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Counting Unit Words as Nominal Auxiliaries

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Abstract

This paper discusses the syntax of counting unit words, which are in construal with both a numeral and an NP, and exhibit properties of both functional and lexical elements. Using Mandarin Chinese as a sample language, the paper (A) identifies the shared properties of various kinds of counting unit words, including measure words and numeral classifiers, and their shared surface position; (B) divides them into Individual-Level and Range-Level ones, and argues for their different base positions. Counting unit words are analyzed as nominal auxiliaries that realize the head of a functional projection. Based on the newly explored properties of numeral classifiers, the paper argues against the assumption that the occurrence of numeral classifiers with count nouns correlates with the alleged mass noun status of all nouns in the language. Instead, the paper argues that the occurrence is possible because nominal auxiliaries may apportion entities in a way of representing the natural units of entities that show atomicity. It is this property of nominal auxiliaries that is absent in non-classifier languages. Thus the contrast is not in the semantics of noun roots at all. (35 pages) Key words: auxiliary, counting unit word, measure, classifier, apportion, numeral

Counting Unit Words as Nominal Auxiliaries

1. Introduction

Any word that links a numeral with an NP is a counting unit word (CUW). Such a word can be a so-called measure term, such as *gōngjīn* in (1a), or container measure word such as *xiāng* in (1b), or numeral classifier (classifier, henceforth), such as *duǒ* in (1c).[1]

(1) a. 五公斤蘋果
wǔ gōngjīn píngguǒ
five kilo apple
'five kilos of apples'

b. 五箱蘋果
wǔ xiāng píngguǒ
five box apple
'five boxes of apples'

c. 五朵花
wǔ duǒ huā
five CL flower
'five flowers'

CUWs are called "measures" in Chao (1968: 584-520). The counting unit function of classifiers, among other types of CUWs, has long been recognized. For instance, Li (1924: 81) claims that classifiers are such elements that are added after a numeral and function as the units of entities to be quantified. Similarly, Lü (1942:18) calls classifiers *danwei ci* 'unit word'.

As we know, measure words and classifiers for mass nouns are also seen in many languages such as English (e.g. *two liters of water, two drops of water*). Languages such as Chinese show a special property: a CUW must be present for any noun that occurs with a numeral, regardless of whether the noun is a mass or count noun. Why does Chinese have this requirement, whereas English does not? How are CUWs different in the two types of languages? What is the syntax of CUWs in general? These are the empirical issues to be studied in this paper.

In this paper, I analyze CUWs as nominal auxiliaries. Specifically, I identify the shared properties of various kinds of CUWs (Section 2), and their shared surface syntactic position (Section 3). Then, I divide them into two major types based on their formal characteristics (Section 4), and argue for the different base positions of the two major types (Section 5 and Section 6). Like Borer (2005), among others, I distinguish the structural position for elements that establish units (a low projection) from the structural position for elements that function as counting units (a high projection).

The proposed analysis can be taken as a step toward understanding the properties of nominal auxiliaries, especially those of classifiers, and understanding how classifier languages are different from non-classifier languages such as English.

In this paper, I do not discuss constructions that contain the functional word *de*, since such constructions are syntactically and semantically different from the ones without *de* (Cheng & Sybesma 1998, Tang 2005, Zhang 2009a).

2. Unified properties of CUWs

2.1 Dual dependencies on numerals and NPs

CUWs must be semantically in construal with both an NP and a numeral at the same time.

In counting, a number and a counting unit are dependent on each other. Counting must have a counting unit (e.g., inch, box, group, piece or item), and counting makes no sense if there is no number. A formal semantic study of the mutual dependency between numerals and measurement unit words is seen in Rothstein (2007: 13).

Moreover, although NPs do not semantically depend on CUWs, CUWs do depend on NPs. Counting makes no sense, if there is no NP that denotes the entities which a counting

[1] The abbreviations used in this paper are: CL numeral classifier; AUX auxiliary; DE modification; Q question; PRF perfect aspect; PRG progressive; EXP experiential; PASS passive; DCLC default classifier construction; BCLC bare cluster construction; CLCC classifier copying construction; GCLC *ge* complex classifier construction.

operation applies to.

The dependency of a kind of elements on nouns is also seen in other elements such as morphological number markers (e.g. plural markers) and diminutive markers. Like many CUWs, such elements also function as dividers of mass, establishing units (Doetjik 1996, 1997, Borer 2005, Wiltschoko 2005). However, the established units do not have to be for counting, and thus the dependency on numerals is not seen in these elements. Bare plurals in English and nouns in diminutives in German do not have to occur with a numeral. Moreover, the Chinese nominal suffix *–men*, which denotes plurality, even rejects the occurrence of a numeral. Thus CUWs are fundamentally different from these elements.

Even for classifiers, if they are not in construal with a numeral, as in a reduplication form, as in (2), they are not CUWs.

(2) 朵朵鮮花
duǒ-duǒ xiān-huā
CL-CL fresh-flower
'each fresh flower'

Thus the notion of CUW is configurationally defined, like that of subject and object. Another analogy is the word *have*: it can be either a verb root or an auxiliary, depending on the context.

Generally, a dual dependency of an element on another two elements is seen in ditransitive verbs, which require the co-occurrence of two internal arguments (following Marantz 1984, among others, I do not assume that an external argument interacts with a verb as closely as internal ones). CUWs can be treated as elements that exhibit dual dependency in the nominal domain. Parallel to the verbal and nominal elements that show dual dependency, coordinators also show dual dependency, since they require the co-occurrence of at least two conjuncts.

This dual dependency of CUWs means that their structure properties are more than simply selecting an NP (contra Cheng & Sybesma 1998: 407 and Selkirk 1977). It is unlikely that a CUW and its associated NP form a saturated unit, excluding the numeral (cf. Corver 1998). Moreover, it is also unlikely that a numeral and a CUW form a constituent, excluding the associated NP (Selkirk 1977, Tang 1990a, Croft 1994: 151, Hsieh 2008). I will argue for the syntactic structure of the constructions that host CUWs in Section 3.

2.2 Semantic contents of CUWs

CUWs are neither purely lexical nor purely functional. Unlike lexical elements such as nouns and verbs, CUWs do not encode entities, actions, events, or states. Instead, they express counting units only. They have no thematic relation with another element, a typical property of functional elements. However, unlike purely functional elements, CUWs are interpretable, having intrinsic semantic features. They can be focused and can bear contrastive stress. In (3a), the CUW *gōngjīn* 'kilo' is in contrast to the CUW *bàng* 'pound'. In (3b), the CUW *wǎn* 'bowl' is in contrast to the CUW *sháo* 'spoon'. In (3c), the CUW *juǎn* 'roll' is in contrast to the CUW *zhāng* 'piece'.

