridges'

e. shi ge ren
ten CL person
'ten persons'

Synchronicaly, all five patterns are seen in many modern languages (Aikhenvald 2003; Peyraube 1998). In Modern Mandarin, only the last two patterns remain. The examples in (131) and (132) belong to pattern D and the examples in (133) belong to pattern E.

Since the CLs of pattern D share certain semantic features with the noun (e.g, shape, function), they seem to represent the semantic features of the noun. Consequently, they seem to sort or classify the semantic types of the noun. Therefore, they look less abstract than the CLs of pattern E. The more semantic features are shared between the CL and the noun, the less likely the CL may be replaced by *ge* (Ahrens 1994; Myers 2000). The degree of the abstractness depends on the degree of grammaticalization. As pointed out by Greenberg (1972: 15), a study of the semantic classification of a CL on the associate noun "becomes valuable in considering further stages of dynamic development". In modern Mandarin, the correlation of the CL with the noun in pattern D is not systematic, and thus becomes co-occurrence restrictions (see 4.2.4). It is also not surprising that the correlation is not easy for children to learn (Li et al. 2008) (see 2.7.5 for a discussion of the issue from the expirimental perspective).

We thus conclude that synchronically, the general and basic function of CLs in Mandarin Chinese is not sorting the semantic types of nouns.

2.7.3.5 CL languages without sortal CLs

If the basic function of CLs in a numeral expression is not sorting, we expect to see the existence of languages in which CLs do not classify nominals at all. Indeed, Niuean (Massam 2009) and many Oceanic languages (Mathew Dryer, p.c. July 2008) are such languages. In

these languages, every non-mass noun is in construal with the same CL when it combines with a numeral or quantifier. In the following Niuean examples (Massam 2009: 679), the CL *e* occurs with various types of nouns. This CL has no sorting function at all.

(138)a. (e) ua e kuli
ABS.C two CL dog
'two dogs'

b. tokolima e tagata loloa
PERS-five CL person tall
'five tall people'

c. (e) loga e fua loku
ABS.C many CL fruit papaya
'many papayas'

d. tokologa e Niue
PERS-many CL Niue
'many Niueans'

Thus, on the one hand, numeral CLs do not have to classify nominals; on the other hand, the CLs found in Bantu languages (e.g., Aikhenvald 2003) or the CLs that are incorporated into verbal expressions in sign languages (e.g., Sandler & Lillo-Martin 2006) do classify nominals (or arguments), but they do not have to occur with a numeral or quantifier, and are thus not unit words. It might be more appropriate to call all CLs in numeral expressions mensural CLs and the CLs in Bantu languages sortal ones.

2.7.4 The unreliability of the *de* and pre-CL adjective arguments

In this section, I argue against the assumed correlation between the count-mass contrast and two phenomena in Mandarin Chinese: the occurrence of an adjective to the left of a unit word and the occurrence of the functional element *de* to the right of a unit word (Cheng & Sybesma 1998, 1999).

I have argued that in Chinese, neither nouns nor CLs make a distinction between count and non-count ones themselves, since all nouns are non-count elements (2.3.1) and all CLs are count elements (2.4.2). But the value of [Delimitable] may determine whether a noun is a mass one or non-mass one. Individual, collective, and partitive CLs occur with non-mass nouns and individuating CLs occur with mass nouns (other unit words, i.e., kind CLs, standard and container measures, occur with either mass or non-mass nouns).

Cheng & Sybesma (1998, 1999) try to make a distinction between count CLs and mass CLs (called massifiers) (also see Cheng 2012). The names are used to show that in Chinese, the contrast between count and mass nouns can be distinguished at the level of CLs, if not at the level of nouns. Their count CLs are equivalent to individual CLs and all other kinds of unit words are mass CLs. They formalize the following two criteria.

Criterion A. A pre-CL adjective may occur with a mass noun, as seen in (139a), but not with a "count" noun, as seen in (139b) (Cheng & Sybesma 1998: 390, 1999: 516; also Wang 1994: 30). The term count noun in their analysis is called non-mass and non-count noun in this book.

(139)a. yi da zhang zhi
one big CL paper
'one big piece of paper'

b. *yi da wei laoshi
one big CL teacher

c. yi da tiao hao-han
one big CL good-guy
'one big good guy'

d. san da zhi laohu
three big CL tiger
'three big tigers'

e. san chang tiao xianglian
three long CL necklace
'three long necklaces'

It is true that (139b) is not acceptable. But isolated cases like this do not affect the observation that other examples of the same type are acceptable, as shown in (139c, d, e) (see Cheng & Sybesma 1998: 390 fn. 4 for their acknowledgement of counter-examples). Tang (2005), Hsieh (2008), Liu (2010), and X. P. Li (2011: 34), among others, all present lots of

counter-examples to this claim about pre-CL adjectives. A lot more examples can be found in Zhu (1982: 52), Lu (1987), Luo (1988), and Yang (2005: 33) (Examples of various types of CLs with adjectives have been seen in 2.4.3 above). Therefore, the adjective criterion is empirically problematic.

Criterion B. *De* may occur between a measure word and a mass noun, but not between a CL and a "count" noun (Chao 1968: 555, 588; T'sou 1976; Paris 1981: 32; Zhu 1982: 51; Cheng & Sybesma 1998: 388, 1999: 515). A typical pair of examples is (140):

(140)a. san wan de tang
three bowl DE soup
'three bowls of soup'

b. *san ge de laoshi
three CL DE teacher
'three teachers'

Again, the unacceptability of (140b) is one of few isolated cases. In fact, all types of CLs can be followed by *de* in an appropriate context, as shown in (141a). (141b) (X. P. Li 2011: 40) and (141c) (mentioned by James Huang in his talk at National Tsing Hua University, Hsinchu, on July 9, 2010) further show that *de* may follow the individual CLs *li* and *tiao*, respectively.

(141)a. Shufen chi-le yi-bai {ge/gongjin/bao/pian/dui/zhong} de pingguo.
Shufen eat-PRF one-hundred CL/kilo/bag/slice/pile/kind DE apple
'Shufen ate 100 apples or 100 {kilos/bags/slices/piles/kinds} of apples.'

b. Shufen chi-le san-fen-zhi-yi li de ganmao-yao.
Shufen eat-PRF one-third CL DE cold-pill
'Shufen took one third of a cold pill.'

c. Yi liang tiao de maojin ni zong mai-de-qi ba!
one two CL DE towel you after.all buy-can PRT
'You should be able to afford to buy one or two towels!'

The context for *de* to show up has nothing to do with the count-mass contrast. Instead, it has to do with the syntactic position of *de*. In Chapter 3, I will spell out my analysis. Shortly speaking, there are two sources of *de*: one introduces a constituent directly and the other surfaces in a comparative ellipsis construction. Constructions of individual, individuating, and kind CL host the latter *de* only, whereas those of the other types of unit words (partitive and collective CLs, standard and container measures) host *de* of either source. Note that the division here does not match with Cheng & Sybesma's distinction between count and mass CLs. If one just considers the phonological form of *de* without considering its structural position, then, *de* may occur with all types of CLs or unit words, as seen in (141).[22]

Therefore, Cheng & Sybesma's (1998, 1999) claim that one type of CLs (the "count" type) may not be modified by an adjective, and may not be followed by *de*, whereas the other type (the "mass" type) can, is descriptively inadequate.

As mentioned above, several works, including Tang (2005: 432, 440-446), Hsieh (2008: 34), X. P. Li (2011), Liu (2010), etc. have already presented a lot of counter-examples to falsify the alleged distinction. Wu & Bodomo (2009: 489) point out that the two alleged types of CLs can occur with the same NP (See also Borer 2005: 98), as shown in (142). *Ben* in (142a) and *li* in (142b) are Cheng & Sybesma's count CLs, and *xiang* in (142a') and *wan* in (142b') are their mass CLs.

[22] Hsieh (2008: 39) mentions that *de* may follow an individual CL if the quantity expressed by the numeral is either approximate or emphasized. She did not show the case in which the encoded quantity is estimated but not emphasized. Late in 3.5.2, I show that the quantity emphasis condition is the only condition.

(142) a. san ben shu
three CL book
'three books'

a'. san xiang shu
three box book
'three boxes of books'

b. san li mi
three CL rice
'three grains of rice'

b'. san wan mi
three bowl rice
'three bowls of rice'

Examples like (143) (see Her & Hsieh 2010: 541) show that the two alleged constraints on the assumed count CLs (i.e., individual CLs) can even be violated at the same time. The CLs *ke* in (143a) and *tiao* in (143b) are typical individual CLs, but they are both preceded by a modifier and followed by *de*.

(143) a. san da ke de gaolicai
three big CL DE cabbage
'three big cabbage'

b. san da tiao de yu
three big CL DE fish
'three big fish'

In conclusion, the alleged two criteria cannot make any distinction in CLs in Chinese, regardless of whether the assumed distinction correlates with the count-mass contrast.

2.7.5 Experimental perspective

We have claimed that the special function of CLs in CL languages is not dividing. On the contrary, it is the existance of individual CLs, which do not divide, that separete CL languges from non-CL languages (2.7.2). Thus, the traditional hypothesis that all nouns in CL languages are mass nouns is wrong.

The hypothesis that all nouns in CL languages are mass nouns has gone so far to lead people to believe that speakers of CL languages think differently about objects and stuff in the world from speakers of non-CL languages (a Whorfian effect), and some experimental studies such as Lucy (1992) have tried to prove the belief. However, recent studies such as Sandhofer et al. (2000), Colunga & Smith (2005), Barner et al. (2009), Li et al. (2009a, b) have not only reached a different interpretation from Lucy-type of experiments, but also got new experiment results that do not support the Whorfian idea. The new research of both children and adults "presented evidence that speakers of Japanese, English, and Mandarin Chinese do not perceive objects differently" (Barner et al. 2009: 331).

We have also claimed that the basic function of CLs is not to classify, but to encode counting units (2.7.3). The separation of the general function from other functions of CLs is also attested in acquisition research, such as Fang (1985), Erbaugh (1986), Miao & Zhu (1992), Hu (1993), Myers & Tasy (2000), Chien et al. (2003), Huang (2009), and Li et al. (2010), from both production and comprehension perspectives. Chien et al. (*ibid.* p. 96) state that "Different studies have shown different results regarding the order of classifier acquisition, but they all pointed to the conclusion that children first acquire the general classifier *ge* and use it as a "syntactic place-holder", and they report (p. 113) that "supporting the well-established finding from earlier production studies that young children predominately use the general classifier *ge* for almost any noun, we found that hearing the general classifier *ge* did not make young children search for a particular referent." Li et al. (2010: 224) report a similar result. One can see that the counting unit function of CLs is primary, and the sorting function for some CLs is secondary. The primary funciton is acquired earlier than the secondary one. As expected, nonnative adult learners of Mandarin also overuse *ge* (Polio 1994). Moreover, aphasia studies also indicate that brain damage patients neutralize CLs to *ge* more often than normals (Tzeng, Chen and Hung 1991). As pointed by Myers (2000: 204), the finding of the aphasia study "is consistent with our claim

that *ge* is chosen by default when memory-access problems prevent accessing the exemplars that guide the selection of specific classifiers."

2.8. Chapter summary

In this chapter, I have argued for a more refined syntactic analysis of the count-mass contrast. I list my main conclusions as follows:

A. The count-mass contrast of linguistic elements is decomposed into two features: [Numerable] and [Delimitable]. [+Numerable] means a noun can combine with a numeral directly, and thus it is a count noun. [-Numerable] nouns are non-count nouns. No noun in Chinese is a count noun. [+Delimitable] means a noun can combine with a shape, size, or boundary modifier, and thus it is a non-mass noun. A mass noun is defined by both [-Numerable] and [-Delimitable]. Not all nouns in Chinese are mass nouns.

B. Some CLs occur with mass nouns and some with non-mass nouns. Like other types of unit words, all CLs specify units and tell us what counts as one in counting. Individual CLs occur with non-mass nouns, and their semantic function is to represent the natural units of the elements denoted by non-mass nouns. Such CLs have no dividing function at all. It is the existance of this type of CLs that separates CL languages from other languages.

C. The feature [+Numerable] may be distributed in different types of elements cross-linguistically and within the same language. In Mandarin Chinese, except in idiomatic expressions and compounds, nouns do not have this feature, whereas unit words do. In languages such as English, the feature is found in both count nouns and unit words such as measure words.

D. Like in English, quantifiers in Chinese also show co-occurrence restrictions with respect to numerability. Since only unit words are [+Numerable] in the language, if a quantifier occurs with [+Numerable], it must occur with a unit word.

E. Numerability is different from the notion number, although they interact in various ways cross-linguistically.

Chapter 3 Classifiers and Plurality

3.1. Introduction

3.1.1 The independent status of number

Like the linguistic notions such as gender and person, number has its independent status. In Chapter 2, we have decomposed countability into two features, numerability and delimitability, and also addressed the issue that numerability is different from plural number. In this chapter, we explore the grammatical property of plurality and its representations in the CL language Mandarin Chinese. CL languages have been generally claimed to have no productive morphological form for plurality, however, the fact reported in this chapter will falsifiy this claim.

The linguistic notion number encodes the contrast between singularity and plurality (including dual and paucal plurality in some languages).[23] Plurality is underspecified with the exact quantity, and thus it has no semantic dependency with numerals. Whether a plural form is compatible with a numeral is up to the pure formal properties of the relevant functional categories in the language, i.e., whether the plural marker has [+Numerable]. In this chapter we will show that plurality is compatible with numerals in languages such as English (e.g., *three apples*), but not in many languages including Mandarin Chinese.

We are going to answer two basic questions in this chapter:

How does Chinese, a CL language, encode the number contrast?

Why are the number markers optional in the language?

It is well-recognized that personal pronouns in the language have the plural marker *–men*, which is obligatory in use.

(144)

	singular	plural
1st person	wo	wo-men
2nd person	ni	ni-men
3rd person	ta	ta-men

A less mentioned fact is that kinship terms in the language also have the same obligatory plural marker:

(145)a. Yani kanjian-le gugu.
Yani see-PRF aunt
'Yani saw her aunt.'
Not: 'Yani saw her aunts.'

b. Yani kanjian-le gugu-men.
Yani see-PRF aunt-PL
'Yani saw her aunts.'
Not: 'Yani saw her aunt.'

As for other types of nominals of the language, it has been generally assumed that there is no plural marker. The most frequently discussed plural-encoding forms are *xie* 'some' (e.g., Iljic 1994) and *–men* (e.g., Li & Thompson 1989: 40, 83; Iljic 1994, 2001; Li 1999; Rijkhoff 2002: 154). However, *xie* can occur with a mass noun (e.g., *na xie shui* 'that amount of water'), and thus it does not express a contrast to any sense of singularity. The suffix *–men*, although obligatory for pronouns and kinship terms, is restricted to common nouns that are both definite and human-denoting, and thus it is not a productive number marker.[24] Indeed, if we consider *xie* and *–men* only, we cannot conclude that there is a

[23] See Corbett (2000: Ch. 7) for other uses of plural forms cross-linguistically, including honorific and exaggerative uses. Other formative forms, including CLs, may also have special or extended uses beyond their basic use (e.g., Bisang 1999; Zhang 2012b).

[24] Historically, the plural marker *-men* could also occur with non-human nouns such as *ma* 'horse' (Ōta 2003

systematic number contrast in the language.

However, we will argue that the language does have a productive formal way to encode plurality, an understanding that has not been reached so far, although the relevant facts have been recognized. Productivity here means that a certain formal strategy can be implemented recursively to encode a certain formal contrast consistently. If productivity counts as an effective criterion for attesting a certain property (i.e., feature), the investigation of this chapter will lead to the conclusion that Mandarin Chinese has the property of number.

In 3.1.2 and 3.1.3, we introduce notions of general number and abundant plural. Both will be identified in the number system of Mandarin Chinese. Then in 3.2 and 3.3, we discuss the plurality and singularity markers in the language, respectively. 3.4 is about the correlations between morphological and semantic markedness of number marking, and 3.5 is a theoretical discussion of the issue on number in CL languages. 3.6 concludes the chapter.

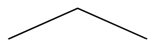
3.1.2 General number and the optionality of number marking

According to Corbett (2000), nominals that are not specified with either singular or plural express the so-called general number. For instance, in the Fouta Jalon dialect of Fula (in Guinea), we find a three-way system of number (Corbett 2000: 12):

(146)	*general*	*singular*	*plural*	[Fula]
a.	toti ‘toad(s)’	totii-ru ‘toad’	totii-ji ‘toads’	
b.	nyaari ‘cat(s)’	nyaarii-ru ‘cat’	nyaarii-ji ‘cats’	
c.	boofo ‘egg(s)’	woofoo-nde ‘egg’	boofoo-de ‘eggs’	
d.	biini ‘bottle(s)’	biinii-ri ‘bottle’	biinii-ji ‘bottles’	

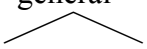
Thus, cross-linguistically, the contrast between singular number and plural number can be represented differently. As clearly discussed in Corbett (2000: 9-19), languages such as English do not have general number, and therefore, there is a binary contrast: singular vs. plural, as shown in (147a). In languages such as Fula, plurality is not only in contrast to singularity, but also in contrast to the general number, a ternary contrast. The ternary contrast does not affect the formal status of number feature in the language.

(147) a.



(Corbett 2000: 19, Figure 2.4)

b.



(Corbett 2000: 11, Figure 2.1)

Many CL languages use bare nouns to express general number. So does Mandarin Chinese (Rullmann & You 2006). In this language, a bare noun can denote either singular unit or plural units, depending on the context. Some possible interpretations of the bare noun *xigua* ‘watermelon’ are listed in (148a), and similarly, some possible interpretations of the bare noun *shui* ‘water’ are listed in (148b).

(148)a. Zhuo-shang you xigua.
table-on have watermelon
‘There is a watermelon on the table,’
‘There are watermelons on the table.’
‘There is a slice of watermelon on the table.’
‘There are slices of watermelon on the table.’

b. Zhuo-shang you shui.
table-on have water
‘There is a drop of water on the table,’
‘There are drops of water on the table,’
‘There is a cup of water on the table,’
‘There are cups of water on the table,’

[1958]: 316).

‘There is a pile of watermelon on the table.’ ‘There is a liter of water on the table,’
‘There are piles of watermelon on the table.’ ‘There are liters of water on the table,’

It has been generally assumed that elements that encode plurality but are optional are not real plural markers (e.g., Acquaviva 2008; see also the comment mentioned in Danon 2011: 300 fn. 3). In Rijkhoff (2002: 155), the apparent number markers in CL languages are analyzed as nominal aspect markers, rather than number markers, although he acknowledges that the boundary between the two is not sharp. In Wiltschoko (2009) (also see Cowper & Hall 2012), optional plural-denoting elements are analyzed as adjuncts of certain element such as NP, n, or nominal root, whereas obligatory ones are analyzed as head elements of an independent functional projection (NumP).

However, if we consider the issue of optionality only, we find that not all well-recognized grammatical category markers are always obligatorily realized as overt morphological forms. The complementizer *that* in English is optional in some contexts, as shown in (149a), although the independent projection of CP is well-established. The same optionality is seen with the complementizer *te* in Japanese (Travis & Lamontagne 1992: 159; Sato 2010). The accusative case marker *o* in Japanese is also optional in some contexts, as shown in (149b), although the marker is not a nominal adjunct. The same optionality is seen with the accusative marker *yi* in Turkish (Travis & Lamontagne *ibid*.: 158). Similarly, AspP headed by aspect markers is also well-recognized in Mandarin Chinese, although the use of aspect markers is not always obligatory, as shown in (150).

(149)a. John believes (that) Mary will win.
b. John-ga dare-(o) nagutta no? [Japanese]
John-NOM who-ACC hit Q
‘Who did John hit?’

(150)a. Yani yijing yishidao (-le) wenti de yanzhongxing.
Yani already realize-PRF issue DE seriousness
‘Yani has realized the seriousness of the issue.’
b. Yani zao-jiu zhidao (-le) Jianmin hui lai.
Yani early-then know-PRF Jianmin will come
‘Yani knew long ago that Jianmin would come.’

The above comment, of course, does not explain the optionality of plural markers in some languages. Such an optionality occurs in all languages in which general number is available, such as Persian, Korean (Kim 2005), and Indonesian (Dalrymple & Mofu, to appear) (the Persian examples below are cited from Cowper & Hall 2012: Sec. 7.2).

(151)a. Muš tuye zirzæmin hæst. [Persian]
mouse in basement is
‘There are mice/there’s a mouse in the basement.’
b. Muš-ha tuye zirzæmin hæst-ænd.
mouse-PL in basement be-PL
‘The mice are in the basement.’

If the general number is available in a language, plural marking cannot be obligatory. In such a language, although plurality is in contrast to singularity, however, “the distinction is made ‘when it matters’ and not automatically, as in languages like English” (Corbett 2000: 14). This means that in such a language, only when the meaning of plurality is salient in the context, a plural marker occurs. As a consequence, the use of a plural marker is not

obligatory. Corbett (2000: 2) states that "If number forms are available, then surely they must be used? This is an Anglo-centric assumption and is quite false." The number markers in Mandarin Chinese, to be presented in this chapter, have consistent forms and consistent meanings, occurring with all types of nouns, even though they are optional.[25]

In some languages plural markers are not compatible with numerals, for no semantic reason. We will show that along with languages such as Hungarian and Turkish, Mandarin Chinese also exhibits the incompatibility between plural markers and numerals, for no semantic reason (3.2.5). If plural markers were adjuncts, they would not be rejected in the structure-building, without a semantic reason. Plural markers in such languages thus do not behave like adjuncts.

3.1.3 Abundant plural

There are different types of plurals. Not only paucal plural, which encode small quantity of plurality, but also anti-paucal plural. The latter is called abundant plural. This type of plural denotes many instances of x (Corbett 2000: 87).[26]

Abundant plural is found in both material mass nouns and count nouns. For material mass nouns, abundant plural encodes abundant units of the mass. Recall the mass plural examples in (52), repeated here as (152a) (2.2.6). As clearly stated in Mathieu (2012: Sec. 10.3.3), mass plurals "appear neither dividing nor counting. Rather, they appear to denote abundance." Such plural forms are used "when the exact number is impossible to pinpoint or when it is irrelevant" (Mathieu 2012: Sec. 10.3.3). Examples of abundant plural of mass nouns have been reported in unrelated languages, including English (152a), French, Hebrew, and Biblical English (see Mathieu 2012: Sec. 10.3.3 for examples and references). The modern Greek example in (152b) is from Alexiadou (2011: 36) (for more Greek examples and an extensive discussion, see Tsoulas 2006), and the Niuean example in (152c) is from Massam (2009: 682 fn. 20; C = common). In St'át'imcets (Davis & Matthewson 1999: 61) and Ojibwe (Mathieu 2012: Sec. 10.3.1), mass nouns are pluralized freely, to express the abundant meaning. In Persian (Ghaniabadi 2012), mass nouns can also be pluralized to express "a large amount of whatever the noun denotes" (Cowper & Hall 2012: Sec. 7.2). Wiltschko (2012: Sec. 9.2.2) also reports that mass nouns in Blackfoot and Halkomelem may have plural markers to express this "abundant" meaning.

(152)a. the (*three) waters of the Nile

[25] If we consider personal pronouns, kinship terms, and nouns that denote one-to-one natural pairs such as married couples, the pair of a master and his apprentice, Chinese seems to have even a dual suffix, i.e., *-lia*, as shown by (ia) through (id). (ie) is not acceptable, probably because one teacher usually has more than one student, and thus the default relation between teachers and students is not one-to-one. The same constraint applies to (if). Lü et al. (1999 [1980]: 366) claim that *–lia* is a short form of *liang ge* 'two CL', which might function as an appositive, to the right of a compound. However, this claim does not explain the unacceptability of (ie) - (ih). According to the Animacy Hierarchy of number marking (Corbett 2000: 56), personal pronouns and kinship terms are more likely to have number markers than other nominals. The restrictive application of dual marking here seems to follow the hierarchy. Note that in the presence of general number, this dual number is also optional.

(i) a. ta-lia
3-DUAL
'they two'

b. xiong-di-lia
elder.brother-younger.brother-DUAL
'two brothers'

c. fu-qi-lia
husband-wife-DUAL
'husband-wife couple'

d. shi-tu-lia
master-apprentice-DUAL
'master and apprentice'

e. *shi-sheng-lia
teacher-student-DUAL

f. *guan-bing-lia
officer-soldier-DUAL

g. *yuan-yang-lia
mandary.duck.male-female-DUAL

h. *ri-yue-lia
sun-moon-DUAL

[26] Abundant plural is different from exaggerative plural, since the latter may have just two elements involved (Corbett 2000: 234-235, esp. his example (26)).

b. {hithikan nera /hithike nero} sto patoma. [Modern Greek]
dripped water.PL/dripped water on the floor
'A lot of water dripped on the floor.'

c. e tau vai [Niuean]
ABS.C PL water

Note that when Mandarin *xie* 'some' occurs with a mass noun, it is not an abundant plural marker, since the *na xie shui* 'that XIE water' may denote any amount of water, including a very tiny amount.

For non-mass nouns, abundant plural can be seen in two forms in English. It can be found in a bare plural unit word followed by *of*, as in (153).

(153)a. After years of hard work, ... (*=> two years)
b. There are tons of potatoes. (*=> two tons)
c. There are bottles of wine. (*=> two bottles)

Abundant plurality can also be expressed by reduplication of bare nouns, with a preposition such as *after, by*, *upon,* as in (154) (Pi 1995, cited by Travis 2001) (only *upon* allows the noun to be in plural form). Also, as shown in (155), "different size domains can be reduplicated" (Travis 2001: 458).[27]

(154)a. Student after student visited the professor on Monday.
b. Gertrude watched program after program all afternoon.
c. Jon washed plate after plate for hours after the party.
d. Eric can drink mug upon mug of coffee in a single hour.
e. The careful artist completed the mosaic tile by tile.
f. In fairy tale after fairy tale, good triumphs over evil.
g. Bags upon bags of marshmallows were stolen this week.

(155)a. cup after cup of coffee
b. cup of coffee after cup of coffee
c. cup after steaming cup of coffee
d. steaming cup after steaming cup of coffee
e. steaming cup of coffee after steaming cup of coffee

3.2. Unit plurality

3.2.1 RUWNs as unit plurality-denoting nominals

In many languages, noun reduplication can express plurality (Rijkhoff 2002: 152). In Mandarin Chinese, however, it is the reduplication of unit words that expresses plurality systematically, as seen in (156) (Song 1980; Li & Thompson 1981: 34; Guo 1999; Yang 2005; Paris 2007; Hsieh 2008: 66).[28]

[27] Reduplication is not iconic. See Travis (1999) for arguments against iconic approach to reduplication.

[28] Reduplicate unit words, when they are not followed by a noun, can function as a subject, as in (ia), or an adverbial, as in (ib) (Song 1978; Guo 1999). We do not discuss such constructions.

(i) a. Zhiyu naxie haizi, ge-ge dou hui Fawen.
as.for DEM kid CL-RED all know French
'As for those kids, they all know French.'

b. Ta e-shang de qingjin tiao-tiao zhan-chu
3SG forehead-on DE blue-vein CL-RED show-out
'The veins on his forehead became visible one after another.'

(156)a. He-li piao-zhe (yi) duo-duo lianhua.
river-in float-PRG one CL-RED lotus
'There are lotuses floating on the river.'
b. Di-shang you yi dui-dui lianhuan.
ground-on have one CL-RED lotus
'There are piles of lotuses on the ground.'

I will call the nominals containing a reduplicate unit word, like the underlined parts in (156), Reduplicate Unit Word Nominals (RUWNs).

Unlike bare nouns in the language, RUWNs never allow a singular reading. Therefore, the reduplicate unit word in such a nominal can be identified as a plural marker. Accordingly, the word *yi* 'one' in the nominal is not a numeral (this *yi* will be discussed in 3.2.6).

Reduplicate unit words denote plurality of units, rather than plurality of individuals. In (156a), the individual CL *duo* is reduplicated, and thus the plurality of the lotus units overlaps with the plurality of lotus individuals. In (156b), the collective CL *dui* 'pile' is reduplicated, and thus it is the plurality of the unit pile that is expressed.

The plurality type expressed by a reduplicate unit word is abundant plurality. (156a) may not be accepted if there are only two or three lotuses in the river. Similarly, (156b) may not be accepted if there are only two or three piles of lotuses on the ground.

The combination of the above two properties, unit plurality and abundant plurality, is also found in the English examples in (153).

3.2.2 The productivity

All types of mono-syllabic unit words can be reduplicated to express plurality of units in Mandarin Chinese.

(157)a. Mingtian qiang-shang hui gua-zhe (yi) zhan-zhan ming deng. [Individual CL]
tomorrow wall-on will hang-PRG one CL-RED bright light
'There will be bright lights hung on the wall tomorrow.'
b. Yani bei-shang lu-chu (yi) tiao-tiao shang-ba. [Individuating CL]
Yani back-on show-out one CL-RED wound-scar
'There are scars on Yani's back.'
c. Yaunzi-li dui-zhe yi dui-dui xinjian. [Collective CL]
yard-in pile-PRG one CL-RED letter
'In the yard, there are piles of letters.'
d. Panzi-li li-zhe yi pian-pian xigua. [Partitive CL]
plate-in stand-PRG one CL-RED watermelon
'In the plate, there stood slices of watermelon.'
e. Yani ba yi jin-jin rensen cheng-le-you-cheng. [Standard measure]
Yani BA one jin-RED ginseng weigh-PRF-again-weigh
'Yani weighed the jins of ginseng again and again.'
f. Zhuo-shang fang-zhe yi ping-ping yao-shui. [Container measure]
table-on put-PRG one bottle-RED medicine-liquid
'There are bottles of medicine-liquid on the table.'
g. Yani jingli-guo zhong-zhong monan. [Kind CL]
Yani experience-EXP kind-RED hardship
'Yani has experienced various kinds of hardship.'

In addition to the above non-initial positions, RUWNs can also occur at the

left-peripheral position of a clause, as seen in (158) (for more examples see Liu 1980: 10; H. Yang 2005: 63; Hsieh 2008: 3):

(158)a. Ge-ge xuesheng dou you ziji de wangye. [Individual CL]
CL-RED student all have self DE webpage
'All students have their own web pages.'

b. Yi gu-gu zhengqi cong jiqi pen-le chulai. [Individuating CL]
one CL-RED steam from machine spray-PRF out
'Puffs of stream came out of the machine.'

c. Shuang-shuang qingren bu-ru hui-chang. [Collective CL]
CL-RED lover step-in meeting-place
'All pairs of lovers stepped into the meeting place.'

d. Pian-pian xigua dou hen tian. [Partitive CL]
CL-RED watermelon all very sweet
'Every slice of watermelon is sweet.'

e. Cun-cun jifu dou ke dedao baohu. [Standard measure]
inch-RED skin all can get protection
'Every inch of the skin can get protected.'

f. Pan-pan cai dou hen tebie. [Container measure]
plate-RED dish all very special
'Every dish is special.'

g. Zhong-zhong jixiang biaoming Zhong-yi bu kekao. [Kind CL]
kind-RED sign indicate Chinese-medication not reliable
'Various signs indicate that Chinese medication is not reliable.'

Reduplicate unit words may also be modified by delimitive adjectives, exhibiting [+Delimitable], as in numeral expressions (2.4.3).

(159) Yani ba da-pian-da-pian luobo ban-dao sela-li.
Yani BA big-CL-big-CL carrot mix-to salad-in
'Yani mixed big slices of carrots into the salad.'

3.2.3 The problems the distributive plural analysis

The plurality encoded by reduplication has been called 'distributive plural' in Sanches (1973: 13). Similarly, Li & Thompson (1981: 34) claim that reduplication forms "signify 'every'" (also see Steindl 2010: 53). Some grammar books in late 50's and early 60's (see the review in Song 1980) and Hsieh (2008: 6) also claim that reduplicate CLs have a distributive reading. In Hsieh (2008: 67), based on the assumed distributive reading, RUWNs without *yi* are claimed to have a singular, rather than plural, feature.

Indeed, the reading of (158a), for instance, is that each of the multiple students has his or her own web page. The example does not mean that some students have this property while others do not, although such a meaning is also a plural meaning. However, as correctly pointed out by Song (1980: Sec. 2.2.3) and Guo (1999: 7), the distributive or exhaustive meaning comes from the adverb *dou* 'all' in the containing clause, rather than the reduplication itself. They also observe that whenever *dou* is allowed (even though it does not show up), the distributive or exhaustive meaning occurs. In (158c), (158g), and all of the examples in (157), there is no *dou* and no exhaustive reading is attested.

Another source for a possible distributive reading of a RUWN is the occurrence of certain non-collective modifier, such as *zuge* 'one after another' in the sentence, as in (160). Thus the default plurality reading of a RUWN can be specified into a distributive plural

reading in the context (See Yang 2002: 31).

(160) Yi zhuang-zhuang xin-shi zuge jiechu.
one CL-RED heart-thing on.after.another remove
'The worries are removed one after another.'

Considering a restricted range of data, Cheng (2009) claims that reduplicate CLs in Mandarin Chinese must occur with *dou* 'all' and that they denote the meaning of 'every'. This claim is descriptively not accurate.

In the language, however, some nouns, instead of CLs, may be reduplicated to express distributive plurality, if they occur preverbally, as seen in (161) (Sanches 1973: 13). The distributive analysis applies here, since such nominals must occur with *dou* 'all' and always denote the meaning of 'every'. Note that the construction is not productive. Many nouns such as *deng* 'lamp' and *qiang* 'wall' may not be reduplicated. The restriction that only some nouns may be reduplicated to express a plural reading is also seen in other languages (see Rijkhoff 2002: 152).

(161) a. Zi-zi dou liulu-chu tade chouhen.
character-RED all reveal-out his hatred
'All characters show his hatred.'
b. Cun-cun dou faxian-le zhe ge bingdu.
village-RED all find-PRF this CL virus
'This kind of virus has been found in all of the villages.'

The fact that reduplicate unit words do not have to encode a distributive reading is seen in their compatibility with collective verbs. In (162a), for instance, the RUWN *yi ping-ping jiu* 'bottles of wine' is selected by the collective verb *hunhe* 'mix'. Since collective verbs do not select distributive nominals, the RUWNs in (162) are not distributive nominals.

(162)a. Yani ba yi ping-ping jiu hunhe zai yiqi.
Yani BA one bottle-RED wine mix at together
'Yani mixed the bottles of wine together.'
b. Yani ba yi pian-pian shuye dui zai yiqi.
Yani BA one CL-RED leaf gather at together
'Yani gathered leafs together.'

3.2.4 The issue of definiteness and specificity of RUWNs

If a RUWN is initiated with *yi* 'one', it is indefinite, as in (156) and some examples in (157). Otherwise, RUWNs can be definite, if they occur in the subject position, as in (158a). A RUWN can also start with a demonstrative, to encode a definite unit-plurality, as seen in (163). The availability of these various readings means that the reduplication of a unit word as a morphological strategy to encode unit plurality is underspecified with definiteness.

(163)a. Wo zhongyu kanjian-le na yi zuo-zuo gao-lou.
I finally see-PRF that one CL-RED high-building
'I finally saw the high buildings.'
b. Ni dasuan ba zhi yi jin-jin chaye fang-dao nali?
you plan BA this one kilo-RED tea put-to where
'Where do you plan to put these kilos of tea?'

Reduplicate unit words also seem to be underspecified with specificity. In (157a), the RUWN is non-specific. But in the examples in (164) below, they are specific. In (164a), the RUWN *yi ben-ben* shu 'books' follows the causative marker BA, which introduces a definite or specific causee nominal only. In the existential coda construction in (164b) (Huang 1987; Zhang 2008), the RUWN *yi ge-ge jincha* 'policemen' is the subject of the secondary predicate *na-zhe qiang* 'holding guns', and the nominal in this position must be indefinite specific.

(164) a. Yani ba yi ben-ben shu reng-dao-le he-li.
Yani BA one CL-RED book throw-to-PRF river-in
'Yani threw certain books into the river.'
b. Men-wai zhan-zhe yi ge-ge jincha na-zhe qiang.
door-out stand-PRG one CL-RED policeman hold-PRG gun
'Outside the door stood some policemen with guns.'

However, a RUWN may not start with a quantificational D-element, such as the universal quantifier *mei* 'every', the quantifier *renhe* 'any', and the interrogative word *na* 'which'.

3.2.5 Numerability of number markers

Reduplicate unit words are incompatibility with numerals, as shown by (165):[29]

(165) Zhuo-shang bai-zhe (*jiu) ben-ben xin shu.
table-on put-PRG nine CL-RED new book
'There are new books on the table.'

Similarly, in some languages, plural markers never occur with any numerals, a well-known fact stated in textbooks such as Booij (2007: 127). In the Hungarian examples in (53), repeated here as (166), the plural marker *–k* may not occur with the numerals (Csirmaz & Dekany 2010: (88)). The same constraint is also found in Turkish, Western Armanian (Bale et al. 2011b), and Bangla (Dayal 2011: 4).

(166)a. három takaró-(*k)
three blanket-PL
'three blankets'

b. három kutyá-(*k)
five dog-PL
'five dogs'

[Hungarian]

Note that in (166), the plural is not an abundant plural, therefore, the constraint seen in (165) does not have to come from the semantic type of the plurality.

In Indonesian, another CL language, both mass nouns and non-mass nouns can be reduplicated (Dalrymple & Mofu, to appear: Sec. 4.2). Reduplicate mass nouns, as in (167a) and (167b), encode multiple units of massive objects (similar to the examples in (152)), and reduplicate non-mass nouns, as in (168a), encode plurality. Like in Hungarian (see (166)) and Bangla (Dayal 2011), in Indonesian, plurality in the form of reduplication does not go easily with numerals. In (168b) (Sato 2009: 10; also see Dalrymple & Mofu, to appear: sec. 3.3), the numeral may not occur with the reduplicate form.

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[29] The plural-denoting suffix *–men,* which obligatorily occurs with plural pronouns and optionally with plural human-denoting nouns, is also incompatible with numerals, if the CL is not a collective one, as shown in (ia). But *–men* may occur with a numeral, if the CL is a collective CL, as shown in (ib) (Hsieh 2008: 7).

(i) a. san ge laoshi-(*men)
three CL teacher-PL
'three teachers'

b. na san qun xuesheng-men
DEM three CL student-PL
'those three groups of students'

(167)a. Mereka telah kemasukan air laut terlalu banyak dan air-air itu sudah
they have ingested water sea excessive many and water-RED that already
berhasil dikeluarkan. [Indonesian]
successfully Pass.exit.Kan
'They have ingested too much sea water, and those [amounts of] water have successfully been taken away.'

b. Minyak-minyak itu muncrat dari manhole kapal dan membeku setelah
oil-RED that stream from manhole ship and solidify then
membentuk seperti sabu dan mengotori pantai sekitar.
form like bubble and make.dirty beach around
'The [streams of] oil streamed from the manhole of the ship and solidified, and then formed bubbles and polluted the beach.'