(3) a. 露露買了三公斤櫻桃，而不是三磅櫻桃。
Lùlù mǎi-le sān gōngjīn yīngtáo, ér bùshì sān bàng yīngtáo.
Lulu buy-PRF three kilo cherry but not three pound cherry
'Lulu bought three kilos of cherries, not three pounds of cherries.'

b. 露露喝了三碗湯，不是三勺湯。
Lùlù hē-le sān wǎn tāng, bú shì sān sháo tāng.
Lulu drink-PRF three bowl soup but not three spoon soup
'Lulu ate three bowls of soup, not three spoons of soup.'

c. 露露拿了三卷紙，而不是三張紙。
Lùlù ná-le sān juǎn zhǐ ér bùshì sān zhāng zhǐ.
Lulu take-PRF three roll paper but not three CL paper
'Lulu took three rolls of paper, but not three pieces of paper.'

CUWs can also satisfy s-selection of verbs:

(4) a. 露露{抬起了/*畫了} 三公斤櫻桃。
Lùlù {táiqǐ-le / huà-le} sān gōngjīn yīngtáo.
Lulu carry-PRF / draw-PRF three kilo cherry
'Lulu {carried/*drew} three kilos of cherries.'

b. 露露{打開了/*看懂了} 三包書。
Lùlù {dǎkāi-le / kàn-dǒng-le} sān bāo shū.
Lulu open-PRF / read-understand-PRF three bag book
'Lulu {opened/*read-understood} three bags of books.'

c. 露露{擦乾了/*儲存了}三灘水。
Lùlù {cā-gān-le / chǔcún-le} sān tān shuǐ.
Lulu wipe-dry-PRF / store-PRF three CL water
'Lulu {wiped/*stored} three puddles of water.'

One can carry kilos of cherries, or draw a picture of cherries, but not draw a picture of certain kilos of cherries. There is a semantic incompatibility between the verb *huà* 'draw (pictures)' and the measure term *gōngjīn* 'kilo', as seen in (4a). Likewise, one can open bags of books, or get to understand a certain book, but not get to understand bags of books. There is an incompatibility between the verb *kàn-dǒng* 'read-understand' and the container measure word *bāo* 'bag', as seen in (4b). Similarly, one can wipe off puddles of water, or store bottles or jars of water, but not store puddles of water. There is an incompatibility between the verb *chǔcún* 'store' and the classifier *tān* 'puddle', as seen in (4c).

Since CUWs exhibit properties of both lexical and functional categories, they belong to semi-functional elements, in the sense of the studies in Corver & Riemsdijk (2001). Following traditional Chinese grammars (Lu 1951: 42; Chao 1968: 584), I treat such elements as nominal auxiliaries, along with demonstratives and articles (Roehrs 2009).

2.3 A general apportion function

Each CUW represents a counting unit. CUWs must have the general function of apportion. This function is exhibited in either of the two ways, partitioning elements of any type, or representing the natural units of elements that show atomicity.

2.3.1 Partitioning entities

A CUW may partition entities. The partition can be either initial or non-initial. CUWs can divide elements that show no atomicity, i.e., mass stuff. Thus the division is initial. In each of the examples in (5) and (6), the referent of the NP associated with the CUW does not show natural atomicity. It is divided by the CUW in a specific way.

(5) a. 三升水
sān shēng shuǐ
three liter water
'three liters of water'

b. 三碗水
sān wǎn shuǐ
three bowl water
'three bowls of water'

(6) a. 三滴水
sān dī shuǐ
three CL water
'three drops of water'

b. 三張紙
sān zhāng zhǐ
three CL paper
'three pieces of paper'

c. 三堆泥土
sān duī nítǔ
three pile mud
'three piles of mud'

d. 三份牛奶
sān fèn niúnǎi
three portion milk
'three portions of milk'

In Borer's (2005) terms, the compatibility between such CUWs and mass nouns means that the CUMs are operators that assign range to the open value of $<e>_{DIV}$.

CUMs can also divide entities that already show natural atomicity, i.e., entities denoted by count nouns (Rothstein 2007: 14). The outcome of the new division may be either smaller or bigger than the corresponding natural unit.

(7) a. 三克西瓜
sān kè xīguā
three gram watermelon
'three grams of watermelon'

b. 三勺西瓜
sān sháo xīguā
three spoon watermelon
'three spoons of watermelon'

(8) 三片西瓜
sān piàn xīguā
three piece watermelon
'three pieces of watermelon'

Watermelons show natural atomicity. Usually, a single watermelon is heavier than one gram, has a larger quantity than that contained by a spoon, and can be divided into many pieces. The CUWs *kè, sháo,* and *piàn* divide a watermelon in (7) and (8).

If the outcome of a new division by a CUW is bigger than the natural unit of entities that show natural atomicity, the partition must group, rather than divide, such entities, in a certain way. For instance, cherries show natural atomicity, and each cherry is lighter than a kilo. In (9a), multiple cherries are grouped together by the CUW *gōngjīn* 'kilo'. Presumably, container CUWs should include so-called temporary classifiers such as *zhuō* 'table' in (9c). Multiple people are grouped together by the CUW *zhuō* in this example. Also, in (10a), the classifier *tào* 'set' means a whole group of different stamps of a certain theme. Each *tào* is composed of several pieces of stamps. Other examples in (9) and (10) show that same point.

(9) a. 三公斤櫻桃
sān gōngjīn yīngtáo
three kilo cherry
'three kilos of cherries'

b. 三箱櫻桃
sān xiāng yīngtáo
three box cherry
'three boxes of cherries'

c. 兩桌客人
liǎng zhuō kèrén
two table guest
'three tables of guests'

(10) a. 三套郵票
sān tào yóupiào
three set stamp
'three sets of stamps'

b. 三堆櫻桃
sān duī yīngtáo
three pile cherry
'three piles of cherries'

c. 三群羊
sān qún yáng
three herd sheep
'three herds of sheep'

d. 三份樱桃
sān fèn yīngtáo
three portion cherry
'three portions of cherries' (e.g. each portion has two)

A non-initial division also includes other situations in which the division does not correlate with the natural boundary of elements that show atomicity. For instance, a kilo of watermelon might contain a whole and a portion of another watermelon. So the unit kilo both groups and divides entities.

(11) 一公斤西瓜
yī gōngjīn xīguā
one kilo watermelon
'one kilo of watermelon'

2.3.2 Representing the natural unit of entities that show natural atomicity

A CUW may also represent the natural unit of entities that show natural atomicity. Chao (1968: 585) calls CUWs with this function "individual measures", in contrast to other CUWs. In (12a), for example, the CUW *zhāng* represents the natural unit of stamps.