(168) a. siswa-siswa
student-RED
'students'

b. tiga siswa-(*siswa)
three student-RED
'three students'

The following German examples are from Krifka (2007: 26). In (169a), *Pfunde* 'pound.PL' is in a plural form, in the absence of a numeral. In (169b), however, the numeral *drei* 'three' occurs, and then only the singular form *Pfund* rather than the plural form may show up. We thus see another case of incompatibility between numerals and plural markers.

(169)a. Peter hat viele Pfunde verloren.
Peter has many pound.PL lost
'Peter lost many pounds.'

b. drei {Pfund/*Pfunde} Papier
three pound/pound.PL paper
'three pounds of paper'

If reduplicate unit words are plural markers, their incompatibility with numerals, as seen in (165), makes Mandarin Chinese pattern with languages such as Hungarian, Bangla, and Indonesian.

The observation that reduplicate unit words are not compatible with numerals indicates that RUWNs have no syntactic position for a numeral. This is confirmed by the fact that such nominals also reject modifiers that must be licensed by numerals, such as *yue* 'roughly (for a numeral)', *zonggong* 'in total', and *zuzu* 'as many as':

(170)a. *He-li piao-zhe yue (yi) duo-duo lianhua.
river-in float-PRG roughly one CL-RED lotus

b. *He-li piao-zhe zonggong (yi) duo-duo lianhua.
river-in float-PRG in.totoal one CL-RED lotus

Yang (2005) claims that a reduplicate unit word may not occur with a numeral bigger than one because both have plural features, and each nominal may not have two plural features. Hsieh (2008: 59) correctly points out that Yang's claim cannot explain the acceptability of examples like *three books* and the unacceptability of examples like **three book* in English. In our opinion, what is wrong with Yang's claim is that the property of a numeral expression is confused with plurality, which has no semantic dependency on numerals (3.1.1).

Hsieh (2008: 67) notes that "the reduplication indicates an indeterminate amount". This

indeterminate amount is compatible with the property of plurality. Plurality cares about its contrast with singularity, and it does not care about the exact amount.

In Chapter 2, we define the feature of numerability as the compatibility between an element and a numeral. We now see that plural markers in Mandarin Chinese and some other languages reject numerals. This means that the plural markers have [-Numerable].

Plural markers in English may occur with numerals and thus have [+Numerable]. One may even find a very different pattern of the interaction between numerals and plural markers in English. Examples like those in (171) are mentioned in Krifka (1998: Ch. 7, fn. 1; also see Borer 2009: Sec. 1.1):

(171)a. 1.0 apples (= (7e))
b. *1.0 apple
c. *one apples
d. one apple
e. 0.5 apples
f. zero apples

It seems that a plural marker must occur if a numeral other than *one* is present. But the adnominal *one*, according to Kayne (2009; cf. Barbiers 2007), is not necessary a numeral. If the adnominal *one* is not a numeral, it is possible that an English numeral must occur with a plural marker in a numeral expression.

3.2.6 The issue of *yi* 'one' in RUWNs

The only possible numeral-like element that may precede a reduplicate unit word is *yi* 'one'. If RUWNs are plural nominals, as pointed out by Hsieh (2008: 59), it is unclear why the numeral *yi* 'one' occurs with them. I call the *yi* in a RUWN RED-YI (RED is a short form for Reduplication). RED-YI is different from the numeral *yi* in the following aspects.

First, semantically, since RUWNs denote plural, the meaning of RED-YI is opaque, whereas the meaning of a real numeral is not opaque. In all of the examples above, the RED-YI may not be replaced by any other numeral, as shown in (172) (Steindl 2010: 69).

(172) {yi/*san} zhi-zhi xiao ya
one/three CL-RED small duck
'ducks'

Second, in certain contexts, RED-YI is optional (see (156a)), but in some other constructions, it is obligatory. For instance, if a RUWN follows a verb such as *you* 'have', as in (173a), or the perfect aspect marker *le*, as in (173b), or a demonstrative, as in (173c), *yi* is obligatory. Also, if the unit word is the CL *wei* or the standard measure *jin* 'cattie', as in (173d) and (173e), respectively (Kao 2012: 7), *yi* is obligatory.

(173) a. Nali you *(yi) ping-ping yinliao.
there have one bottle-RED beverage
'There are bottles of beverage.'
b. Lang chi-le *(yi) zhi-zhi xiao yazi. (Steindl 201x)
wolf eat-PRF one CL-RED little duck
1. The wolf ate a lot of little ducks.collective reading
2. The wolf ate one little duck after the other.iterative reading
c. na *(yi) zhi-zhi xiao ya
that one CL-RED small duck
'those ducks'

d. *(yi) wei-wei keren
one CL-RED guest
'guests'

e. *(yi) jin-jin rensen
one catty-RED ginseng
'catties of ginseng'

On the other hand, if the unit word is a kind CL, RED-YI may not occur (also see (158g)):

(174) a. Yani tingjian-le (*yi) zhong-zhong qiguai de shengyin. [Kind CL]
Yani hear-PRF one kind-RED strange DE sound
'Yani heard various kinds of strange sound.'
b. (*Yi) Zhong-zhong jixiang biaoming Zhong-yi bu kekao. [Kind CL]
one kind-RED sign indicate Chinese-medication not reliable
'Various signs indicate that Chinese medication is not reliable.'

In contrast, a real numeral does not have these distributional properties. Thus, as stated by Steindl (2010: 69), RED-YI "does not function as a numeral here".

In Lan (2010), RED-YI is analyzed as a distributive D-element. But we have shown that the possible distributive reading of a RUWN is related to *dou* 'all' in the hosting sentence, rather than any element internal to the nominal.

The non-numeral usages of *yi* are also found in other constructions. In (75), repeated here as (175), the word *yi* is not a numeral. In expressions such as *yi-dan* 'if', *yi-qie* 'all', the morph *yi* is also not a numeral. Similarly, it is possible that RED-YI is not a numeral, either.

(175)a. {yi/*san} shen nitu
one/three body mud
'a body covered all over in mud'

b. {yi/*san} lian you
one/three face oil
'a face covered all over in oil'

Song (1978) claims that the string of [*yi* AA] is a short form of [*yi* A *yi* A], where A is a unit word. If so, RED-YI is similar the preposition *after, by*, or *upon* in the reduplicate forms of abundant plurals in English (3.1.3), or an empty morph (or called stem extender) (e.g., *fact-**u**-al*, *resum-**p**-tion*, *hu-**li**-hutu* 'confused', *tu-**li**-tuqi* 'unsophisticated'). Such an element is attached to another morpheme, without any meaning. In (176a), *yi* occurs to the left of the reduplicant and the base. In (176b), the second *yi* disappears and the first one remains. In (176c), *yi* does not occur. The three sentences mean the same.

(176)a. Naxie daoyu jiu xiang yi-ke-yi-ke baoshi.
those island just look.like one-CL-one-CL diamond
'Those islands look like diamonds.'
b. Naxie daoyu jiu xiang yi-ke-ke baoshi.
those island just look.like one-CL-CL diamond
c. Naxie daoyu jiu xiang ke-ke baoshi.
those island just look.like CL-CL diamond

Like unit words in numeral expresssions, reduplicate unit words may also be modified by delimitive adjectives. We have seen one example in (159). The modification is also compatible with the empty morph *yi*, as seen in (177) (Song 1978: Sec. 8).

(177) Guchang-shang, pu-zhe yi xiao kuai yi xiao kuai doujia he guzi.
ground-on, spread-PRG one small CL one small CL pod and millet
'On the ground, spread small patches of pods and millets.'

In summary, the reduplicate form of a unit word is identified as a plural marker in Mandarin Chinese and it has the following formal properties:

(178)a. It denotes unit plurality;
b. It is attested in all types of unit words;
c. It is underspecified with definiteness and specificity;
d. It is not compatible with a numeral, and thus has [-Numerable].

Other properties include the following:

(179)a. If *dou* 'all' occurs, a distributive meaning emerges (Song 1980);
b. The semantic type of the plurality is abundant plurality;
c. It never follows the quantificational D-element *mei* 'every', *renhe* 'any', and *na* 'which'.

3.3. Unit singularity

In Section 3.2, we have shown that Mandarin Chinese has plural markers, they are just special morphological forms of CLs, and the number markers are not compatible with any numerals. Recall that bare nouns in the language express general number, which is underspecified with either singular or plural. We thus expect that Chinese may encode singularity by forms that are different from both bare nouns and plural markers. Also, both singular and plural markers should exhibit parallel basic syntagmatic properties, such as incompatible with numerals. In this section, we introduce such singular nominals in Mandarin Chinese.

3.3.1 PUWNs as unit singularity-denoting nominals

Indeed, a CL that is neither in a reduplicate form nor occurs with a numeral consistently encodes singularity, a fact that has been noted by Li & Liu (1978: 4-5).

Compare the examples in (180) and (181). The numeral *san* 'three' starts a nominal in (180a), follows the proximal demonstrative *zhe* in (180b), follows the universal quantifier *mei* 'each' in (180c), and follows the interrogative determiner *na* 'which' in (180d). Of course, *san* can be replaced with any other numeral, including *yi* 'one'. In each of the examples in (181), the absence of the numeral to the left of the unit word correlates with the consistent singular reading.

(180)a. Yani mai-le san ben shu.
Yani buy-PRF three CL book
'Yani bought three books.'

b. zhe san ben shu
this three CL book
'these three books'

c. mei san ben shu
every three CL book
'every three books'

d. Na san ben shu?
which three CL book
'Which three books?'

(181)a. Yani mai-le ben shu.
Yani buy-PRF CL book
'Yani bought a book.'

b. zhe ben shu
this CL book
'this book'

c. mei ben shu
every CL book
'every book'

d. na ben shu
which CL book
'which book'

I will call a nominal that contains a string of a unit word and an NP, but without a

numeral, like *ben shu* 'CL book' in (181a) those in (181b-d), Plain Unit Word Nominals (PUWNs).[30]

In Mandarin Chinese, no noun may be next to a numeral directly (2.3.1). It is a unit word that links a numeral and a noun. The unit word functions as a counting unit in counting (Chapter 2). In PUWNs, no numeral occurs, but they encode exactly one unit. In (181), for instance, the CL *ben* occurs, without any numeral, but the meaning of a single book is expressed. I thus claim that the CL of the PUWN is a singular marker.

Bisang (1999) has reported various extended uses of CLs in CL languages. In Chapter 2, we have argued that when a CL occurs with a numeral, it denotes a counting unit. We now see an extended use of CLs in Mandarin Chinese: as a number marker, in the absence of a numeral. Plurality is expressed by the reduplication of CLs and singularity is expressed by the plain form of CLs, in the same syntactic context: i.e., in the absence of a numeral.

It needs to be emphasized that we do not claim that CLs in Mandarin Chinese are singular markers in general. CLs in different syntactic contexts have different syntactic functions. Only in the absence of a numeral, a plain CL that is followed by a noun functions as a singular marker.

3.3.2 The productivity

I further observe that all types of unit words may express singularity, in a PUWN, as shown in (182).

(182)a. Wo xiang mai ben shu. [Individual CL]
I want buy CL book
'I want to buy a book.'

b. Wo gang chi-le kuai ji-rou. [Individuating CL]
I just eat-PRF chunk chicken-meat
'I just ate a slice of chicken-meat.'

c. Wo xiang mai ping jiu. [Container measure]
I want buy bottle wine
'I want to buy a bottle of wine.'

d. Wo gang mai-le jin yangrou. [Standard measure]
I just buy-PRF catty mutton
'I just bought a catty of mutton.'

e. Wo gang chi-le pian xigua. [Partitive CL]
I just eat-PRF slice water-melon
'I just ate a slice of water-melon.'

f. Wo gang yujian-le qun qiangdao. [Collective CL]
I just meet-PRF group robber
'I just met a group of robbers.'

g. Tamen zhaodao-le zhong hen tebie de zhiwu. [Kind CL]
they find-PRF kind very special DE plant
'They found a kind of very special plant.'

The PUWNS in (182) start with the unit word. A PUWN can also start with a demonstrative, as in (181b), or the universal quantifier *mei* 'every', as in (181c) (D. Yang 1996; Cheng & Sybesma 1999: 530; R. Yang 2001: 66, among others), or the question word *na* 'which', as in (181d). PUWNs that start with the unit word are indefinte, and thus they occur in syntactic positions for indefinite nominals, e.g., the object of a verb, as seen in (181a)

[30] In S. Wang (1989: 110), the PUWN initiated with *ge* is claimed to function as an indefinite determiner.

and (182). PUWNs that do not start with the unit word, as those in (181b) through (181d) may occur in any argument position. Thus, there is no intrinsic restriction on the syntactic function of the singularity expressed by a PUWN.

In the experimental studies of Huang (2009) and Huang & Lee (2009), children between three and a half and five years of age are already sensitive to the quantificational difference between bare nouns and unit word-initial PUWNs, and they also understand that the singular reading of such PUWNs.

The singular interpretation of PUWNs is also observed in other CL languages. The following Bangla example is cited from Simpson et al. (2011: 188):

(183) Tumi ki alo-Ta jele dite parbe please? [Bangla]
you Q light-CL turn.on give can please
'Can you turn on the light, please?'

One constraint on the form of a PUWN is that it may not start with a disyllabic unit word. In (184), the unit words in the PUWNs are disyllabic but the nominals start with either a demonstrative or a quantifier. Both PUWNs are acceptable. In (185), however, all PUWNs start with a dysyllabic unit word, and the forms are not acceptable. I leave this morphological issue for future research.

(184)a. Siyu mai-le na xiao bao chaye.
Siyu buy-PRF that small backage tea
'Siyu bought that small package of tea.'
b. Siyu jiancha-le mei gongjin chaye.
Siyu check-PRF every kilo tea
'Siyu checked every kilo of tea.'

(185)a. *Siyu mai-le xiao bao chaye.
Siyu buy-PRF small backage tea
Intended: 'Siyu bought a small package of tea.'
b. *Siyu jiancha-le gongjin chaye.
Siyu check-PRF kilo tea
Intended: 'Siyu checked every kilo of tea.'
c. *Siyu mai-le guantou xiancai.
Siyu buy-PRF can pickle
Intended: 'Siyu bought a can of pickles.'

3.3.3 The problems of the numeral-deletion analysis

It has been generally assumed that a PUWN is derived by the deletion of the numeral *yi* 'one' (e.g., Lü 1944), and therefore, clauses containing PUWNs are treated as *yi*-gapping constructions. In this section, I falsify this *yi*-deletion analysis of PUWNs.

First, the assumed deletion has no antecedent, and thus violates the basic identity condition of ellipsis. For instance, the numeral *qi* 'seven', which is very similar to *yi* phonologically, is available in the first conjunct in (186a), and one should expect the deletion of *qi* in the second conjunct to be possible, contrary to the fact. On the other hand, PUWNs may be uttered out of blue, without a context-support, to encode singularity consistently. In (186b), *yi* does not occur anywhere, but the PUWN *ben zazhi* 'CL magazine' denotes singularity exclusively. If deletion needs an antecedent, to satisfy the recovery condition (e.g., Chomsky 1965: 144), (186b) cannot be the result of deletion.[31]

[31] As pointed out by Kayne (2011: Sec. 4), numerals may not be deleted in English, either. (ii) is acceptable, but

(186)a. *Yani mai-le qi ben xiaoshuo, wo mai-le ~~qi~~ ben zazhi.
Yani buy-PRF seven CL novel I buy-PRF seven CL magazine
Intended: 'Yani bought seven novels and I bought seven magazines.'
b. Yani mai-le qi ben xiaoshuo, wo mai-le ben zazhi.
Yani buy-PRF seven CL novel I buy-PRF CL magazine
'Yani bought seven novels and I bought one magazine.'

Second, the assumed deletion cannot be a lexical-specific operation. If one assumes that the numeral *yi* is so special (e.g., as the default numeral, as suggested to me in a conference), that its deletion does not need an antecedent, we still cannot explain why it may not be deleted in other contexts. One wonders why the deletion fails in (187b), (187c), (188b) and (189b).

(187)a. Yani chi-le pian yao.
Yani eat-PRF CL pill
'Yani took a pill.'
b. Yani chi-le san-fenzhi-{yi/*_} pian yao.
Yani eat-PRF three-part-one CL pill
'Yani took one third of a medicine pill.'
c. Yani ba chengji tigao-le {yi/*_} bei.
Yani BA score increase-PRF one time
'Yani doubled the scores.'

(188)a. Yani he-le bei shui
Yani drink-PRF cup water
'Yani drank a cup of water.'
b. Yani he-le di {yi/*_} bei shui.
Yani drink-PRF ORD one cup water
'Yani drank the first cup of water.'

(189) a. Qing jin yi hao fangjian!
please enter one number room
'Please enter Room No. 1!"
b. *Qing jin __hao fangjian!
please enter number room

It is clear that the alleged deletion fails exactly in the contexts of numerals. According to Wiese (2003), numerals have three uses: cardinal, as in (187b) and (187c), ordinal, as in (188b), and proper-name-like nominal, as in (189a). Obviously, when *yi* occurs as a real numeral in all of these uses, it may not be deleted. I conclude that numerals in Mandarin Chinese may not be deleted, and PUWNs have not undergo any numeral-deletion operation.

We claim that like RUWNs, PUWNs do not have a syntactic position for a numeral. Therefore, there is no numeral to be deleted. Our claim is supported by the following fact. The focus marker *zhi* 'only' may scope over various C-Commanded elements. In (190a), *zhi* focuses the numeral *yi* 'one' in Reading A, the noun *yingtao* 'cherry' in Reading B, and the whole VP *chi-le yi ge yingtao* 'ate a cherry' in Reading C. In (190b), (190c) and (190d), *zhi* occurs with the PUWN *ge yingtao* 'CL cherry'. In (190b), an intended numeral is in contrast, and *zhi* is supposed to focus on the numeral. However, the sentence is not acceptable. In (190c), the noun *yingtao* is in contrastive, and therefore, *zhi* focuses on the noun. In (190d), the VP *chi-le yi ge yingtao* 'ate a cherry' is in contrastive, and therefore, *zhi* focuses on the VP. Both sentences are acceptable. The acceptability contrast between (190b) on the one side, and (190c) and (190d) on the other side, indicates there is no numeral in the PUWN for *zhi* to focus on.

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not at all with the interpretation of (i).
(i) Mary has written four papers, whereas John has only written four squibs.
(ii) (*)Mary has written four papers, whereas John has only written squibs.

(190) a. Yani zhi chi-le yi ge yingtao.
Yani only eat-PRF one CL cherry
A: 'Yani ate only one cherry (rather than two cherries).'
B: 'Yani ate only a cherry (rather than a peach).'
C: 'Yani only ate a cherry (rather than doing something else).'

b. *Yani zhi chi-le ge yingtao, er bu-shi liang ge yingtao.
Yani only eat-PRF CL cherry but not-be two CL cherry
Intended: 'Yani ate only one cherry, rather than two cherries.' (= A above)

c. Yani zhi chi-le ge yingtao, er bu-shi xiantao.
Yani only eat-PRF CL cherry but not-be peach
'Yani ate only a cherry, rather than a peach.' (= B above)

d. Yani zhi chi-le ge yingtao, er bu-shi zuo-le fan.
Yani only eat-PRF CL cherry but not-be make-PRF meal
'Yani only ate a cherry, rather than cooked a meal.' (= C above)

In a numeral expression, a CL is next to a numeral. With respect to the surface adjacency between a demonstrative and a CL, as seen in (191a) and (191b), Greenberg (1990 [1972]: 168) states that "[S]yntactically also there is variability in that the classifiers need not be confined to numerical constructions. In Mandarin and other languages the classifier is required with demonstratives even in non-numeral phrases." The claim is adopted by many (e.g., T'sou 1976: 1215; Lyons 1977: 461; Croft 1994: 150; Rijkhoff 2002: 165; Gil 2008: 7; Lehmann 2008: 3; Huang et al. 2009: 14; Bisang 1999: 145; 2011: 7).

(191) a. zhe ben shu (= (181b))
DEM CL book
'this book'

b. na ben shu
DEM CL book
'that book'

However, examples like (191a) and (191b), which are used to support Greenberg's statement, show a semantic constraint: their interpretations must be singular. This is pointed out by Greenberg (1990 [1972]: 188) himself: "in Mandarin the classifier *ben* required with *shu* 'book' with any number (e.g., *i ben shu* 'one book', *san ben shu* 'three books') occurs with the demonstrative also (*che ben shu* 'this book') but only in the singular."[sic.] In our analysis, such examples are PUWNs, and they are simply singular unit-denoting nominals, without a syntactic position for a numeral.[32] Thus, indeed, a CL does not have to follow a numeral, but when it does not, it does not function as a counting unit, as in a numeral expression. Instead, it is a singular marker.

3.3.4 The issue of definiteness and specificity of PUWNs

Unit word-initial PUWNs are indefinite, and thus although they may occur in the object position of a transitive verb, as in (191a) and (182), or in the direct object of a ditransitive verb, as in (192a), they do not occur in the postion of a topic or primary subject, as seen in (192b).

[32] A demonstrative may also be combined with a reduced *yi* 'one', deriving *zhei* (*zhe* + *yi* 'this + one') and *nei* (*na* + *yi* 'that + one') (e.g., Cheng & Sybesma 1999: 530 fn. 17). However, because of reanalysis, *zhei* and *nei* can also function as a pure demonstrative, followed by a numeral other than *yi* 'one'. So (i) is acceptable (Bisang 1999: 145). The opaque function of *yi* in *zhei* in (i) is similar to the opaque function of *et* 'and' in the phrase *and etcetera*, where two conjunctions (*and, et*) occur in a row, and *cetera* means 'the rest'.

(i) zhei san feng xin
this three CL letter
'these three letters'

(192)a. Yani gei-le wo ba dao.
Yani give-PRF I CL knife
'Yani gave me a knife.'
b. *Ba dao hen gui.
CL knife very expensive

This is in contrast to languages such as Cantonese, Vietamese (Daley 1998), and Yongren Lolo (Gerner 2003: 993-4), where a CL-initial PUWN can be either definite or indefinite (see Simpson et a. 2011: 169, and the references thereof), although it also denotes a singular unit.

If a PUWN starts with a demonstrative, as in (191), it is definite. Since unit words in such a use occur in both definite and indefinite nominals, they themselves are not specified with any definiteness feature.

An indefinite PUWN can also be either specific or non-specific. In (182a) and (182c), the PUWNs are clearly nonspecific. Data like (193) show that the claim that CL-initial nominals must be non-specific in Mandarin Chinese (Cheng & Sybesma 1999: 526; Hsieh 2008: 126-127) is not accurate. First, the causee position following the causer marker *ba* is a typical position for a definite or specific indefinite nominal. Since a PUWN may occur in this position, as seen in (193a), it can be specific (See Chen 2003: 1178 for more such examples). Second, the subject of a secondary predicate in an existential coda construction (Huang 1987) must be specific indefinite. Since a PUWN may also occur in this position, as seen in (193b), it can be specific. Third, an indefinite nominal occurring between *you* 'have' and a modal is always interpreted as specific (Tsai 2010: 210). Since a PUWN may also occur in this position, as seen in (193c), it can be specific. Thus the singular marker is not specified with any specificity feature.

(193) a. Shouwei ba ge cong nanfang lai de xiaotou fang-pao-le.
guard BA CL from south come DE thief release-away-PRF
'The guard got released a thief who had come from the south.'
b. Shufen mai-le zhang zhuozi san tiao tui.
Shufen buy-PRF CL table three CL leg
'Shufen bought a table which has three legs.'
c. Zhe ci you ge ren {keneng/yiding} hui lai.
this time have CL person possibly/surely will come
'This time, a certain person will {possibly/surely} come.'

In summary, the following four major properties are shared by the plural feature of reduplicate unit words and the singular feature of the plain unit words in PUWNs:

(194)a. The number feature denotes the number of units, which does not have to be the number of the individuals denoted by the associate noun;
b. It is attested in all types of unit words;
c. It is underspecified with definiteness and specificity;
d. It is not compatible with a numeral.

3.4. Morphological and semantic markedness

I have identified the unit word that is not preceded by a numeral as a singular marker, and reduplicate unit word as a plural marker, in Mandarin Chinese. The newly identified singular and plural markers in Mandarin Chinese share properties with well-recognized number

markers in languages such as English. First, they have stable morphological forms. Plural markers are reduplicate unit words, and singular markers are non-reduplicated unit words in PUWNs. Second, they are productive and systematic. They are found with all types of unit words. Third, they are underspecified with either definiteness or specificity properties. Fourth, they show consistent syntagmatic properties. In English, number markers are compatible with numerals and trigger agreement on verbal elements, whereas in Mandarin Chinese, number markers block the occurrence of numerals.

According to Greenberg Universal 35, in many languages, the singular feature is not associated with any overt phonological content but the plural is. In both English and Mandarin Chinese, plural forms are morphologically marked. In English, the suffix –s is used for regular plural forms, in contrast to the unmarked forms for singularity. In Mandarin Chinese, the reduplicate forms of unit words for plurality is in contrast to the plain forms of unit words for singularity. In some languages, both singular and plural number are overtly expressed, e.g., in Babungo, Bukiyip, Kisi, Nasimo, and Ngiti (cited in Rijkhoff 2002; 150), and Ojibwe (Mathieu 2012). In the following Kisi examples (Childs 1995: 14), the number marking is related to class membership:

(195)a.	nì-léŋ	b.	nì-láŋ	[Kisi]
	ear-CL.SG		ear.CL.PL	
	'ear'		'ears'	

However, in my understanding, one contrast of the plurality-marking between English and Mandarin Chinese is the pattern of the semantic markedness of the plural feature (Bale et al. 2011a). As shown in Bale et al. (2011a), English plural forms are semantically unmarked, although they are morphologically marked. Therefore, a nominal with a plural marker may denote a singular element, element smaller than one, and even zero, as shown in (171), some of them are repeated here in (196) (in fact, English plurals may even occur with mass nouns e.g., *clothes*; see McCawley 1979; Ojeda 2005).

(196) a. 1.0 eggs b. 0.5 eggs c. zero eggs

The semantic unmarkedness of plurals in English is also shown in the so-called "inclusive plural". In (197), the plural noun children in A is not interpreted as plural, and therefore, the answer in B is appropriate, but the answer in C is not (Krifka 1989, 2008: Sec. 5.1); see Bale et al. 2011a: 203, 209 for a further discussion of cross-linguistic variations and some pragmatic constraints on the singular interpretation of such a plural nominal in English).

(197) A. Do you have children? B. Yes, one. C. *No, (just) one.
(198) A. Do you have two or more children? B. *Yes, one. C. No, (just) one.

In (197), no numeral occurs in A's question. Therefore, counting is not an issue. A only asks for the existence of children. B's affirmative answer, followed by the quantity information "one" is appropriate. But C's negative answer followed by the quantity "one" is self-contradictory. In (198), a numeral occurs in A's question, and thus counting is an issue here. Therefore, B's affirmative answer followed by the information that is not compatible with the numeral given by A is not acceptable; but C's negative answer followed by the numeral that is not compatible with the numeral given by A is an appropriate one.

In Mandarin Chinese, however, plural forms are semantically marked. Since general number is available in the system, a plural marker is used only when the singular-plural

contrast matters in the context. They thus never occur in nominals that do not denote plurality. In contrast, in the absence of a plural marker, i.e., in the absence of a reduplicate unit word, a bare nominal denotes general number and thus may express either singularity or plurality.

(199) Wo mai-le shu.
I buy-PRF book
'I bought {a book/books}.'

Also, In Mandarin Chinese, question A in (200), for example, may not be answered by the positive answer in B. Instead, if there is only one light, only C is the appropriate answer, with a stress on the numeral *yi* 'one'. In this aspect, Mandarin plural forms are like plural forms in Western Amenian (Bale & Khanjian 2008: 73; also Bale et al. 2011a: 209).

(200)A. Qiang-shang shi-bu-shi gua-zhe zhan-zhan ming deng?
wall-on be-not-be hang-PRG CL-CL bright light
'Are there bright lights hung on the wall?'
B. *Dui, qiang-shang gua-zhe yi zhan ming deng.
right, wall-on hang-PRG one CL bright light
C. Bu dui, qiang-shang gua-zhe YI zhan ming deng.
not right, wall-on hang-PRG one CL bright light
'No, there is ONE bright light hung on the wall.'

The unmarkedness of the singular form is also seen in the fact that a form usually interpreted as a singular gets a plural reading in an irrealis context, as shown by (201b):[33]

(201)a. Wo mai-le ben shu.
I buy-PRF CL book
'I bought a book.'

b. Wo xiang mai ben shu.
I want buy CL book
'I want to buy {a book/books}.'

This contrast in the markedness pattern is consistent, and is observed also in the systems of third person pronouns. The number marking in pronouns is obligatory in both English and Chinese. However, in colloquial English, the third person plural pronoun can take a singular antecedent, so long as it does not refer to an identified referent (this is a similar non-specific condition for number flexibility in (201b)):

(202)a. Someone left their jockstrap in the locker room. (Rullmann 2003)
b. Someone came this morning, but I didn't see them.
c. There's someone at the door. Go see what they want.
(203)a. *Bill left their jockstrap in the locker room.
b. *The man came this morning, but I didn't see them.

In Chinese, however, the third person singular pronoun *ta* 'he/she/it' can take a plural antecedent, regardless of whether its referent is identified. In (204a,b,c), the antecedent of *ta* is a topic or subject, which is identified; whereas in (204d), the antecedent of *ta* is the nonspecific nominal *ji feng xin* 'several letters'. The context for the special *ta* can be realis, as in (204a,b), as well as irrealis, as in (204c) (contra Xu 1999).

[33] In Rullmann & You's (2006: 184) judgment, (201a) also allows a plural reading. Our judgment is different from theirs.

(204)a. Zhexie shu, wo yiqian meitian wanshang dou kan ta.
these book I before every evening all read 3SG
'These books, I read them every evening in the past.'

b. Zhexie dingpao dou huai-le, ba ta reng-le ba. (Zhu 1982: 82)
those bulb all bad-PRF BA 3SG dump-ASP PRT
'Those bulbs are all defective, let us dump them.'

c. Zhexie jiahuo, zhineng dui ta bukeqi. (Xu 1999: 7)
these chap cannot.but to 3SG impolite
'As for these chaps, (we) cannot but be impolite to them.'

d. Wo xiang xie ji feng xin, ranhou ba ta ji-chuqu. (Yuying Julia Su, p.c.)
I want write several CL letter then BA 3SG mail-out
'I want to write several letters, and mail them.'

This semantic markedness contrast between English and Chinese does not affect the syntactic status of plural markers in either language. Thus, as in English, plural markers in Mandarin Chinese also head a functional projection, NumP.

3.5. PL marking in CL languages

3.5.1 Reviewing Sanches-Greenberg's Generalization

The empirical issue investigated in this chapter leads to the theoretical issue of the relationship between CLs and plural markers. The so-called Sanches-Greenberg Generalization states that "[N]umeral classifier languages generally do not have compulsory expression of nominal plurality, but at most facultative expression." (Greenberg 1974: 25; also see Sanches 1973) Indeed, in CL languages such as Japanese, Thai, and Korean, reported plural markers are not systematic (Mizuguchi 2004: 18, 145, among others). The Sanches-Greenberg Generalization has been extended into a complementary distribution relation between CLs and plural markers in T'sou (1976), Doetjes (1996, 1997), and Chierchia (1998). It has been assumed that a language has either CLs or plural markers, and if a language has both systems, a CL does not occur with a plural marker in the same construction (e.g., Borer 2005: 95).

However, it has been observed that obligatory number marking can be seen on the morphological forms of CLs themselves. In Northern Kam, the singular-plural contrast is obligatorily expressed by the inflection of CLs, regardless of whether a numeral occurs, as in (205), or no numeral occurs, as in (206) and (207) (Gerner 2006: 243-244, 249).

(205)a. i^{45} jiu^{22} na^{45} b. ham^{11} tˌiu^{22} na^{45} [Norther Kam]
one CL:SG river three CL:PL river
'one river' 'three rivers'

(206)a. wəi^{31} tu^{33} b. məi^{31} tu^{33}
CL:SG garment CL:PL garment
'a garment' 'garments'

(207)a. ɤa^{55} hoŋ^{22} b. ʔa^{55} hoŋ^{22}
CL:SG loom CL:PL loom
'a loom' 'looms'

Allan (1977: 294) and Aikenvald (2003: 100-101) also report the cases where CL languages have number markings.

Although, as pointed out in Doetjes (to appear: 2), the Sanches-Greenberg generalization does not go the other way, i.e., it does not make any claim about non-CL languages, one still finds the co-occurrence of CLs and plural marking in non-CL languages. Krifka (2008: 7)

presents the following German examples to show this. Persian (Ghomeshi 2003: 55-56; Gebhardt 2009) and Hungarian (Csirmaz & Dékány 2010: 13) also allow a numeral and a CL to occur in the same nominal, regardless of whether they are CL languages. The existence of such data also challenge the alleged complementary distribution relation between CLs and plural markers.

(208)a. zwanzig Stück Semmel-n
twenty CL bread.roll-PL
'twenty bread-rolls'

b. fünf Mann Mensch-en [German]
five CL person-PL
'five people'
(title of a play by Jandl & Mayröcker)

There are also languages that have neither CLs nor plural markers, such as Yudja (Lima 2010, 2011), Karitiana (Müller et al. 2006), and Dëne (Wilhelm *ibid.*). The existance of such languages is beyond the empirical coverage of the alleged complementary distribution relation between CLs and plural markers.

For languages that have general number, as we mentioned in 3.1.2, the use of a plural marker cannot be compulsory. Nevertheless, it is still possible for the language to have a systematic formal contrast between singularity and plurality and morpho-syntactic ways to represent the contrast. We have used Chinese to show this possibility.

The assumed complementary distribution has been rationalized by the hypotheses that (A) mass nouns are inherently plural; (B) all nouns of CL languages are mass nouns, and therefore, (C) they have no contrast between singularity and plurality, and accordingly, there is no plural marker in such languages (e.g., Chierchia 1998). In Chapter 2, I have argued against hypothesis B, and in this chapter, I have falsified hypothesis C. As for hypothesis A (also see McCawley 1998 [1988]: 568), it has been shown to be problematic by Schaden (2010), and the references therein. Also see Moltmann (1997) for a claim that it is the semantic selectional requirements such as the Accessibility Requirements that are the conditions on the part structure of an argument in a situation, rather than syntactic restrictions to plural or mass NPs, as opposed to singular count NPs.

The facts discussed in this chapter and the previous chapter shed light on the relations between CLs and plural markers. In a numeral expression, a CL must occur with the numeral, and the CL functions as a counting unit semantically, and as a bearer of the feature numerability syntactically. My proposal that number and numerability are different notions can capture the co-occurrence of plural markers and CLs.

In Mandarin Chinese, when a CL occurs in the absence of a numeral, it is a number marker: a plain CL encodes singularity, and CL in reduplicate form encodes plurality. Thus, the notion of number can be encoded by special syntagmatic relation, and special morphological form, of CLs themselves in CL languages.

We have shown that CL languages also have a productive way to encode the notion of plurality. Cognitively speaking, the fact that CL languages also have productive ways to encode the notion of nominal plurality indicates that the contrast between singularity and plurality is not restricted to languages such as English. Acquisition studies also show that Mandarin Chinese and Japanese children "were not delayed relative to English-learning children for 1 versus 4 comparisons" (Li et al. 2009b: 1651), suggesting that children of the CL languages are conceptually sensitive to the singular-plural contrast.

3.5.2 PL marking strategies in CL languages

Number is expressed by morphological forms of nominal-internal elements. The morphological strategies can be affixation, reduplication, etc. Different languages may mark number information on different types of elements. In English and Lezgain, for instance,

nouns mark number by suffixation (Corbett 2000: 179); in Mokilese (Corbett 2000: 212) and St'át'imcets (Davis & Mathewson 1999: 61), nouns mark number through demonstrative or determinative affixes; and in spoken French, number contrast is basically marked on articles (*le* and *la* singular, versus *les* plural) (Corbett 2000: 179).

In CL languages, we have shown that in Mandarin Chinese, plurality is expressed by reduplication of unit words. In this language, when CLs are reduplicated to encode plurality, they keep their possible s-selection restrictions on nouns. For instance, the individual CL *pi* is for horses, but not for other animinals. The restriction maintains when the CL is reduplicated as a plural marker:

(209) a. yi pi-pi ma
one CL-RED horse
'horses'

b. *yi pi-pi zhu
one CL-RED pig

In other numeral CL languages reported in Gerner (2006) (see (205) - (207)), number is also encoded by special morphological forms of CLs. In some other Kam-Tai languages, plurality can be expressed by the reduplication of noun or CLs (Gerner 2006: 255). In Indonesian, plurality is expressed by reduplication of nouns (Dalrymple & Mofu, to appear), as seen in (210):

(210) siswa-siswa [Indonesian]
student-RED
'students'

In the same language, different nominal systems may also mark number information in different ways. In English, plural marking in pronouns is very different from that in nouns. In Mandarin Chinese, for personal pronouns and kinship terms, the plural marker is the suffix *–men.* But reduplicate unit words in RUWNs are words. The difference correlates with Corbett's (2000: 75) claim that between the two ways of number marking, direct morphological operations and number words, the former is more likely for personal pronouns and kinship terms than for other types of nominals.

Since not many studies on number marking in CL languages have been seen in the literature, especially number marking through reduplication, we would like to make a brief comparison between Mandarin Chinese and another CL language, Indonesian, reported in Dalrymple & Mofu (to appear). The major similarities of the two numeral CL languages are the following:

First, general number is available, i.e., bare nouns may encode either plural or singular entities (e.g., Dalrymple & Mofu *ibid.*: (2): *telur* 'egg, eggs'). Second, plurality may be expressed by reduplication.

(211) pulau-pulau [Indonesian, Dalrymple & Mofu *ibid.*: (1)]
island-RED
'islands'

Third, the plural reading of reduplication does not have to connected to either definiteness or distributivity (see 2.2 and 2.3 for Mandarin Chinese; Dalrymple & Mofu *ibid.*: Sec. 3 for Indonesian).

The major differences include the following:

First, in the presence of a numeral, a unit word such as a CL is obligatory in Mandarin Chinese, but optional in Indonesian, as seen in (212a) (Dalrymple & Mofu *ibid.*: (3)); in the

latter language, a numeral may even precede a mass noun directly, as seen in (212b) and (212c) (Dalrymple & Mofu *ibid*.: (29)). This is similar to Yudja, discussed in 2.3.1.