(12) a. 三張郵票
sān zhāng yóupiào
three CL stamp
'three stamps'

b. 三朵花
sān duǒ huā
three CL flower
'three flowers'

Only classifiers may represent the natural unit of entities that show natural atomicity. But classifiers do not have to do so. In (6a), the classifier *dī* 'drop' apportions water, and in (10a), the classifier *tào* 'set' groups the entities together. Obviously, neither all CUWs, nor all classifiers, encode the natural units of count entities. In the first way of apportion, classifiers, as seen in (6), (8), and (10), are not in contrast to other CUWs.

2.4 The functions of nominal auxiliaries in classifier languages

In many non-classifier languages such as English, CUWs apportion entities in the first way only, and thus they have measure CUWs such as *kilo*, container CUWs such as *box*, classifiers for mass nouns such as *drop*, partitive classifiers such as *portion*, and collective classifiers such as *group*. In classifier languages such as Chinese, CUWs may also apportion entities in the second way, i.e., represent the natural unit of entities that show natural atomicity.

In the current literature of classifiers, it has been assumed that all nouns in classifier languages are mass nouns, and therefore, classifiers are required for counting (Hansen 1972, Graham 1989, Krifka 1995, Doetjes 1996, 1997, Chierchia 1998). In (13a), the mass noun *water* may not be merged with the numeral directly, unlike the count noun *books* in (13b). So it has been assumed that all nouns in Chinese are like *water* in English, and the classifier between a numeral and a noun is like the word *cups* in (13c).

(13) a. *three water b. three books c. three cups of water

In this assumption, it is the lexical properties of noun roots (mass vs. count) that correlate with the existence of classifiers. There are problems in this assumption.

First, classifiers such as Chinese *ge* (see Chao 1968: 508, Zhang 2009a), *zhī* (for chickens, birds) and *bù* (for movies or other intelligent products), *běn* (for books), are not able

to divide mass at all, as seen in (14). If classifiers emerge for dividing mass, why do such classifiers fail to do so?

(14) *sān ge {zhǐ/zhēngqì/yóu/xiě/ròu/bù/qián/yǎnlèi}
three CL paper/steam/oil/blood/meat/cloth/money/tear

Second, some classifiers group entities rather than divide mass (e.g. *tào* in (10a)).

Third, the same classifier, such as *duī* 'pile' and *fèn* 'portion', may either divide or group entities, as seen in (6c)/(6d) and (10b)/(10d), respectively.

Therefore, linking the existence of classifiers in classifier languages to the dividing of mass misses the real distributions of classifiers in natural language. Moreover, non-classifier languages such as English also have classifiers such as *drop* for water and *piece* for paper. To replace this problematic assumption, I propose that it is the second way of the apportion function of CUWs that distinguishes classifier languages from other languages. Thus the use of classifiers for count nouns correlates with the properties of the nominal auxiliaries, CUWs, rather than the properties of noun roots. I compare my analysis with the old analysis in (15).

(15)	fact	old alleged contrast	newly realized contrast
	the use of classifier for count nouns	the count-mass distinction of noun roots	the second way of apportion by nominal AUXs
English	-	+	-
Chinese	+	-	+

Nominal auxiliaries may represent the natural units of entities that show atomicity in Chinese, but not in English. Parallel cross-linguistic variations are also observed in verbal auxiliaries. For instance, verbal auxiliaries may express counter-factual modality by subjunctive mood in English, but not in Chinese.

In fact, it is not true that there is a clear lexical distinction between count and mass nouns even in English. Count nouns may function as mass nouns (the Universal Grinder; Pelletier 1975), and mass nouns may function as count nouns (the Universal Sorter; Bunt 1985). See Borer (2005), Rothstein (2007), among others, for arguments against the lexical approach.

2.5 Summary

In this section, I have reported the shared properties of CUWs: the same dual dependency, the same interpretability, and the same ability to apportion entities. CUWs are thus identified as a type of nominal auxiliaries. Like verbal auxiliaries, the nominal auxiliaries exist in all languages. Cross-linguistic variations in the function of the auxiliaries are expected. The occurrence of such an auxiliary with a count noun in classifier languages demonstrates one function of the auxiliaries that is absence in other languages, i.e. representing the natural units of entities that show atomicity.

3. The unified surface position of CUWs

The exact position of a CUW in a nominal construction is language-specific. In languages such as Chinese, Hebrew (Borer 2005: 251), and German (Alexiadou et al. 2007: 401), a CUW occurs between a numeral and an NP directly. In English, it can be between a numeral and the linking word *of*, e.g., the word *kilo* in *three kilos of oil*. In this section, I identify the surface structural position of CUWs in Mandarin Chinese. I already presented a general defining structural property of such words: they must occur with both a numeral and an NP. In 3.1, I report a generalization about numerals in Mandarin Chinese, and then in 3.2 I make my proposal, which captures both the general property and the generalization.

3.1 Numeral Generalization in Mandarin Chinese

How is the dependency between a CUW and a numeral (see 2.1) syntactically represented? I observe that a counting unit must be in the form of a head element, and a numeral must be adjacent to a CUW in Mandarin Chinese.

Two facts show that a counting unit must be in the form of a head element in Mandarin Chinese. First, in Chinese, head elements may license the silence of their complements to their right, whereas non-head elements may not license silence of the string to their right. (16a) shows that the verb *mǎi* 'buy' licenses the silence of its object, and the meaning of the silent object can be recovered from the object of the previous sentence, i.e., *shū* 'book'. In (16b), we see that the CUW *běn* may also license an empty NP, and the meaning of the NP can be recovered from the previous sentence, i.e., *shū*. In (17a), the verb *mǎi* 'buy' licenses the silence of its object, and the meaning of the silent object can be recovered from the sentence-initial topic, *niúròu-tāng* 'beef soup'. In (17b), the container measure word *wǎn* 'bowl' may also license the silence of an NP to its right, and the meaning of the NP can be recovered from the sentence-initial topic, *niúròu-tāng*. This fact shows that CUWs are head elements.

(16) a. 寶玉買了書，黛玉也買了。
Bǎoyù mǎi-le shū, Dàiyù yě mǎi-le.
Baoyu buy-PRF car Daiyu also buy-PRF
'Baoyu bought books, and so did Daiyu.'

b. 寶玉買了三本書, 黛玉也買了三本。
Bǎoyù mǎi-le sān běn shū, Dàiyù yě mǎi-le sān běn.
Baoyu buy-PRF three CL book Daiyu also buy-PRF three CL
'Baoyu bought three books, and so did Daiyu.'