(212) a. lima (orang) guru
five CL teacher
'five teachers'

b. duo air laut
two water sea
'two (areas of) sea water'

c. sepuluh kayu [Indonesian]
ten wood
'ten (pieces of) wood'

Second, plurality is expressed by reduplication of unit words in Mandarin Chinese, but by reduplication of nouns in Indonesian, as seen in (211) above. Note that even mass nouns can be reduplicated, to express multiple units of the massive objects. This is similar to English mass plurals (see (167) above).

Third, the reading of "inclusive plural" is not found in Mandarin Chinese (see (197)), but is found in Indonesian (Dalrymple & Mofu *ibid*.: Sec. 5.2.3 (48)). In this aspect, Indonesian plurals are again more like plurals in English.

3.6. Chapter summary

In this chapter, we have identified the number system in Mandarin Chinese, a CL language. The system can be summarized in (213):

(213) general number: bare noun

singular	plural
plain unit word	reduplicate unit word

The existence of general number, which is encoded by bare nouns, means that in this language, plural entities do not have to be expressed by plural markers. When the contrast between plurality and singularity is salient in the context, the former is expressed by reduplication of unit words and the latter is expressed by plain unit words, in the absence of any numeral. The basic properties of the number markers are summarized in (214):

(214)a. The number feature denotes the number of unit;
b. It is attested in all types of unit words;
c. It is underspecified with definiteness and specificity;
d. It is not compatible with a numeral, and thus has [-Numerable];
e. Unlike in English, there is no negative correlation between morphological and semantic markedness of number marking.

The facts discussed in this chapter show that CL languages do have systematic ways to encode the contrast between singularity and plurality. They also show that CLs in Mandarin Chinese have [+Numerable] in numeral expressions, but have [-Numerabl] when they function as number markers.

Chapter 4 The Syntactic Constituency of Numeral Expressions

4.1. Introduction

This chapter addresses one of the most fundamental issues in the study of the syntactic structures of numeral expressions: their constituency. As we defined in Chapter 1, such constructions contain three basic elements in Mandarin Chinese, i.e., a numeral, such as *san* 'three' in (215), a noun, such as *putao* 'grape' in (215), and a unit word between them, such as the CL *ke* in (215a), the standard measure *gongjin* 'kilo' in (215b), and the container measure *wan* 'bowl' in (215c).

(215)a.	san ke putao	b. san gongjin putao	c. san wan putao
	three CL grape	three kilo grape	three bowl grape
	'three grapes'	'three kilos of grapes'	'three bowls of grapes'

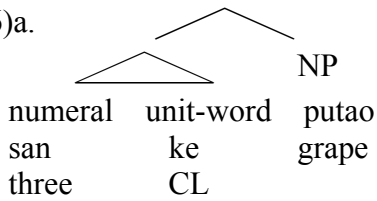
One basic question is, among the three elements, whether there is any syntactic hierarchy. If the unit word surfaces between the other two elements, as in Mandarin Chinese, the question is whether the unit word C-Commands the noun.

Greenberg (1990b [1975]: 227) makes the following statement, without specifying the "many indications":

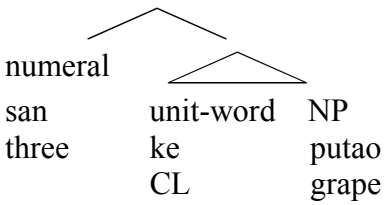
> "There are many indications that in the tripartite construction consisting of quantifier (Q) [= numeral], classifier (Cl), and head noun (N), Q is in direct construction with Cl and this complex construction, which will be called the classifier phrase, is in turn in construction with N."

What is stated here is that numeral expressions have a unified left-branching structure, in which the numeral and the unit word form a constituent first, excluding the noun, as in (216a). In this structure, the unit word never C-Commands the NP. Similiar proposals have been made in Li & Thompson (1981: 105), Paris (1981: 105-117), Tang (1990a), Croft (1994: 151), Lin (1997: 419), R. Yang (2001), and Hsieh (2008). In contrast, Tang (1990b: 413, 2005), Cheng & Sybesma (1998, 1999), and Li (1999), among others, have proposed a unified right-branching structure, in which a unit word and the noun form a constituent first, excluding the numeral, as in (216b). In this structure, the unit word may C-Command the NP.

(216)a.



b.



In contrast to both schools, X. P. Li (2011: 118) proposes that both left- and right-branching structures are possible, and that the former is mapped to a quantity or measure reading, and the latter is mapped to an individual or counting reading. For instance, *liang ping jiu* 'two bottle wine' has a pure quantity reading in (217a), but an individual reading in (217b). It is claimed that (217a) has a structure like (216a), and that (217b) has a structure like (216b).

(217)a. tade wei neng zhuangxia liang ping jiu.
his stomach can contain two bottle wine
'His stomach can contain two bottles of wine.'

b. Ta ling-le liang ping jiu, zuo-shou yi ping, you-shou yi ping.
he lift-PRF two bottle wine left-hand one bottle right-hand one bottle
'He carried two bottles of wine, one in the left hand and the other in the right hand.'

Although not many arguments have been proposed for any of the above three approaches, I will examine all of those that I have found.

In 2.4.1, I have introduced seven types of unit words: standard measure, container measure, individual CL, individuating CL, collective CL, partitive CL, and kind CL. I will propose that unit words exhibit two different patterns of constituency. On the one hand, numeral expressions of container measures, standard measures, partitive CLs, and collective CLs have a left-branching structure, as in (216a). On the other hand, numeral expressions of individual, individuating, and kind CLs have a right-branching structure, as in (216b).

The proposal is based on arguments from four aspects: the scope of a left-peripheral modifier; the effect of adjective lowering; the predicate status of the combination of a numeral and a unit word; and the semantic selection relation between a unit word and a noun.

The constituency issue is the first step in analyzing the syntactic structures of numeral expressions. The categorial labels of the constituents identified in this chapter will be specified in the next chapter.

In addition to this introduction section and the final summary section (Section 4.6), the organization of the chapter is the following. Section 4.2 presents the four arguments for a non-unified analysis of the constituency of numeral expressions, and makes the proposal that there are two possible structures. Section 4.3 discusses three invalid arguments in the constituency study. Section 4.4 discusses semantic mappings of the syntactic structures. Finally, Section 4.5 discusses the occurrence of the functional word *de* following a unit word, with respect to the proposed constituency.

4.2. Four arguments for the non-unified analysis

In numeral expressions, unit words do not behave the same syntactically. In this section, I present certain differences, and link the differences to the constituency issue.

4.2.1 The scope of a left-peripheral modifier

Two incompatible modifiers may co-occur if they scope over separate constituents. In each of the examples in (218) and (219), two incompatible modifiers co-occur:

(218)a. dada de san wan xiao yingtao
big DE three bowl small cherry
'three big bowls of small cherries'

b. fangfangzhengzheng de yi bao sanjiao binggan
square DE one package triangle cookie
'a square package of triangle cookies'

c. yuanyuan de yi guan fang-tang
round DE one can square-sugar
'a round can of sugar cubes'

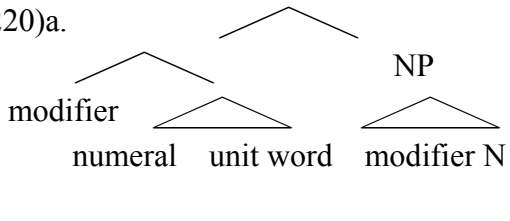
d. hen da de yi zhuo xiao keren
very big DE one table small guest
'a very big table with small guests sitting at it'

(219)a. dada de yi dui xiao yingtao
big DE one pile small cherry
'a big pile of small cherries'

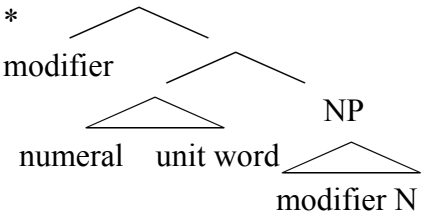
b. hen chang de yi pai chao-duan de xiao qiche
very long DE one row super-short DE small car
'a very long row of super-short small cars'

The acceptability of this type of data indicates that the scope of the left-peripheral modifier excludes the NP, which has its own modifier. This fact shows that the two modification domains belong to two separate constituents, and that the first constituent is composed of a numeral and a unit word, as well as the modifier. Putting the categorial labels of the constituent nodes aside, among the three structures in (220), only (220a) can capture the fact that the left modifier does not scope over the NP. Thus, data like (218) and (219) should have a left-branching structure for the three basic elements of the constructions.

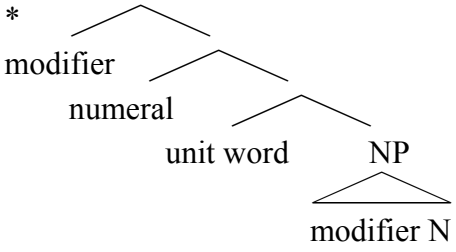
(220)a.



b. *



c. *



In (218), the unit words are all container measures, including the so-called temporary CL *zhuo* 'table' in (218d), which can be understood as a contextually-defined container measure. In (219), the unit words are collective CLs.[34] Other types of unit words may not have modifiers that are not compatible with the modifiers of the associated nouns, as seen in (221), for whatever reason. The unit word is the individual CL *li* in (221a), the individuating CL *di* in (221b), the partitive CL *pian* in (221c), the standard measure *gongjin* 'kilo' in (221d), and the kind CL *zhong* 'kind' in (221e).

(221)a. *[dada de] san li xiao yingtao [Individual CL]
big DE three CL small cherry

b. *hen da de yi di xiao shui [Individuating CL]
very big DE one CL small water

c. *hen da de yi pian xiao {xiangjiao/juzi} [Partitive CL]
very big DE one CL small banana/orange
Intended: 'three very big slices of small cheeries'

[34] Although constructions of collective CLs allow incompatible modifiers, as shown in (219), the example in (ia), which looks like a collective CL construction, does not, as seen in (ib). In such a CL copying construction, the first CL can be replaced by the individual CL *ge*, and thus it is not a real collective CL (see 6.5).

(i) a. san qun yang-qun
three CL sheep-CL
'three groups of sheep'

b. *dada de san qun xiao yang-qun
big DE three CL small sheep-CL

d. *hen zhong de yi gongjin qing muliao [Standard measure]
very heavy DE one kilo light wood
e. *hen da de yi zhong xiao yu [Kind CL]
very big DE one kind small fish

Therefore, the left-peripheral modifier test cannot be used to tell the structure of the constructions that have these types of unit words.

It is necessary to be clarified that the occurrence of the left-peripheral modifier cannot be the result of movement from a position between the numeral and the unit word. This is because the modifier must be followed by *de*, however, an adjective next to a unit word unit word may not occur with *de*, as shown in (222) (Tang 1990b: 418; see 5.4.2 of this book). If *de* emerges during the alleged movement, the derivation violates the Inclusiveness Condition (Chomsky 1995: 228), which excludes the additing of any new element during movement.

(222) * yi [dada de] wan xiao yingtao
one big DE bowl small cherry

My conclusion to this subsection is that numeral expressions with a container measure or a collective CL have a left-branching structure, in which the numeral and the unit word form a constituent, excluding the noun.

4.2.2 The effect of adjective-lowering

A delimitive modifier of a noun can occur as a modifier of an individual CL (Zhu 1982: 52; see my 2.4.3). (223a) and (223a') are different only in the position of the delimitive adjective *chang* 'long': it precedes the CL *tiao* in (223a), but follows the same CL in (223a'). The two numeral expressions mean the same, regardless of the position of the adjective. Other examples in (223) show the same pattern. This is the effect of adjective-lowering introduced in 2.4.1.2.

(223)a. yi chang tiao xianglian = a'. yi tiao chang xianglian
one long CL necklace one CL long necklace
Both: 'one long necklace'
b. yi bo pian shuye = b'. yi pian bo shuye
one thin CL leaf one CL thin leaf
Both: 'one thin leaf'
c. yi hou ben jiaoke-shu = c'. yi ben hou jiaoke-shu
one thick CL text-book one CL thick text-book
Both: 'one thick text-book'
d. yi yuan ding maozi = d'. yi ding yuan maozi
one round CL hat one CL round hat
Both: 'one round hat'
e. yi xiao fang zhang zhuanpian = e'. yi zhang xiao fang zhuanpian
one small square CL photo one CL small square photo
Both: 'one small square photo'

However, such an alternation is not seen in the numeral expressions of a container measure or collective CL, as shown in (224).

(224)a. yi xiao he kouzi
one small box button
'one small box of buttons'
≠ b'. yi he xiao kouzi [Container meas.]
one box small button
'one box of small buttons'

b. yi da dui maozi
one big CL hat
'one big pile of hats'
≠ b'. yi dui da maozi [Collective CL]
one CL big hat
'one pile of big hats'

The possible displacement of the modifier in (223) indicates that the unit word C-Commands the noun, so that the modifier of the former can be semantically related to the modifier of the latter. The C-Command relation can be represented by a right-branching structure such as (216b). In (224), however, the readings of the left examples are different from those of the right ones. If the structure of all of the examples in (224) is left-branching, as in (216a), the unit word does not C-Command the noun. This structure captures the fact that the modifier of the former does not hold a dependency relation with the modifier of the latter.

For other types of unit words, the test does not apply, since no acceptable minimal pair can be found. For instance, a mass noun may not be modified by any delimitive adjective (see 2.2.2), and thus the individuating CL construction in (225b) is not acceptable for an independent reason. As for kind CLs, when adjectives such as *da* 'big' and *xiao* 'small' precede them, the size reading disappears, and thus the acceptability of both (226a) and (226b) has a different nature from that of the examples in (224).

(225)a. yi da di shui
one big CL water
'a big drop of water'
≠ b. *yi di da shui [Individuating CL]
one CL big water

(226)a. yi da lei shuiguo
one big CL fruit
'a major type of fruit'
≠ b. yi lei da shuiguo [Kind CL]
one CL big fruit
'a type of big fruit'

The effect of adjective-lowering is similar to the effect of the Neg-Raising. One reading of (227a) is synonymous to (227b). In this reading of (227a), it seems that the meaning of the negation is raised from the lower clause to the matrix clause. Inportantly, Neg-Raising is attested in complementation structures only. The higher position of the negation must C-Command the lower postion of the negation.

(227) a. I don't think she is at home.
b. I think she is not at home

My conclusion to this subsection is that individual CL constructions have a right-branching structure and container measure or collective CL constructions have a left-branching structure.

4.2.3 The predicate status

The combination of a numeral and a unit word may function as a predicate of a dimension-denoting element, such as *chang* 'length', *zhong* 'weight', or *rongliang* 'capacity' . The combination may occur either to the left or the right of the dimension-denoting element, when the whole expression is introduced by *de* and functions as a modifier of a noun. In both (228a) and (228b), the attributive introduced by *de* occurs to the left of the noun *gunzi* 'stick'. The word *chang* 'length' takes *san cun* 'three inch' as its predicate. In the attributive, *san cun* precedes *chang* in (228a), but the order is the other way around in (228b) (see Corver 2009:

72ff for a predicate analysis of the combination of a numeral and a measure word in English and Dutch).

(228)a. [[san cun] chang] de gunzi [Standard measure]
three inch long DE stick
b. [chang [san cun]] de gunzi
Both : 'a stick that is three inches long'

In (228), the unit word is the standard measure *cun* 'inch'. In the following (229), the unit word is the standard measure *liang* (1 *liang* = 50 grams). In this example, *zhong* 'weight' takes *san liang* 'three *liang*' as its predicate. Other examples in (230) and (231) also show this predicate function of the combination of a numeral and a unit word. In addition to the standard measure in (228) and (229), the unit word is a container measure in (230) , and a partitive CL in (231).

(229) [[san liang] zhong] de danjieshi [Standard measure]
three liang heavy DE gallstone
'a gallstone that is two liangs heavy'
(230)a. [[san ping] rongliang] de jiujing [Container measure]
three bottle capacity DE alcohol
'three bottles of alcohol'
b. [[san bei] rongliang] de mianfen
three cup capacity DE flour
'three cups of flour'
(231)a. [[san duan] chang] de kewen [Partitive CL]
three paragraph long DE text
'three paragraphs of text'
b. [[san ceng] gao] de loufang
three flour high DE building
'a building that has three floors'
c. [[wushi ye] hou] de biji-ben
fifty page thick DE note-book
'a notebook that has fifty pages'

In contrast, the combination of a numeral and an individual CL may not have this function, as seen in (232). In (232a), the dimension word *chang* 'length' takes the whole string *san gen kuaizi* 'three CL chopstick' as its predicate. In the absence of the word *kuaizi* 'chopstick', the string *san gen* 'three CL' alone may not function as a predicate (note: in the intended readings of all of the examples in this subsection, the dimension word does not modify the noun to its right).

(232)a. [san gen *(kuaizi) chang] de gunzi [Individual CL]
three CL chopstick long DE stick
'a stick that is as long as three chopsticks'
b. [yi li *(putao) da] de danjieshi
one CL grape big DE gallstone
'a gallstone that is as big as a grape'

The contrast is seen not only in attributive expressions, but also in the so-called double subject constructions such as (233), and comparative constructions such as (234). In Corver

(2009), a measure phrase, such as *two feet* in *two feet long*, is analyzed as a nominal predicate. Similarly, in (233a), *liang mi* 'two meter' is the predicate of *chang* 'length' in Zhang (2009). If we replace the standard measure *mi* 'meter' with the individual CL *zhang*, the sentence becomes unacceptable, as seen in (233b). In the comparative construction (234a), *san cun* 'three inch' independently functions as an excessive measure expression (e.g., Xiang 2005), but *san gen* 'three CL' may not do so, as seen in (234b) (note that in (233a), the combination of the numeral and the unit word may also precede the dimension word if the auxiliary *you* 'have' occurs; e.g., the string *na zhang zhuozi you liang mi chang* is synonymous to (233a)).

(233)a. Na zhang zhuozi [chang liang mi]. [Standard measure]
that CL table long two meter
'That table is two meters long.'

b. *Na ge zhuozi [chang liang zhang]. [Individual CL]
that CL table long two CL

(234)a. Baoyu bi Daiyu [gao san cun] [Standard measure]
Baoyu than Daiyu tall three inch
'Baoyu is three inches taller than Daiyu.'

b. *Baoyu bi Daiyu [gao san gen]. [Individual CL]
Baoyu than Daiyu tall three CL

Since only a constituent can be a predicate, the acceptable examples in (228) through (231), (233a), and (234a) are a clear indication that the combination of the numeral and the unit word is a syntactic constituent. The impossibility for the combination of the numeral and the individual CL to function as a predicate in (232) and (233b), or as an excessive measure expression in (234b), fails to support the constituency of the combination.

Other types of CLs behave like individual CLs in this aspect. The examples in (235) all show that the combination of a numeral and a CL may not be a predicate of the dimension word *da* 'bigness, size'.

	[Individuating CL]	[Collective CL]	[Kind CL]
(235)a.	*[san di da] de shui	b. *[san dui da] de juzi	c. *[san zhong da] de juzi
	three CL big DE water	three pile big DE orange	three kind big DE orange

Data like the following might blur the distinction I just showed, since both the partitive CL *jie* in (236a) and the individual CL *du* in (236b) seem to combine with the numeral *liang* 'two' to function as a resultative.

(236)a. Baoyu ba yi gen cong qie-cheng liang jie.
Baoyu BA one CL onion cut-as two CL
'Baoyu cut an onion into two sections.'

b. Baoyu ba yi du qiang gaizao-cheng liang du.
Baoyu BA one CL wall change-as two CL
'Baoyu changed one wall into two walls.'

However, in (236b), the noun *cong* may not show up to the right of the final *jie*, as seen in (237a), whereas the noun *qiang* 'wall' can still show up to the right of the final *du*, as seen in (237b). The contrast indicates that (236b) actually is the result of deletion of the final noun. Thus, as claimed above, the contrast between partitive and individual CL constructions remains. In (236a), *liang jie* is a constituent, whereas in (236b), *liang du* is not.

(237)a. Baoyu ba yi gen cong qie-cheng liang jie (*cong).
Baoyu BA one CL onion cut-as two CL onion
'Baoyu cut an onion into two sections.'
b. Baoyu ba yi du qiang gaizao-cheng liang du (qiang).
Baoyu BA one CL wall change-as two CL wall
'Baoyu changed one wall into two walls.'

My conclusion to this subsection is that standard measure, container measure, and partitive CL constructions have a left-branching structure, in which the numeral and the unit word form a constituent, excluding the noun.

4.2.4 Semantic selection

It is well-known that there is a semantic selection relation between CLs of certain types and their associated nouns. We have addressed the syntagmatic nature of selection in 2.2.1. Selection means that syntagmatically "certain forms arbitrarily behave alike in one way and certain others behave alike in another" (Chao 1968: 6). According to Bloomfield (1933: 165), "The features of selection are often highly arbitrary and whimsical." A recent discussion of the selection of CLs is seen in Wu & Bodomo (2009: 488). In (238a), for instance, the individual CL *pi* may occur with *ma* 'horse', but not with *zhu* 'pig'.

(238)a. san pi {ma/*zhu}
three CL horse/pig
'three horses'
b. san zhan {deng/*lazhu}
three CL lamp/candle
'three lamps'
c. san sou {chuan/*feiji}
three CL ship/plane
'three ships'
d. san ze {xiaohua/*jianyi}
three CL suggestion/joke
'three jokes'
e. san tiao {*xiaohua/jianyi}
three CL suggestion/joke
'three suggestions'

Even the more general individual CLs such as *jian* (件) have selectional restrictions. *Jian* may occur with *liwu* 'gift', *shi* 'matter', *yifu* 'clothes', *jiaju* 'furniture', *zuopin* 'literature or art product', but not with nouns such as *shu* 'book', *deng* 'lamp', *qianbi* 'pencil', or *hua* 'flower'.

Semantic selection is also found in individuating CLs, which occur with mass nouns. In (239a), for instance, the individuating CL *ji* (劑) may occur with *yao-shui* 'medicine-liquid', but not with *ji-tang* 'chicken-soup'.

(239)a. liang ji {yao-shui/*ji-tang}
two CL medicine-liquid/chicken-soup
'two doses of liquid medicine'
b. liang pao {niao/*ji-tang}
two CL urine/chicken-soup
'the amount of pee of two peeing events'
c. liang {pian/*zhang} yun
two CL/CL cloud
'two pieces of cloud'
d. liang {gu/*tiao} zheng-qi
two CL/CL steam-air
'two puffs of steam'
e. liang pi {bu/*zhi}
two CL cloth/paper
'two units of cloth'
f. liang zhang {*bu/zhi}
two CL cloth/paper
'two units of paper'
g. yi gu {kongju/*heping}
one CL fear/peace
'one unit of fear'
h. yi pai {*kongju/heping}
one CL fear/peace
'one unit of peace'

The acceptability contrasts in (239) clearly shows that like other nouns, mass nouns may also occur with particular CLs (contra Chao 1968: 508 "Mass nouns do not have specific

classifiers"; also p. 503; Hundius & Kölver 1983: 168; Krifka 2008: Sec. 2).

As pointed by T'sou (1976: 1224), "These are instances of intentional violation of selectional restrictions. They are very much in evidence and the ability to produce them is part of linguistic competence and must be accounted for in an adequate grammar." In Yu Kwang-Chung's (1999) poem, the same CL *pi* in (238a) is used with the noun *taiyang* 'sun', as in *yi pi taiyang* 'one CL sun', to describe the sudden rising of the sun in a dawn, in which the sun looks like a galloping horse. The occurrence of such an effect in turn shows the existence of s-selection of the CL.

A less discussed fact is that kind CLs also show selectional restrictions. Huang & Aherens (2003: 362) list as many as fourteen kind CLs in Mandarin Chinese, and describe their compatible nouns (although no unacceptable forms are given). Our following examples show the acceptability contrast between different kind CLs occuring with different nouns.[35]

(240)a. san kuan {*shi/shouji/*xuesheng/*lilun}
three CL matter/cellphone/student/theory
'three kinds of cellphones'

b. san dangzi {shi/*shouji/*xuesheng/*lilun}
three CL matter/cellphone/student/theory
'three kinds of things'

c. san tao {*shi/*shouji/*xuesheng/lilun}
three CL matter/cellphone/student/theory
'three kinds of theories'

Unlike individual, individuating and kind CLs, other types of unit words do not show selectional restrictions on nouns. In (241a), the container measure *chexiang* 'cattle-car (of a train)' is blind to the semantic distinction between *ma* 'horse' and *zhu* 'pig'. The lack of selectional restriction is also seen in the examples of the standard measure in (242), the collective CLs in (243), and the partitive CL in (244) (Note: it is the semantic conflict rather than the arbitrary selectional restrictins that accounts for the constraint that standard and container measures do not occur with immaterial notions, as shown in 2.2.1).

(241)a. san chexiang {ma/zhu} [Container measure]
three cattle.car horse/pig
'three cattle-cars of horses/pigs'

b. san wan {yao-shui/ji-tang}
three bowl medicine-liquid/chicken-soup
'three bowls of liquid-medicine/chicken-soup'

(242) san sheng {yao-shui/ji-tang} [Standard measure]
three liter medicine-liquid/chicken-soup
'three liters of liquid-medicine/chicken-soup'

(243)a. yi dui {shu/shoujuan} [Collective CL]
one pile book/handkerchief
'one pile of books/handkerchiefs'

b. yi pian {qiche/mayi}
one CL car/ant
'one big area of cars/ants'

[35] The 14 kind CLs are: *zhong, ban, pai, ma, mazi, dang, dangzi, deng, lei kuan, hao, shi,* and *yang*. We can add another one: *tao*, as seen in (240c).

(244) san pian {xigua/huluobo/juzi} [Partitive CL]
three CL watermelon/carrot/orange
'three slices of watermelon/carrot/orange'

Long & Ma (2008) claim that standard measures never occur with animate nouns. But this constraint simply reflects our conventional world knowledge, since we usually do not measure animate entities with standard measures. Thus it is a pragmatic constraint, rather than co-occurrence restriction. If a proper context is found, the constraint disappears. Imagine if the total weight of certain students is 550 kgs, the following sentence is then natural:

(245) Zhuangzai-zhe 550 gongjin xuesheng de na ge qiqiu manman de sheng-qilai le.
load-PRG 550 kg student DE that CL balloon slow DE rise-up PRT
'The balloon that has 550 kg students with it is rising up slowly.

Therefore, a semantic selection is found in individual, individuating, and kind CLs, but not in other types of unit words.

Selection relation must be represented in a local syntactic relation, i.e., the two elements that hold the relation must form a constituent, excluding other elements. The right-branching structure, as in (216b), can capture this relation, since the unit word and the noun form a constituent. The left-branching structure, as in (216a), however, does not capture the relation, since the unit word and the noun do not form a constituent.

In Hsieh (2008: 47 fn. 15), a unified left-branching structure is proposed. In order to explain the semantic selection between an individual CL and a noun, a feature-percolating theory is mentioned. However, since the CL in the assumed left-branching structure does not C-Command the noun, the assumed percolation is hard to be maintained.

Based on the semantic selection of a unit word on its associated noun, I conclude that individual, individuating and kind CL constructions have a right-branching structure, in which the unit word and the noun form a constituent, excluding the numeral. However, no parallel selection is found for other types of unit words, and thus there is no evidence to support this constituency for them.

4.2.5 Two possible structures

The content of the discussion in this section is summarized in (246).

(246)a. The arguments used to distinguish a left-branching structure from a right-branching structure:

Argument A: the combination of a numeral and a unit word as the scope of a left-peripheral modifier => Left-branching

Argument B: the effect of adjective lowering:
The presence of the effect => Right-branching
The absence of the effect => Left-Branching

Argument C: the predicate status of the combination of a numeral and a unit word => Left-branching

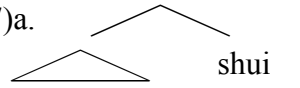
Argument D: Semantic selection of a unit word on a noun => Right-branching

b.

	Left-branching	Right-branching
Container measure	Argument A, B, C	
Standard measure	Argument C	
Collective CL	Argument A, B	
Partitive CL	Argument C	
Individual CL		Argument B, D
Individuating CL		Argument D
Kind CL		Argument D

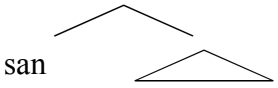
From the four constituency tests listed in (246a), we can conclude that the constructions of the first four types of unit words listed in (246b), i.e., container measures, standard measures, collective CLs, and partitive CLs, have a left-branching structure, in which the numeral and the unit word form a constituent, excluding the noun, as shown in (247a), and that the constructions of individual and individuating CLs have a right-branching structure, in which the CL and the noun form a constituent, excluding the numeral, as shown in (247b).

(247)a.



san ping water
three bottle
'three bottles of water'

b.



san di shui
three CL water
'three drops of water'

In addition to the above four argments, two more arguments will be added later in 5.5.3, to support the constituency contrast.

One further fact supporting the formal division between the group of individual, individuating and kind CL constructions on the one side, and the constructions of the rest types of unit words on the other side is that the default CL *ge* may alternate with the unit words of the former group only (see 2.4.1.5).

(248)a. san {tai/ge} dianshi-ji — Individual CL
three CL/CL TV-set
'three television sets'

b. Yani faxian-le san {tiao/ge} cuowu. — Individuating CL
Yani find-PRF three CL/CL error
'Yani found three errors.'

c. Mei ge cunzi dou faxian-le zhe liang {zhong/ge} bingdu. — Kind CL
every CL village all find-PRF this two CL virus
'These two kinds of virus have been found in every village.'

d. san {pian/*ge} xiaojiao — Partitive CL
three CL/CL banana
Intended: 'three slices of banana'

e. san {dui/*ge} xiaojiao — Collective CL
three CL/CL banana
Intended: 'three piles of banana'

f. san {lan/*ge} xiaojiao — Container measure
three basket/CL banana
Intended: 'three baskets of banana'

g. san {bang/*ge} xiaojiao — Standard measure
three pound/CL banana
Intended: 'three pounds of banana'

4.3. Three invalid arguments

In this section, I falsify three arguments that have been used in the literature to support the syntactic constituency analyses of numeral expressions. The arguments are related to the co-occurrence of a numeral and a unit word, the position of certain partitive markers, and the immobility of the movement of a numeral-CL string.

4.3.1 The co-occurrence of a numeral and a unit word

In CL languages such as Chinese, a numeral and a CL are adjacent. Greenberg (1972) thus claims that the two elements should form a constituent. Similarly, Croft (1994: 151) claims that since a CL and a numeral co-occur, they must form a constituent. Thus a unified left-branching structure for all types of CL constructions is proposed from this co-occurrence perspective. The claim is adopted in Wilhelm (*ibid.*: 60).

This is not an effective argument, however. In English, an auxiliary (e.g., *have* or *be*) needs to occur with a subject or expletive, but the two elements never form a constituent. Also, as pointed out by Krifka (2008: Sec. 6.3), while the co-occurrence of two elements might lead to a certain morphological combination, this does not mean in itself that the two elements form a constituent in the syntactic structure. The combination of a numeral and a CL, such as *liar* (= *liang* 'two' + *ge* CL) and *sa* (= *san* 'three' + *ge* CL), can be similar to the fusion of a preposition and its following article in French *aux* (= *à les* 'to the') and German *beim* (= *bei dem* 'at the').

A numeral and a CL may also form a phonological phrase. However, as is well-known, phonological phrases are not necessarily isomorphic to syntactic constituents. For instance, the syntactic constituency of (249a) is not reflected in the phonological grouping in (249b) (Jackendoff 1997: 26) (ω marks a prosodic word boundary).

(249) a. $[_{DP}$ a $[_{NP}$ $[_{AP}$ big] house]] b. $[_{\psi}$ $[_{\omega}$ a big] $[_{\omega}$ house]]

4.3.2 The positions of the partitives *duo* 'more' and *ban* 'half'

4.3.2.1 The position of *duo* 'more'

Lü et al. (1999 [1980]: 184) claim that *duo* 'more' may follow a measure word, but not a CL in general (with exceptions; see 4.3.2.3 below). Wang (1994: 35) uses the occurrence of the post-unit word *duo* to distinguish CLs from measure words. In Hsieh (2008: 46), it is assumed that if *duo* follows a unit word, the unit word and its preceding numeral should form a constituent. If so, the structure should be left-branching. X. P. Li (2011: 114) uses the same argument to claim that such *duo* constructions have a left-branching structure.

However, the position of *duo* is not a reliable argument in judging the constituency of the containing structure, for the following reason.

Duo is an additive partitive quantifier, scoping over the single unit-morpheme to its immediate left. The unit morpheme can be a numeral unit, such as *shi* 'ten', *bai* 'hundred', *qian* 'thousand', etc., or a measure word, or a CL. In (250), for instance, the unit morpheme to the immediate left of *duo* is *shi* 'ten', which is the second morpheme of the word *wu-shi* 'fifty'. The quantity expressed by this example is 50 plus a part of *shi* 'ten'. It can be any number between 50 and 60.[36]

[36] The distributions of the partitive markers *duo* 'more', *ban* 'half', and *ji* 'a few, several' are different. Although *duo* may follow either a numeral or a unit word, as seen in (251) and (252), *ban* follows a unit word only, rather than a numeral, as seen in (i); and the host of *ji* may follow a numeral, rather than a unit word, as

(250) wu-shi duo feng xin
five-ten more CL letter
'fifty and more letters' (50 < x < 60)

Importantly, *duo* does not scope over the two-morpheme string *wu-shi* 'fifty' in (250), since the reading of the phrase may not cover figures such as 70, which is 50 plus 20 (20 is part of 50). The following minimal pair is telling (from Lü et al. 1999 [1980]: 184; 1 *mu* = 6.666 m^2). Both (251a) and (251b) can be roughly translated as '10 *mu* and more (of) land'. But precisely speaking, they cover different ranges.

(251) a. shi duo mu di
ten more mu land
'10 *mu* and more (of) land' (10 < x < 20)
b. shi mu duo di
ten mu more land
'10 *mu* and more (of) land' (10 < x < 11)

In (251a), *duo* 'more' is adjacent to *shi* 'ten' to its left. In this case, it means part of ten. The quantity expressed by the whole phrase is 10 plus a part of 10, i.e., any figure between 10 and 20 (e.g., 12 *mu*). In (251b), *duo* is adjacent to the standard measure *mu* to its left. In this case, it means part of one *mu*. The quantity expressed by the whole phrase is 10 plus a part of one *mu*, i.e., any figure between 10 and 11 *mu* (e.g., 10.6 *mu*).

Similarly, the reading of (252a) is 30 plus part of 10. The quantity expressed by the whole nominal is thus any number between 30 and 40, e.g., 33 *mu*. In contrast, the reading of (252b) is 30 plus a part of one *mu*. The quantity expressed by the whole nominal is any number between 30 and 31 *mu*, e.g., 30.4 *mu*.

(252) a. san-shi duo mu di
three-ten more mu land
'30 *mu* and more (of) land' (30 < x < 40)
b. san-shi mu duo di
three-ten mu more land
'30 *mu* and more (of) land' (30 < x < 31)

Therefore, if *duo* follows a unit word, as in (251b) and (252b), it scopes over the unit only, excluding the numeral. Recall that in Chapter 2 we claim that a unit word tells us what counts as one in counting. If *duo* follows a unit word, its partitive meaning scopes over the one unit encoded by the unit word. Thus, nothing indicates that the numeral and the unit word form a syntactic constituent.

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seen in (ii). But *ji* may also precede a numeral, whereas the other two may not, as seen in (iii).

(i) a. shi mi ban b. *shi ban mi (ii) a. *shi mi ji b. shi ji mi
ten meter half ten half meter ten meter several ten several meter
'10.5 meters' '10 and more meters'

(iii) a. ji bai mi b. *duo bai mi c. *ban bai mi
several hundred meter more hundred meter half hundred meter
'several hundreds meters'

Also note that the single numeral morpheme next to *duo* or *ji* may not be a single-digit one:

(iii) a. *shi-wu duo mi b. *shi-wu ji mi c. *ji wu mi
ten-five more meter ten-five several meter several five meter

4.3.2.2 The position of *ban* 'half'

Lü et al. (1999 [1980]: 60) claim that *ban* 'half' may follow a measure word, but not a CL in general (with exceptions; see 4.3.2.3 below). In Hsieh (2008: 46), it is assumed that if *ban* follows a unit word, the unit word and its preceding numeral should form a constituent. The argument is again not valid.

Like *duo* 'more', *ban* 'half' is also a partitive quantifier, scoping over one single adjacent morpheme. When *ban* follows a unit word, it scopes over the unit word only, excluding the numeral. For instance, in the three examples in (253), *ban* follows *mi* 'meter'. The reading of (253a) is 5 plus a half of a meter, i.e., 5.5m. The reading of (253b) is 13 plus a half of a meter, i.e., 13.5m. This example never means the half of 13 (i.e., 6.5). Similarly, the reading of (253c) is 300 plus a half of a meter, i.e., 300.5m.

(253) a.	wu mi ban	b. shi-san mi ban	c. san-bai mi ban
	five meter half	ten-three meter half	three-hundred meter half
	'5.5 meters'	'13.5 meters'	'300.5 meters'

Since *ban* never scopes over the combination of a numeral and a unit word, its position does not show whether the combination is a constituent or not.

4.3.2.3 The condition for the occurrence of post-unit *duo* and *ban*

When Lü et al. (1999 [1980]) claim that *duo* 'more' and *ban* 'half' may not follow a CL, they also report some exceptions. We have shown that when these two partitive markers follow a unit word, they scope over the unit word only, introducing an additional fractional quantity. My own observation is that if the internal argument of a verb is an incremental theme (Krifka 1989, Dowty 1991) (such a theme is also called internal argument of incremental verbs; see e.g., Kennedy 2011), the argument may contain a fractional numeral, or the partitive marker *duo* 'more' or *ban* 'half'. In other words, if a context allows the occurrence of a fractional numeral, it also allows the occurrence of *duo* or *ban* after a unit word, including a CL. In (254a), the verb *yong* 'use' takes the object that has the fractional numeral 3/4. In (254b) and (254c), we see that in the same context, the object can contain the partitive marker *duo* and *ban*, respectively. In (255a), however, the verb *zhaixia* 'pick' may not take the object that has the fractional numeral 3/4. Then in (255b) and (255c), in the same context, the object may not contain the partitive marker *duo* and *ban*, respectively. The examples in (256) and (257) show the same kind of contrast.