(17) a. 牛肉湯，寶玉應該買。
Niúròu-tāng, Bǎoyù yīnggāi mǎi.
beef-soup Baoyu should buy
'Beef-soup, Baoyu should buy.'

b. 牛肉湯，寶玉應該買五碗。
Niúròu-tāng, Bǎoyù yīnggāi mǎi wǔ wǎn.
beef-soup Baoyu should buy five bowl
'Beef-soup, Baoyu should buy five bowls of it.'

Second, a CUW may not be modified by a phrasal element in the language. Consider the acceptability contrast in (18) and (19).

(18) a. *sān dà de běn shū
three big DE CL book

b. sān dà běn shū
three big CL book
'three big books'

(19) a. *sān dà de xiāng shū
three big DE box book

b. sān dà xiāng shū
three big box book
'three big boxes of books'

The adjectives in (18a) and (18b) are the same, thus the acceptability contrast is not semantic. (18a) differs from the acceptable (18b) in the occurrence of the functional element *de*. A well-accepted assumption is that when a modifier is followed by *de*, it is a phrasal element (e.g. Tang 1990b:420). Thus, *dà* 'big' is a phrasal element in (18a), but not in (18b). The same contrast is seen in (19), where the position of a classifier is taken by a container

CUW. If we replace *dà* 'big' by *xiǎo* 'small', we get the same pattern. We can see that consistently, CUWs reject phrasal modifiers. This constraint would be unexpected, if CUWs were phrasal, since phrasal modifiers are able to modify phrases. Tang (1990b:418) correctly points out that in data like (18b), "the adjective and the classifier function as a compound rather than a phrase."[2]

Since a CUW must be a head element, its modifier may not occur with the degree word *hěn* 'very', which requires the presence of *de*. This is demonstrated in the contrast between (20a) and (20b).

(20) a. *sān hěn dà (de) xiāng shū
three very big DE box book

b. sān dà xiāng shū
three big box book
'three big boxes of books'

Another two facts show that a numeral must be adjacent to a CUW in Mandarin Chinese. First, a numeral alone may not occur as an argument. In the English example (21a), the numeral *five* can occur in the object position independently in the answer part of the dialogue. However, this is impossible in Chinese, as seen in (21b). Similarly, in the English example in (22a), the numeral *four* can occur in the subject position independently in the answer part of the dialogue. However this is impossible in Chinese, as seen in (22b).

(21) a. Q: How many pens did John buy?
A: He bought five.

b. Q: 寶玉買了幾枝筆？
Bǎoyù mǎi-le jǐ zhī bǐ?
Baoyu buy-PRF how.many CL pen
'How many pens did Baoyu buy?'

A: 他買了五*(枝).
Tā mǎi-le wǔ *(zhī).
he buy-PRF five CL
'He bought five.'

(22) a. Q: How many people are enough for carrying this piano?
A: Four is enough.

b. Q: Jǐ ge rén cái néng táiqǐ zhè jiǎ gāngqín?
how.many CL person then can carry this CL piano
'How many people are enough for carrying this piano?'

A: Sì *(ge) jiù gòu-le.
four CL just enough
'Four is enough.'

Second, a numeral may not be adjacent to an NP in Mandarin Chinese. This is seen in the unacceptability of data like (23). A numeral is adjacent to a simple NP in (23a), an NP that contains an AP in (23b), and a string composed of a noun and a classifier in (23c) (Zhang 2009b).

(23) a. *sān [$_{NP}$ shū]
three book

b. *sān [$_{NP}$ dà de shū]
three big DE book

c. *sān shu-ben
three book-CL

Considering the four facts above, I come up with the following generalization:

(24) A cardinal numeral is licensed by an adjacent overt CUW, and the CUW must be a head element, in Mandarin Chinese.

In the current syntactic theories, the facts in (18) through (23) have not been well accounted for. The unacceptability of data like (18a) has been noted since Tang (1990b:419), but its implication has not been explored. In Cheng & Sybesma (1999:529 fn.16), it is conjectured that "This may be due to some obligatory cliticalization of classifier to Numeral"

[2] Measure words such as *gongjin* 'kilo' and *mi* 'meter' are not gradable and thus may not be modified. So we do not discuss such CUWs here.

(also see Yang 2001:72). However, the classifier *běn* in (18b) 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 classifier is an enclitic and *de* is also an enclitic (Huang 1989), why can the classifier not take the cluster *da de* 'big DE' as its host in (18a)? It is clear that the dependency between a numeral and a classifier is beyond cliticalization.

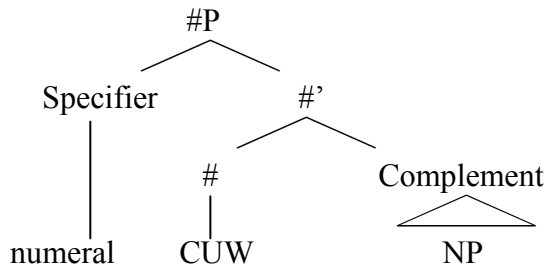
The acceptability contrast in (21) and (22) has not been discussed, as far as I know. Note that numerals are not proclitics, since they can be stressed. Thus the dependency reported in (24) is also beyond cliticalization.

The unacceptability of data like (23) has been ascribed to the alleged lexical semantic property of Chinese noun roots, i.e., all nouns are mass nouns in Chinese, and therefore a numeral has to be followed by a classifier, which functions as a mass-divider. Under this assumption, one explains the unacceptability of (23) and **three water* (= (13a)) in the same way (Krifka 1995, Chierchia 1998). However, we have seen in (18a), (19a), and (23c) that the occurrence of a classifier or measure word with a numeral is not sufficient to ensure the acceptability of the nominal. See 2.4 for more arguments against this assumption.

3.2 The complementation structure

We need to represent both the general dual dependency of CUWs and the Numeral Generalization in Chinese. I propose that a CUW heads a functional projection #P, taking a numeral as its specifier, and hosting the associated NP in its complement.

(25)



This complementation structure captures the dual dependency of CUWs. I assume that numerals are nominals (Corver & Zwarts 2006), and are base-generated at Spec of #P (see Borer 2005:35, 59, Ritter 1991), and a CUW surfaces at #. Following Ritter (1991), Li (1998), and Borer (2005), I further assume that for an individual-denoting argumental nominal, #P is dominated by DP. I will discuss the complement of # in later sections. In this structure, both an NP and a numeral are necessary for licensing a CUW, and thus neither is an adjunct, which by definition is syntactically optional.

This Spec-Head relation between a numeral and a CUW also represents the Numeral Generalization syntactically. Between a head and the Spec of the same head, no phrasal element may intervene. However, the requirement of the overtness of the head by numerals in Chinese is a special effect. In the generative grammar, the dependency of a head element on the overt occurrence of its Spec element is called an EPP effect, regardless of whether the head element is overt (Chomsky 2000). For instance, Infl in English requires an overt element at the Spec position. However, for certain functional projections, the overtness of an element at the Spec position requires the overtness of an element at the head position. Let us call this dependency "backward EPP" effect. This effect can be attested in the so-called verb second requirement on matrix (or root) declaratives in many Germanic languages. In (26a), for instance, *Jan* is at Spec of CP and *sla* 'hit' is at C. If C is not realized by an overt verbal head element, as in (26b), the form is not acceptable.

(26) a. Jan sla ik. b. *Jan ik sla. (Dutch)
John hit I John I hit
'John, I hit.'

A similar effect is seen in the fact that a fronted non-subject wh-element must be followed by a head element in English. The fronted *what* at Spec of CP must be followed by *does* in (27a), whereas the auxiliary *does* at C does not require the occurrence of an element at Spec of CP, as seen in (27b). We can see the dependency asymmetry between an overt Spec and an overt head element.

(27) a. What *(does) Bill usually read? b. Does Bill usually read novels?

Of course, there are intra- and inter-language variations. For instance, there is no verb second requirement on declaratives in English, as seen in the translation of (26a), and fronted subject wh-elements in English does not have to be followed by a head element (e.g. *Who usually reads the book?*).

I claim that #P in Chinese exhibits a similar backward EPP effect. A numeral at the Spec of # depends on the occurrence of an overt element at #. Intra- and inter-language variations are also expected. For instance, numerals in English do not exhibit this effect.

The dependency of a Spec element on the occurrence of a local head element does not mean that the Spec and the head element form a syntactic constituent. Yang (2001:58) claims that since a numeral and a classifier never separate, they must form a constituent (see Zhang 2009a for more arguments against the claim).

In addition to the dual dependency and the Numeral Generalization, the proposed structure in (25) also captures the fact that CUWs are not purely lexical. The projection of #P is not lexical and thus the head # is not reserved for any lexical element such as a noun or a verb.

3.3 Summary

In this section, I have argued that a cardinal numeral is licensed by an adjacent overt CUW, and the CUW must be a head element, in Mandarin Chinese, and this dependency is recognized as a Spec-head relation in syntactic representations. The surface position of all types of CUWs is the head of #P.

In some other studies (e.g. Borer 2005, Svenonius 2008, Saito et al. 2008: 262 fn. 10), the structural position of numerals is also the Spec of a certain functional projection. However, the nature of the elements that realize the head of this projection has not been given a unified analysis. My identification of CUWs as a kind of nominal auxiliaries and exploration of their dependency on numerals can fill this gap.

4. Two types of CUWs

4.1 The dimension-dependency on the associated NPs

When we count, we count the counting unit against a certain dimension, such as weight or length. If the entities that the counting applies to show atomicity, the entities themselves may be taken as a counting dimension. I elaborate this below.

Counting units can be semantically divided into individual-level (IL) counting units and range-level (RL) counting units. This contrast is the space counterpart of the temporal contrast between individual-level and stage-level predicates. In both contrasts, the individual-level ones exhibit certain stable properties, whereas the non-individual-level ones vary with a certain factor. The counting dimension of an IL-CUW is independent of the meaning of the

associated NP, and thus stable, whereas that of a RL-CUW is dependent on the meaning of the associated NP, and thus varies with the NP.

To be precise, each IL-CUW presupposes a specific physical dimension for counting, such as weight, length, capacity. Every measure term has its own dimension. For instance, the dimension of *kilo* is weight, and the dimension of *meter* is length. All container counting units take capacity as their dimension. The specification of the dimension for measure term CUWs and container CUWs is independent of the associated NPs. Both types of CUWs are IL ones. However, RL-CUWs do not have a measuring dimension independent of the associated NP. They simply name the counting unit of the dimension defined by the associated NP.

For instance, *dūn* in (28a) expresses a counting unit against the dimension of weight, and the dimension is independent of the meaning of *gānzhè* 'sugar-cane'. In contrast, *gēn* in (28b) does not express a counting unit against any abstract physical dimension. Instead, it simply establishes a counting unit for measuring whatever denoted by the associated NP, i.e., sugar-canes here. One can see that *gēn* is a natural counting unit for sugar-canes, but it has nothing to do with capacity, weight, or size.

(28) a. 三噸甘蔗
sān dūn gānzhè
three ton sugar-cane
'three tons of sugar-canes'

b. 三根甘蔗
sān gēn gānzhè
three CL sugar-cane
'three sugar-canes'

Similarly, *píng* in (29a) expresses a counting unit against the dimension of capacity, which is independent of the meaning of *shuǐ* 'water'. In contrast, *dī* in (29b) does not express a counting unit against any abstract physical dimension. Instead, it simply represents a counting unit for apportioning water here, in one possible way. In another possible way of apportioning water, the classifier *tān* 'puddle' is used as a counting unit, as in (29c). The counting in both (29b) and (29c) takes water itself as dimension, rather than capacity, weight, or size.

(29) a. 三瓶水
sān píng shuǐ
three bottle water
'three bottles of water

b. 三滴水
sān dī shuǐ
three CL water
'three drops of water'

c. 三灘水
sān tān shuǐ
three CL water
'three puddles of water'

One way to see whether a counting unit has a dimension independent of the associated NP is to paraphrase the whole nominal with an explicit word to express the dimension. One can paraphrase the string [Num CUW NP] (Num is a numeral) with the construction [Num CUW y *de* NP], where y encodes an explicit dimension. If the CUW is an IL one, it is easy to find the related dimension and thus such a paraphrase is possible. But one cannot do the parallel paraphrase if the CUW is an RL one:[3]

(30) a. 三公斤沙子
sān gōngjīn shāzi
three kilo sand
'three kilos of sand'

b. 三公斤重的沙子
sān gōngjīn zhòng de shāzi
three kilo weight DE sand
'the amount of sand that weights three kilos'

[3] If the associated NP is a count noun, the [Num CUW y *de* N] string is ambiguous, as seen in (i). Reading B is not for counting. I leave aside an analysis of constructions in such a reading (See Schwarzchild 2006).