(254)a. Zuo zhe ge dangao wo yong-le 3/4 ge pingguo.
make this CL cake I use-PRF 3/4 CL apple
'I used three quaters of an apple to make this cake.'

b. Zuo zhe ge dangao wo yong-le yi ge duo pingguo.
make this CL cake I use-PRF one CL more apple
'I used one apple and (some) more to make this cake.'

c. Zuo zhe ge dangao wo yong-le yi ge ban pingguo.
make this CL cake I use-PRF one CL half apple
'I used one and a half apples to make this cake.'

(255)a. *Ta cong shu-shang zhaixia-le 3/4 ge pingguo.
he from tree-on pick-PRF 3/4 CL apple

b. *Ta cong shu-shang zhaixia-le yi ge duo pingguo.
he from tree-on pick-PRF one CL more apple

c. *Ta cong shu-shang zhaixia-le yi ge ban pingguo.
he from tree-on pick-PRF one CL half apple

(256)a. Na zhi yang yao-sui-le 3/4 zhi qianbi.
that CL goat chew-broken-PRF 3/4 CL pencil
'That goat chewed three quaters of a pencil into pieces.'

b. Na zhi yang yao-sui-le san zhi duo qianbi.
that CL goat chew-broken-PRF three CL more pencil
'That goat chewed three and more pencils into pieces.'

c. Na zhi yang yao-sui-le san zhi ban qianbi.
that CL goat chew-broken-PRF three CL half pencil
'That goat chewed three and a half pencils into pieces.'

(257)a. *Wo mai-le 3/4 zhi qianbi.
I buy-PRF 3/4 CL pencil

b. *Wo mai-le san zhi duo qianbi.
I buy-PRF three CL more pencil

c. *Wo mai-le san zhi ban qianbi.
I buy-PRF three CL half pencil

The same numeral expression may occur in one context, but not another. The acceptability contrast exhibited in the above data is neither a contrast between CLs and measure words (as claimed by Lü et al., *ibid*, and Wang, *ibid*.), nor a contrast in the nominal-internal constituency (as claimed by Hsieh, *ibid*, and X. P. Li, *ibid*). Just as existential verbs may not take a definite argument in the VP domain, so certain verbs may be sensitive to other formal properties of nominal arguments. Thus, it is possible that non-incremental verbs such as those in (255) and (257) disallow their internal argument to have a fractional number. Instead, only integers are allowed.

4.3.3 The movement argument

In Mandarin Chinese, the combination of a numeral and a unit word may not be fronted:

(258)a. Shufen mai-le san ben shu.
Shufen buy-PRF three CL book
'Shufen bought three books.'

b. *San ben, Shufen mai-le shu.
three CL Shufen buy-PRF book

(259)a. Shufen mai-le san jin niurou.
Shufen buy-PRF three jin beef
'Shufen bought three jin of beef.'

b. *San jin, Shufen mai-le niurou.
three jin Shufen buy-PRF beef

This is different from the following Japanese examples, where the combination of the numeral *san* 'three' and the CL *satu* may be separated from the associated noun *hon* 'book' in (260b):

(260)a. Taroo-wa san-satu no hon-o katta.
Taroo-TOP three-CL NO book-ACC bought
Both: 'Taroo bought three books.'

b. San-satu, Taroo-wa hon-o katta.
three-CL Taroo-TOP book-ACC bought

Saito et al. (2008: 260) use the contrast between (258) and (260) to show that the CL construction in Chinese is right-branching and thus the combination of the numeral and the CL may not move, whereas the CL construction in Japanese is left-branching and thus the combination of the numeral and the CL can move (see Watanabe 2010 for more discussion of the syntax of Japanese CL constructions). In this chapter, I have also argued that individual CL constructions in Chinese have a right-branching structure, in which the numeral and the unit word do not form a constituent excluding the NP, and thus the unacceptability of (258b)

is expected. Our conclusion is compatible with Saito et al.'s. However, if the constructions of some other types of unit words, such as the standard measure in (259a), have a left-branching structure, as we have proposed, how is it that the combination of the numeral and the unit word may still not move, as seen in (259b)?

The unacceptability of (259b) does not falsify my analysis, however. One accout of the unacceptability is that the parallel left quantity-denoting constituent of a nominal may not move in Chinese, either, as seen in (261b). The constituency status of the string *hen duo* 'very many' is not controversial. The fact that the string may not move does not affect its constituent status.

(261)a. Shufen mai-le hen duo (de) shu.
Shufen buy-PRF very many DE book
'Shufen bought many books.'

b. *Hen duo (de), Shufen mai-le shu.
very many DE Shufen buy-PRF book

Although it is not clear to me why the language has this constraint, at least data like (261) indicate that such a movement argument, if it is considered, is not a valid argument against the analysis proposed here. There might be an independent explantion for the general ban on the left dislocation of quantifiers in Chinese.

4.4. Remarks on a semantic mapping analysis

Non-unified structures of classifier constructions have also been seen in the literature. However, different structures are claimed to correlate with particular readings. In this section, I argue against such a mapping.

X. P. Li (2011: 117) claims that for a numeral expression in Mandarin Chinese, a quantity (= his measure) reading is mapped to the left-branching structure, whereas an individual (= his counting) reading is mapped to the right-branching structure. Four main arguments are presented to support such a quantity-individual mapping (p. 113-116; 119-120): (A) the silence of a numeral; (B) the position of *duo*; (C) the position of *de*; and (D) the deletion of the noun after a reduplicate container measure word. In addition to these four arguments, he also mentions another argument: reduplicate unit words (e.g., *ping-ping* 'bottle-bottle') may not take a nominal in a quantity reading as its antecedent (p. 115-116; 120). Similar observation has been reported in Y.H. Audrey Li (1998: 698) and Rothstein (2009). But it is hard to see how this fact is related to the internal constituency of a numeral expression. I thus ignore this final argument. Argument B has been shown to be invalid in 4.3.2.1 above. The problems of Argument C will be discussed in 4.5. In this section, I falsify Arguments A and D.

X. P. Li claims that only the right-branching structure allows the numeral to be silent. This silent numeral argument for the quantity-individual mapping of constituency is based on the examples like (262), assuming there is a silent *yi* 'one' in the position marked by __.

(262) Siyu mai-le __ ben shu.
Siyu buy-PRF CL book
'Siyu bought a book.'

In 3.3, I have argued that such a PUWN has no position for a numeral. If so, nominals like *ben shu* 'CL book' in (262) contain only two overt elements and thus there is no way to use such examples to look for the contrast between a left-branching and right-branching structure of a three-element nominal.

Now we turn to Argument D. X. P. Li (p. 120) notes that when a container measure is reduplicated, the noun to its right may not be deleted if the whole nominal has an anaphoric

relation to an antecedent that is a numeral expression, as shown in (263) (his judgment):

(263) zhe ge tong zhuang-le san ping jiu, ping-ping *(jiu) dou hen gui.
this CL bucket hold-PRF three bottle wine bottle-bottle wine all very expensive
'This bucket holds three bottles of wine, each of which is expensive.'

According to Li, *san ping jiu* 'three bottle wine' in this sentence has a quantity reading (= his measure reading). Under this hypothesis, the nominal should have a left-branching structure, and the numeral-unit word complex *san ping* 'three bottle' is a modifer of the noun. If so, the impossible deletion can be accounted for, assuming the modified noun may not be deleted. However, first of all, if the first clause of (263) has a quantity reading, it should not function as an antecedent of another form, especially a form that encodes a distributive reading (his p. 111; 116; note the occurrence of *dou* 'all' in the example). Second, the assumption that a modified noun may not be deleted is problematic. The following sentence also has a quantity reading, but the noun to the right of the unit word, which is assumed to be a modifed noun in his analysis, is deleted:

(264) Baoyu yao mai san bang yingtao, Daiyu yao mai wu bang.
Baoyu want buy three pound cherry Daiyu want buy five pound
'Baoyu wants to buy three pounds of cherries, and Daiyu wants to buy five pounds.'

We conclude that the above arguments for the quantity-individual mapping of constituency are not convincing.

The syntactic contrast between a quantity reading and individual reading of a nominal has been systematically studied since Y.H. A. Li (1998). Y.H. A. Li presents certain tests to separate the two readings in Mandarin Chinese. For instance, the quantity reading of *san ge ren* 'three CL person' in (265a) may not enter into a co-referential relation with a following pronoun, but the individual reading of the same nominal in (265b) may do so (Y.H. A. Li 1998: 698).

(265) a. San ge ren_i tai-bu-dong zhe jia gangqin. *$Tamen_i$ de liliang tai xiao.
three CL people lift-not-move this CL piano they DE strength too small
'Three people cannot lift up this piano. Their strength is too weak.'
b. Ta mingtian hui kandao san ge ren_i, hai hui gen $tamen_i$ zuo pengyou.
he tomorrow will see three CL people and will with them make friends
'He will meet three people tomorrow and will make friends with them.'

Rothstein (2009) also presents a few contrastive properties of the two readings. They are compatible with Y.H. A. Li's observations. She (p. 110) also mentions that in English, "[O]n the measure reading, the suffix *-ful(s)* can often be added to the classifier, but this is inappropriate for the individuating reading." The examples in (266) are given to show the contrast:

(266) a. Add two cup(ful)s of wine to the soup. [quantity]
b. Bring two cup(#ful)s of wine for our guests. [individual]
c. We needed three bucket(ful)s of cement to build that wall. [quantity]
d. Three bucket(#ful)s of mud were standing in a row against the wall. [individual]

According to Akmajian & Lehrer (1976: 412), "[T]he suffix *–ful* added to nouns is a

partially productive way of converting nouns to quantifiers." If a speaker chooses the quantifier version of an expression (i.e., the *–ful* form), instead of the plain noun version, the intended meaning must be a quantity (or measure) one, instead of an individual one.

Rothstein further reports certain morphological contrasts of the two readings in Hebrew. However, no constituency contrast is presented.

In Y.H. A. Li (1998), a pure quantity reading of a numeral expression is represented by a functional projection NumP (note that there is no QuantP in her system; see next chapter for the distinction between NumP and QuantP in my analysis), and an individual reading is represented by DP. The latter has one more layer of functional projection than the former. Liao (2010) argues that the contrast should be represented at a higher level, such as in the projection of modals. In neither Y.H. A. Li's work nor Liao's work, where the distinction between quantity and individual readings is also discussed, have we seen any argument to support a contrast in the nominal-internal constituency.

The different types of constituency argued in my 4.2 do not correlate with the quantity-individual contrast. Each of the structures may have both readings. In (267), the individual CL *duo* and the noun *hua* 'flower' form a constituent first, excluding the numeral *san* 'three' (i.e., right-branching structure). Now we see that (267a) has an individual reading and (267b) has a quantity reading. In (268), the kind CL *zhong* 'kind' and the noun *yu* 'fish' also form a constituent first, excluding the numeral *san* 'three'. (268a) has an individual reading and (268b) has a quantity reading. In (269), the container measure *ping* 'bottle' and the numeral *san* 'three' form a constituent first, excluding the noun *jiu* 'wine' (i.e., left-branching structure). (269a) has an individual reading and (269b) has a quantity reading.

(267) a. Wo ba san duo hua dou fang zai zhuozi-shang le. [individual]
I BA three CL flower all put at table-on PRT
'I put all of the three flowers on the table.'

b. Zheli zhi neng fang san duo hua. [quantity]
here only can put three CL flower
'Only three flowers can be put here.'

(268) a. You san zhong yu you de hen kuai. [individual]
have three kind fish swim DE very fast
'There are three kinds of fish which swim very fast.'

b. Ni zuiduo zhi neng tiao san zhong yu. [quantity]
you most only can choose three kind fish
'You can choose only three kinds of fish at most.'

(269) a. Wo ba san ping jiu dou fang zai zhuozi-shang le. [individual]
I BA three bottle wine all put at table-on PRT
'I put all of the three bottles of wine on the table.'

b. Zhe zhi bing-tong zhi neng fang san ping jiu. [quantity]
this CL ice-bucket only can put three bottle wine
'This ice-bucket can hold only three bottles of wine.'

In X. P. Li (2011), individual CL constructions have a default individual reading (p. 121), as in my (267a), and such a reading has a right-branching structure. For the possible quantity reading of such constructions, as in my (267b), he resorts to the operation of semantic shift (p. 137). Since quantity reading has a left-branching structure in his analysis, the assumed semantic shift must correlate with a change in the syntactic structure. However, no syntactic evidence has been shown to support a left-branching structure for individual CL constructions.

Moreover, consider the examples of modification constructions in (218) and (219). One

of the examples is repeated here as (270). Zhang (2006) shows that if a construction has a pre-numeral modifier, it has a specific and thus individual reading, but the modification evidence shows that in such examples, the construction clearly has a left-branching structure. This is unexpected if individual readings correlate with a right-branching structure.

(270) dada de san wan xiao yingtao
big DE three bowl small cherry
'three big bowls of small cherries'

Furthermore, English numeral-initial NPs such as *three small children* have no CL, but they also have the two readings (Y.H. A. Li 1998: 695). The numeral-initial nominals in (271a) and (271b) both have a quantity reading, whereas the one in (272) has an individual reading. There is no evidence for a difference in the C-Commanding relation of *three* and *small children* between (271a) and (272).

(271) a. That bed sleeps three small children.
b. That hotel suite accommodated 100 guests.
(272) Three small children have arrived. They are all in the kitchen.

I thus claim that the contrast between a left- and right-branching structure of unit constructions does not correlate with the contrast between quantity and individual readings.[37]

In addition to the two syntax-semantics mappings falsified above, some other mappings are also seen in the literature. For instance, Tang (1990a: 353) mentions that in English, mass noun constructions have a left-branching structure and count noun constructions have a right-branching structure. The same correlation is also stated in Watanabe (2006: 261, 270) for Japanese. It is beyond the scope of this book to discuss these languages. In my analysis of Mandarin Chinese, the contrast between a left-branching and right-branching structure is obviously not that between count and mass nouns, since there is no count nouns in Chinese (Chapter 2). Also, my conclusion that individuating and individual CL constructions have an identical constituency shows that there is no constituency difference between numeral expressions of mass nouns and those of non-mass nouns in the language.

The division between the left- and right-branching structures argued for in this chapter also has no correlation with the division between the alleged sortal and mensural CL constructions (see 2.7.3). According to Grinevald (2002: 261) and Rijkhoff (2002: 48), individual CLs are sortal ones and individuating CLs are mensural ones. In my analysis, both kinds of CLs have a right-branching structure. My division of the left- and right-branching structures also does not match Ōta's (2003 [1958]: 147) division between measuring (*ji-liang* 計量) and counting (*ji-shu* 計數) constructions: the former is for standard measure and container measure and the latter is for the rest, including individual and collective CL constructions. In my analysis, collective CL constructions have the same structure as that of standard and container measures. Since the sortal-mensural division and the measuring-counting division are not supported by any syntactic evidence, it is not surprising that they do not correlate with the syntactic analysis presented here.

4.5. Constituency and the occurrence of *de* following a unit word

4.5.1 Background

[37] Following Rothstein (2009), X. P. Li (2011) also uses numeral expressions with a constainer measure to support his claim. He correlates the container reading with an individual reading, which is assumed to have a right-branching structure, and correlates the containee reading with a quantity reading, which is assumed to have a left-branching structure. The correlations have been falisified in Zhang (2012a).

In Mandarin Chinese, the functional element *de* may introduce a modifier such as an adjective or relative clause to the left of another element. We have seen such examples before (e.g., (218) and (219)). *De* may also surface between a unit word and a noun. If the unit word is an individual or individuating CL, there are certain constraints, which will be explained as we progress. However, in general, all types of unit words may be followed by *de*, as observed in Tang (2005: 444), Hsieh (2008: 42), X. P. Li (2011), and Her & Hsieh (2010: 540), as shown in (141), repeated here as (273).[38]

(273)a. Shufen chi-le yi-bai {ge/gongjin/bao/pian/dui/zhong} de pingguo.
Shufen eat-PRF one-hundred CL/kilo/bag/slice/pile/kind DE apple
'Shufen ate 100 apples or 100 {kilos/bags/slices/piles/kinds} of apples.'

b. Shufen chi-le san-fen-zhi-yi li de ganmao-yao.
Shufen eat-PRF one-third CL DE cold-pill
'Shufen took one third of a cold pill.'

c. Yi liang tiao de maojin ni zong mai-de-qi ba!
one two CL DE towel you after.all buy-can PRT
'You should be able to afford to buy one or two towels!'

Hsieh (2008: 45) claims that "The use of *de* calls for the organization of all the relevant information in an N-C sequence as a constituent" (her N = numeral; C = CL). The same idea is found in X. P. Li (2011: 119, his Argument C, as I mentioned at the beginning of 4.4 above). They thus both argue for a unified left-branching structure from this *de*-perspective.

However, we have shown that an individual CL construction may not have two incompatible modifiers (see 4.2.1). If *de* occurs, the constraint remains. The consistency does not support a left-branching structure for the numeral expression.

(274) *Shufen chi-le hen da de yi-bai ge (de) xiao pingguo.
Shufen eat-PRF very big DE 100 CL DE small apple

Moreover, if an individual or an individuating CL s-selects a noun, it does so regardless of the presence of *de*. In (275), the noun *pingguo* 'apple' may occur with the CL *ge*, but not the CL *zhan*. The latter is for lamps. The selection restriction is not affected by the occurrence of *de*. I have argued that the selection supports a right-branching structure, rather than a left-branching one (4.2.4). This consistency does not support a left-branching structure for the numeral expression.

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[38] I do not consider numeral expressions that express an inherent or individual-level property of the entity denoted by the noun, as shown in the underlined part in (i) (Tang 2005: 434).

(i) a. Ta mai-le liang tao [wu ben de shu].
he buy-PRF two CL five CL DE book
'He bought 2 sets of 5 volume books.'

b. Ta mai-le liang mi [yi gongfen de shengzi].
he buy-PRF two meter one cm DE rope
'He bought two meters of the rope that is 1 cm thick.'

c. yi ge shi bang de xigua
one CL ten pound DE watermelon
'one watermelon that has ten pounds'

In such constructions, the higher unit word can be either a CL, as in (ia) and (ic), or a measure word, as in (ib) (contra Her & Hsieh 2010: 536). Semantically, such attributive constructions are for classifying, rather than counting. Syntactically, they are different from the pseudo-partitive constructions discussed in this book. Like in other constructions that contain a complex attributive, the functional word *de* must occur to the right of the attributive, i.e., the right of the second unit word in (i) (contra Her & Hsieh 2010: 536). In Dutch, the counterpart of *de* here is analyzed as a nominal copula in Corver (2009: 125). In both English and Dutch, the measure words may not be plural when they occur in attributive constructions. See Schwatzchild (2006), Hsieh (2008), Corver (2009: 125), Liao & Wang (2011: Sec. 5), and X. P. Li (2011) for discussions of such constructions.

(275) Shufen chi-le yi-bai {ge/*zhan} (de) pingguo.
Shufen eat-PRF 100 CL/CL DE apple
'Shufen ate 100 apples.'

We thus need a more plausible analysis of the *de* versions of various numeral expressions.

4.5.2 The quantity-reading condition

Morphologically, the functional element *de* is an enclitic consistently (Huang 1989), although it is usually called a particle. Hsieh (2008: 40, 45) observes that *de* may follow an individual CL, as in (275), when the quantity is emphasized. We further find that in a context where the quantity is not emphasized, *de* may not follow an individual CL, individuating CL, or kind CL, but may follow a unit word of other types, i.e., a partitive CL, collective CL, container measure, or standard measure.

(276)a. *Zhuozi-shang you san ge de pingguo. [Individual CL]
table-on have three CL DE apple

b. *Zhuozi-shang you san di de you. [Individuating CL]
table-on have three CL DE oil

c. *Zhuozi-shang you san kuan de fuzhuang. [Kind CL]
table-on have three kind DE clothes

(277)a. Zhuozi-shang you san pian de xiangjiao. [Partitive CL]
table-on have three CL DE banana
'There are three slices of banana on the table.'

b. Zhuozi-shang you san dui de yingtao. [Collective CL]
table-on have three pile DE cherry
'There are three piles of cherries on the table.'

c. Zhuozi-shang you san bao de pingguo. [Container measure]
table-on have three bag DE apple
'There are three bags of apples on the table;

d. Zhuozi-shang you san bang de yingtao. [Standard measure]
table-on have three pound DE cherry
'There are three pounds of cherries on the table.'

The division between (276) and (277) coincides with the one between the right-branching type and the left-branching type of numeral expressions. Specifically, the individual CL *ge* in (276a), the individuating CL *di* in (276b), and the kind CL *kuan* in (276c) have a right-branching structure (see 4.2.5). They all disallow *de* in the same context, where no clue shows that the quantity is emphasized. In contrast, the partitive CL *pian* in (277a), the collective CL *dui* 'pile' in (277b), the container measure *bao* 'bag' in (277c), and the standard measure *bang* 'pound' in (277d), all have a left-branching structure. They all allow *de* in the same context.

If the same right-branching type of numeral expressions occurs in a context where quantity is emphasized, their acceptability improves significantly. In (278), the quantity reading is attested in the presence of the adverb *yigong* 'total', and in (279), the quantity reading is attested in the predicate *zugou* 'enough'.

(278)a. Zhuozi-shang yigong you 300 ge de pingguo.
table-on total have 300 CL DE apple
'There are 300 apples in total on the table.'

b. Zhuozi-shang yigong you 300 di de you.
table-on total have 300 CL DE oil
'There are 300 drops of oil in total on the table.'

c. Zhuozi-shang yigong you jin 300 kuan de fuzhuang.
table-on total have about 300 kind DE clothes
'There are about 300 kinds of clothes in total on the table.'

(279)a. Yi liang ge de pingguo jiu zugou le.
one two CL DE apple just enough PRT
'Just one or two apples are enough.'

b. Yi liang di de you jiu zugou le.
one two CL DE oil just enough PRT
'Just one or two drops of oil are enough.'

c. Yi liang kuan de fuzhuang jiu zugou le.
one two kind DE clothes just enough PRT
'Just one or two kinds of clothes are enough.'

Note that when a quantity is emphasized, the quantity does not have to be a precise one. Hsieh (2008: 37) lists some examples in which an estimate quantity is expressed by an individual CL and *de*. Our (278c) and (279) show this point.

The fact that the occurrence of *de* in the right-branching numeral expression is sensitive to a quantity reading is further seen in the following examples. In the presence of a demonstrative, where an individual rather than a quantity-reading is more prominent, the contrast emerges (Cheng & Sybesma 1998: 393 claim that no demonstrative may occur with a post-unit *de*. However, I find (280) natural. All of the nominals in (280) can be found via an internet search):

(280)a. Ni ba na san xiang de shu qingli-diao! [Container measure]
you BA that three box DE book clear-away
'Clear away those three boxes of books!'

b. Ni ba na yi dui de lüyou-shu qingli-diao! [Collective CL]
you BA that one pile DE travel-book clear-away
'Clear away that pile of travel books!'

c. Ni ba na san jin de fanqie qingli-diao! [Standard measure]
you BA that three kilo DE tomato clear-away
'Clear away those three kilos of tomatoes!'

d. Ni ba na liang bufen de kewen bei yixia! [Partitive CL]
you BA that two part DE text recite once
'Recite those two parts of the text!'

(281)a. *Ni ba na san ge de pingguo qingli-diao! [Individual CL]
you BA that three CL DE apple clear-away

b. *Ni ba na san di de you qingli-diao! [Individuating CL]
you BA that three CL DE oil clear-away

c. *Ni ba na san zhong de niu-rou qingli-diao! [Kind CL]
you BA that three kind DE cow-meat clear-away

The above contrast tells us that with respect to the occurrence of *de*, the left-branching type is less constrained, whereas the right-branching type is licensed only in a quantity

context. We try to explain this contrast in the next subsection.

Note that in 4.4, I argued against the claim that a left-branching structure encodes a quantity reading exclusively and a right-branching structure encodes a non-quantity reading exclusively. The pattern observed here further falsifies the claim.

4.5.3 Different sources of *de*

It is possible that there are two different sources of *de* related to a numeral expression, and that the left-branching constructions can contain either of them, while the right-branching constructions can contian only one of them, the one that is related to a quantity reading.[39]

One argument for the quantity reading of the *de* version of the right-branching numeral expressions is the following. While a numeral expression may have either a quantity reading or an individual reading (Y.H. A. Li 1998), if it has an exclusively individual reading in a certain context, it may not host *de.* This suggests that the *de* version of a numeral expression is not compatible with an individual reading. I use (282) and (283) to show this point. In (282a), a modifier occurs to the left of the numeral *100*. Such a construction always has a specific and thus an individual reading (Zhang 2006). In (282b), the word *yigong* 'altogether, in total' signals a quantity context. In this context, a pre-numeral modifier may not occur, as shown in (282c). In the examples in (282), no *de* follows the CL *ge*.

(282)a. [Shufen mai de] 100 ge xigua
Shufen buy DE 100 CL watermelon
'the 100 watermelons that Shufen bought'

b. Ta yigong chi-le 100 ge xigua.
He total eat-PRF 100 CL watermelon
'He ate 100 watermelons in total.'

c. *Ta yigong chi-le [Shufen mai de] 100 ge xigua.
he total eat-PRF Shufen buy DE 100 CL watermelon

The contrast in (283) below shows that when *de* follows an individual CL, the construction is subject to the same constraint, although no quantity adverb such as *yigong* 'total' shows up.

(283)a. 100 ge de xigua
100 CL DE watermelon
'100 watermelons'

b. *[Shufen mai de] 100 ge de xigua
Shufen buy DE 100 CL DE watermelon

(283b) is different from (282a) only in the presence of *de* to the right of the CL *ge*. We can see that the *de* construction may not host a pre-numeral modifier (more examples showing a similar constraint are seen in Cheng & Sybesma 1998: 394; Tang 2005: 448). The constraint seen in (283b) is the same as the one in (282c). In both cases, the exclusive individual reading of the pre-numeral modifier construction is in conflict with something: it is in conflict with the adverb *yigong* 'total' in (282c), and with the post-CL *de* in (283b). It is plausible to assume that like the adverb, the post-CL *de* in (283b) also provides a quantity context. Accordingly, the *de* version of the right-branching numeral expression is associated with a quantity reading.

In the rest of this sub-section, I show that the *de* version of an individual CL

[39] In a *de*-nominal, [XP de YP], XP is a major constituent of the nominal (Zhang 2012b). A possible derivation of such a nominal is the following basic steps, where *de* is a realization of n. But the argumentation of this book is independent of this hypothesis of the derivation.
<i> [XP YP]; <ii> YP [XP t_{YP}]; <iii> de [YP [XP t_{YP}]]; <iv> [$_{nP}$ [XP t_{YP}] [$_{n'}$ de [YP t_i]]]

construction is a quantity-comparative modification construction. The modification analysis of the *de* version of measure word constructions has been seen in Cheng & Sybesma (1998: 393) and Tang (2005). In X. P. Li (2011), the *de* construction is called the as-many/much-as construction. I now combine these insights and propose that the construction is a specific type of modification construction: elliptical comparative modification construction.

Elliptical comparative modification constructions are independently observed in Mandarin Chinese. Before moving on, I introduce the fact that in Mandarin Chinese, the cluster *name-X* 'that X', where X is an adjective such as *da* 'big', *duo* 'many', and *huai* 'bad', needs a discourse or linguistic antecedent. In (284a), the cluster *name da* 'that big' takes *zhima* 'sesame seed' as its antecedent. In such a construction, the word *name* 'that' can be deleted, without affecting the reading. (284a) and (284b) have the same reading. In this construction, *de* introduces a comparative modifier. (284c) is my analysis of (284b).

(284)a. Shufen mai-le [yi ge [[zhima name da de] wanju]].
Shufen buy-PRF one CL sesame that big DE toy
b. Shufen mai-le yi ge zhima da de wanju.
Shufen buy-PRF one CL sesame big DE toy
Both: 'Shufen bought a toy as big as a sesame seed.'
c. Shufen mai-le [yi ge [[zhima ~~name~~ da de] wanju]].
Shufen buy-PRF one CL sesame that big DE toy

Similarly, I claim that *de* in (285a) also introduces a comparative modifier. The full form of (285a) is (285b), where the first *pingguo* 'apple' and *name duo* 'that many' are deleted at PF. (286) shows the same point. In the following, I discuss (285) only.

(285)a. Shufen chi-le yi-bai ge de pingguo.
Shufen eat-PRF 100 CL DE apple
'Shufen ate 100 apples.'
b. Shufen chi-le [[[yi-bai ge ~~pinguo] name duo~~ de] pingguo].
Shufen eat-PRF 100 CL apple that many DE apple
(286)a. Shufen chi-le san-fen-zhi-yi li de ganmao-yao.
Shufen eat-PRF one-third CL DE cold-pill
'Shufen took one third of a cold-pill.'
b. Shufen chi-le [[[san-fen-zhi-yi li ~~ganmao-yao] name duo~~ de] ganmao-yao].
Shufen eat-PRF one-third CL cold-pill that much DE cold-pill

In (285b), the antecedent of *name duo* 'that many' is the numeral expression *yi-bai ge pingguo* 'one hundred CL apple', which is a syntactic constituent.[40] The deletion of the noun, i.e., *pingguo* 'apple' in (285b), is an instance of Backward Deletion, in which the licensing string ("antecedent") occurs to the right of the ellipsis site, and both the licensing string and the ellipsis site must be right-peripheral in their respective domains (Wilder 1997: 92). In (287), for instance, Backward Deletion of *any of our sales people*, which is the object in the relative clause of the subject, is licensed by the object of the verb *like* (Wilder 1997: 87):

(287) [Anyone [who meets ~~any of our sales people~~]]
[really comes to like <u>any of our sales people</u>]

[40] *Name* 'so, that' has a distal feature, in contrast to *zheme* 'this', which has a proximal feature. The latter may not be bound (cf. Ducceschi 2012), and therefore, *name* in all of the examples discussed here may not be replaced by *zheme*.

Similarly, in (285b), the ellipsis site of *pingguo* is right-peripheral in the domain of [*yi-bai ge* ~~*pingguo*~~], and its licensing string *pingguo* is right-peripheral in the domain of the object of the verb *chi-le* 'eat-PRF'.

The operation of the deletion of the string *name duo* 'that many' in (285b) is parallel to the operation of the deletion of *name* in (284c). The nonparallel details of the two operations can also be explained. In (284c), the delimitable word *da* 'big' may not be deleted with *name* 'that', since its absence will lead to a different reading. Compare (284b) with (288).

(288) Shufen mai-le yi ge zhima de wanju.
Shufen buy-PRF one CL sesame DE toy
'Shufen bought a toy that is made of sesame seeds.'

Following the same recoverability principle in deletion (Hankamer 1973, Chomsky 1965, 1968), the delimitable word *duo* in (285b) must be deleted together with *name*, since its presence may lead to a partitive reading of *duo* (see 4.3.2), which is not the intended reading. Compare (285a) with (289).

(289) Shufen chi-le yi-bai ge <u>duo</u> de pingguo.
Shufen eat-PRF one-hundred CL more DE apple
'Shufen ate more than 100 apples.'

It is thus the general recovery condition of PF deletion that explains why the delimitable word must not be deleted in (284), and must be deleted in (285).

There is a similarity between the *de* version of a numeral expression and the elliptical comparative construction in (284). As noted in Cheng & Sybesma (1998: 392), in the *de* version of a container measure construction, the referent of a container measure does not have to be present in the discourse. In (290a), there are two container-denoting words, *wan* 'bowl' and *bei* 'cup', and neither is followed by *de*. It seems that there are two elements competing for the container instrument for the single drinking event. The sentence is found to be unacceptable. In (290b), however, *bei* is followed by *de*, but *wan* is not. In this case, it is clear that *wan* denotes the instrument, and *bei*, like *sheng* 'liter', denotes a measure unit. In the discourse context of (290b), no cup has to be present. The wine can be contained in a jar or a bottle.

(290)a. *Ta yong xiao wan he-le san bei jiu.
he with small bowl drink-PRF three cup wine
b. Ta yong xiao wan he-le san bei de jiu.
he with small bowl drink-PRF three cup DE wine
'He drank three cupfuls of wine from a small bowl.'

In the elliptical comparative construction in (284), similarly, the referent of *zhima* 'sesame seed' does not have to occur in the discourse, and usually it does not. In this sense, (284) and the *de* construction in (290b) are similar. What is relevant here is the property under the comparison: size in (284) and volume in (290b).

Two arguments support this elliptical comparative analysis of the *de* version of individual CL constructions.

First, if an expression cannot occur in a full-fledged quantity comparative construction, it may not occur in a *de* version of a numeral expression. The forms in (291a) and (292a) are not acceptable, nor are those in (291b) and (292b). This correlation supports my hypothesis that the a-forms and b-forms are derivationally related.

(291)a. *[yixie shu name duo de shu]
some book that many DE book
Lit.: 'as many as some books'
=> b. *yixie de shu
some DE book

(292)a. *[mei (yi) ben shu name duo de shu]
every one CL book that many DE book
Lit.: 'as many as every book'
=> b. *mei (yi) ben de shu
every one CL DE book

Second, if a nominal has an exclusive non-quanity reading in a certain context, it may not function as an antecedent of *name duo* 'that many', and consequently *de* may not follow the CL of such a nominal. According to Li (1998), Chinese operator *dou* 'all' ranges over an entire set of individuals to derive a universal expression, and the operator *you* 'exist, have' asserts the existence of individuals. "The number expression occurring with *dou* and *you* must be interpreted as denoting individuals, rather than quantity." (p. 697) Li's two examples are cited here as (293a) and (293b):

(293)a. San ge xuesheng dou lai zher le.
three CL student all come here PAR
'The three students all came here.'
b. You san ge xuesheng lai zher le.
have three CL student come here PAR
'There are three students that came here.'

As expected, *de* may follow neither the CL of the nominal that is in construal with *dou*, as seen in (294a), nor the CL of the nominal that is in construal with *you*, as seen in (294b). This is in contrast to the examples in (278) and (279), in which a quantity context is provided and *de* may occur.

(294)a. San ge (*de) pingguo dou lan le.
three CL DE apple all rotten PAR
'The three apples all got rotten.'
b. You san ge (*de) pingguo lan le.
have three CL DE apple rotten PAR
'There are three apples that got rotten.'

In my elliptical comparative perspective, *de* introduces a modifier to the left of another element (i.e., the modifiee). The surface order is further derived by ellipsis. The syntactic position of *de* is the same as that of (284c). Crucially, the noun following *de* is not in a numeral expression at all. The noun that is in a numeral expression has been deleted, and the containing numeral expression is embedded in the modifier. Thus the position of *de* in this case does not show the constituency of the elements within a numeral expression (contra Hsieh 2008: 45; X. P. Li 2011: 115; 119).

We have seen that the *de* version of the right-branching structure is constrained by the quantity-reading condition, but for the *de* version of the left-branching structure, this condition is not seen. This contrast can be explained by the hypothesis that when *de* occurs in a left-branching numeral expression, it is ambiguous between the *de* that introduces a comparative modifier and the *de* that does not. It is in the latter case that *de* occurs between the two syntactic constituents of the left-branching structure, i.e., between the numeral-unit-word string and the NP. In the former case, *de* is a comparative modification marker, which is external to the numeral expression. The two analyses in (295) show the

contrast:

(295)a. [[san bei ~~jiu] name duo~~] de jiu
three cup wine that much DE wine
'three cupfuls of wine'

b. [[san bei] de jiu]
three cup DE wine
'three cups of wine'

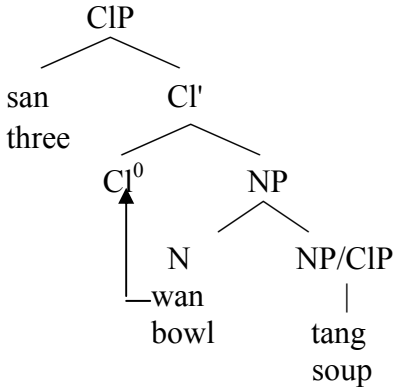
In (295a), *de* is out of the numeral expression *san bei jiu* 'three cup wine', whereas in (295b), *de* occurs between two syntactic constituents of a numeral expression, *san bei* 'three cup' and *jiu* 'wine'.

I have proposed a fine-grained analysis of the *de* versions of numeral expressions, to capture the constraint on the occurrence of *de* with individual, individuating, and kind CL constructions, and the absence of the constraint on the other types of numeral expressions. This analysis is different from Cheng & Sybesma's (1998) relativization analysis, Tsai's (2003: 173) NP-internal DP analysis, and Tsai's (2011) clitic analysis, to be briefly illustrated below.

In Cheng & Sybesma (1998: 406), the *de*-less numeral expression (296a) has the structure in (296b), where a container measure word moves from N to Cl. The structure is a right-branching one, which I have argued against in 4.2.

(296)a. san wan tang
three bowl soup
'three bowls of soup'

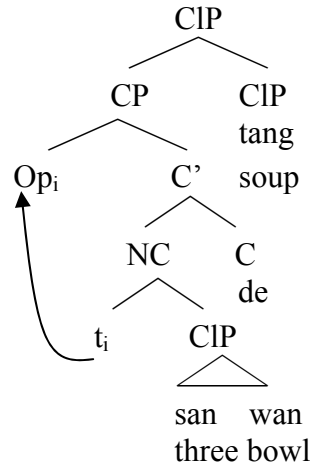
b.



In their relativization analysis of the *de* version of numeral expressions, (297a) has the structure in (297b) (Cheng & Sybesma 1998: 398), where *de* is always base-generated between *san wan* 'three bowl' and *tang* 'soup'. This is compatible with my (295b), but not (295a).

(297)a. san wan de tang
three bowl DE soup
'three bowls of soup'

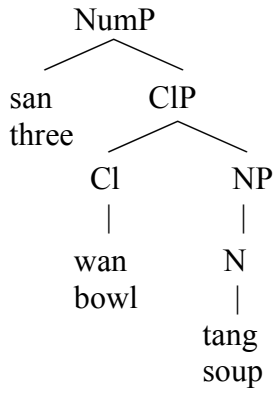
b.



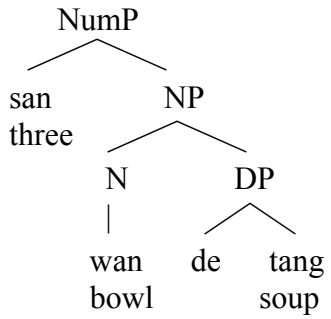
(NC = Nominal Clause)

In Tsai's (2003: 173) NP-internal DP analysis, (296a) and (297a) have the structures in (298a) and (298b), respectively. Both structures are right-branching, which cannot capture the facts presented in 4.2 of this book.

(298)a.