(i) sān gōngjīn zhòng de xīguā
three kilo heavy DE watermelon
A: 'three kilos of watermelons' B: 'watermelons that are three kilos each'

(31) a. 三瓶沙子
sān píng shāzi
three bottle sand
'three bottles of sand'

b. 三瓶容量的沙子
sān píng róngliàng de shāzi
three bottle capacity DE sand
'the amount of sand that has the capacity of three bottles'

(32) a. 三粒沙子
sān lì shāzi
three cl sand
'three grains of sand'

b. *三粒 ??? 的沙子
*sān lì ??? deshāzi
three CL de sand

(30a) can be paraphrased into (30b), where the word *zhòng* 'weight' denotes the dimension of counting. (31a) can be paraphrased into (31b), where the word *róngliàng* 'capacity' denotes the dimension of counting. The CUW *gōngjīn* in (30a) and the CUW *píng* 'bottle' in (31b) are both IL ones. However, (32a) cannot be paraphrased into a phrase with a dimension-denoting word, as shown in (32b). The CUW *lì* in (32a) is an RL-CUW.

Note that RL-CUWs show an aspect of relativity, but this relativity is not in the quantity denoted by a counting unit. Instead, it is in the dimension of counting. If one considered the quantity denoted by a counting unit, one would treat container CUWs as a kind of non-individual notion, since the capacity of a big bottle of water can be different from the capacity of a small bottle of alcohol. This kind of variation is not under our consideration.

The relation between the two types of CUWs and their ways of apportion is summarized in (33). The terms in the brackets are the terms given by Chao (1968: 619) for the type of CUWs.

(33)

ways of apportion		IL-CUW		RL-CUW
Partition	Initial dividing	三升水 sān shēng shuǐ three liter water 'three liters of water' (Standard Measure)	三碗水 sān wǎn shuǐ three bowl water 'three bowls of water' (Container Measure)	三滴水 sān dī shuǐ three CL water 'three drops of water' (Partitive Measure)
	Non-initial dividing	三公斤樱桃 sān gōngjīn yīngtáo three kilo cherry 'three kilos of cherries' (Standard Measure)	三箱樱桃 sān xiāng yīngtáo three box cherry 'three boxes of cherries' (Container Measure)	三套郵票 sān tào yóupiào three set stamp 'three sets of stamps' (Group Measure)
Representing the natural unit of entities that show atomicity				三張郵票 sān zhāng yóupiào three CL stamp 'three stamps' (Individual Measure)

I conclude that IL-CUWs are dimension-independent, whereas RL-CUWs are not.

4.2 Adding possibility

The contrast between IL- and RL-CUWs is seen in the possibility of adding calculation. In

arithmetical operations, adding is possible for quantities of the same dimension only. Quantities of different dimensions may not be added together. If the same IL-CUW occurs with NPs denoting different kinds of entities, since the dimension remains the same, the quantity achieved by the counting in one case can be added to the quantity achieved by the counting in another case, as seen in (34). In (34a), the same IL-CUW *gōngjīn* 'kilo' occurs with both *dòufu* 'tofu' and *miànbāo* 'bread', and the adding is successful. Similarly, in (34c), the same IL-CUW *xiāng* 'box' occurs with both *shū* 'book' and *yīfu* 'clothes', and the addition is also successful.

(34) a. 三公斤豆腐加三公斤麵包一共有六公斤。
Sān gōngjīn dòufu jiā sān gōngjīn miànbāo yīgòng yǒu liù gōngjīn.
three kilo tofu add three kilo bread altogether have six kilo
'Three kilos of tofu and three kilos of bread are six kilos altogether.'

b. 三盤豆腐加三盤麵包一共有六盤。
Sān pán dòufu jiā sān pán miànbāo yīgòng yǒu liù pán.
three plate tofu add three plate bread altogether have six plate
'Three plates of tofu and three plates of bread are six plates altogether.'

c. 三箱書加三箱衣服一共有六箱。
Sān xiāng shū jiā sān xiāng yīfu yīgòng yǒu liù xiāng
three box book add three box clothes altogether have six box
'Three boxes of books and three boxes of clothes are six boxes altogether.'

However, if the same RL-CUW occurs with NPs denoting different kinds of entities, since the dimensions are different, the quantity achieved by the counting in one case may not be combined with the quantity achieved by the counting in another case. For instance, in (35a), the same RL-CUW *kuài* occurs with both *dòufu* 'tofu' and *miànbāo* 'bread', and the adding is not possible.

(35) a. *三塊豆腐加三塊麵包一共有六塊。
*Sān kuài dòufu jiā sān kuài miànbāo yīgòng yǒu liù kuài.
three CL tofu add three CL bread altogether have six cl
Intended: 'Three chunks of tofu and three chunks of bread are six chunks.'

b. *三卷紙加三卷行李一共有六卷。
*Sān juàn zhǐ jiā sān juàn xíngli yīgòng yǒu liù juàn.
three CL paper add three CL luggage altogether have six CL
Intended: 'Three rolls of paper and three rolls of luggage are six rolls.'

c. *三張地圖加三張桌子一共有六張。
*Sān zhāng dìtú jiā sān zhāng zhuōzi yīgòng yǒu liù zhāng.
three CL map add three CL table altogether have six CL
Intended: 'Three maps and three tables are six items.'

The examples in (34) and (35) can be examined in the same context, e.g., when one moves stuff from one place to another. (34a) or (34b) forms a minimal pair with (35a), since the same NPs are considered. The acceptability contrast between them rejects a pragmatic account. Of course, if the NPs with the same RL-CUW denote similar entities, adding is possible. Compare (36) with (35b).

(36) 三張椅子加三張桌子一共有六張。
Sān zhāng yǐzi jiā sān zhāng zhuōzi yīgòng yǒu liù zhāng.
three CL chair add three CL table altogether have six CL
'Three chairs and three tables are six items.'

Thus, the constraint on adding possibility further shows the differences between the two types of CUWs.

4.3 Counting unit resolution

In morphology, resolution refers to a rule which specifies the form of an agreeing element when the controller consists of conjoined nominals (Givon 1970, Corbett 1991: 261). If we translate a sentence like *Mary and John are happy* into a language like French, where predicative adjectives agree with subjects in gender, we need resolution to establish the gender of the adjective, since one conjunct of the subject is feminine and the other is masculine. A similar resolution is required for CUW specification. In (37a), the two conjuncts have the same IL-CUW, *bāo* 'bag', which has a unique counting dimension, capacity, and this dimension is independent of the two very different NPs *cháyè* 'tea' and *pútao* 'grape'. Therefore, there is no issue of resolution. In (37b), however, although the forms of the RL-CUWs for the two conjuncts are the same, they occur with NPs denoting different types of entities and thus have different counting dimensions. Therefore, resolution is required. Importantly, only the general RL-CUW *ge* can be the result of the resolution, rather than *zhāng*, although the latter is the shared form of the RL-CUWs of the two conjuncts. In (37c), although the forms of the RL-CUWs for the two conjuncts are the same, they occur with NPs denoting different types of entities and thus have different counting dimensions. Therefore, again, resolution is required. In this case, the RL-CUW *pī* cannot be the result of the resolution, for the same reason as above. The general RL-CUW *ge* cannot, either, since *ge* is not able to associate with mass nouns such as *bù* 'cloth' (see (14)).

(37) a. 那裡有幾包茶葉和幾包葡萄。每包都很值錢。
Nàli yǒu jī bāo cháyè hé jī bāo pútao. Měi bāo dōu hěn zhíqián.
there have several bag tea and several bag grape each bag all very valuable
'There are several bags of tea and several bags of grapes. Each bag is valuable.'

b. 那裡有幾張地圖和幾張桌子。每{*張/個}都很值錢。
Nà li yǒu jī zhāng dìtú hé jī zhāng zhuōzi měi {*zhāng/gè} dōu hěn zhíqián.
there have several CL map and several CL table each CL/CL all very valuable
'There are several maps and several tables. Each item is valuable.'

c. 那裡有幾匹馬和幾匹布。*每{匹/個}都很值錢。
Nàli yǒu jī pī mǎ hé jī pī bù. *Měi {pī/gè} dōu hěn zhíqián.
there have several CL horse and several CL cloth each CL/CL all very valuable
Intended: 'There are several horses and several rolls of cloth. Each item is valuable.'

This contrast further reveals the fundamental differences between the two types of CUWs.

4.4 Predicating and selecting of the associated NPs

Other than occurring with an NP and expressing the way to count the entities denoted by the NP in a certain dimension, IL-CUWs do not interact with the NP as RL-CUWs do. For instance, unlike *tiáo*, which expresses a stick-like shape, *mǐ* 'meter' does not specify any characteristics of the associated NP. Later in 5.2, I argue that like other characteristic-denoting

elements, classifiers like *tiáo* are predicates of the associated NPs. Thus RL-CUWs may be, whereas IL-CUWs are not, predicates of the associated NP. Moreover, unlike RL-CUWs *zhǎn* (for lamps only) and *fēng* (for letters only), IL-CUWs are not restricted to any semantic type of NPs. If pragmatically allowed, they may occur with any NPs. This property of IL-CUWs shows that their relation to the associated NPs is not as close as that between RL-CUWs and the associated NPs.

This contrast has long been noted in the literature, where the term "measure word" is used for our IL-CUW and "classifier" is used for our RL-CUW. Tai & Wang (1990:38) state that "A classifier categorizes a class of nouns by picking out some salient perceptual properties, either physically or functionally based, which are permanently associated with entities named by the class of nouns; a measure word does not categorize but denotes the quantity of the entity named by a noun."

Since RL-CUWs semantically interact with the associated NPs, if an RL-CUW selects count nouns, obviously, it never occurs with a mass noun (see (14) in 2.4). In contrast, if an RL-CUW selects mass nouns, it never occurs with a count noun. For instance, *dī* is for liquid mass and *kuài* and *tuán* are for solid mass. Some other RL-CUWs do not have this constraint, e.g. *kǔn* (for books and sticks), and *pī* (批) (for books, goods, food).

However, IL-CUWs are more consistent. As pointed out by Schwarzschild (2006:69), measure words may occur with either count or mass nouns.

(38) a. sān {gōngjīn/xiāng} zhǐ
three kilo / box paper
'three kilos of paper'

b. sān {gōngjīn/xiāng} píngguǒ
three kilo / box apple
'three kilos of apples'

4.5 Degree vs. appearance elaboration

There are three contrasts between IL-CUWs and RL-CUWs in Mandarin Chinese, with respect to degree and appearance elaboration.

In Chinese, *dà* 'big' and *xiǎo* 'small' are ambiguous in size-denoting and degree denoting. The latter reading can be seen in the examples in (39).

(39) a. 大好形勢
dà hǎo xíngshì
big good situation
'very good situation'

b. 小現身手
xiǎo xiàn shēnshǒu
small show skill
'show the skill a little bit'

The first contrast between IL- and RL-CUWs with respect to degree and appearance elaboration is that an adjective to the left of an IL-CUW must be degree-denoting, and thus excludes any adjective that does not encode degree (see Borer 2005: 252 for a similar constraint on container CUWs in Hebrew), whereas an adjective to the left of an RL-CUW does not have this constraint. In (40a), *dà* modifies the IL-CUW *píng* 'bottle', because the size meaning is overlapped with the degree meaning. Without such an overlap, pure size or shape-denoting adjectives may not occur with container measure words. The shape-denoting adjectives *cháng* 'long' may not occur with *píng* in (40b), and the shape-denoting adjective *fāng* 'square' may not occur with *pán* 'plate' in (40c).

(40) a. 三大瓶水
sān dà píng shuǐ
three big bottle water
'three big bottles of water'

b. *三長瓶水
*sān cháng píng shuǐ
three long bottle water

c. *三方盤花生
*sān fāng pán huāshēng
three square plate peanut

However, no such a constraint is found on RL-CUWs. Adjectives that denote physical appearances can precede RL-CUWs, to elaborate the encoded characteristics of the associated NPs. The adjectives *cháng* 'long', *fāng* 'square', *hòu* 'think', *báo* 'thin', *yuán* 'round' may all occur with RL-CUWs, as seen in (41).

(41) a. 三大塊冰
sān dà kuài bīng
three big CL ice
'three big chunks of ice'

b. 三長條項鍊
sān cháng tiáo xiàngliàn
three long CL necklace
'three long necklaces'

c. 三方塊冰
sān fāng kuài bīng
three square CL ice
'three ice cubes'

d. 三{厚/薄}片麵包
sān {hòu / báo} piān miànbāo
three thick/thin CL bread
'three {thick/thin} pieces of bread'

e. 三圓片{胡蘿蔔/肉餅/洋蔥/玻璃}
sān yuán piàn {húluóbo /ròu-bǐng /yangcōng /bōlí}
three round CL carrot/ meat-cake/ onion/ glass
'three round pieces of {carrot/meat-cake/onion/glass}'

Note that measure terms such as *shēng* 'liter' are not gradable and thus are never modified. Compare the acceptable (42a) and (42b) with the unacceptable (42c).