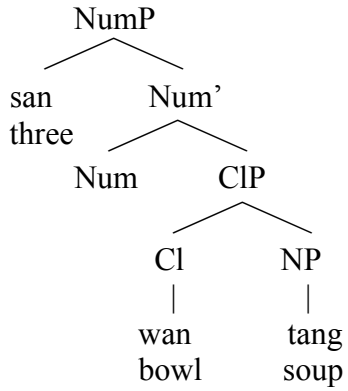


b.

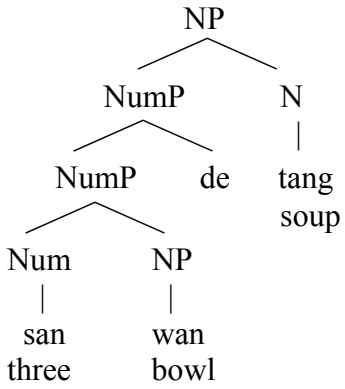


In Tsai's (2011: 7) clitic analysis, (296a) and (297a) have the structures in (299a) and (299b), respectively (no argument is given in his paper for the branching contrast), and *de* in (299b) is analyzed as a clitic.

(299)a.



b.



(299a) is similar to the two trees in (298), and thus it shares their empirical problems.

Tsai claims that in other constructions, *de* heads a functional projection and thus licenses an empty category to its right; however, since *de* in (299b) is a clitic, it cannot serve as a licensor of an empty category to its right. But, morphologically, we know that *de* is an enclitic in all constructions, in need of a phonological host to its left (Huang 1989). There is

no non-clitic form of *de*. If we assume the *de* in (299b) is special in other aspects, we need to identify the aspects.

Moreover, none of the three analysis, the relativization analysis, the NP-internal DP analysis, and the clitic analysis, considers the *de* construcitons of other types of unit words. Accordingly, the arguments for my ellipsis comparative analysis of the constructions have not been taken into account.

4.6. Chapter summary

In this chapter I have investigated the constituency of numeral expressions in Chinese. I have argued that the constituency of the numeral expression with an individual, inviduating, and kind CL is different from that of the constructions with other types of unit words.

I have discussed four issues: the scope of a left-peripheral modifier; the effect of adjective lowering; the predicate status of the combination of a numeral and a unit word; and the semantic selection of a unit word on a noun. Based on the different behaviors of the different types of unit words, I have identified two structures: a left-branching structure for numeral expressions of container measures, standard measures, partitive CLs, and collective CLs; and a right-branching structure for numeral expressions of individual, individuating, and kind CLs. In the former structure, the unit word does not C-Command the NP, whereas in the latter structure, the unit word does C-Command the NP.

I have also falsified invalid arguments such as the co-occurrence of a numeral and a unit word and the position of the partitive markers *duo* ‘more’ and *ban* ‘half’. I have also argued against the quantity-individual semantic mappings with the different syntactic structures. Finally, I have presented a comparative deletion analysis of the constructions in which the functional particle *de* follows a unit word.

A further issue to be investigated is the categorial labels of the nodes of the different structures. This issue will be discussed in the next chapter.

Chapter 5 Syntactic Representations of Numeral Expressions

5.1. Introduction

The goal of this chapter is to capture the major relations and interactions among different elements of a numeral expression in syntactic representations, in both CL languages such as Chinese and non-CL languages.

In Chapter 4, we have reached the conclusion that there are two basic configurations of numeral expressions in Mandarin Chinese: a left-branching structure for constructions of container measures, standard measures, partitive CLs, collective CLs, and a right-branching structure for constructions of individual, individuating, and kind CLs. The unit word does not C-Commands the NP in the former structure, but it does in the latter structure. Thus the basic hierarchical relations have been identified, but no syntactic labels have been given to the structures.

In this chapter, we argue for two functional projections below DP: UnitP and DelP, in addition to NumP (or called #P or $\#^{max}$), which represents number (e.g. Ritter 1991, 1995), and QuantP, which hosts quantifiers such as *much* (Borer 2005). Theoretically, we adopt Szabolcsi's (2011: 2) theory that "[E]ach syntactic head carries one and only one feature", although a morph may bear different features. The two newly identified functional heads host [Numerable] and [Delimitable], respectively.

With the two functional projections, we will present our derivations of the left- and right-branching structures of Chinese numeral expressions, and address the realizations of the head of UnitP in different constructions, both cross-linguistically and in the same language.

I argue that a numeral and a unit word hold a Spec-Head relation of UnitP in certain steps of the derivation, and thus the occurrence of either of them means the projection of UnitP. But the occurrence of a plural marker correlates with the projection of NumP, rather than UnitP. In the structure of mass nominals, there is neither UnitP nor DelP. This analysis is thus different from Borer (2005) in the base-position of numerals, in the syntactic relation between number markers and the CLs of numeral expressions, and in the functional projections to encode countability. In discussing the cross-linguistic variation in the realizations of unit elements, the current research also challenges Wilhelm's (2008) numeral-oriented analysis.

The chapter is organized as follows. Section 5.2 argues that the unit word in a numeral expression heads UnitP, and Section 5.3 argues that NumP is for number markers, including the CLs in PUWNs and RUWNs in Mandarin Chinese. Section 5.4 then argues for DelP, to host delimitive adjectives. Section 5.5 gives syntactic labels to the major types of structures of numeral expressions in Chinese, and presents possible derivations of the constructions. In Section 5.6, I use the two features, numerability and delimitability, to represent various kinds of null versions of individual and individuating CLs in different languages. Section 5.7 is a brief summary.

5.2. The projection of UnitP

5.2.1 Unit words and the head of UnitP

We have seen in Chapter 2 that a unit word is [+Numerable] and is thus always countable. It has been proposed by many syntacticians that the countability of human language is represented by a functional projection. Chinese CLs have been generally considered to be the realization of the head of this functional projection. However, different scholars give different labels to the functional category, e.g., DivP or CLP (e.g., Borer 2005). As I argued in 2.7.2, the general function of CLs in numeral expressions is to represent a unit for counting, telling us what counts as one in counting. This general function of CLs is more than dividing. I thus

do not use the label DivP.[41]

CLs in numeral expressions have been treated as nominal auxiliaries in Chao (1948, 1968: 584) and Lu (1951: 42), as numeral auxiliaries in Ōta (2003 [1958]: 146), and as light nouns in Huang (2009), although no systematic argument has been given. I find at least six shared properties between auxiliaries of clauses and CLs in numeral expressions (an additional one, the place-holder argument, will be presented in next chapter). If the former may head a functional projection, so may the latter.

First, neither auxiliaries of clauses nor CLs in numeral expressions may function as an argument or predicate.

Second, they both select substantive categories. Auxiliaries select verbal phrases and CLs in numeral expressions select nominal phrases.

Third, neither is selected by any substantive category. No verb has to occur with an auxiliary, and no noun has to occur with a CL. Bare nouns may function as arguments or predicates independently.

Fourth, they both can be absent or have null forms in certain constructions and in certain languages. Not all clauses have overt auxiliaries (Kayne 2012: Sec. 4). Similarly, in Chinese, idiomatic expressions have no CL between a numeral and a noun, as seen in (300). Non-CL languages have no CLs.

(300) wu ma fen shi [idiomatic expression in Mandarin Chinese]
five horse divide body
'five horses pull a body apart (as an ancient death penalty).'

Fifth, they both may have an EPP-like property, i.e., they are next to an overt element in addition to the selected substantive category. In English, an auxiliary is next to the subject or the expletive (the subject is null in imperatives). Parallel to that, a CL in a numeral expression always occurs with a numeral or quantifier.

Sixth, they both license ellipsis, like many other head elements.[42] Auxiliaries license VP ellipsis. Likewise, CLs in numeral expressions license NP ellipsis. As in other languages (e.g., Hankamer 1971; Sag 1980; Lobeck 1987, 1995; Chao 1988, Zagona 1988), head elements in Chinese may license the ellipsis of the string to their right, whereas phrasal elements may not do so. In (301a), the overt modal *hui* 'will' licenses the VP ellipsis, whereas in (301b), the adverbial NP *jin-nian* 'this year' does not license the VP ellipsis.

(301)a. Baoyu huì mai baoxian, Daiyu ye hui ~~mai baoxian~~.
Baoyu will buy insurance Daiyu also will buy insurance
'Baoyu will buy insurance, and Daiyu will also buy insurance.'

b. *Baoyu qu-nian mai-le baoxian, Daiyu jin-nian ~~ye mai-le baoxian~~.
Baoyu last-year buy-PRF insurance Daiyu this-year also buy-PRF insurance

Parallel to the head elements that license ellipsis, the CL *ben* in the second conjunct of (302) may also license an empty NP to its right, and the meaning of the NP can be recovered from an NP in the first conjunct, i.e., *shu* 'book'.

[41] Cheng & Sybesma (1999) claim that CLP is the counterpart of DP in non-CL languages. The claim receives critical response from Wu & Bodomo (2009). Ndayiragije & Nikema (2011) further show that in some languages with both determiners and CLs, a CL may occur with a determiner in the same nominal.

[42] I adopt the theory that only head elements may license ellipsis. This theory does not entail that all kinds of head elements may do so. The complememtizer *for*, the determiner *the*, and the non-finite Infl *to* in ECM and raising constructions do not license the ellipsis of their complements.

(302) Baoyu mai-le san ben shu, Daiyu ye mai-le san ben ~~shu~~.
Baoyu buy-PRF three CL book Daiyu also buy-PRF three CL book
'Baoyu bought three books, and so did Daiyu.'

Head elements can not only license ellipsis, but also be stranded. In (303a), the modal *keyi* 'can' is stranded. The missing VP has a dependency with the left-peripheral *mai xiaoshuo* 'buy novel'. In (303b), the word *nali* 'there' is not a head element and thus it cannot be stranded. Similar to the head element in (303a), the individual CL *ben* in (303c) is also stranded, and the missing NP has a dependency with the topic *xiaoshuo* 'novel'. This fact shows that CLs in numeral expressions are head elements.[43]

(303)a. Mai xiaoshuo, Baoyu dangran keyi.
buy novel Baoyu of.course can
'Buy novels, of course Baoyu can.'
b. *Mai xiaoshuo, Baoyu danran keyi zai nali.
buy novel Baoyu of.course can at there
c. Xiaoshuo, Baoyu yinggai mai wu ben.
novel Baoyu should buy five CL
'Novels, Baoyu should buy five copies.'

However, CLs also have certain properties that are shared with substantive elements, rather than functional elements.

First, CLs seem to be an open system to certain extend (T'sou 1976: 1217; Loke 1997; Aikhenvald 2003: 99; H. Zhang 2007: 57; Wu & Bodomo 2009: 490). Considering the fact that CLs are not a closed class, it is reasonable to cast doubt on the functional head status of CLs.

Second, individual, individuating, and kind CLs have selectional restrictions (4.2.4). In the literature, it has been claimed that elements with selectional properties should be treated as substantive, rather than functional elements (Cardinaletti & Giusti 2006: 52).

Third, in Mandarin Chinese, non-kind CLs can be modified by delimitive adjectives (2.4.3). However, if this type of adjectives are hosted by a specific functional projection (to be argued in 5.4), there is no problem for two functional projections to co-occur.

But the conflict between the six functional-head properties and the first two substantive-category properties mentioned above indeed challenges our current understanding of the contrasts between functional and substantive elements. CLs may belong to what Borer (2005: 100) calls "twilight zone between the substantive and the functional", or semi-lexical category in the sense of Corver & van Riemsdijk (2001), or functional category in the faculty of language in the broard sense, rather than in the narrow sense (see Déchaine & Tremblay 2011). If formal features of various types can be bundled into formatives in various ways, it should not be surprising that there are gradient differences between substantive and functional elements.

Regardless of to what degree the projection headed by CLs of numeral expressions is functional or substantive, the projection is established. I simply label the projection UnitP, and go ahead to examine its structural properties, leaving its exact theoretical status for future

[43] The following question has been raised to me: why the string after the unit word *bei* in (ia) may not move, if the unit word is a head element. My answer is that *de* and the element to its right never form a maximal projection (Zhang 1999; 2009), thus such a string may not move (Chomsky 1994; 1995: 253).
(i) a. [[san bei] de jiu] (= (295b)) b. *[de jiu]$_i$ .....[[san bei] t$_i$]
three cup DE wine
'three cups of wine'

research.

5.2.2 The Spec-Head relation between a numeral and a unit word

In a numeral expression, a numeral and a unit word exibit a dependency relation. Counting makes sense only when we know what counts as one unit. The quantity of *two bags of apples* is different from *two slices of apples*, although the numerals are the same. Li (1924 [1992: 81]) notes that a CL in a numeral expression encodes the unit for counting. From a semantic perspective, a numeral needs an operator to access the unit for counting. In Krifka (1995: 400; also Wilhelm *ibid.*: 55), the operator is called OU (for Object Unit), and a unit word such as a CL is a linguistic form of OU. If no unit word shows up, the unit meaning is part of the semantics of either the noun or the numeral in non-CL languages (Quine 1968; also see Wilhelm *ibid.*). In Kobuchi-Philip (2007), a unit word is the semantic argument of a numeral. In Mandarin Chinese, since a numeral always occurs with a unit word such as a CL, when it combines with a noun, the semantic argument of the numeral is always overt.

The main semantic function of CLs in numeral expressions is to specify a unit for counting, rather than to make a semantic classification (see 2.7.3). Therefore, the co-occurrence of CLs with numerals makes the CLs in numeral expressions different from other types of CLs that are incorporated into verbal expressions in sign languages (e.g., Sandler & Lillo-Martin. 2006) or noun CLs in Bantu languages (e.g., Aikhenvald 2003; Svenonius's 2008 SortP).

While some scholars call CLs in numeral expressions nominal auxiliaries, as I mentioned in the last subsection, others (e.g., Ōta 2003 [1958]: 146) call them numeral auxiliaries. We can see the general acknowledgment of the dependency between numerals and CLs in numeral expressions.

In the last subsection, we have argued for the head status of CLs, and the above discussion shows the dependency between CLs and numerals in numeral expression. We now turn to the status of numerals.

Cross-linguistically, numerals have been identified as NPs or APs (e.g., Zweig 2006, Corver & Zwarts 2006, Corver et al. 2007: 755; Stavrou & Terzi 2008).[44] Numerals in numeral expressions have been assumed to be base-generated at a Spec position (Borer 2005: 96). The relation between a numeral and a CL is represented as a Spec-Head relation in Cheng & Sybesma (1998: 406). However, in Aboh et al. (2011: 8), it is assumed that numerals are phrasal in English but are heads in Mandarin Chinese. Their theoretical background is that modification possibility can show the phrase level of an element. Their only argument is that in (304a) the numeral is modified by *exactly*, but in its Chinese counterpart, (304b), however, the adverb *jiu* 'exactly' must precede the whole VP, rather than the numeral *san* 'three'. This argument is weak. In (304c), any of the three adverbs, *zonggong* 'in total', *dayue* 'estimately', and *zuzu* 'as many as', may occur to the immediate left of the numeral. The constraint on the adverb *jiu* 'exactly' is lexical, and thus does not apply to other adverbs. Therefore, numerals in Chinese, as in English, can be modified.

(304)a. I bought exactly three books.
b. Wo jiu mai-le san ben shu.
I exactly buy-PRF three CL book
'I bought exactly three books.'

[44] Yang (2005: 45) also claims that numerals are phrasal. But her two arguments are either incomplete or unconvincing. One argument is that a numeral can be replaced by the question phrase *ji* 'how many'. But in order to show the numeral replaced by *ji* is phrasal, we need to see *ji* is phrasal. Another argument is that numerals can be conjoined. But conjuncts do not have to be phrasal (Zhang 2009a).

c. Wo mai-le {zonggong/dayue/zuzu} san ben shu.
I buy-PRF in.total/estimately/as.many.as three CL book
'I bought {three books in total/three books estimately/as many as three books.'

The non-head status of numerals can be supported by the fact that unlike head elements in Chinese (see 5.2.1 above), numerals may not license ellipsis or be stranded. In (305), the numeral *san* 'three' may not license the ellipsis of string to its right, i.e., *ben shu* 'CL book'.[45]

(305) Baoyu mai-le san ben shu, Daiyu ye mai-le san *(ben shu).
Baoyu buy-PRF three CL book Daiyu also buy-PRF three CL book
'Baoyu bought three books, and so did Daiyu.'

One might wonder why the deletion in English examples such as (306) does not require this licensing condition, assuming numerals in English are not head elements.

(306) Bill bought five books and Kim bought six ~~books~~.

In fact, we can find other examples in English in which deletion does not have to follow a head element. Assume sluicing is derived by deletion in English (Merchant 2001). In (307), the string after *which model*, which is not a head element, is deleted.[46]

(307) They discussed a certain model, but they didn't know which model.

To represent the dependency between a numeral and a unit word, and the non-head status of numerals, following (Borer 2005: 96) and Cheng & Sybesma (1998: 406), I assume that a numeral is base-generated at the Spec of UnitP and an individual, individuating, or kind CL, is realization of Unit. The base-positions of the elements in (308a) are shown in (308b):

(308)a. san ge xuesheng
three CL student
'three students'

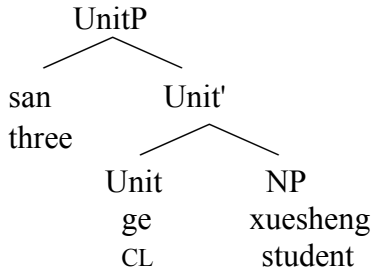
[45] Examples like the following do not seem to pattern with (305b). In (i), the numeral *si-bai* 'four hundred' is stranded. A plausible analysis of such an example is that the final morpheme of the numeral, *bai* 'hundred' in (i), is reanalyzed as a collective CL, similar to *shuang* 'pair' or *da* 'dozen'. See 2.3.1.

(i) Baoyu mai-le san-bai ben shu, Daiyu mai-le si-bai.
Baoyu buy-PRF three-hundred CL book Daiyu buy-PRF four-hundred
'Baoyu bought 300 books, and Daiyu bought 400.'

[46] Chinese sluicing constructions, however, are not derived by deletion (Wei 2011). Instead, the wh-phrase in the constructions is the predicate of an empty subject. In (ia), the copula *shi* 'be' to the left of *shui* 'who' is obligatory. As illustrated in (ib), there is an empty subject for the predicate *shui*, but no deletion occurs in this sluicing construction.

(i) a. Shufen gu-le yi ge zhushou, dan wo bu zhidao *(shi) shui.
Shufen hire-PRF one CL assistant but I not know be who
'Shufen hired an assistant, but I don't know who.'
b. Shufen gu-le [yi ge zhushou]$_i$, dan wo bu zhidao [pro$_i$ shi shui].
Shufen hire-PRF one CL assistant but I not know be who

b.



In the structure in (308b), the numeral asymmetrically C-Commands the unit word. The locality of the dependency between the two elements is reduced to the "closest c-command" (see Chomsky 2000: 122).

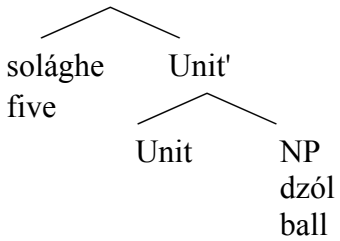
Since a numeral and a unit word hold a Spec-Head relation in certain step of the derivation, the occurrence of either of them means the projection of UnitP. But the occurrence of a plural marker does not correlate with the projection of UnitP.

Accordingly, for a numeral expression without a plural marker and a CL, UnitP is still projected. In this case, the head of Unit is null. The base-positions of the elements in (309a) (Wilhelm 2008: 46) are represented in (309c). The string *wu ma* 'five horse' in (309b), an expression in Classical Chinese or idiomatic expression in modern Chinese, has a similar structure. It is possible that in a non-CL language, individual CLs consistently have a null form (see 5.6.2), whereas in Chinese idiomatic constructions, an individual CL shows up in the form of a zero-allomorph.

(309)a. sológhe dzól [Dëne]
five ball
'five balls'

b. wu ma fen shi [idiomatic expression in Mandarin Chinese]
five horse divide body
'five horses pull a body apart (as an ancient death penalty).'

c.



I put aside the details of the categories of the Spec and Complement of Unit. Such details do not affect the argumentation of this book. Regarding the Spec of Unit, it needs further study to specify whether the category of numerals in a specific language or construction is nominal or adjectival, or both (Zweig 2006, Danon 2009). Regarding the Complement of Unit, it is possible that the nominal complement of Unit is nP, or other functional categories (see 5.4).

5.2.3 The surface position of numerals and other quantifiers

There are two major kinds of quantifiers: those that may be followed by the functional word *de* and those that may not, as shown in (310a) and (310b), respectively (2.5). As in Chapter 2, we only consider the ones that do not occur with *de*.

(310)a. daliang (de) xuesheng
many DE student
'most students'

b. haoji (*de) ge xuesheng
several DE CL student
'several students'

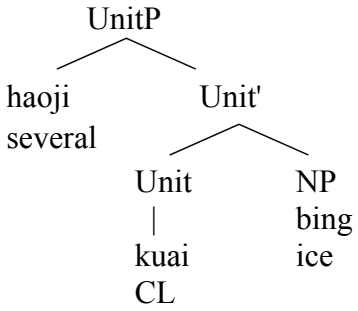
We have showed that within the quantifiers that do not occur with *de*, some of them, including numerals, must be followed by a unit word, and some reject a unit word, when they occur with a noun. The examples of the two types are in (311a) and (311b), respectively. We have also mentioned in 2.5.2 that the latter type of quanitifiers, together with those patterning with *daliang* in (310a), is not used for counting.

(311)a. haoji *(kuai) bing
several CL ice
'several chunks of ice'

b. yidianr (*kuai) bing
a.little CL ice
'a little ice'

I have just argued that the base-position of a numeral in a numeral expression is Spec of UnitP. I extend this claim to all quantifiers that need to occur with a unit word. The occurrence restrictions of such quantifiers are thus represented by the Spec-Head relation. So *haoji* 'several' in (311a) is also base-generated at Spec of UnitP. The base-positions of the elements in (311a) are shown in (312):

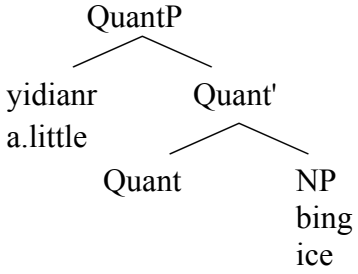
(312)



Moreover, following Borer (2005), I assume that all kinds of quantifiers surface at Spec of QuantP, and QuantP can be projected without UnitP (roughly equivalent to her DIV^{max}). In Gebhardt (2009), a numeral quantifier has the feature [+Absolute], for a precise quantity, and a non-numeral quantifier has the feature [-Absolute], for a non-precise quantity.

If there is neither a numeral nor a unit word, as in (311b), UnitP is not projected. The structure of (311b) is (313):

(313)

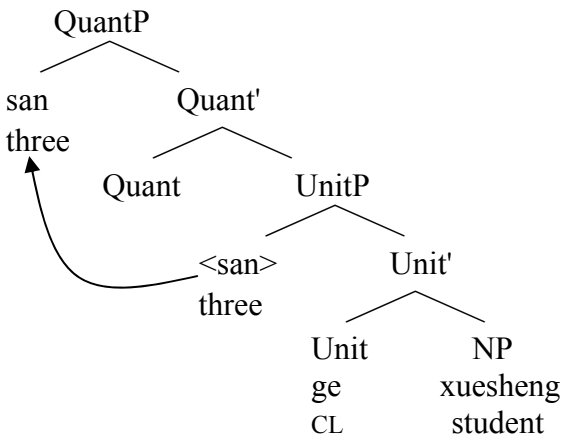


QuantP encodes quantity, while UnitP encodes counting. Only counting needs numrals and counting unit. Some animals are able to discriminate between different quantities without counting (see Agrillo et al. 2011 and the references thereof). Moreover "some developmental studies indicate that infants may also preferentially use continuous variables in quantity discrimination" (Agrillo et al. *ibid.* p. 281). In Feigenson et al. (2002), for example,

12-month-old children were allowed to choose one of the containers, after they saw crackers placed sequentially into two containers. It is observed that infants were able to choose the larger quantity when comparing one cracker versus two, and two crackers versus three, however, when crackers were of different sizes, the choice was determined by total surface area or total volume (Agrillo et al. *ibid.* p. 282). Thus the separation of a quantity-denoting category (QuantP) and a counting-denoting category (UnitP) has its cognitive foundation.

I also adopt Borer & Ouwayda's (2010: 12) claim that a numeral must move from its base-position to Spec of QuantP. A numeral never occurs with another quantifier. This fact can be captured if numerals and quantifiers compete for the same surface position. So this numeral-raising hypothesis is plausible to us. Moreover, a numeral does not have to surface next to a unit word, whereas the base-generated Spec-Head relation may not be intervened by any other element (e.g., an adjective). From this perspective, the raising of a numeral away from UnitP is also plausible. Accordingly, a more complete form of (308b) should be (314):

(314)



Presumably, parallel to a numeral, quantifiers like the one in (312) are also raised to Spec of QuantP.

The Spec of QuantP thus must contain a quantifier such as a numeral. The whole QuantP encodes a quantized entity, which can function as an incremental theme of a telic event (Krifka 1989, Dowty 1991), as shown by the example in (315).

(315) Yani manmande ao-hua-le yidianr bingtang.
Yani slow bake-melt-PRF a.little sugar
'Yani slowly baked a little sugar until it melted.'

Considering Li's (1998) idea that pure quantity readings are represented by a functional projection below DP, I assume that QuantP is the functional projection for such readings (I do not use her label NumP, which is for the feature number in my analysis; see next section).

Regular pronouns do not take QuantP as their antecedent (Li 1998; Kayne 2011: Sec. 4), although an English phrase such as *that many* or Chinese phrase *name duo* 'that many' may take a QuantP as its antecedent (4.5.3). In the two examples in (316), the object of the second conjunct refers to the quantity of five copies, rather than the entities of the five books expressed by the first conjunct. This constraint separates QuantP from other kinds of nominal categories.

(316) a. John bought five books and I also bought {that many/*them/*it}.
b. Baoyu mai-le wu ben shu. Daiyu ye mai-le {name duo/*tamen/*ta}.
Baoyu buy-PRF five CL book Daiyu also buy-PRF that many/3PL/3SG
'Baoyu bought five books, and Daiyu also bought that many.'

Numerals may also move further to Spec of DP, to encode definite or generic readings. Wu (2006, contra Li & Thompson 1989: 130; Cheng & Sybesma 1999: 528-530; 2009: 144) convincingly shows that numeral-initial nominals in Mandarin Chinese can yield a definite reading. In (317a) (Wu 2006: 129), *dou* 'all' does not show up, therefore, Cheng & Sybesma's (1999: 539) claim that the definite reading of a numeral-initial nominal is related to *dou* does not apply here. The preposed object *san ben shu* 'three CL book' in (317b) is also definite (Liao & Wang 2011: 158). Moreover, in (317c) (Wu & Bodomo 2009: 492), the two nominals both have a generic reading.[47]

(317)a. San ge wen guan xia–de zhi daduosuo.
three CL rotten official scare-DE keep shiver
'The three rotten officials were shivering with fear.'
b. Wo san ben shu kan wan yihou, you mai-le ling yi ben.
I three CL book read finish after then buy-PRF another one CL
'After I read the three books, I bought another one.'
c. Yi jia feiji de sudu bi yi sou lunchuan de sudu kuai.
one CL plane DE speed than one CL ship DE speed fast
'An airplane's speed is faster than a ship's.'

The numeral *zero* in English may move to DP to license a NPI, as in (318) (cited from Postal 2002).

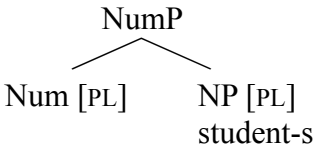
(318) Hector sent zero presents to any of his ex-wives.

5.3. The co-occurence of QuantP, UnitP, and NumP

5.3.1 CLs and NumP

Adopting Ritter (1991), among others, I assume NumP (or called #P or #^{max}) is for the feature number, which is the locus of the contrast between morphological singularity and plurality. The syntactic structure of the English word in (319a) is represented in (319b).

(319)a. students
b.



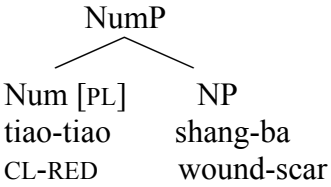
The head of NumP can be realized by an independent word, such as *mau* in the Hawaiian example in (320) (cited from Dryer 2005).

(320) 'elua a'u mau i'a [Hawaiian]
two my PL fish
'my two fish'

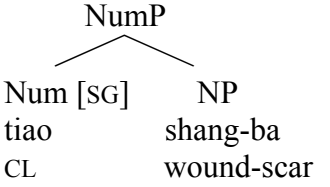
[47] In Wu & Bodomo's (2009: 500) structure, it is not clear where the syntactic position for a numeral is.

For Mandarin Chinese, NumP can host a RUWN or PUWN. Since such a nominal rejects numerals (Chapter 3), no UnitP is projected for NumP in Mandarin Chinese. The structure of the internal argument of (321a) is represented in (321b); and the structure of the internal argument of (322a) is represented in (322b) (the possible DP projection dominating NumP is omitted).[48]

(321)a. Baoyu bei-shang lu-chu tiao-tiao shang-ba.
Baoyu back-on show-out CL-RED wound-scar
'There are scars on Baoyu's back.'

b.


(322)a. Baoyu bei-shang lu-chu tiao shang-ba.
Baoyu back-on show-out CL wound-scar
'There is a scar on Baoyu's back.'

b.


So far, we have identified two syntactic positions for CLs: the head of UnitP (5.2.1 above) and the head of NumP. The latter is for the unit words in RUWNs and PUWNs.

The structure in (319b) is independent of UnitP and thus numerability, and therefore it can also represent the so-called mass plural (2.2.6).

Moreover, although NumP is an independent functional projection, it is possible for a plural marker to host other features such as gender features in addition to a number feature, and for some other element such as adjective or determiner to exhibit number features. In the Walloon example in (323a) (cited from Berstein 2001), the plural marker *–ès* (feminine) is attacted to the adjective, and in the German example in (323b), we see the plural article *die* (also, English indefinite articel *a* has [-PL] feature; see Danon 2011: 309 for more discussion). Thus, the same φ-features often appear on multiple forms within the same DP, a phenomenon of agreement (Danon 2011: 303).

(323) a. dès vètès- ouh [Walloon]
some green.F.PL door
'some green doors'

b. die Bücher [German]
the.PL book.PL
'the books'

5.3.2 Certain attested numeral and quantifier constructions

So far, we have discussed three functional projections: QuantP, UnitP, and NumP. Regarding UnitP, I have argued that a numeral and a unit word are in a Spec-Head relation. Therefore, if one of them occurs, UnitP is projected. If neither occurs, UnitP is not projected.

QuantP is project if a quantifier occurs. In 5.2.3 I also claim that UnitP is always

[48] Our analysis is different from Yang (2005: 85 fn. 19). In her analysis, NumP is projected above CLP. In order to generate a reduplicate CL form, a CL moves from the head of CLP to the head of NumP, and then moves further to D. At D, it is spelled out as a reduplicate form. My analysis does not have the CL-to-Num movement.

dominated by QuantP. So in all cases where UnitP occurs, QuantP is also projected, but not vice versa.

I have also assumed that if a number marker occurs, NumP is projected.

Some combinations of the three functional projections are listed in (324), with relevant examples. (I omit the possible projection of DP above the functional projections in (324) and omit both QuantP that dominates UnitP and possible DP in the trees in this subsection). In (324), CL refers to the CL in a numeral expression. *C means the combination is impossible in Mandarin Chinese.

(324)

	quantifier		CL	PL-marker	example	QuantP	UnitP	NumP
	non-numeral	numeral						
A	-	+	+	-	(314)	✓	✓	
B	-	+	-	-	(309a) (309b)	✓	✓	
C	+	-	+	-	(312)	✓	✓	
D	+	-	-	-	(313)	✓		
E	-	+	+	+	(325)/*C	✓	✓	✓
F	-	+	-	+	(326)/*C	✓	✓	✓
G	+	-	+	+	(328)/*C	✓	✓	✓
H	+	-	-	+	(330)/*C	✓		✓

In the patterns represented by the first four rows of (324), there is no number marker. Therefore, NumP is not projected.

A. This represents the numeal expressions in Mandarin Chinese, as seen in (314).

B. This represents the numeral expressions without CLs and number markers, as in (309a) and (309b).

C. This represents the construction in which a CL occurs with a non-numeral quantifier, as in (312).

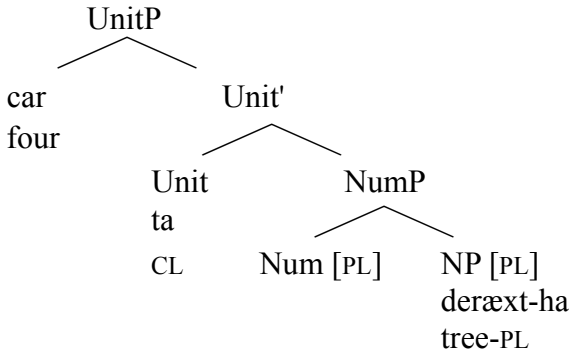
D. This represents the construction in which a non-numeral quantifier combines with a bare noun, as in (313).

In E and F, a numeral occurs with a plural marker. This is impossible in Mandarin Chinese (3.2.5).

E. For constructions that have a CL, a number marker, and a numeral, both UnitP and NumP are projected. In this case, since a unit word is higher than a plural marker, UnitP is projected above NumP (Gebhardt 2009). In my analysis, the base-positions of the elements in (325a) (Gebhardt 2009: 227) are represented in (325b). A similar Persian example, *se-ta ketab-ha* 'three-CL book-PL => three books', is found in Ghomeshi (2003: 59 (36b)).

(325)a. car ta deræxt-ha [Persian]
four CL tree-PL
'four trees'

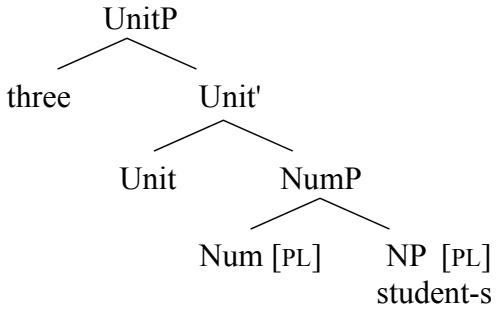
b.



F. For constructions that have both a plural marker and a numeral, both UnitP and NumP are projected, although the head of Unit can be null. The base-positions of the elements in (326a) are represented in (326b), where UnitP is added to the structure in (319b)., to host the numeral.

(326) a. three students

b.



Recall that the co-occurrence of a numeral and a plural marker is not possible in languages such as Hungarian, Finnish, Bangla, and Mandarin Chinese (2.2.6 and 3.2.5). But for some languages, the interactions could be more complicated. In Finnish, for instance, although, as seen in (327a), no plural noun occurs with a numeral, as noted in Brattico (2010), if a demonstrative precedes the numeral, the demonstrative must be plural, as seen in (327b). The plural agreement is licensed by the projection of NumP, and the numeral is hosted in UnitP (cf. Danon 2011: 301).

(327) a. Kolme auto-a aja-a tiellä. [Finnish]
three car-part.SG drive-SG road
'Three cars drive on the road.'

b. Ne kaksi pien-tä auto-a seiso-ivat tiellä.
those.PL two.SG small-part.SG car-part.SG stand-past.3PL road.adess
'Those two small cars stood at the road.'

G. For constructions that have a CL and a PL marker, but not a numeral, both UnitP and NumP are also projected. (328a) is an English example in which a kind CL, a PL marker, and a quantifier co-occur, without a numeral. In the Ahmao example in (328b) (Wang 1986: 76), similarly, the quantifier *pidzan* 'several' and a portmanteau morph *dzhai*, which contains a CL and a singular (SG) number morpheme, occur together, without a numeral. In such examples, the quantifier is hosted by UnitP and the plural marker is licensed by NumP. The configurations of the structures for such examples should be similar to (325b) and (326b).

(328)a. many kinds of books

b. pidzau dzhai tci [Ahmao]
several CL.MED.SG.INDEF road
'several roads'

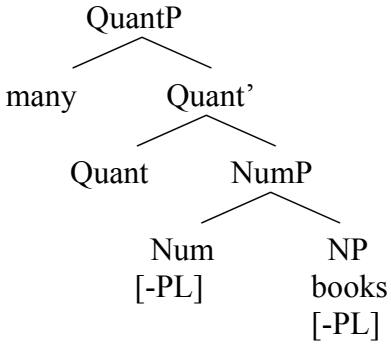
This pattern is not seen in Mandarin Chinese, since no quantifier may occur with a plural marker in the language, as shown by (329):

(329) He-li piao-zhe (*daliang/*haoji) duo-duo lianhua.
river-in float-PRG much/severl CL-RED lotus
'There are lotuses floating on the river.'

H. A non-numeral quantifier may combine with a plural noun, as in (330). The quantifier is hosted by QuantP and the number marker is licensed by NumP. Since there is neither a numeral nor a unit word, UnitP is not projected. The structure for (330a) is (331). This pattern is impossible in Chinese, as seen in (329) above.

(330) a. I bought many books. b. I bought so much clothes.

(331)



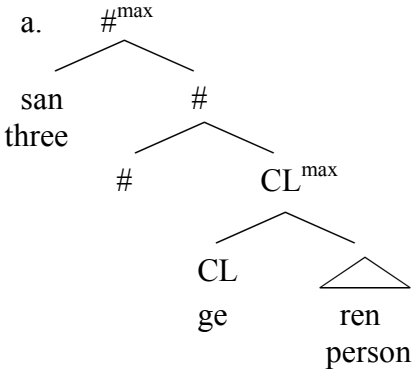
This approach is different from Borer (2005) in three major aspects: the base-position of numerals, the syntactic relation between number markers and CLs in numeral expressions, and the functional projections to encode mass nominals. The last difference will be addressed later at the end of 5.6.1. The other two aspects are elaborated as follows.

First, numerals are base-generated in Spec of $\#^{max}$ in Borer (2005: 96; also Li 1999: 86, Huang et al. 2009: 312), as in (332a), but in Spec of UnitP in the present approach, as in (332b).[49][50]

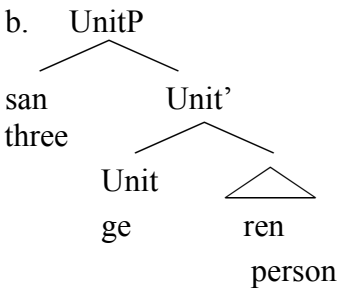
[49] In Huang et al. (2009: 312), numerals are base-generated at Spec of NumP, but on page 296 of the same book, numerals are generated at the head of NumP. See Bartos (2011: 317) for a critical comment on Huang et al.'s inconsistent treatment of numerals.

[50] My analysis is compatible with Munn and Schmitt's (2005: fn. 5) claim that ''Num may not be the locus for overt numerals, which may be higher in the structure''. Massam (2009: 675) also points out that "in Niuean, it is clear that number and numerals are not in the same projection, as argued by Pearce (2007) also for various Oceanic languages." Similarly, Espinal (2010: 987 fn. 8) states that her analysis of Catalan and Spanish suggests that, in addition to Num, a different function must be attributed to numerals. According to her, semantically, numerals introduce a cardinality function over singularities or pluralities.

(332) a.



b.



In both approaches, CL is hosted by a functional projection: CL^{max} in (332a) and UnitP in (332b). However, (332b) captures the formal dependency between a CL and a numeral (5.2.2), but (332a) does not.

Second, a plural marker and a CL are hosted in the same functional head, CL or Div, in Borer (2005), but in my analysis, the projection of NumP is independent of the projection of UnitP. In my analysis, a CL is always hosted by Unit, but a plural marker is related to Num. This analysis, as well as Gebhardt (2009), is able to cover the possible co-occurrence of a CL and a number marker in the same construction, as in (325) and (328) (also see Allan 1977: 294; Aikenvald 2003: 100-101; Gerner & Bisang 2008; Ueda 2009: 123; Csirmaz & Dékány 2010: 13, among others). Moreover, in my analysis, the occurrence of a numeral means the projection of UnitP, even in the absence of both a plural marker and a CL. We have discussed such examples in 5.2.2.

5.4. The projection of DelP

5.4.1 Delimitive adjectives and DelP

I have just argued that numerbility is represented by the projection of UnitP. In Chapter 2, I have also argued that delimitability is a feature independent of numerability. In this subsection, I argue that delimitability projects another functional projection. In de Belder (2011a,b), a more specific projection, SizeP, is proposed. We have seen in Chapter 2 that delimitability is related to not only size information such as big and small, but also shape information such as thin and round and boundary infomation such as whole or partial. I thus extend de Belder's SizeP into DelimitP, shortened as DelP.

Syntactically, the projection of DelP is attested in at least two aspects. One is that the head of such a projection can be realized by a diminutive marker, as argued in de Belder (2011b). The occurrence of a diminutive marker indicates atomicity and thus a non-mass reading.

(333)a.	pane	b.	panino	[Italian]
	bread		bread-DIM	
	'bread'		'bread roll'	
(334)a.	Brot	b.	Bröchen	[German]
	bread		bread-DIM	
	'bread'		'bread roll'	

In Gan, the diminutive suffix *tsi7* can follow various types of elements: N, Adj, V, CL, and D (proper names) (X. P. Li 2011b). The unselective selection of the diminutive marker is not a typical property of a substantive element. See Fortin (2011: Chapter 2) for a discussion of the properties of such affixes. It is possible that like CLs in numeral expressions, diminutive affixes are semi-functional heads or nominal-internal auxiliaries.

Another consideration to support the projection of DelP is that a functional projection may license a particular type of modifiers. In Cinque (1994), different types of adjectives are hosted in the Spec of various functional projections. The projection of DelP to host delimitive adjectives at its Spec is compatible with Cinque's approach (also see Déchaine & Tremblay 2011 for the claim that size adjectives are semi-lexical elements).

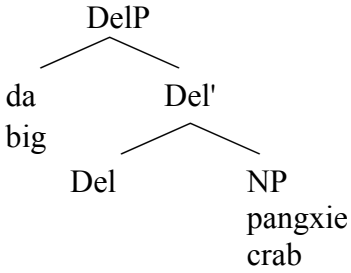
It is obvious that a nominal with a delimitive adjective does not have to occur with a numeral or unit word, as seen in (335a), where the delimitive adjective *da* 'big' occurs, without any numeral or unit word. Thus DelP can be projected in the absence of UnitP. On the other hand, a numeral expression does not have to contain a delimitive adjective, as seen in (335b), where the CL *zhi* occurs, without any delimitive adjective. Thus UnitP can be projected without DelP. We thus see the independence of DelP from UnitP.

(335)a. Wo yao mai da pangxie.
I want buy big crab
'I want to buy big crabs.'

b. Wo yao mai san zhi pangxie.
I want buy three CL crab
'I want to buy three crabs.'

The structure of the object in (335a) is (336) (the possible DP projection dominating DelP is omitted). In this structure, DelP is projected, in the absence of UnitP.

(336)



Mass nouns reject dimitive adjectives (2.3.2), and therefore, no DelP is immediately projected above NP for a mass noun such as *you* 'oil'.

5.4.2 The syntax and morphology of pre-unit word adjectives

In this subsection, three issues will be addressed: the position of DelP, the category-level of pre-unit-word modifiers, and the representations of multiple delimitive adjective constructions, in Mandarin Chinese.

Recall that in Chinese, not only non-mass nouns, such as *pangxie* 'crab' in (337a), but also unit words, such as the CL *zhi* in (337b), can be modified by delimitive adjectives (2.4.3 and 4.2.2):

(337)a. san zhi da pangxie
three CL big crab
'three big crab'

b. san da zhi pangxie
three big CL crab
'three big crab'

One might claim that the adjective in (337b) has moved from the position in (337a). However, it is not always possible to associate a pre-CL adjective to a post-CL adjective, since mass nouns reject delimitive adjectives, as shown in (338b) (Chapter 2). In (338a), the adjective *xiao* 'small' has to be base-generated above UnitP. Moreover, a pre-CL delimitive adjective may occur with a post-CL delimitive adjective, as shown in (338c, d).

(338)a. san xiao di shui
three small CL water
'three small drops of water'

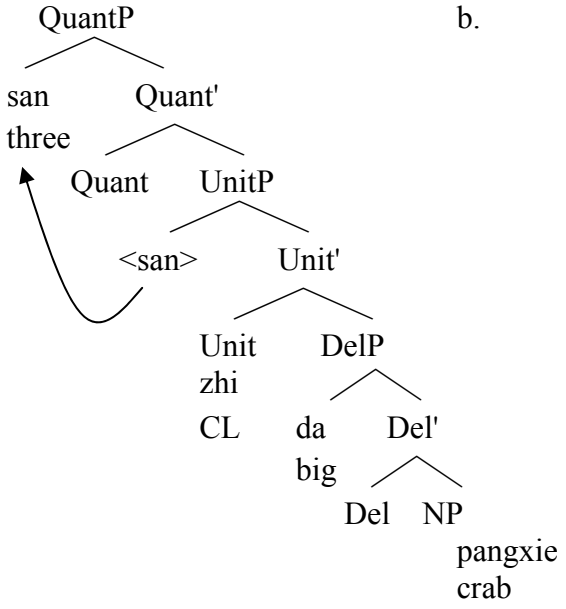
b. *san di xiao shui
three CL small water

c. san da ke fang xigua
three big CL squre watermelon
'three big square watermelon'

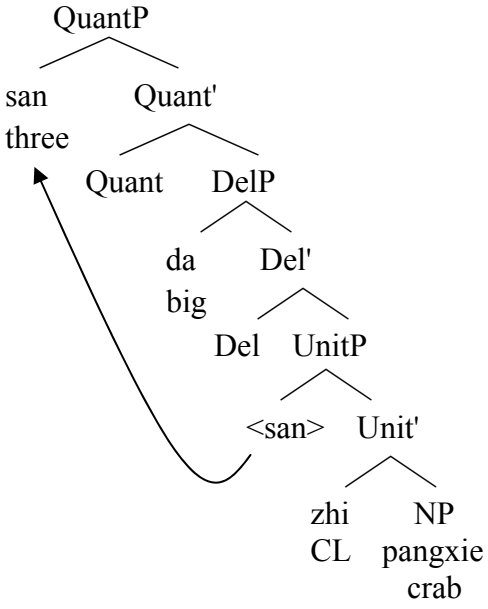
d. san xiao pian yuan shuye
three small CL round leave
'three small round leaves'

Thus a DelP higher than UnitP is independently required. Accordingly, I claim that in (337a), DelP is projected below UnitP, and in (337b), DelP is projected above UnitP. In both sentences, the adjective occurs in its base-position, hosted by DelP. (339a) is the structure of (337a), (339b) is the structure of (337b); and (339c) is the structure of (338c).[51]

(339)a.



b.

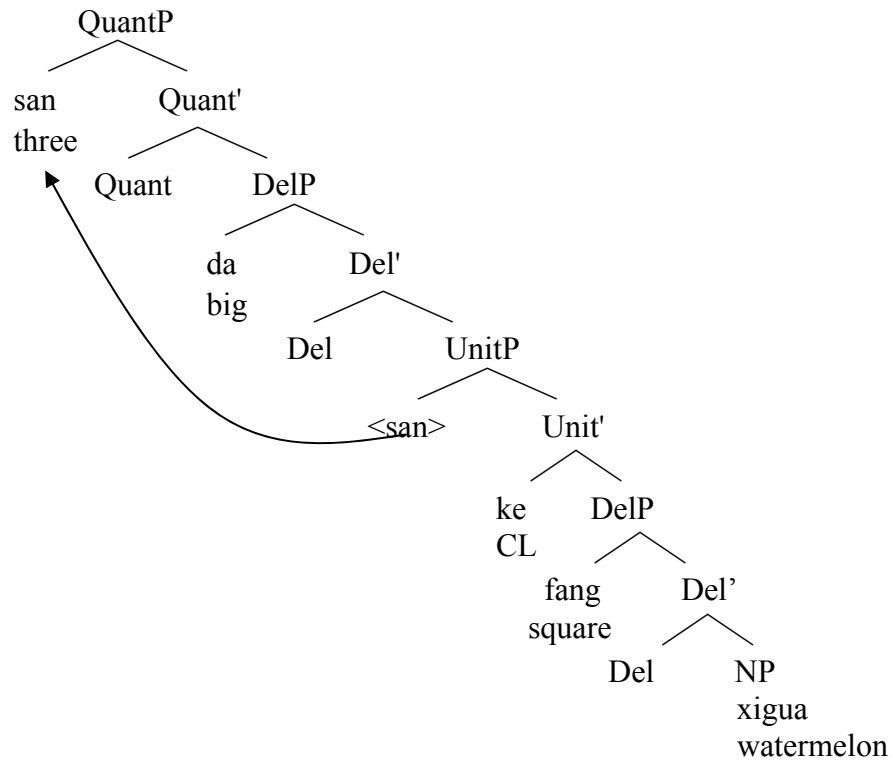


[51] Like other kinds of modifiers, delimitive modifier may also occur to the left of a numeral (Zhang 2006), or even the left of a demonstrative, with the support of the functional word *de* (see 4.2.1). I leave open the syntactic derivations of such constructions.

(i) dada de san zhi pangxie
big DE three CL crab
'three big crabs'

(ii) da de nei zhi pangxie
big DE that.one CL crab
'the big crab'

c.



That functional categories are projected in different positions is also seen in other cases (e.g., Negation). See Déchaine & Tremblay 2011 for a discussion of the relevant theoretical issues.

In structures like (339b), DelP is not below UnitP. This analysis is different from the one in de Belder (2011a,b), where SizeP is under DivP, which correlates with my UnitP. The possibility for DelP to project in two positions shows that it does not pattern with a typical functional projection. It behaves like something between a functional and a substantive projection (See Fortin 2011: Ch. 2 for more discussion of such semi-functional properties of dimunitives, which are analyzed as realizations of Del in this book) (More cases of multiple projections of DelP with the same UnitP will be introduced in Chapter 6).

Returning to (337), we see the synonymous relation between (337a) and (337b). This semantically transparent relation is compatible with the right-branching structure in which the position of a pre-CL adjective is hosted by a higher DelP, and thus C-Commands a possible post-CL adjective, which is hosted by a lower DelP (the representation of a left-branching structure is discussed in the next section).

We now turn to the category-level of pre-unit-word modifiers. When a delimitive adjective modifies a noun, it can be followed by the functional word *de*, as seen in (340). In addition to the simple form of the adjective in (340a), a pre-*de* adjective can also be in a reduplicate form, as in (340b), in a coordinate construction, as in (340c), or with a degree word *hen* 'very', as in (340d) (Wang 1995: 306, 314). For the three complex forms, the occurrence of *de* is obligatory.

(340)a. chang de xianglian
long DE necklace
'long necklace'

b. chang-chang *(de) xianglian
long-RED DE necklace
'long necklace'

c. chang erqie cu *(de) xianglian
long and thick DE necklace
'long and thick necklace'

d. hen chang *(de) xianglian
very long DE necklace
'very long necklace'

However, when an adjective modifies a unit word, no *de* is allowed to intervene between them, as seen in (341a) and (341b) (note that we are talking about the *de* to the left of a unit word, not to the right of a unit word; the latter issue is discussed in 4.5). As expected, none of the three complex forms may precede a unit word. The example in (341c) shows this constraint.

(341)a. san chang (*de) tiao xianglian
three long DE CL necklace
'three long necklaces'

b. san da (*de) xiang xianglian
three big DE box necklace
'three big boxes of necklaces'

c. *san chang-chang (de) tiao xianglian
three long-RED DE CL necklace
'three necklaces'

The ban of *de* in data like (341a) has been noted since Tang (1990b: 419). In Cheng & Sybesma (1999: 529 fn.16), it is conjectured that "[T]his may be due to some obligatory cliticalization of CL to Numeral" (also see Yang 2001: 72). However, in the presence of *chang* 'long', the CL *tiao* in (341) is not next to a numeral. Moreover, it is well recognized that a clitic may be hosted by a cluster that is composed of another clitic and its host (e.g., both *'d* and *'ve* are clitics and the latter is hosted by *I'd* in *I'd've brought some for you, if I'd known*.). Thus, if a CL is an enclitic and *de* is also an enclitic (Huang 1989), why can the CL not take the cluster *chang de* 'big DE' as its host in (341a)? It is clear that the constraint in (341) is beyond the alleged clitic status of the CL.

It is well-recognized that pre-*de* modifiers are phrasal (e.g., Fan 1958, C. Huang 1989, Tang 1990b: 420). So the constraint under the discussion is the following generalization:

(342) An adjective to the left of a unit word cannot be phrasal.

But such adjectives do not show properties of syntactic head elements. For instance, they do not license ellipsis:

(343) *Baoyu mai-le san da kuai doufu, Daiyu mai-le si xiao ~~kuai doufu~~.
Baoyu buy-PRF three big CL tofu Daiyu buy-PRF four small CL tofu

Therefore, I do not adopt Tang's (1990: 418) claim that the cluster *chang-tiao* in (341a) is a complex head cluster. Instead, extending Matushansky's (2006) theory, I assume that the pre-unit word adjective is syntactically at Spec of DelP, but it undergoes a morphological merger operation and is thus adjacent to the unit word at PF.

Such an adjective to the left of an individual or individuating CL behaves like a phrasal prefix or proclitic morphologically. Phonologically, each of such an adjective must be monosyllabic (Liu 1980: 10). This constraint rules out reduplicate adjectives, as in (344a), and adjectives that are modified by another element, as in (344b), to the left of an individual or individuating CL.

(344)a. *san chang-chang tiao feizao
three long-RED CL soap
Intended: 'three long soaps'

b. *san quantou-da kuai bing
three fist-big CL ice
Intended: three chunks of ice and each as big as a fist'

Moreover, some types of clitics do not bear stress, but some other types may (e.g., in

African French; see Salvesen 2011). A pre-unit word adjective may bear contrastive stress, as in (345) (stressed elements are in capitals):

(345) Ta zhua-le san DA tiao yu, bu shi san XIAO tiao yu.
he catch-PRF three big CL fish not be three small CL fish
'He caught three big fish, not three small ones.'

Two delimitive modifiers can occur with the same nominal or unit word (I have not seen any example in which there are more than two delimitive adjectives to the left of a unit word), if each of them is monosyllabic. In each example in (346) and (347), two delimitive adjectives occur in a row ((346c) and (346e) are cited from Y. Li 2000: 57). Thus either DelP may be projected recursively or a single DelP may have multiple Specs. Both possibilities are compatible with the analysis proposed here.

(346)a. si xiao yuan pian shuye
four small round CL leaf
'four small round leaves'

b. si xiao fang kuai bing [pre-CL Adj]
four small square CL ice
'four small square chunks of ice'

c. yi xiao bo pian mianbao
four small thin CL bread
'four small thin slices of bread'

d. si da hou pian luobo
four big thick CL turnip
'four big thick slices of turnip'

e. si da chang chuan tang-hulu
four big long CL sugar-fruit
'four big long strings of sugared fruit'

(347)a. si pian xiao yuan shuye
four CL small round leaf
'four small round leaves'

b. yi ge da fang hezi [pre-NP Adj]
one CL big square box
'four big square box'

If there are two adjectives to the left of a unit word, neither of them may occur with *de*, as seen in (348a), and thus neither of them may surface as a phrase, as stated in (342). They all undergo morphological merger with the unit word. The situation for an adjective to the right of CL, as in (348b), is different. In this case, DelP is projected below UnitP and there is no morphological constraint on the form of the delimitive adjectives.

(348)a. si xiao (*de) yuan (*de) pian shuye [pre-CL Adj]
four small DE round DE CL leaf
'four small round leaves'

b. si pian xiao (de) yuan (de) shuye [pre-NP Adj]
four CL small DE round DE leaf
'four small round leaves'

5.5. The right- and left-branching numeral constructions in Chinese

After establishing UnitP and DelP, in addition to NumP and QuantP, we are ready to label the nodes of the two syntactic structures argued for in Chapter 4: a right-branching structure and a left-branching structure.

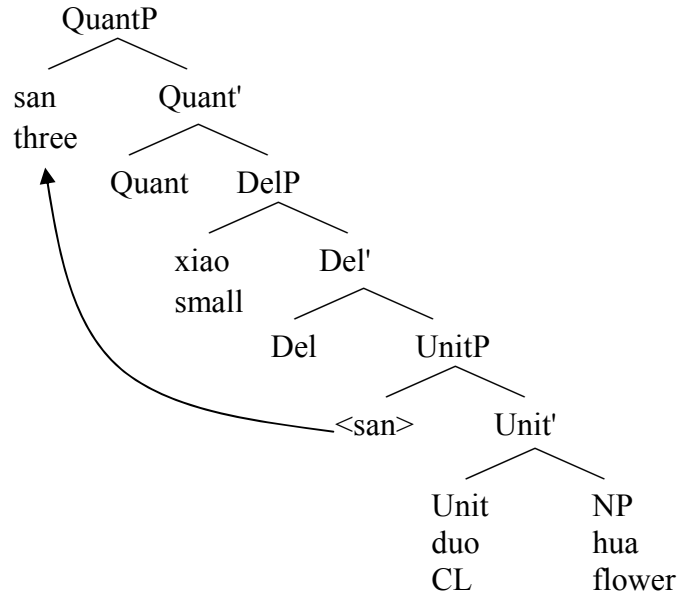
5.5.1 The representations of the right-branching structure

Individual, individuating, and kind CL constructions have a right-branching structure (4.2.5). In the three trees in (339) above, we have specified the labels of the constituent nodes for the right-branching structures of individual CLs. One more such example is (349a), where, the individual CL *duo* occurs. It has the structure in (349b). In (350a), the individuating CL *duo*

occurs. It has the structure in (350b). As for constructions with a kind CL, they also have a right-branching structure. (351a), where the kind CL *lei* occurs, has the structure in (351b). We can see that there is no structural difference among the constructions headed by the threee types of CLs: the CLs are all base-generated at Unit, C-Commanding the NP.

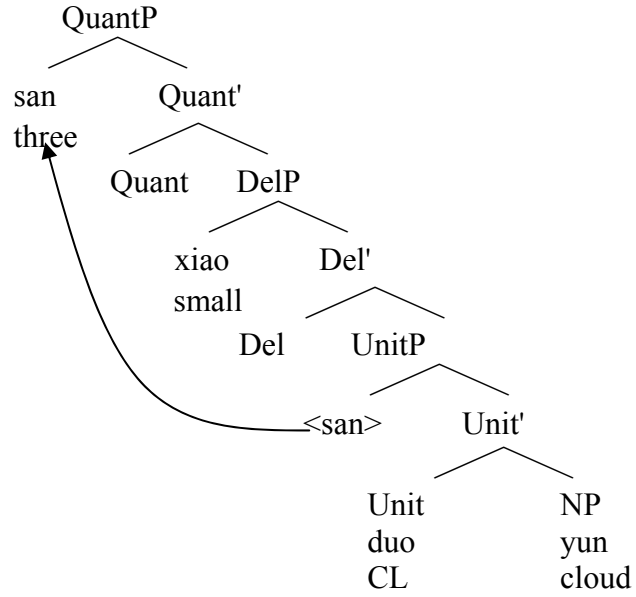
(349)a. san xiao duo hua [Individual CL]
three small CL flower
'three small flowers'

b.



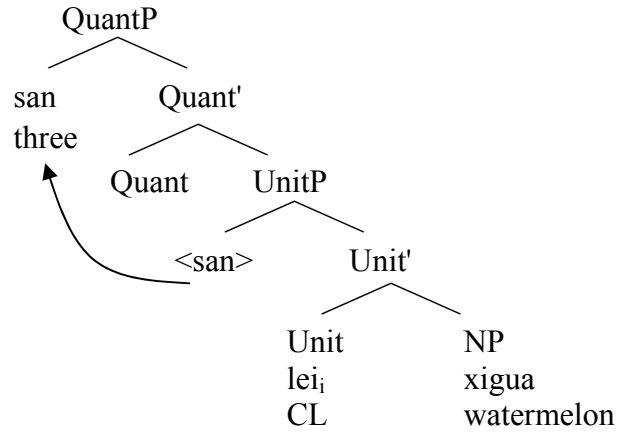
(350)a. san xiao duo yun [Individuating CL]
three small CL cloud
'three small pieces of cloud'

b.



(351)a. san lei xigua [Kind CL]
three CL watermelon
'three kinds of watermelons'

b.



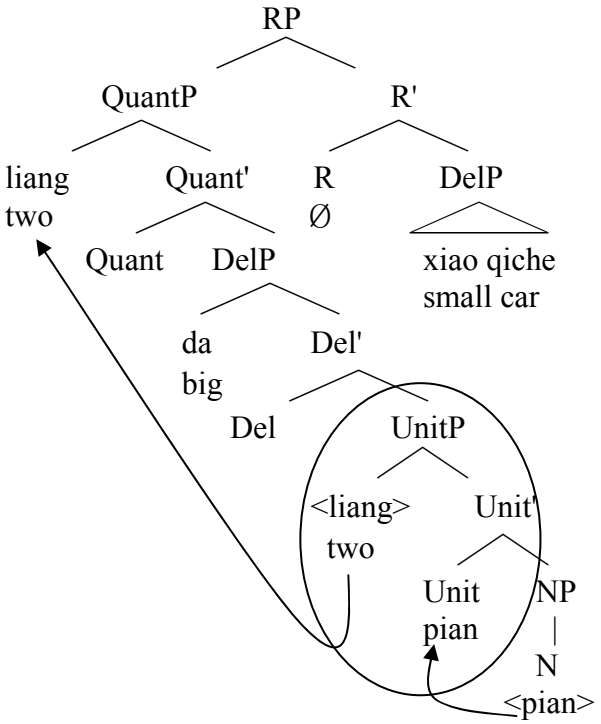
5.5.2 The representation of the left-branching structure

A left-branching structure is for numeral expressions of container measures, standard measures, collective CLs, and partitive CLs (see 4.2.5). In this structure, the unit word does not C-Command the associated NP. Therefore, the unit word and the NP may have incompatible adjectives, and the former does not have a selection relation with the latter.

However, the unit words of the left-branching structure, such as the standard measure *gongjin* 'kilo' and container measure *bei* 'cup' in *san bei cha* 'three cup tea' also share formal properties with CLs of the right-branching structure (2.4.1). I claim they all surface at the same syntactic position in numeral expressions, i.e., the head of UnitP, but the unit words of the left-branching structure are base-generated at N, and then undergo head movement and surfaces at Unit. Moreover, in the left-branching structure, the QuantP, which contains the UnitP headed by the unit words, and the NP are integrated together by RP (Relator Phrase) in the sense of den Dikken (2006). For instance, the structure for (352a) is (352b). In this structure, the locality between the numeral *liang* 'two' and the unit word *pian* is achieved derivationally, after the latter moves to Unit and before the former moves to Spec of QuantP, as illustrated by the encircled part.

(352)a. liang da pian xiao qiche [Collective CL]
two big CL small car
'two big areas of small cars'

b.



In this analysis, collective CLs, partitive CLs, standard CLs, and container CLs are all base-generated at N, and surface at Unit, and the hosting QuantP and the NP are Spec and Comp of R, respectively, as in (352b). There are three characteristics in the proposed derivation of the left-branching structure.

First, there is a head movement from N to Unit in the derivation. A similar head movement from N to a functional head is proposed in Cheng & Sybesma (1998: 406; see (296b) above) for container measure constructions. Tang (2005: 452-453) presents three arguments against this kind of movement, trying to show that nouns such as *beizi* 'cup' and *benzi* 'notebook' are different from unit words such as the container measure *bei* 'cup' or *wan* 'bowl' and thus they may not move to the position of a unit word. A, unlike either a measure word or an individual CL, a noun may not be followed by another noun, as shown by the noun *wan* in (353a). B, unlike a unit word, an NP can occur at an argument position, as shown by *da de wan* 'big DE bowl' in (353b). C, a noun "cannot appear alone with numerals like *yi* 'one'," as in (353c).

(353)a.	yi ge wan (*shui)	b. Da de wan hen gui.	c. yi *(ge) wan
	one CL bowl water	big DE bowl very expensive	one CL bowl
	'one bowl'	'Big bowls are expensive.'	'one bowl'

However, all of these three arguments simply show that nouns and unit words have different distributions. Unit words in numeral expressions are defined by their syntactic local relation to a numeral. Their surface positions can be the result of syntactic operations. One can claim that if the word *wan* 'bowl' is base-generated at N, and then if the CL *ge* is base-generated at Unit, *wan* has no way to move to Unit. The surface order of (353a) is thus derived. In (353b), no numeral occurs and thus UnitP is not projected. Then there is no N-to-Unit movement. (353c) simply shows that the head of UnitP cannot be empty in Chinese. Therefore, the movement analysis is not challenged. An element has the function of a unit word only when it occurs in a specific syntactic position, i.e., syntactically local to a numeral. In none of the three examples in (353), the word *wan* is local to a numeral, and thus it is not a

unit word. This is similar to the situation that Infl can be realized by an auxiliary or a raised verb, but the possibility of the verb movement does not blur the distinction between auxiliaries and verbs.

Following Roberts (2010), Branigan (2011: 40), and Hartman (2011), I assume that head movement can be an operation in narrow syntax. The N-to-Unit movement in the left-branchng structure is an instance of nominal-internal head movement. Nominal-internal head movement has been independently attested in Modern Hebrew (Borer 1999, Ritter 1991), Irish (Duffield 1996), Welsh (Rouveret 1991), and Romance languages (Longobardi 1994), among other languages. Such head movement is parallel to the head movement in the verbal domain (Pollock 1989). Along with the literature cited above, this study of nominal-internal head movement shows the cross-categorial symmetry in displacement phenomena (Chomsky 1970).

Note that in both left-branching and right-branching structures, the unit word surfaces at a head position, therefore, the string to its right can be elided, regardless of the syntactic relation between the unit word and the string. We have seen the ellipsis and stranding examples of individual CL constructions in (302) and (303) above. Similarly, the container measure *wan* 'bowl' in the second conjunct of (354a) may also license an empty NP to its right, and the meaning of the NP can be recovered from an NP in the first conjunct, i.e., *tang* 'soup'. Also, the container measure *wan* 'bowl in (354b) is stranded, and the missing NP has a dependency with the topic *niurou-tang* 'beef soup'.

(354)a. Baoyu he-le san wan tang, Daiyu ye he-le san wan ~~tang~~.
Baoyu drink-PRF three bowl soup Daiyu also drink-PRF three bowl soup
'Baoyu ate three bowls of soup, and so did Daiyu.'

b. Niurou-tang, Baoyu yinggai he wu wan.
beef-soup Baoyu should drink five bowl
'Beef soup, Baoyu should eat five bowls of it.'

Second, the unit word starts from the position of N, which is not a position for functional elememt. Recall that the CL *ge* may alternate with an individual, individuating, or kind CL, but not a unit word of any other types, in a numeral expression (4.2.5). The contrast matches the contrast between those with the right-branching structure and those with the left-branching structure. This restriction on the functions of *ge* indicates that this CL is base-generated at the head of UnitP, rather than N. The types of the unit words that may not alternate with *ge* can be less abstract and thus are not base-generated at the position of a functional head.

The substantive properties can be clearly seen in container measures. Such unit words may have complex forms, containing a non-delimitive modifier, such as *ma* 'horse' in (355a), and *suliao* 'plastic' in (355b). It is plausible that the complexes are base-generated at N and move to a functional position. In contrast, individual and individuating CLs may not have such complex forms, as seen in (355c). They are more like intrinsic functional elements, base-generated at a functional head.

(355)a. wu ma-che liangshi
five horse-cart food
'five horse-carriages of food'

b. wu suliao-tong qiyou
five plastic-bucket gasoline
'five plastic buckets of gasoline'

c. *wu suliao-duo hua
five plastic-CL flower

Third, the RP structure captures the possible predicate function of the combination of a

numeral and a partive CL, or a measure measure, or a standard measrue (4.2.3). RP encodes predication relation (den Dikken). The Spec and the Complement of RP may establish a subject-predicate, or predicate-subject, relation. The label of RP is not substantially different from other predication-denoting labels, such as nP or nominal PredP. The possible predicate status of the combination of a numeral and a measure word in English and Dutch is also argued for in Corver (2009).

In my analysis, the contrast between the unit words that are base-generated at a functional head and those that start out in N has nothing to do with the contrast between count and mass status of nominals. My analysis is different from Cheng & Sybesma (1998, 1999; see my 2.7.4 above), where it is claimed that the alleged count unit words are base-generated at the functional head Cl, whereas the alleged mass unit words start out in N and then undergo N-to-Cl movement.

5.5.3 The occurrence of *de* and the order of adjectives

In this subsection, we address the occurrence of the particle *de* and the order of delimitive adjectives in numeral expressions, with respect to the contrast between the left- and right-branching structures. The two aspects further support our syntactic analysis of numeral constructions.

In 4.5, I have analyzed the availability of the functional word *de* to the right of a unit word: it is available for the left-branching structure in general, and for the right-branching structure in the quantity reading, but not available for the right-branching sructure in the non-quantity reading. In that section, I have also argued that if *de* occurs in a right-branching construction, it is in fact out of the numeral expression, since the surface order is the result of deletion from a comparative modification construction.

From the structure in (352) we can see that the constituent boundary between the Spec of R and the complement of R makes the occurrence of *de* always possible. *De* can simply surface at the position of R. This captures the fact that there is no quantity-reading constraint on the occurrence of *de* in the left-branching structure. From a differen perspective, if the RP here is substantially not different from nP, and *de* heads nP (Zhang 1999), the general availability of *de* for the left-branching structure is captured.

In contrast, there is no syntactic position parallel to R in the right-branching structure of a numeral expression. Therefore, the possible *de* construction must be derived by comparative deletion, from a quantity-denoting construction (see 4.5.3 for details). Therefore, such a *de* construction alwyas has a quantity reading.

Another fact with respect to *de* is the structure of a special type of quantifiers. If it is possible for a quantifier to be followed by *de*, the quantifier may not be followed by a CL. At the beginning of 2.5, we mention such quantifiers, e.g., as *daliang* 'a lot', *suoyou* 'all', *quanbu* 'all', *daduoshu* 'most', *dabufen* 'most'. In (356a), *dabufen* 'most' may not be followed by the CL *wei*, and in (356b), *daduoshu* 'most' is subject to the same constraint.[52]

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[52] *Dabufen* 'most' may occur with any nouns, while *daduoshu* 'most' occurs with various kinds of nouns (mass and non-mass), except material mass nouns. In (ib), the material noun *moshui* 'ink' may not follow *daduoshu*.

(i) a. {dabufen/daduoshu} shu diao-dao di-shang le.
most/most book fall-to ground-on PRT
'Most of the books fell on the ground.'

b. {dabufen/*daduoshu} mo-shui liu-dao di-shang le.
most/most ink-water flow-to ground-on PRT
'Most of the ink flew to the ground.'

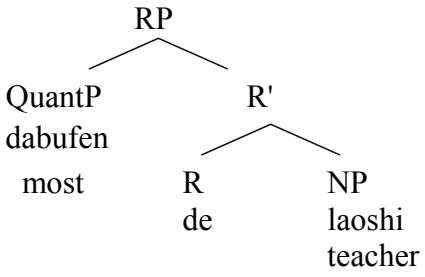
c. {dabufen/daduoshu} qingkuang dou hen hao.
most/most situation all very good
'Most of the situations are very good.'

(356)a. dabufen (*wei) laoshi
most CL teacher
'most teachers'

b. daduoshu (*wei) laoshi
most CL teacher
'most teachers'

It is possible that each of such quantifiers is a QuantP, and it is linked to the NP by R, which is realized by *de*. Therefore, there is no syntactic position for a unit word. The absence of the CL *wei* in (356) is accounted for. The structure of (356a) is (357):

(357)



We now move to the issue of the order of delimitive adjectives in numeral expressions. When a shape and a size adjective co-occur with the same modifiee, the shape adjective should be closer to the modifiee than the size adjective (Vendler 1968), regardless of how this order constraint is syntactically represented (see McKinney-Bock 2010 and the references therein). In Chinese, this default order is observed in the absence of the functional word *de* (Sproat & Shih 1988, 1990). In our following discussion, we use examples without *de*, to see the effect of the default order. Compared with (358a), (358a') is not acceptable. Similarly, compared with (358b), (358b') is not acceptable.

(358)a. si pian xiao yuan shuye
four CL small round leaf
'four small round leaves'

a'. *si pian yuan xiao shuye
four CL round small leaf
[pre-NP Adj]

b. si xiao yuan pian shuye
four round small CL leaf
'four small round leaves'

b'. *si yuan xiao pian shuye
four small round CL leaf
[pre-CL Adj]

If two delimitive adjective do not occur in a row in a numeral expression, the above order constraint is seen in individual CL constructions only, but not in the constructions of container measures, collective CLs, and partitive CLs. In (359), where the individual CL *tiao* and *pian* occur, the size adjective *xiao* 'small' must precede the shape adjective *chang* 'long' or *fang* 'square'. In (360), where the container measure *pan* 'plate', the collective CL *dui* 'pile', and the partitive CL *kuai* occur, the order of the two adjectives is free.

(359)a. si xiao tiao chang qiezi
four small CL long eggplant
'four small long eggplants'
[Individual CL]

a'. *si chang tiao xiao qiezi
four long CL small eggplant

b. si xiao pian fang binggan
four small CL square cookie
'four small round cookies'
[Individual CL]

b'. *si fang pian xiao binggan
four square CL small cookie

(360)a. si xiao pan yuan binggan [Container measure]
four small plate round cookie
'four small plates of round cookies'

a'. si yuan pan xiao binggan
four round plate small cookie
'four round plates of small cookies'

b. si da dui chang qiezi [Collective CL]
four big pile long eggplant
'four big piles of long eggplants'

b'. si chang pai xiao qiche
four long row small eggplant
'four long row of small eggplant

c. si da kuai chang qiezi [Partitive CL]
four big chunk long eggplant
'four big chunks of long eggplants'

c'. si fang kuai da fanqie
four square chunk big eggplant
'four square chunks of big eggplants'

Such a comparision between the two orders of adjectives is impossible for other types of unit words. Kind CL and standard measures may not be modified by size and shape adjectives, and the noun following an individuating CL may not be modified by these kinds of adjectives, either. Thus the test of the adjective order does not apply to the numeral expressions of these unit words.

The contrast in the adjective order indicates that in a numeral expression, an individual CL, as well as its modifier, C-Commands the modifier of the associate NP, and therefore, they are all in the same domain, in which the two types of adjectives follow the Vendler order. Our right-branching structure captures this adjective order fact. In our proposed structure, the pre-CL adjective is hosted by the DelP above UnitP, and it C-Commands the modifier of the noun, which is hosted by the DelP below UnitP.

In contrast, for container measures, collective CLs, and partitive CLs, their modifiers do not interact with the modifiers of the NP, and therefore the Vendler order is not enforced. The absence of the interaction indicates the absence of C-Command relation between the two adjectives. Our left-branching structure captures this adjective order fact. In the structure, the pre-unit word adjective is hosted by a DelP within the Spec of R, but the modifier of the noun is hosted by a DelP within the complement of R. The two adjectives have no C-Command relation. Therefore, the lack of the Vendler's order effect is explained.

5.6. Various realizations of the head of UnitP

According to Chomsky's (2001: 2) Uniformity Principle, "[I]n the absence of compelling evidence to the contrary, assume languages to be uniform, with variety restricted to easily detectable properties of utterances". In line with this principle, I assume that universally, UnitP is projected for numeral expressions, and a unit word surfaces at the head of UnitP. I also assume that the numeral of such an expression is hosted at Spec of UnitP. I have aruged that a numeral expression in Mandarin Chinese has either a left-branching or right-branching structure, depending on the type of the unit words. It is possible that numeral expressions in other languages have different structures. According Borer (1984), functional categories are the locus of parametric variations. We thus expect Unit, as a functional head, to be the locus of some parametric variations. In this subsection, I discuss the different realizations of Unit in different languages and for different numeral constructions in the same language.

5.6.1 Representing the noun types and shifts

With the two functional projections, UnitP and DelP, our theory can precisely represent the syntax of various kinds of nominals with respect to countability, classified in 2.2.2. Recall the summary in (22), repeated here as (361):

(361)

	[Numerable]	[Delimitable]	example	countability status
a.	+	+	*apple* in (7a), (13a)	count with a delimitable feature
b.	+	-	*belief* in (7f), (13f)	count without a delimitable feature
c.	-	+	*furniture* in (8b), (13b)	non-count, non-mass
d.	-	-	*oil* in (8a), (13d)	mass

For type a, the type of count nouns with a delimitable feature, if both a numeral and a delimitive adjective occur, both UnitP and DelP are projected, but the head of UnitP is null in English.

For type b, the type of count nouns without a delimitable feature, if a numeral occurs, UnitP is projected, but DelP is not projected. Like the nominals of type a, the head of UnitP for this type is also null.

For type c, the type of non-mass and non-count nominals such as *furniture* in English and *pangxie* 'crab' in Chinese, if a delimitive adjective occurs, DelP is projected; but if a numeral occurs, there must be an overt unit word to realize the head of UnitP, such as *piece* in English, and an individaul CL in Mandarin Chinese.

For type d, the type of mass nominals such as *oil* in English, DelP is never projected; but if a numeral occurs, there must be an overt unit word to realize the head of UnitP. The overt form, such as *drop*, correlates to an individuating CL in Mandarin Chinese. If there is no numeral, neither UnitP nor DelP is projected.

In English, nominals of type c and type d are different from those of type a and type b in the overtness of the head of UnitP, when a numeral occurs: the head of UnitP must be overt for type c and d, whereas it is null for type a and type b.

The absence of DelP is crucial for mass nouns. This analysis is thus different from the one in Borer (2005), where mass readings are represented by the absent of DivP (correlating to my UnitP) alone. This is the third major difference of the current analysis from Borer (2005), in addition to the two differences mentioned at the end of 5.3.2. Instead of Borer's single functional projection DivP, we have both UnitP and DelP, to encode the contrast between count and non-count nouns, and the contrast between mass and non-mass nouns.

We now specify the representations of the output of the three shifts introduced in 2.2.5. In the output of the Universal Grinder, neither UnitP nor DelP is projected. Thus there is neither overt nor covert Unit or Del for the nominal *apple* in (362).

(362) There is apple in the salad.

In the output of the Universal Sorter, such as *two chocolates* in (363) (de Belder 2011a: 70; 2011b: 173), the head of UnitP is realized by a silent version of a kind CL, and the Spec of UnitP is the base-position of the numeral of the construction.

(363) I studied two chocolates: a low fat variety and a normal one.

Note that English does have overt kind CLs such as *kind* and *type*, but if an overt CL

occurs, the plural marker will occur on the CL, rather than the noun (*two kinds of chocolate*). So if one assumes that there is a deletion of a unit word, one needs to explain the apparent transferrence of the plural marker from the unit word to the noun. A similar situation is seen in (364), where the plural marker seems to be "transferred" to the remaining adjective when the modified noun is missing.

(364) I've got three smalls and five larges.

In both (363) and (364), the head of UnitP is silent. In English, Unit takes NumP as its complement (see patter F in (324)), and thus the plural marker on the element next to the numeral is captured.

This is also true of the Universal Packager. In the output of the Universal Packager, such as *two waters* in (365), the numeral is base-generated at Spec of UnitP, and the head of UnitP is realized by a silent version of a container measure. This silent container measure can be a pro-form, interpreted in the discourse (cf. Wiese & Maling's 2005 implicit CL analysis of the Universal Packager effect).

(365) Give me two waters.

In this analysis, the features of numerability and delimitability help us to identify the occurrence of UnitP and DelP, and the types of the covert forms allowed in certain constructions.

5.6.2 Major typological patterns of null head of UnitP

Following Croft (1994: 151-152), I assume that standard measures (e.g., *kilo*), container measures (e.g., *bottle* in *three bottles of milk*), kind CL (*kind* in *three kinds of chocolate*), partitive CLs (e.g., *section* in *three sections of orange*), and collective CLs (e.g., *group* in *three groups of students*) are universally available. In my analysis, these five types of unit words all surface at the head of UnitP.

We now concentrate ourselves on the cross-linguistic variations of the null head of UnitP.

In languages such as Chinese, the head of UnitP is always realized by an overt element, in regular productive phrasal nominals. Specifically, individual CLs select nominal with [+Delimitable] and individuating CLs select nominal with [-Delimitable]. In this pattern of languages, there is no null head of UnitP.

The second pattern is that the silent Unit correlates with both individuating and individual CLs in Mandarin Chinese. The silent Unit in Yudja (Lima 2010, 2011), Ojibwe (Mathieu 2012), and Halkomelem Salish (Wilhelm *ibid.*: 64) selects a nominal with either [+Delimitable] or [-Delimitable]. In other words, any noun may surface with a numeral directly, including a mass noun, as shown in (366) (Lima 2010: 7; 2011), (367), and (368) (Mathieu 2012: Sec. 10.3.2) (parallel examples in Halkomelem and Blackfoot can be found in Wiltschko 2012: (33), (34)). In (366) and (367), where the nouns are mass nouns, the silent Unit is a covert counterpart of an individuating CL in Chinese, and in (368), where the noun is not a mass noun, the silent Unit is a covert counterpart of an individual CL in Chinese.

(366) txabïa apeta (= (50)) [Yudja]
three blood
'three units of blood'
(the exact unit is decided by the context: drops, puddles, or containers)

(367) a. bezhig azhashki
one mud
'one chunk of mud'
b. niizh azhashki-n
two mud.PL.IN
'two chunks of mud'
[Ojibwe]

(368)a. bezhig baagan
one nut
'one nut'
b. niizh baagan-an
two nuts.PL.IN
'two nuts'

As we mentioned in Chapter 2, in compounds and idiomatic expressions in Chinese, like in Yudja, no CL occurs, regardless of the delimitability value of the noun:

(369)a. san-jiao-xing
three-angle-shape
'triangle'
b. wu-ma-fen-shi
five-horse-divid-body
'five horses divide a body'
c. wu-jin shangdian
five-medal shop
'hardware store'

Similarly, in English compounds, both silent individual CLs and silent kind or individuating CLs can be found (the examples in (370) are from Wiltschko 2012: Sec. 9.2.3):

(370) a. three card trick b. five spice powder

The third pattern is that the silent Unit correlates with Chinese individual CLs only, but not individuating CLs. The silent Unit in Dëne (Wilhelm *ibid.*) and Karitiana (Müller et al. 2006) selects only nominals with [+Delimitable], i.e., non-mass nouns. In (371a) (Wilhelm *ibid.*: 46), the non-mass noun *dzól* 'ball' combines with the numeal 'five' directly, whereas in (371b) (Wilhelm *ibid.*: 47), the mass noun *bër* 'meat' may not do so. The same contrast is reported in Karitiana (Müller et al. 2006).

(371)a. solághe dzól
five ball
'five balls'
b. *solághe bër
five meat
[Dëne]

Some Formosan languages in Taiwan seem to behave like Dëne and Karitiana (Tang 2004). They have neither CLs nor plural morphology, and numerals can combine with non-mass nouns directly, but not with mass nouns.

Wilhelm (*ibid.*: 48) also reports that in Dëne, abstract nouns encode unbound concepts and they may not combine with a numeral directly.

The fourth pattern is seen in languages like English. In English, generally speaking, the silent Unit selects nominals with [+Numerable], whereas an overt Unit selects nominals with [-Numerable]. In *three books*, where *books* is [+Numerable] and [+Delimitable], the Unit is silent. Similarly, in *three beliefs*, where *beliefs* is [+Numerable] and [-Delimitable], the Unit is also silent. In contrast, in *three pieces of paper* or *three pieces of furniture*, where *paper* or *furniture* is [-Numerable], the Unit is realized by *pieces*.

Since Unit is always [+Numerable], we can see that in English, Unit as a bearer of the feature also takes nominals that have this feature as its complement. Therefore, there is an [+Numerable]-Agree relation between the silent Unit and its selected noun, in English.

The above four patterns are summarized in (372).

(372) Realizations of the head of UnitP

	standard and container measures, kind, collective, and partitive unit words	other unit words that select [-Delimitable] N	other unit words that select [+Delimitable] N
Chinese	overt	individuating CL	individual CL
Yudja	overt	∅	
Dëne	overt		∅
English	overt	∅ for [+Numerable] N	

The above classification of the various patterns of the realization of Unit is made on the consideration of three fundamental factors: the overtness of the functional head Unit, the selection of the delimitability feature by Unit, and the selection of the numerability feature by Unit.

In Manarin Chinese, since the head of UnitP may not be silent, no noun may be next to a numeral, and thus all nouns in the language are non-count nouns. In contrast, since the silent head of UnitP selects both [-Delimitable] and [+Delimitable] nouns in Yudja, all nouns are count nouns in the language. The feature delimitabilty may make further classifications in the languages. In Dëne, the silent head of UnitP selects [+Delimitable] nouns only, thus only nouns of this type are count nouns in the language. Finally, since the silent head of UnitP selects nouns with [+Numerable], regardless of whether they are [+Delimitable] (e.g., *ball*) or [-Delimitable] (e.g., *belief*), only nouns of this type are count nouns.

In my analysis, no morphological plurality marker is considered for the syntax of countability, and unit words can be silent. Considering languages such as Yudja, Dëne, and Tongan, where a bare noun may combine with a numeral directly, without any CL or number marker, I agree with Wilhelm (*ibid.*: 63-64) that "a grammatical marker of countability is not a universal requirement" (contra Doetjes 1997). In contrast to the overt grammatical marker approach, in my approach, silent unit words may encode countability in the syntactic structures of numeral expressions. Like other types of functional heads, human languages may differ in the overtness of the head of UnitP.

The idea that languages may have silent elements to encode counting unit is not new. For example, Sharvy (1978) states that English might have empty CLs correlating to Chinese individual CLs. Thus *three books* contains a silent individual CL, *Open three beers* contains a silent container measure, and *We tasted three Canadian beers* contains a silent kind CL. Krifka (2008: Sec. 6.3) also states that "[C]ount nouns in [+Num -Cl] languages have meaning with 'built-in' classifiers" (also Krifka 1995: 406; Muromatsu 2003: 84). Moreover, Delsing (1993), Van Riemsdijk (2005) and Vangsnes (2008) claim that kind readings of numeral expressions in Germanic languages have a silent CL. Thus when *three wines* means 'three kinds of wine', a silent kind CL occurs. Csirmaz & Dékány (2010: 11) also argue for the existence of zero CLs in Hungarian.

The analysis of this book has developed the idea of silent CL, and further identified the possible conditions for a silent CL to occur. According to my investigation, the availability conditions for silent CLs, as well as the exact conditions for certain types of overt CLs in Chinese, may correlate with the co-occurrence restrictions of the CLs. Also, identifying the exact type of a silent unit element (kind CL or container measure, etc.) is decided syntagmatically, as seen in (363). But generally speaking, the ambiguity possibility does not falsify the existence of empty unit words (contra Doetjes 1996: 48-49).

In this analysis of numeral expressions, individual and individuating CLs behave like auxiliaries in nominal domains. Axiliaries are base-generated at the functional heads. Their

formal features and overtness at PF are subject to language variation, as expected (Kayne 2012).

Grammatical formatives such as tense markers, definiteness markers (e.g., articles), and counterfactual markers (e.g., subjunctive mood markers) are found to be overt in many non-CL languages, but not overt in Chinese. In contrast to this pattern, individual CLs as unit words in numeral expressions are obligatorily overt in Chinese, but not overt in non-CL languages. Moreover, the effects of Universal Sorter and Universal Packager, which contain covert kind CLs and covert container measures, respectively, are also absent in Chinese. All of these indicate that Chinese does not show context-dependent flexibility in certain aspects. With more and more studies of syntactic issues, we cast a reasonable doubt on the belief that Chinese syntax is more discourse-dependent than other languages, and the claim that Chinese is a discourse-oriented language (e.g., Tsao 1977).

5.6.3 A comparison with numeral-oriented approaches

The proposed unit word-oriented analysis of the language variation in the syntax of numeral expressions is different from the noun-semantics-oriented analysis and number-morphology-oriented analysis, which I have argued against in 2.6.2 and 2.6.3, respectively.

this unit word-oriented analysis of the language variation is also different from the numeral-oriented analysis proposed in Wilhelm (*ibid.*) (adopted in Hsieh 2008: 36-37). Following Krifka (1995: 400), Wilhelm (2008: 54) first introduces an operator or function that specifies the objects to be counted as atoms. This atom-accessing function is called OU (short form for Object Unit) (1995: 400). She then makes the following statement (p. 56):

> in general, counting involves an atom-accessing function OU. Languages differ in whether OU is part of the meaning of numerals or expressed separately by numeral CLs. In other words, I propose that there is crosslinguistic variation in the semantics of numerals, and that this variation is responsible for the difference between Chinese and Dëne/English. Chinese, Dëne, and English are the same, however, in that in each of them the count/mass distinction is based on atomicity, and not on number properties such as inherent singularity.

According to this numeral-oriented approach, in languages such as Dëne and English, the unit meaning of CLs is integrated into numerals, countability correlates with atomicity of the element denoted by a noun, and only count nouns may semantically be compatible with a numeral. In Chinese, however, unit meanings are expressed by CLs, rather than numerals.

I do not adopt this approach for the following four reasons.

First, in non-CL languages such as Yudja (Lima 2010, 2011) and Halkomelem Salish (Wilhelm 2008: 64), a numeral may occur with a mass noun, as in (366). Thus, if the unit meaning is integrated into the numerals in such languages, the theory cannot explain why the combination of a numeral with a mass noun is impossible in Dëne, but possible in Yudja and Halkomelem Salish. In my unit word-oriented approach, both types of languages may have silent CLs and they differ in the selection of the delimitability feature by the silent CLs. The variation correlates exactly with that between individual and individuating CLs in CL languages. In Wilhelm (*ibid.*), the pattern of Halkomelem Salish is mentioned, without an analysis (her p. 64).

Second, the five types of unit words listed at the beginning of 5.6.2 also exist in non-CL languages that have no plural markers. The following Dëne examples are from Wilhelm (2008: 47), and the Karitiana examples are from Müller et al. (2006: 133).

(373)a. solághe nedádhi bër
five pound meat
'five pounds of meat'

b. náke tutılı tł'ólátúé [Dëne]
two bottle beer
'two bottles of beer'

(374)a. Myhin-t kilo-t ouro na-aka-t i-'ot-<o>t [Karitiana]
one kilo-OBL gold DECL-AUX-NFUT part-fall-RED-NFUT
'One kilogram of gold fell.'

b. ĵonso naka-ot-Ø sympom-t byt-ypip ese
woman DECL-bring-NFUT two-OBL bowl-in water
'The woman brought two bowls of water.'

In another non-CL and non-plural-marker language, Yudja (Lima 2010: 10-11), the partitive CL *txa* is available, to distinguish the part of an entity (e.g., pieces of meat from an animal) from the whole body of the entity (e.g., the whole animal). In the latter case, *txa* does not occur.

If a numeral always contains unit information in such languages, an additional operation is necessary to get rid of the information when the numeral occurs with any unit word of the five types. This is because a numeral is in construal with one unit only. For instance, when the meaning of 'five groups of students' or 'five boxes of books' is expressed, the numeral for 'five' in a non-CL language must exhibit the same properties of the corresponding numeral in a CL language. It is not clear to me how this is achieved in this numeral-oriented approach.

Third, the assumption that the count and non-count distinction is based on atomicity is problematic. The problem is discussed in Rothstein (2010), Krifka (2008), Chierchia (2010), among others (see my 2.6.2). The numeral-oriented approach tries to cover English, as well as other languages, but does not explain the complexity of the languages. In my Chapter 2, I proposed a four way contrasts for the count-mass distinction. My new analysis can explain not only the regular cases, but also the cases that are labeled as "semantics-syntax mismatches" in Wilhelm (*ibid.*: 64), e.g., *furniture*.

Fourth, the two arguments used to support the idea that unit meanings are integrated into numerals in non-CL languages are weak. Both arguments are intended to show numerals in non-CL languages are different from those in CL-languages. The first argument is that some numerals in Dëne are specifically for human, which might mean that "Dëne basic numerals contain a general classifier that accesses the atoms or object units in the denotation" (Wilhelm *ibid.*: 58). The argument implies that a numeral that contains unit information should not exist in CL languages. However, Mandarin Chinese does have words that encode the combination of a numeral and a CL. For instance, *lia* = *liang* 'two + CL', and *sa* = *san* 'three + CL' (see footnote 25 in Chapter 3 for a different use of *lia*).

(375)a. lia mantou
two+CL steamed.bread
'two items of steamed bread'

b. lia pingguo
two+CL apple
'two apples'

(376)a. sa mantou
Three.CL steamed.bread
'three items of steamed bread'

b. sa pingguo
three.CL apple
'three apples'

In neither Dëne nor Mandarin Chinese, is such morphological contraction systematic. Therefore, they do not tell us the general structural contrasts between CL and non-CL languages.

The second argument to support the idea that unit meanings are integrated into numerals in non-CL languages is that "In English and Dëne, but not in Mandarin and other languages with obligatory numeral classifiers, numerals can be used pronominally. In the latter, only the

numeral-classifier combination can be used pronominally." In (377), *one* alone can mean 'one new blanket', whereas in the Mandarin Chinese examples in (378), *yi* 'one' alone may not stand for 'one new blanket'.

(377) I bought two new blankets. One is black and one is red.

(378)a. Wo mai-le liang tiao xin tanzi. Yi tiao hei de, yi tiao hong de.
I buy-PRF two CL new blanket one CL black DE one CL red DE
'I bought two new blankets. One is black and one is red.'

b. *Wo mai-le liang tiao xin tanzi. Yi hei de, yi hong de.
I buy-PRF two CL new blanket one black DE one red DE
(Intended: 'I bought two new blankets. One is black and one is red.')

The data indeed show that numerals in the two languages behave differently. However, I doubt whether the contrast can show that a numeral contains unit information in non-CL languages. Data like (377) and (378a) can be derived by deletion. In (377), the NP *new blanket* is deleted after each instance of *one* (see 5.2.2).[53] In (378a), the NP *xin tanzi* 'new blanket' is deleted after each instance of *yi tiao* 'one CL'. The deletion is licensed by the CL *tiao*, which is a head element (5.2.1). (378b) is not acceptable simply because a numeral is not a head element, and thus it cannot license the deletion of the string *tiao xin tanzi* 'CL new blanket'. (See 5.2.2 for a comparision between English and Chinese in this respect).

The two approaches, the unit-word-oriented and the numeral-oriented approach to numeral expressions, have been seen in Quine (1969: 36), in a slightly different version. Quine states that a CL in a CL language can be treated as a constituting part of a numeral, so that a numeral is sensitive to the semantic type of the noun when it applies to the noun. On the other hand, a CL can also be treated as a unit word for the noun, so that a numeral can apply to the noun. Quine does not make a choice between the two approaches. But the present approach to individual and individuating CLs argues for the second one.

In addition to Wilhelm's (*ibid.*) semantically numeral-oriented approach, Lehmann (2008) proposes a morphologically numeral-oriented approach to the existence CLs in CL languages. In the latter approach, "[T]he primary function of numeral classifiers is to serve as dummy nouns that those numerals which are affixes can attach to." (*Ibid*. p. 5) However, numerals in Mandarin Chinese, regardless how long they are, always require the occurrence of a CL when counting. In (379), the numeral *yibaiwushisan* 'one hundred and fifty-three' has five syllables. It does not look like an affix, but the CL *zhang* is obligatory.

(379) yibaiwushisan *(zhang) zhuozi
153 CL table
'153 tables'

Second, as shown in 2.7.1, when a numeral occurs in a verbal expression in English, a CL is required. If numerals do not need CLs in nominals in English, they should not require the occurrence of CLs in verbal expressions as well. One should not expect the same numerals to behave differently morphologically in the same language.

5.7. Chapter summary

In this chapter, I have argued for two new projections between DP and NP: UnitP and DelP, in addition to NumP and QuantP. The two projections represent numerability and

[53] The word *one* in (377) is different from the pronominal use of *one* in data like (i) or (32a). In (i), the word *one* cannot be followed by a noun such as *car*.
(i) John bought a big car and Mary bought a small *one* (*car).

delimitability, the two features identified in Chapter 2. Numerals are argued to be base-generated at Spec of Unit and a unit word such as a CL heads UnitP. Thus the occurrence of either a numeral or a unit word in a numeral expression means the projection of UnitP. Delimitive adjectives are argued to be hosted at Spec of DelP.

Plural markers, including reduplicate unit words in Mandarin Chinese, are hosted in NumP. UnitP and NumP are different functional projections. Thus, the occurrence of a plural marker does not correlate with the projection of UnitP,

In the proposed analysis, countability is represented by functional structures, rather than substantive properties of nouns. In this aspect, the analysis is compatible with Borer's (2005) syntactic approach to countability, although the details of our functional structures are different.

Using the two new labels, UnitP and DelP, I have also presented the derivations of the left- and right-branching structures of Chinese numeral expressions, established in Chapter 4. Then, based on the selections of the two features, numerability and delimitability, I have represented various realizations of the head of UnitP in different types of languages, and within the same language. The null Unit in Yudja is a covert counterpart of either an individual or individuating CL in Chinese. The null Unit in Dëne is a covert counterpart of individual CL in Chinese. While identifying the differences in the realizations of the function head of Unit, I have argued against numeral-oriented analyses of cross-linguistic variations of the presence of CLs. In this analysis, language variations are represented by fine, yet discrete, gradiations of properties of overt and covert functional elements.

Chapter 6 Noun-Classifier Compounds and Place-Holder Classifiers

6.1. Introduction

In Chinese, a compound can be made of a noun and a CL, as shown by the underlined part in the examples in (380). I will call the compound-internal CL lower CL, and the one out of the compound higher CL, in a numeral expression. In (380b), for instance, *qun* is the lower CL and *ge* is the higher one.

(380)a.	yi di shui-di	b.	yi ge yang-qun	c.	yi zu xian-tiao
	one CL water-CL		one CL sheep-CL		one CL line-CL
	'one drop of water'		'one flock of sheep'		'one group of lines'

One goal of this chapter is to show that even for a nominal that has a built-in element to denote unit, another unit word is still required to link the nominal to a numeral in Chinese. Thus the occurrence of a CL between a numeral and a nominal in Chinese is clearly a syntactic issue. It reflects a syntagmatic relation between a numeral and a nominal in the language, as claimed in Chapter 2. In this respect, the language system has a consistent syntactic pattern, not affected by semantics.

Another goal of the chapter is to show how CLs exhibit different syntactic properties in different syntactic positions. The lower CLs are identified as a realization of Del, if they are not kind CLs. If CLs can be a realization of Del, in addition to the realization of Unit and Num (Chapter 5), we see how the syntactic context decides the syntactic status of linguistic formatives. The higher CLs in cases such as (380a) and (380b) are a place-holder of Unit, without semantic contents. I argue that a construction with a place-holder CL may have a different structure from the corresponding construction in which the same CL is not a place-holder.

Identifying the possible place-holder function of the higher CL in numeral expressions is significant in at least two aspects. First, the surface position of a unit word in a numeral expression must be the position of a functional head. Second, CLs provide one more instance of evidence for the parallelism between the syntax of nominals and the syntax of verbal or clausal constructions: both may have X^0 place-holders. The English auxiliary *do* in the so-called *do*-support is a place-holder of a functional head in the verbal domain, regardless of how one analyzes the condition for its occurrence (see Bruening 2010). Japanese also has a similar empty verb, *suru* 'do', functioning as a place-holder (Kishimoto 2011). We now find similar place-holders in the nominal domain (See Aboh et al. 2010: 782 and the references thereof for a summary of more parallelisms between nominal and clausal constructions, with respect to the structural makeup and syntactic operations).

The chapter is organized as follows. Section 6.2 presents new data to show the syntactic similarities and differences between N-CL compounds and bare nouns in Mandarin Chinese. Section 6.3 reports, on the one hand, how the lower CL decides the delimitability of the compound, and plays a role in the non-mass status of the compound when the noun root is a mass noun; and on the other hand, how the lower CL has no influence on the non-count status of the compound. These two properties lead us to see that, while the higher CL heads Unit, the lower CL never does so. Instead, it can be a realization of Del. In Section 6.4, various relations betweens the higher CL and the lower CL are discussed. The section shows that if there is no place-holder CL, although there are two CLs, only the lower one can be an individuating CL, and only the higher one encodes a counting unit. The two CLs also interact with respect to delimitive modifiers. In Section 6.5, I present the semantic emptiness of the higher CL, if it is *ge* or a copy of the lower CL, arguing for their place-holder status. In Section 6.6, I present the syntactic derivations of different numeral expressions that contain

an N-CL compound, including those containing a place-holder. Section 6.7 is a brief summary.

6.2. Basic properties of N-CL compounds

6.2.1 The components of N-CL compounds

In some languages, one can find the so-called singulatives, as shown by the suffixes in (381b), (382b) (Acquaviva 2010: 7), and the right morpheme of the examples in (383) (Yi 2010: 94):

(381)a.	hteb	b.	hteb-a			[Moroccan Arabic]
	‘fire wood’		‘piece of firewood’			
(382)a.	glao	b.	glav-enn			[Breton]
	‘rain’		‘raindrop’			
(383)a.	mwul-pangwul	b.	pis-pangwul	c.	kilum-pangwul	[Korean]
	water-drop		rain-drop		oil-drop	
	‘water drop’		‘rain drop’		‘oil drop’,	

Similar complex words are found systematically in Mandarin Chinese, with the following characteristics. First, the counterparts of singularives are just CLs. Any type of CL may follow a noun, forming a compound, as seen in (384) (see Loke 1997 for a discussion of the historical origin of such compounds in Mandarin Chinese).

(384)a.	shui-di	zhi-zhang	tu-dui	[Individuating CL]
	water-CL	paper-CL	earth-CL	
	‘water-drop’	‘paper-piece’	‘earth-pile’	
b.	hua-duo	shu-ben	ma-pi	[Individual CL]
	flower-CL	book-CL	horse-CL	
	‘flower’	‘book’	‘horse’	
c.	huluobo-pian	pinguo-kuai	hua-ban	[Partitive CL]
	carrot-CL	apple-CL	flower-CL	
	‘carrot-slice’	‘apple-chunk’	‘flower-petal’	
d.	yang-qun	yaoshi-chuan	shu-dui	[Collective CL]
	sheep-CL	key-CL	book-CL	
	‘sheep-flock’	‘key-bunch’	‘book-pile’	
e.	shu-zhong	dongwu-lei	shipin-lei	[Kind CL]
	tree-kind	animal-kind	food-kind	
	‘tree-type’	‘animal-type	‘food-type’	

CLs are thus systematically able to occur in an N-CL compound. Although accidental gaps occur (e.g., the CL *ge* may not occur in such a compound), the pattern of the compound is an attested construction in the language, and its generality should not be ignored in analyzing the formal properties of CLs (cf. Cheng 2012: fn. 3). This is parallel to the situation that one does not deny the availability of the consonant-vowel combination in Mandarin Chinese, even though the combinations such as /k‘u^{2}/, /ku^{2}/, and /su^{3}/ do not exist in the language.

Second, not only all types of CLs, but also all types of nouns may occur in an N-CL compound. The noun root *shui* ‘water’ in (384a) is a mass noun, and the noun root *hua* ‘flower’ in (384b) is a non-mass noun. As for abstract nouns, *kuan* ‘money’ in the N-CL compound in (385a) is a mass noun, whereas *shi* ‘event’ in the N-CL compound in (385b) is a non-mass noun

(385)a. liang ge kuan-xiang
two CL money-CL
'two units of money'

b. liang ge shi-jian
two CL event-CL
'two events'

a'. liang xiang zhuan kuan
two CL special money
'two units of special money'

b'. liang jian shi
two CL event
'two events'

Third, the selection of the delimitability of a CL in an N-CL compound is identical to that of the corresponding free form CL. The individual CL *zhi* occurs with the non-mass noun *qiang* 'gun' in (386a), but not the mass noun *you* 'oil' in (386b). In contrast, the individuating CL *di* occurs with the mass noun *shui* 'water' in (387a), but not the non-mass noun *putao* 'grape' in (387b).

(386)a. qiang-zhi
gun-CL
'gun'

b. *you-zhi
oil-CL

(387)a. shui-di
water-CL
'water drop'

b. *putao-di
grape-CL

The unacceptability of data like (386b) and (387b) indicates that a CL has its consistent selection pattern, regardless of whether it is in a compound or not.

Fourth, compound-internal CLs have a consistent position: they always surface at the end of a word in Chinese. The underlined morphemes in (388), which are not the last morphemes of the words, are lexical roots, not CLs, although they share forms with the nominal or verbal CLs in (389).

(388)a. ge-zi
height-suffix
'height (of a person)'

b. ben-zi
book-suffix
'writing book'

c. yi-xia-zi
one-down-suffix
'immediately'

(389)a. san ge haizi
three CL kid
'three kids'

b. san ben shu
three CL book
'three books'

c. Pai wo san xia!
pat I three CL
'Pat me three times!'

All CLs in Chinese have been developed from other substantive categories such as nouns and verbs (e.g., Li 1924; Peyraube 1998). Thus the form-sharing is not surprising.

This fixed final position of CLs in the compounds makes them different from regular nominal components of a compound, which have no constraint on their positions:

(390)a. dao-di ~ di-dao
road-earth earth-road
'real' 'real'

b. ren-qing ~ qing-ren
person-love love-person
'human relation' 'lover'

c. cha-hua ~ hua-cha
tea-flower flower-tea
'tea flower' 'scented tea'

d. he-fan ~ fan-he[54]
box-meal meal-box
'meal in boxes' 'meal box'

[54] The two forms *he-fan* 'box-meal' and *fan-he* 'meal box' are Beijing Mandarin. Their Taiwan Mandarin countermparts are *he-can* 'box-meal' and *can-he* 'meal box', respectively.

6.2.2 The distributions and readings of N-CL compounds

The distributions of N-CL compounds are similar to those of bare nouns. Like a bare noun, an N-CL compound can occur in an argument position, as in (391a), and a predicate position, as in (391b):

(391)a. Kefei kanjian-le hua-duo.
Kefei see-PRF flower-CL
'Kefei saw (the) flowers.'
'Kefei saw {the/a} flower.'

b. Zhe shi hua-duo.
DEM be flower-CL
'This is a flower.'
'These are flowers.'

Like a bare noun, the interpretation of an N-CL compound can be definite, or indefinite, as seen in (392a), generic, as seen (392b), or kind, as seen in (393). Also like a bare noun, such a compound does not have to denote plural or collective entities (contra Li & Thompson 1981: 82). Singular readings of (392a) and (392b) are possible.

(392)a. Ta xiang yao hua-duo.
he want want flower-CL
'He want to have flowers.'
'He want to have the flower(s).'

b. Hua-duo hui diaoxie.
'Flowers can wither.'
'{That flower/Those flowers/Flowers} can wither.'

(393)a. Zhang Zhongjing faxian-le shancha hua-duo.
Zhang Zhongjing discover-PRF camellia flower-CL
'Zhang Zhongjing discovered camellia.'

b. Zai zhe ge dao-shang, ma-pi yijing miejue-le.
at this CL island-on horse-CL already extinct-PRF
'On this island, horses have become extinct.'

But, as noted in X. P. Li (2011: 53), if the compound-internal CL is a kind CL, the compound is different from a bare noun. Such a compound shows properties of kind-denoting nominals only, whereas a bare noun can be ambiguous in kind and non-kind reading. I use (394) to show that such a compound may not be the argument of the presentational *fei-zhe* 'fly-PRG', whereas a bare noun can.

(394) Tian-shang fei-zhe {niao/*niao-lei}.
sky-on fly-PRG bird/bird-kind
'Birds are flying in the sky.'

If the kind meaning of the compound-internal kind CL is projected to the whole compound, the exclusive kind reading of such a compound is expected.

6.3. Delimitability, numerability and N-CL compounds

6.3.1 Compound-internal CL as a realization of Del

In 2.4.3, we have seen that kind CLs may not be modified by a delimitive adjective, whereas all other types of CLs may. This contrast remains for N-CL compounds. If the lower CL is a kind CL, the whole compound may not be modified by a delimitive adjective, as seen in (395b) and (396b). Again, as we stated above, if the properties of the compound-internal kind CL are projected to the whole compound, the constraint on the compound is expected.

(395)a. hua-lei
flower-type
'flower type'

b. *da hua-lei
big flower-type

(396)a. shu-zhong
tree-type
'tree type'

b. *da shu-zhong
big tree-type

However, if the lower CL is not a kind one, the whole compound may be modified by a delimitive adjective, regardless of whether the noun itself may be modified by such an adjective if it occurs alone. In (397a), *hua* 'flower' is modified by *da* 'big', and thus there is no surprise to see that in (397b) *da* occurs with the compound *hua-duo* 'flower-CL'. In (398a), however, *xue* 'blood' may not be modified by *da* 'big', but the compound *xue-di* 'blood-CL' can be modified by *da* in (398b).

(397)a. da hua
big flower
'big flower'

b. da hua-duo
big flower-CL
'big flower'

c. yi da duo hua
one big CL flower
'one big flower'

(398)a. *da xue
big blood

b. da xue-di
big blood-CL
'big blood-drop'

c. yi da di xue
one big CL blood
'big blood-drop'

In (398b), the values of delimitability of the two elements of the compound are conflicted: *xue* 'blood' has [-Delimitable], as seen in (398a), and *di* has [+Delimitable], as seen in (398c). But the whole compound can be modified by a delimitive adjective and thus has [+Delimitable].

The effect of the compound-internal CL is seen not only in modification, but also in predication. In (399a) and (399b), the mass noun may not be the subject of the delimitable predicate *hen da* 'very big'. In (400a) and (400b), however, the corresponding N-CL compound, which has the same mass noun root as in (399), can be the subject of the delimitable predicate.

(399)a. *You hen da.
oil very big

b. *Qi hen da.
air very big

(400)a. You-di hen da.
oil-CL very big
'The oil drop is big.'

b. Qi-tuan hen da.
air-CL very big
'The (ball-like) air-unit is big.'

Like a diminutive marker, a compound-internal CL itself may not be modified, but it makes the whole compound able to be modified by a delimitive adjective, or to be the subject of a delimitive adjective. I conclude that a compound-internal CL contributes the feature [+Delimitable] to the whole compound, if it is not a kind CL. In other words, it is the compound-internal CL that contributes the non-mass status of the compound, when the noun root is a mass noun.

Syntactically, I thus claim that a compound-internal CL, if it is not a kind CL, is a realization of the head of DelP. The whole compound is thus a non-mass one. It thus always has the feature [+Delimitable]. If the compound-internal CL is a kind CL, it should be base-generated at N, with the feature [-Delimitable]. I will present the syntactic derivations of an N-CL compound in 6.6.1.

So far, we have identified three functional positions of CLs: first, as a realization of Unit (5.2.1) when it is in a simple free form; second, as a realization of Num (5.2.4), when it is in a

RUWN or a PUWN; and third, as a realization of Del, when it is in a compound. So the syntactic status of a CL is context-dependent.

6.3.2 The non-count status of an N-CL compound

Like other nouns in Chinese, N-CL compounds may not combine with a numeral directly, as seen in (401). A unit word is required for such a combination, as in (402). So N-CL compounds are also non-count nouns.

(401)a. *san shui-di
three water-CL

b. *san hua-duo
three flower-CL

(402)a. liang ge shui-di
two CL water-CL
'two drops of water'

b. liang chuan shui-di
two CL water-CL
'two rows of water-drops'

As expected, when quantifiers that need to occur with a unit word (see 2.5) combine with such compounds, a unit word must occur, as seen in (403a); and when quantifiers that reject a unit word combine with such compounds, no unit word may occur, as seen in (403b).

(403)a. Nali you ji *(ge) shui-di?
there have how.many CL water-CL
'How many water drops are there?'

b. Yusan-shang juran mei-you (yi)-dian (*ge) shui-di.
umbrella-on even not-have some CL water-CL
'There is not even any water drop on the umbrella.'

Therefore N-CL compounds behave the same as regular nouns in the language, when they occur with numerals and various quantifiers. Such a compound is a non-count noun, with the feature [-Numerable].

With the two features, [+Delimitable] and [-Numerable], clearly, compounds like *shui-di* 'water-CL' are non-mass and non-count nouns, similar to *pingguo* 'apple' and the English word *furniture.* However, an N-CL compound contains a CL, a unit-denoting element. It expresses atomicity morphologically. But still, it requires the help of a unit word in order to show up with a numeral. Moreover, like simple nouns in the language, such compounds also reject the shifts of Universal Packager and Universal Sorter (2.2.5), since in no context may they combine with a numeral directly. This is in contrast to languages such as Yudja (Lima 2010, 2011) and Karitiana (Müller et al. 2006). In the latter type of languages, any noun can combine with a numeral directly (5.6.2). N-CL compounds tell us that even for a nominal that has a built-in element to denote unit, another unit word is still required to link the nominal to a numeral in Chinese. Thus the occurrence of a CL between a numeral and a nominal in Chinese must be a syntactic issue.

6.4. The relations between the higher and the lower CLs

6.4.1 No multiple individuating

If an N-CL compound has [+Delimitable], it is a non-mass noun. Non-mass nouns do not occur with individuating CLs. Thus if the lower CL is an individuating CL, the higher one cannot be another different individuating CL. Both *di* and *tan* are unambiguously individuating CLs, as seen in (404a) and (404b). The examples in (404c) and (404d) show that they cannot co-occur in the same numeral expression. So, semantically, only one individuating CL is allowed for one mass noun.

(404)a. yi di shui
one CL water
'one drop of water'

b. yi tan shui
one CL water
'one puddle of water'

c. *yi di shui-tan
one CL water-CL

d. *yi tan shui-di
one CL water-CL

Other CLs such as *tiao, zhang, pian* can be ambiguous. *Tiao* is an individual CL when it occurs with *yu* 'fish', but an individuating CL when it occurs with *bu* 'cloth'; *zhang* is an individual CL when it occurs with *zhuozi* 'table', but an individuating CL when it occurs with *zhi* 'paper'; *pian* is an individual CL when it occurs with *shuye* 'leaf', but an individuating CL when it occurs with *bing* 'ice'. If such a CL occurs as a higher CL, as in (405), one cannot exclude the possibility that the CL is an individual CL, representing the unit established by the lower CL. Thus, there is no case in which one mass noun occur with two individuating CLs.

(405)a. san tiao mu-pian
three CL wood-CL
'three pieces of wood strips '

b. san pian mu-tiao
three CL wood-CL
'three pieces of wood strips '

c. san zhang xiao zhi-pian
three CL small paper-CL
'three small pieces of paper'

6.4.2 No multiple counting-units

If the two CLs of a numeral expression have different forms, and the higher one is not *ge*, it is the higher one that encodes the counting unit. In (406a), there is only one CL, *juan*, which denotes a counting unit in a roll shape. In (406b), the lower CL is the same as the one in (406a), but the counting unit is the higher CL, *dui,* which is a collective CL. One uses this expression to count piles of luggage, rather than individual luggage rolls. The examples in (407) show the same point.

(406)a. san juan xingli
three CL luggage
'three rolls of luggage'

b. san dui xingli-juan
three CL luggage-CL
'three piles of luggage-rolls'
Not: 'three rolls of luggage'

(407)a. si duo hua
four CL flower
'four flowers'

b. si pai hua-duo
four CL flower-CL
'four rows of flowers'
Not: 'four flowers'

c. si zhong hua-duo
four kind flower-CL
'four kinds of flowers'
Not: 'four flowers'

Since each counting operation allows only one counting unit, based on the readings of the examples in (406) and (407), we conclude that it is the CL that is local to the numeral that denotes the counting unit. So the higher one is consistently a realization of Unit, as claimed in Chapter 5. The lower one, as claimed in 6.3 above, is a realization of Del, rather than that of Unit.

6.4.3 The semantic interactions between the two CLs

A higher CL and a lower CL may interact in different ways, semantically.

The shape meaning of the whole numeral expression can be either the sum of the meanings of the two CLs, or the hierarchical combination of the meanings of the two CLs. In (408a) and (408b), for instance, both the flat-thin shape denoted by the CL *pian* and the

narrow-strip shape denoted by the CL *tiao* are accessible, regardless of which one is the higher one. The two examples mean the same (note that *pian* is not a collective CL in (408) and (410)).

(408)a. san pian mu-tiao
three CL wood-CL
Both: 'three wood units that are flat-thin and narrow'

b. san tiao mu-pian
three CL wood-CL

In Zhang (2012a), it is argued that s-feature projection is flexible, if the sources of the features are not in a thematic relation. Here we see that the shape features of the two CLs can both be projected. Since the features from the two CLs are compatible, their combination is expected. If the semantic featurs of two CLs are not compatible, they may not be combined. In the unacceptable (409), the CL *li*, which is used for round-shaped small entities, is in conflict with the CL *tiao*, which is used for narrow-strip shaped entities.

(409)a. *san li mu-tiao
three CL wood-CL

b. *san tiao mi-li
three CL rice-CL

Also, as expected, conflict modifiers in the shape composition are not allowed, either, as seen in (410). In this example, *pian* is intended to be an individual CL, rather than a collective CL.

(410) *san da pian xiao mu-tiao
three big CL small wood-CL

Recall that individual and individuating CL constructions are right-branching (Chapter 3), and thus a higher modifier and a lower modifier are in the same domain, which may not hold conflicting semantics. In 6.4.1, we have stated that when the lower CL is an individuating CL, the higher one, if it is neither *ge* nor a copy of the lower one, is an individual CL. So *pian* in (408a) and *tiao* in (408b) are both individual CLs. The ban of conflict modifiers between the higher CL and the nominal is expected in the right-branching structure.

In (411a), however, the higher CL is the collective CL *dui* 'pile'. In this case, the shape of a pile is composed of wood pieces that are in the shape of strips, a hierarchical relation between the two shapes. Conflict modifications are possible, as seen in (411b), since the modifiers have different scopes. Recall that collective CL constructions are left-branching, and thus the two modifiers are not in the same domain (Chapter 4).

(411)a. san dui mu-tiao
three CL wood-CL
'three piles of wood-strips'

b. san da dui xiao mu-tiao
three big CL small wood-CL
'three big piles of small wood-strips'

In this section, I have discussed various relations betweens the higher CL and the lower CL in a numeral expression. I have shown that although there are two CLs, only the lower one can be an individuating CL, and only the higher one encodes a counting unit. The shape meanings of the two CLs can also both be projected, if they are semantically compatible.

6.5. The place-holder CLs

So far, in all of the examples discussed above, the higher CL is neither *ge* nor a copy of the lower CL. In this section, we show that if the higher CL is *ge* or a copy of the lower CL, it

functions as a place-holder of a syntactic position. This means that the upper CL in such constructions has no semantics.

6.5.1 *Ge* as the higher CL

If the higher CL is *ge*, the meaning of the lower CL is projected. First, the real counting unit is the lower one, rather than *ge*. In both (412a) and (412b), the higher CL is *ge,* but the encoded water-units are different. In (412a), the lower CL denotes a unit in a drop shape, and the counting unit denoted by the whole numeral expression is also in a drop shape, identical to the one denoted by the lower CL. In (412b), the lower CL denotes a unit in a puddle shape, and the counting unit denoted by the whole numeral expression is also in a puddle shape, identical to the one denoted by the lower CL.

(412)a. san ge shui-di
three CL water-CL
'three drops of water'

b. san ge shui-tan
three CL water-CL
'three puddles of water'

Moreover, in the following three groups of examples, although *ge* follows the numeral immediately in all of the cases, the reading of the a-forms is decided by the lower CL, and is thus different from the meaning of the b-forms, where *ge* is the only CL (the b-forms are typically found in the northen Mandarin).

(413)a. san ge luobo-pian
three CL carrot-CL
'three carrot-slices' ≠

b. san ge luobo
three CL carrot
'three carrots'

(414)a. san ge yang-qun
three CL sheep-CL
'three flocks of sheep' ≠

b. san ge yang
three CL sheep
'three sheep'

(415)a. san ge shu-zhong
three CL tree-type
'three kinds of trees' ≠

b. san ge shu
three CL tree
'three trees'

We know that if there is only one CL in a numeral expression, the unique CL encodes the counting unit. This is the case for the b-forms of (413), (414), and (415). We have also just seen in 6.4.2 that the higher CL denotes the counting unit. We now see that when an N-CL compound is preceded by the CL *ge*, it is the compound-internal CL that denotes the counting unit.

Second, if *ge* is the higher CL, it has no effect on the s-selection of the verb that takes the numeral expression as its argument. In (416a), the CL *juan*, which denotes a unit in a roll-shape, satisfies the s-selection of the complex verb *ya-bian* 'press-flat', whereas the CL *pian*, which denotes a unit in a flat shape, does not. In (416b), although the higher CL is *ge*, we see the same s-selection pattern. In this example, the selection is satisfied by the lower CL, a non-local element. The examples in (417) show the same point.

(416)a. Daiyu ya-bian-le yi xiao {*pian/juan} zhi.
Daiyu press-flat-PRF one small CL/CL paper
'Daiyu pressed a small {*piece/roll} of paper flat.'

b. Daiyu ya-bian-le yi ge xiao zhi-{*pian/juan}.
Daiyu press-flat-PRF one CL small paper-CL/CL
'Daiyu pressed a small {*piece/roll} of paper flat.'

(417)a. Lu-shang ji-le yi {*di/tan} shui.
road-on accumulate-PRF one CL/CL water
'A {*drop/puddle} of water has accumulated on the road.'
b. Lu-shang ji-le yi ge shui-{*di/tan}.
road-on accumulate-PRF one CL water-CL/CL
'A {*drop/puddle} of water has accumulated on the road.'

Therefore, the higher CL *ge* has no semantic function, behaving like a place-holder of certain syntactic position, in a numeral expression that contains a N-CL compound.

6.5.2 The CL copying constructions

If the higher CL has the same form as the lower CL, it is also semantically vacuous. For instance, if it is a copy of a collective CL, it does not behave like a collective CL. This can be seen in two aspects.

First, the scope of a left-peripheral modifier is changed. If there is only one collective CL, the left-peripheral modifier may be incompatible with the modifier of the NP, as in (418) (4.2.1). In (418b), the left-peripheral modifier is *dada* 'big', which is in conflict with the adjective preceding the NP, *xiao* 'small'. However, if the higher CL is a copy of the lower collective CL, the left-peripheral modifier may not be incompatible with the modifier of the compound. In (419b), the left-peripheral modifier is still *dada* 'big', and the adjective preceding the compound is *xiao* 'small'. This example is not acceptable.

(418)a. san qun yang
three CL sheep
'three flocks of sheep'
b. dada de san qun xiao yang
big DE three CL small sheep
'three big flocks of small sheep'

(419)a. san qun yang-qun
three CL sheep-CL
'three flocks of sheep'
b. *dada de san qun xiao yang-qun
big DE three CL small sheep-CL

In Chapter 4, I use the acceptability of data like (418b) to argue for the grouping of the numeral with the CL, and thus for the left-branching structure of a collective CL construciton. The acceptability contrast between (418b) and (419b) indicates that if the higher CL is a copy of a collective CL, it does not behave like a collective CL. Instead, since the scope of the left-peripheral modifier interacts with the NP in the CL copying construction, a right-branching structure is possible.

Second, the syntactic dependency of modifiers is also changed. In 3.2.2, I have shown that if a CL is a collective CL, there is no correlation between the different positions of the same modifier: immediately before the noun and immediately before the CL, as seen in (420a) and (420b), respectively. The two examples do not mean the same.

(420)a. san qun da yang
three CL big sheep
'three flocks of big sheep'
≠
b. san da qun yang
three big CL sheep
'three big flocks of sheep'

However, if the higher CL is a copy of the lower CL, a correlation between the different positions of the same modifier emerges. In (421a) the adjective *da* 'big' immediately precedes the compound, whereas in (421b), the same adjective immediately precedes the higher CL *qun*. The two examples mean the same.

(421)a. san qun da yang-qun
three CL big sheep-CL
'three big flocks of sheep'

=

b. san da qun yang-qun
three big CL sheep-CL
'three big flocks of sheep'

Thus, the higher copy of a collective CL does not behave like a collective CL any more. The correlation is similar to the semantic correlation between (422a) and (422b), discussed in 4.2.2. Crucially, the CLs in (421) are collective and the ones in (422) are individual.

(422)a. san tou da niu
three CL big cow
'three big cows'

=

b. san da tou niu
three big CL cow
'three big cows'

The above two points show that if the higher CL is a copy of the lower one, it behaves like an individual CL, which is base-generated at Unit and C-Commands the NP, and the structure of the whole conting construction is right-branching.

6.5.3 The alternation possibility

The above two subsections show that if the higher CL is *ge* or a copy of the lower one, it has no semantics, behaving like a place-holder of certain syntactic position. In this subsection, we provide further evidence for the place-holder status of such CLs, i.e., if they are exchangeable, they must be place-holders of the same syntactic position.

In (423), the forms in the three columns mean the same for each row. The higher CL is *ge* in column A, and a copy of the lower CL in column B. The forms in column C have only one CL each, which is identical to the lower CL in the other two collumns.

(423)	A	B	C	
a.	san ge shui-di three CL water-CL A/B/C: 'three drops of water'	san di shui-di three CL water-CL	san di shui three CL water	[Individuating CL]
b.	san ge hua-duo three CL flower-CL A/B/C: 'three flowers'	san duo hua-duo three CL flower-CL	san duo hua three CL flower	[Individual CL]
c.	san ge luobo-pian three CL carrot-CL A/B/C: 'three carrot-slices'	san pian luobo-pian three CL carrot-CL	san pian luobo hree CL carrot	[Partitive CL]
d.	san ge yang-qun three CL sheep-CL A/B/C: 'three flocks of sheep'	san qun yang-qun three CL sheep-CL	san qun yang three CL sheep	[Collective CL]
e.	san ge shu-zhong three CL tree-kind A/B/C: 'three kinds of trees'	san zhong shu-zhong three kind tree-type	san zhong shu three kind tree	[Kind CL]

The alternation between the forms in column A and the forms in column B is always possible. If the higher CLs in both columns are semantically vacuous, the alternation is expected.

Moreover, either group may always be changed into the corresponding simple forms in column C. If the higher CLs in column A and column B are all place-holders, this possibility of change is also expected. The semantics of a place-holder construction can be expressed by

a construction without the place-holder.[55]

The alternation among the three constructions is not found in other kinds of compounds, such as *xizhao-jian* 'bath-room', *you-tiao* 'oil-stick (a kind of fried food)', *ruan-jian* 'soft-ware' and *jiu-bei* 'wine-cup'. For instance, the CL *ge* in (424a) may not be replaced by a copy of the second morpheme of the compound, as in (424b); and (424a) has a different reading from (424c).

(424)a.	san ge jiu-bei	≠	b.	*san bei jiu-bei		c.	san bei jiu
	three CL wine-cup			three cup wine-cup			three cup wine
	'three wine-cups'						'three cups of wine'

The contrast between the possible alternation of N-CL compound constructions and the impossible parallel alternation of other types of compounds supports a syntactic analysis of N-CL compounds.

6.5.4 The significance of place-holder CLs

I have shown that if the higher CL is *ge* or a copy of the lower one, it is a place-holder of certain syntactic position. We have seen that in (423), a place-holder CL may occur with all possible types of CLs. This consistency indicates that the occurrence of place-holder CLs is systematic in the language.

Place-holders are semantically vacuous. The possibility to have a place-holder shows that the presence of a CL between a numeral and a noun in Chinese is a syntactic issue. It further falsifies the assumption that the existence of CLs is caused by the alleged mass status of nouns in the language.

Moreover, the possibility to have a place-holder to occur in the position of a regular CL of a numeral expression means the position must be a functional head position. I have argued that the syntactic position for a CL that occurs between a numeral and a nominal is Unit (Chapter 4). Now we see that Unit can be realized by a place-holder.

A well-known place-holder of a functional head position is the English auxiliary *do*, which occurs in a clausal structure. The finding of the place-holders in nominal constructions supports the cross-categorial symmetry in syntax (Chomsky 1970).

6.6. Syntactic representations of N-CL numeral expressions

6.6.1 The constructions without a place-holder CL

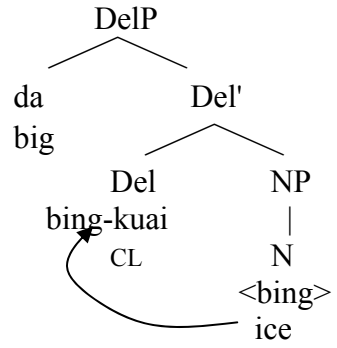
According to our conclusion reached in 6.3.1, the lower CL, if it is not a kind CL, is a realization of Del. In order to derive a possible N-CL compound, I claim that the N head of an NP moves to the head of DelP. The derivation of (425a) is (425b):

(425)a. da bing-kuai
big ice-CL
'big ice-chunk'

[55] The change in the opposite direction is not always possible. Not all single CL constructions may be changed into a double CL construction, due to the gap mentioned in 6.2.1 before. For instance, (ia) may not be changed into either (ib) or (ic).

(i)	a.	san du qiang		b.	*san ge qiang-du	c.	*san du qiang-du
		three CL wall			three CL wall-CL		three CL wall-CL
		'three walls'					

b.



Since the NP lands to the left of the lower CL, the latter always shows up at the right-edge of the compound. This captures the position consistency of the lower CL, mentioned in 6.2.1.

After the N-to-Del movement, the noun alone may not have a syntactic dependency with another element anymore. The N-CL *hua-duo* 'flower-CL' in (426a) is derived by the raising of *hua* at N to *duo* at Del. After the raising, *hua* alone may not be related to the topic *hua* at the sentence-initial position, as shown in (426b). However, the whole compound *hua-duo* may be topicalized, as seen in (426c). The topicalization in (426c) is parallel to that in (427b), where the noun *hua* 'flower' alone does not undergo any head movement. The restriction follows the well-recognized constraint on head movement, which Platzack (2010: 8) formalizes as "If a head β moves to α, the {α + β} acts as one constituent." Of course, the effect of this constraint is the same effect as that of the traditional Lexical Integrity (e.g., Di Sciullo & Williams 1987).

(426)a. Shufen mai-le san ge hua-duo.
Shufen buy-PRF three CL flower-CL
'Shufen bought three flowers.'

b. *Hua, Shufen mai-le san ge <hua>-duo.
flower Shufen buy-PRF three CL flower-CL

c. Hua-duo, Shufen mai-le san ge <hua-duo>.
flower Shufen buy-PRF three CL flower-CL
'Flowers, Shufen bought three.'

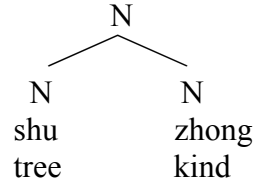
(427)a. Shufen mai-le san ge hua.
Shufen buy-PRF three CL flower
'Shufen bought three flowers.'

b. Hua, Shufen mai-le san ge.
flower Shufen buy-PRF three CL
'Flowers, Shufen bought three.'

If the lower CL is a kind CL, since it does not project a delimitability feature, it is base-generated simply at N, instead of Del. Presumablly, (428a), for instance, is derived by a direct merger of two N roots, as illustrated in (428b). As we discussed in 6.2.2, the kind meaning of the kind CL is projected to the whole compound.

(428)a. shu-zhong
tree-kind
'tree types'

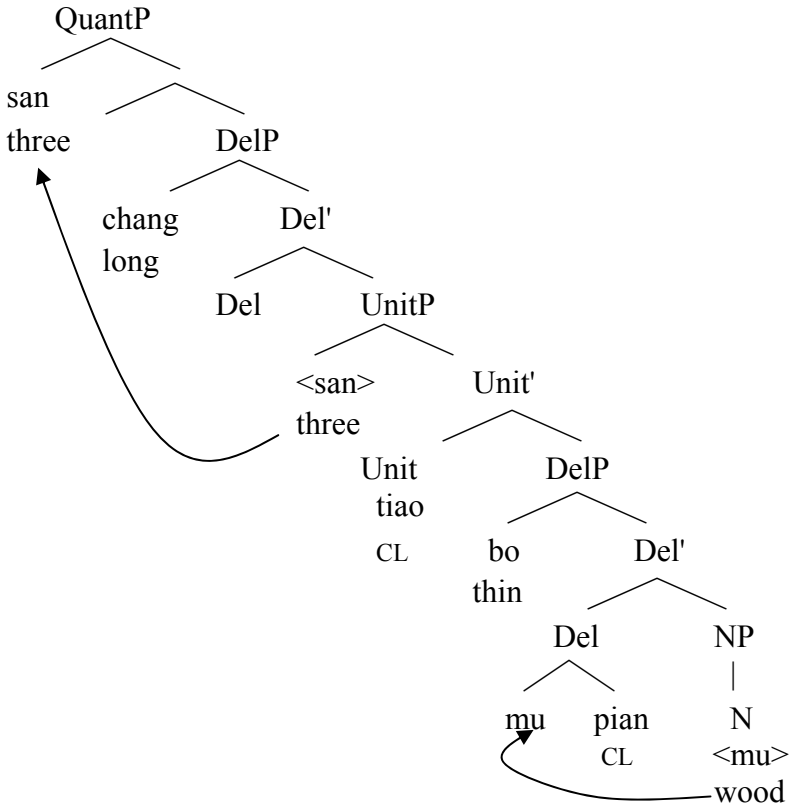
b.



Now let us see the structure of a numeral expression that contains an N-CL compound. We have argued that the higher CL heads UnitP and the lower one, if it is not a kind CL, heads DelP. It is possible that both the higher CL and the compound each have a delimitive adjective, as seen in (429a). The derivation of (429a) is (429b). Note that the two CLs are different in this example and the higher one is not *ge*. Thus there is no place-holder CL in the structure. The higher CL *tiao* is the counting unit. Also recall that a pre-CL adjective may occur with another delimitive adjective that follows the CL, as in (338c,d), and thus the projections of two DelPs have been independently attested.

(429)a. san chang tiao bo mu-pian
three long CL thin wood-CL
'three long and thin wood pieces'

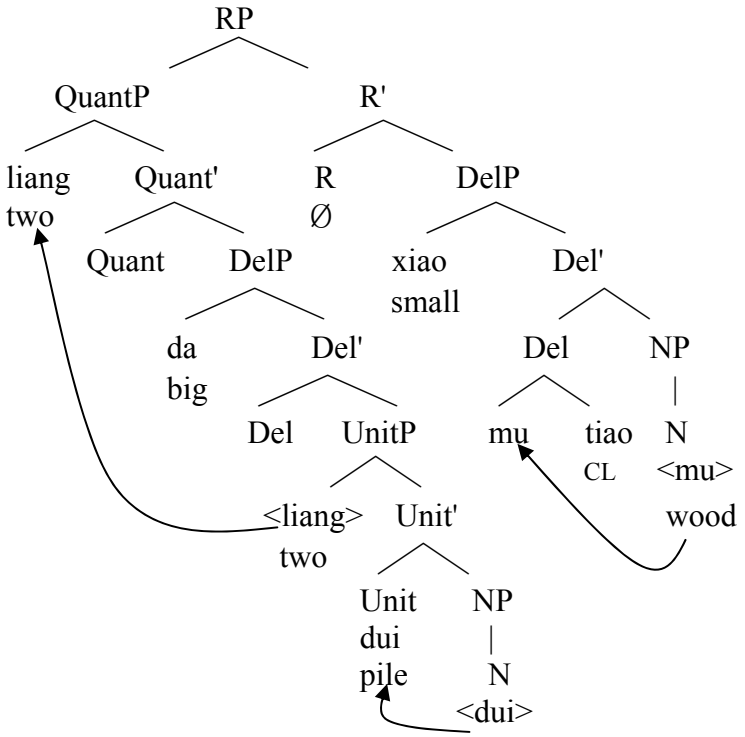
b.



If the higher CL is a collective CL, as we argued in Chapter 3, the construction has a left-branching structure. (430b) is the structure of (430a). The higher CL *dui* is the counting unit.

(430)a. liang da dui xiao mu-tiao
two big CL small wood-CL
'two big piles of small wood strips'

b.

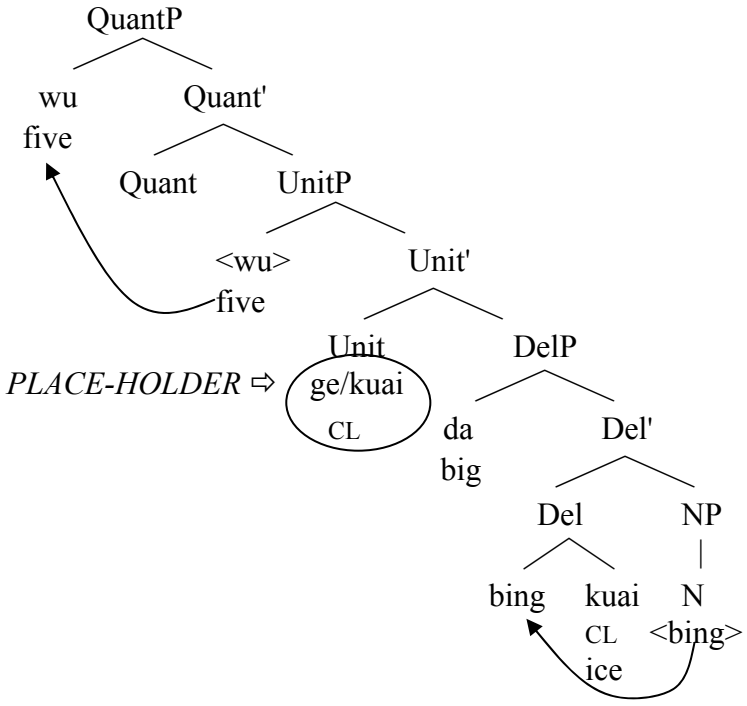


6.6.2 The constructions with a place-holder CL

One property of the place-holder CL constructions is that the higher CL is either *ge* or a copy of the lower CL (5.5). In (431a), *ge* may alternate with *kuai*. The structure of (431a) is (431b).

(431)a. wu {ge/kuai} da bing-kuai
five CL/CL big ice-CL
'five big ice-chunks'

b.

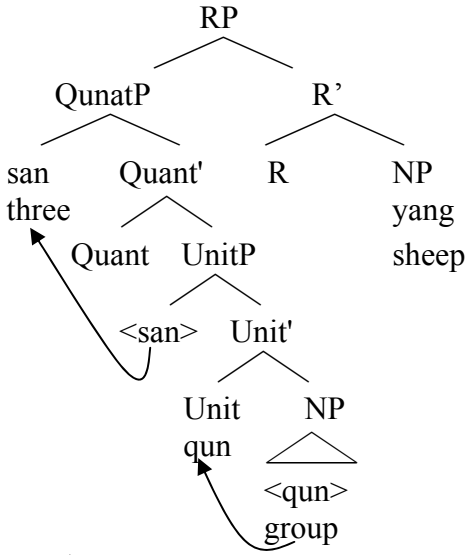


Another property of the place-holder CL constructions is that they have a consistent right-branching structure. Recall that constructions of collective CLs have a left-branching structure, and the constructions of individual CLs have a right-branching structure (Chapter

4). (432b) is the structure of (432a), where the collective CL *qun* occurs. (433b) is the structure of (433a), where the individual CL *tou* occurs. There is no place-holder CL in the two structures.

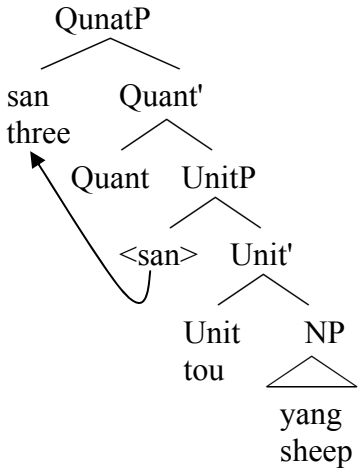
(432)a. san qun yang
three CL sheep
'three groups of sheep'

b.



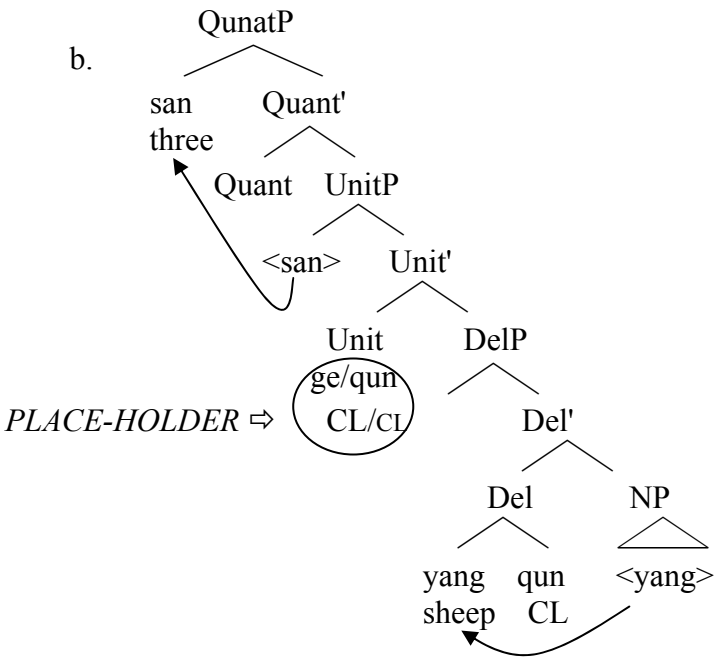
(433)a. san tou yang
three CL sheep
'three sheep'

b.



In 6.5.2 above, we conclude that if the higher CL is a copy of the lower CL, the structure of the whole numeral expression is always right-branching, regardless of the type of the CL. (434b) is the structure of (434a) (= (419a)), in which the higher CL is a copy of the a collective CL, and the structure is right-branching.

(434)a. san {ge/qun} yang-qun
three CL/CL sheep-CL
'three groups of sheep'



Since numeral expressions with a place-holder CL have a consistent right-branching structure, we see the similarity in configuration between (434b) and (429b). The consistent right-branching structures are expected if place-holders must C-Command their associates. In (434b), the place-holder CL *ge/qun* C-Commands the lower CL *qun*.

The above structures capture the fact that CLs display different syntactic properties in different syntactic contexts. It is common for the same form of a formative to play different roles in different syntactic contexts, a phenomenum of syncretism (e.g., *that* is D or C; *for* is preposition and C). In addition to the three possible functional head positions for CLs identified before, Unit, Num, and Del, the structures may also vary with the status of the higher CL. If a CL is a place-holder, the structure of the numeral expression can be different from that of the corresponding construction in which the same CL is not a place-holder.

6.7 Chapter summary

In this chapter, I have shown that even for a nominal that has an internal element to denote unit, another unit word is still required to link the nominal to a numeral in Chinese. Thus the presence of a CL between a numeral and a noun in Chinese is clearly syntactic, rather than semantic.

I have also shown how the presence of a lower CL decides the delimitability of the compound on the one hand, and the presence of the unit word does not make a non-count nominal a count one, on the other hand. These two properties have led us to see that a lower CL is a realization of Del, rather than Unit. Therefore, in addition to Unit and Num, the two syntactic positions identified before, there is a third functional position for CLs: Del.

I have also shown that if the higher CL is *ge* or a copy of the lower CL, it is a place-holder of Unit, without semantic contents. In this case, the structure of the construction may be different from that of the corresponding construction in which the same CL is not a place-holder. N-CL constructions thus tell us more about the syntactic nature of CLs, the syntactic positions of various types of CLs, and the cross-categorial availability of place-holders for functional heads.

Chapter 7 Conclusions

This book has aimed to clarify three major empirical issues with respect to the syntax of CL languages, compared with non-CL languages:

I. The countability issue, i.e., the relationship between CLs and the count-mass contrast;

II. The number issue, i.e., how a CL language expresses the contrast between singularity and plurality;

III. The structure issue, i.e., the constituency and thus the syntactic structures of numeral constructionsni CL languages.

I. The countability issue has been investigated from the following three aspects (A-C).

A. The relation between count and mass, from a syntagmatic perspective.

We have concluded that the contrast between count and mass is not a dichotomous contrast. Instead, there are two features to make the relevant distinctions: numerability and delimitability. [+Numerable] means that a noun may combine with a numeral directly, and [+Delimitable] means that a noun may be modified by a size (e.g., *big*), or shape (e.g., *round*), or boundary (e.g., *whole*) modifier. Like agentivity of VPs (i.e., whether an agent-oriented adverb is allowed) and gradability of APs (i.e., whether a degree word is allowed), numerability and delimitability are defined syntagmatically. The two newly identified features can be attested in the co-occurrence restrictions of articles, quantifiers, adverbs, prepositions, and CLs, in pronominalization, and in the input or output of the Universal Grinder, Universal Packager, and Universal Sorter.

I have claimed that a count noun is defined exclusively by [+Numerable]. It is generally recognized that such a combination possibility is the most reliable grammatical property of count nouns (e.g., Chierchia 2010: 104). This book has further argued that this is the only defining grammatical property of a count noun, cross-linguistically. The syntagmatic property of count nouns is clearly linguistic, rather than extra-linguistic. It is thus not surprising that countability is expressed in various ways, cross-linguistically. For example, in Chinese, no noun may combine with a numeral directly, and therefore, no noun is a count noun (e.g., *san ge pingguo* 'three CL apple' vs. **san pingguo*). Numerability of the language is instead represented exclusively by unit words, including CLs and measure words. In languages such as Yudja (Lima 2010, 2011), Halkomelem Salish (Wilhelm *ibid.*: 64), and Hopi (Whorf 1956 [1941]: 141), every noun can combine with a numeral directly, and thus every noun is a count noun. Between these two patterns, in languages such as English, in an unmarked situation, words like *cat* and *belief* are [+Numerable], and words like *oil* and *furniture* are [-Numerable].

On the other hand, the notion of mass is not the direct negation of count. I claim that it is the combination of two syntagmatic properties that defines mass: [-Numerable] and [-Delimitable]. Words such as *oil* in English and their counterparts in Chinese are mass nouns. This refined analysis makes it possible to precisely identify elements that may not combine with a numeral directly but allow a delimitive adjective, e.g., *furniture* in English, and *pingguo* 'apple' in Chinese. They are non-count and non-mass nouns. Since such words may have size information but still non-count, this book argues against de Belder's (2011a,b) claim that size features entail the count status.

Assuming numerals and delimitive modifiers are universally available, we are able to identify count and mass nominals in any language, with the same criteria.

This book also shows that in Chinese, even for a nominal that has a built-in unit-denoting element, i.e., a noun-CL compound, an independent unit word is still required to link the nominal to a numeral (*san ge hua-duo* 'three CL flower-CL' vs. **san hua-duo*). Thus countability is clearly a syntagmatic relation between a numeral and a nominal in the

language, rather than a semantic property.

B. The distinctive property of CL languages, compared to non-CL languages.

The obligatory presence of a CL in a numeral expression in Chinese means that all nouns are non-count nouns in the language. CLs are thus numerability bearers in the language.

With the two newly identified features, and thus the recognization that not all nouns in Chinese are mass nouns, I have argued that the function of individual CLs, which distinguish numeral CL languages from other languages, is not dividing or individuating. The popular belief that it is the individuating (discreet set-creating) function of CLs that is special in CL languages (e.g., Greenberg 1972: 26; Senft 2000: 27, Grinevald 2000: 79, Krifka 2008: Sec. 6.3) needs reconsideration. Instead, numeral CL languages are different from other languages in that they have overt forms to represent the natural units of the elements denoted by non-mass nouns. Like other types of unit words, individual CLs tell us what counts as one in counting. English verbal numeral expressions also require the presence of an individual CL (*Bill traveled to Paris three *(times)*; see Krifka 2007: 39). Thus the presence of individual CLs has syntactic foundations.

C. The cross-linguistic patterns of the null versions of individual and individuating CLs.

This book presents a new study of language variation with respect to CLs. Although five types of unit words are universally available: standard measures (e.g., *kilo* in *five kilos of apples*), container measures (e.g., *bottle* in *three bottles of milk*), kind CL (*kind* in *three kinds of chocolate*), partitive CLs (e.g., *section* in *three sections of orange*), and collective CLs (e.g., *group* in *three groups of students*), individuating CLs and individual CLs are not found in every language. I have proposed that the functional projection UnitP is universal, and all types of unit words surface at the head of UnitP. In the presence of a numeral, the head of UnitP can be null. This book has presented various patterns of the null forms of Unit, based on the newly identified two features. In languages such as Chinese, the head of UnitP is always realized by an overt element such as a CL, in regular productive phrasal nominals. In languages such as Karitiana (Müller et al. 2006), Yudja (Lima 2010, 2011), Halkomelem Salish (Wilhelm *ibid.*: 64), and Dëne (Wilhelm *ibid.*), the head of UnitP is not realized by an overt element other than the above five types of unit words. However, the silent Unit in Yudja and Halkomelem Salish selects a nominal with either [+Delimitable] or [-Delimitable]. So it is a covert counterpart of either an individual CL or individuating CL in Chinese. In contrast, the silent head of UnitP in Dëne selects only nominals with [+Delimitable]. Thus, the silent Unit in Dëne is a covert counterpart of a Chinese individual CL, but not that of an individuating CL. In languages such as English, generally speaking, the silent Unit selects nominals with [+Numerable], whereas the overt Unit selects nominals with [-Numerable]. In *three books*, where *books* is [+Numerable], Unit is silent. In contrast, in *three pieces of paper* or *three pieces of furniture*, where *paper* or *furniture* is [-Numerable], Unit is realized by *pieces*. This book also argues against numeral-oriented theories of the cross-linguistic variation.

II. The number issue has been probed from the following three aspects (D-F).

D. The relation between the count-mass contrast and morphological number.

Numerability, which is one of the two features responsible for the mass-count contrast, is different from morphological number, which is concerned with the contrast between singularity and plurality. In this new perspective, nouns that have plural markers but reject numerals, such as *clothes, oats, grits,* and *masses* (McClawley 1979 [1975]: 172; Huddleston & Pullum 2002: 342), are [+Plural, -Numerable], and nouns that reject both plural markers

and numerals, such as *furniture* and *school* in *at school* are [-Plural, -Numerable]. The new theory also covers various possible interactions between countability and number, cross-linguistically.

E. Encoding of the notion of number in CL languages.

We have reported that all types of CLs and other types of unit words in Mandarin Chinese can be reduplicated to express unit-plurality, as seen in (435).

(435) Tian-shang piao-zhe (*san) duo-duo bai yun.
sky-on fly-PRG three CL-RED white cloud
'Many pieces of white cloud are flying in the sky.'

Such plural markers are not specified with definiteness or specificity. The semantic type of the encoded plural is abundant plural. The optionality of the plural markers is predicted because the language has general number. General number is expressed by bare nouns in the language.

F. The reduplicate unit words reject numerals, like the plural markers in many languages such as Hungarian and Bangla. Thus plural markers in thses languages exhibit [-Numerable]. Accordingly, no UniP is projected above NumP in these languages, unlike in other languages such as English.

III. The structure issue has been studied from the following two aspects (G and H).

G. The constituency of numeral expressions.

This book has examined the constituency of a numeral expression, which contains three basic elements: a numeral, a unit word, and an NP in Mandarin Chinese. It identifies three structures: a right-branching structure for constructions of individual, individuating, and kind CLs; a left-branching structure for constructions of partitive and collective CLs, and for container and standard measures. In the former structure, the unit word does not C-Command the NP, whereas in the latter structure, the unit word does C-Command the NP. The identification of the two structures is based on the investigation of four issues: the scope of a left-peripheral modifier; the effect of adjective-lowering; the predicate status of the combination of a numeral and a unit word; and the semantic selection of a unit word on a noun.

H. The different syntactic properties of CLs in different syntactic contexts.

Two new functional projections are argued for in this book: UnitP and DelimitP (DelP). The arguments for the functional categories come from the licensing of ellipsis and stranding, and the licensing of certain types of modifiers. This book argues that CLs are base-generated at different syntactic positions in different syntactic contexts.

First, in a numeral expression, the CL heads the (semi) functional projection UnitP. The numeral and the CL hold a Spec-Head relation in their base-positions and thus the occurrence of either of them means the projection of UnitP. But the occurrence of a plural marker does not correlate with the projection of UnitP.

We have shown that in a numeral expression, individual, individuating, and kind CLs are base-generated at the head of the functional projection UnitP, and thus behave like auxiliaries in nominals.

In the structure of mass nominals, there is neither UnitP nor DelP. Identifying the two functional projections in addition to NumP and QuantP, this approach is different from Borer (2005) in the base-position of numerals, in the syntactic relation between number markers and CLs in numeral expressions, and in the functional projections to encode mass nominals.

Second, a CL in a reduplicate form, as in (435) above, heads a functional projection that

is responsible for number, NumP.

Third, if a non-kind CL surfaces in a compound, such as *di* in (436), it heads DelP. In (436), it is the compound-internal CL *di* that licenses the delimitive modifier *xiao* 'small'.

(436) Zhuo-shang you xiao shui-di.
table-on have small water-CL
'There are small drops of water on the table.'

Fourth, if the CL preceding a noun-CL compound is *ge*, as in (437a), or a copy of the compound-internal CL, as in (437b), it is a place-holder of Unit. The structure of a place-holder CL construction is always right-branching, regardless of the type of the CL in the noun-CL compound. In other words, the place-holder CL always C-Commands the compound.

(437)a. Zhuo-shang you san ge xiao shui-di.
table-on have three CL small water-CL
'There are three small drops of water on the table.'
b. Zhuo-shang you san di xiao shui-di.
table-on have three CL small water-CL
'There are three small drops of water on the table.'

The possible place-holder function of CLs suggests that the surface position of a CL in a numeral expression must be the position of a functional head. In this sense, CLs provide one more instance of evidence for the parallelism between the syntax of nominals and the syntax of verbal or clausal constructions: both may have X^0 place-holders (cf. *do* in the *do*-support in English).

The new understandings of the linguistic notions of countability, number, and nominal-internal functional elements all enrich our knowledge of the syntactic computation system of language.

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