(42) a. 三大滴水
sān dà dī shuǐ
three big CL water
'three big drops of water'

b. 三大瓶水
sān dà píng shuǐ
three big bottle water
'three big bottles of water'

c. *三大升水
*sān dà shēng shuǐ
three big liter water

Modification of IL-CUWs in English is less constrained than in Chinese. In English, not only modifiers that denote pure shape may modify IL-CUWs, as seen in (43), but also modifiers that denote other properties such as taste may modify IL-CUWs, as seen in (44a), compared to the unacceptable Chinese example in (44b). (44c) further shows that even for a RL-CUW, such modification is impossible in Chinese, since classifiers do not classify entities with respect to the property of taste.

(43) a. a bottle of water with a long neck (Corver 1998: 226)
b. a can of gasoline bigger than this

(44) a. a tasteless cup of coffee (Hsieh 2008: 50)
b. *yī kǔ bēi kāfēi (IL-CUW)
one bitter cup coffee
c. *yī kǔ dī kāfēi (RL-CUW)
one bitter drop coffee

The constraints on Chinese CUWs indicate that such words are more abstract or functional than their counterparts in English.

Second, since an IL-CUW does not interact with the associated NP semantically, an adjective to its left never modifies the NP. In (46a), *dà* 'big' modifies the IL-CUW *wǎn* 'bowl' only. It is possible that each of the cherries in the bowls is small. In (46b), *dà* may not modify *gōngjīn* 'kilo' (see above). But it may not modify *yīngtáo* 'cherry', either. However, an adjective preceding a RL-CUW does modify the associated NP. The reading of (45c) must be that each of the three cherries is big.

(46) a. 三大碗櫻桃
sān dà wǎn yīngtáo
three big bowl cherry
'three big bowls of cherries'

b. *三大公斤櫻桃
sān dà gōngjīn yīngtáo
three big kilo cherry

c. 三大粒櫻桃
sān dà lì yīngtáo
three big CL cherry
'three big cherries'

As noted by Bunt (1985:199), it is impossible to modify mass NPs by size-denoting adjectives. Then, if the associated NP denotes a mass, the pre-CUW adjective *dà* in (47a) and (47b) modifies the CUWs *dī* and *pāo* exclusively.

(47) a. 兩大滴牛奶
liǎng dà dī niúnǎi
two big CL milk
'two big drops of milk'

b. 兩大泡尿
liǎng dà pāo niào
two big CL urine
'two big units of urine'

It is because of this absence of interactions between an IL-CUW and its associated NP, the modifier of the former can be antonymous to that of the latter. In (48a), for instance, *dà* 'big' modifies the CUW *wǎn* 'bowl', whereas *xiǎo* 'small' modifies the NP *yīngtáo* 'cherry'. But this situation is never seen in RL-CUWs. Li (2008) notices data like (48), but he does not mention the contrast between such data and those in (49), where RL-CUWs occur. The interactions between the RL-CUWs and the associated NPs rule out the co-occurrence of contradictory adjectives.

(48) a. 三大碗小櫻桃
sān dà wǎn xiǎo yīngtáo
three big bowl small cherry
'three big bowls of small cherries'

b. 三小碗大櫻桃
sān xiǎo wǎn dà yīngtáo
three small bowl big cherry
'three small bowls of big cherries'

(49) a. *三大粒小櫻桃
*sān dà lì xiǎo yīngtáo
three big CL small cherry

b. *三小粒大櫻桃
*sān xiǎo lì dà yīngtáo
three small CL big cherry

Third, since degree elaboration can be accomplished only once, IL-CUWs may be modified only once; however, since appearance elaboration can be multiple-dimensional, RL-CUWs can be modified by multiple modifiers at the same time. The IL-CUW *dài* 'bag' in (50a) may not be modified by both *xiǎo* 'small' and *fāng* 'square', whereas the RL-CUW *kuài* in (50b) may be modified by the two adjectives at the same time.

(50) a. *三小方袋冰
*sān xiǎo fāng dài bīng
three small square bag ice

b. 三小方塊冰
sān xiǎo fāng kuài bīng
three small square CL ice
'three small chunks of ice'

4.6 Summary and discussion

So far, I have grouped all types of elements that occur between a numeral and an NP into a general type of nominal auxiliary, CUW (Section 2, Section 3), and then formalized the contrast between two basic types of such auxiliaries (this section). We can see that there is a perspective of unification and a perspective of division in CUWs. Chao (1968: 584-620) and Li & Thompson (1981:104-113) recognize the unification, but do not have a clear theory about the division. Recently, Hsieh (2008, 2009) also realizes the unification, but does not present an analysis the division, either. Many other studies recognize the division, but do not

address the unification (Ōta 1958 [Jiang & Xu 2003: 146], and Zhu 1982:49, Ma 1990:29, Tai & Wang 1990, Croft 1994: 151, Cheng & Sybesma 1998, 1999).

With respect to the division, we have presented five formal contrasts between IL- and RL-CUWs. There is one more argument to support our division: acquisition evidence. In an experimental study of CUW acquisition, Chien et al. (2003) find that Chinese children in their early stages of language acquisition exhibit their ability to distinguish container measure words (IL-CUWs) from classifiers (RL-CUWs) (following Cheng & Sybesma 1999, they call the two types of words massifiers and count classifiers, respectively. In the former group, only container counting units are considered, and thus the group belongs to our IL-CUWs. However, their list of count classifiers (p. 100) includes *kuài* and *piàn,* which occur with mass nouns. So their count classifiers are in fact RL-CUWs. See below for my discussion of their terminology).

When trying to make a division in CUWs, some studies make problematic proposals, however.

For instance, two types of classifiers are distinguished in the literature: sortal classifiers and mensural classifiers. Lyons (1977: 463) claims that a sortal classifier is "one which individuates whatever it refers to in terms of the kind of entity that it is," while a mensural classifier is "one which individuates in terms of quantity" (similar ideas have been adopted in Tai & Wang 1990, Huang & Ahrens 2003). Our above discussion shows that any classifier, if occurs between a numeral and an NP, is a CUW, having something to do with quantify. All pre-NP classifiers are CUWs and thus they are all mensural. If a CUW is sensitive to the semantics of the associated NP, it is sortal, as well as mensural. Thus the alleged contrast between sortal and mensural is hard to be established. Although Lyons divides classifiers into sortal and mensural types, he states that classifiers such as *kuài* 'chunk' can be both sortal and mensural (1977:464).

Another misleading contrast is the one between so called count classifiers and mass classifiers (Cheng & Sybesma 1998: 389, 1999). Wu & Bodomo (2009: 489) point out that the alleged two types of classifiers can occur with the same NP (See also Borer 2005: 99), as shown in (51) and (52). *Běn* in (51a) and *lì* in (52a) are count classifiers, and *xiāng* in (51b) and *wǎn* in (52b) are mass classifiers.

(51) a.	三本書	b. 三箱書
	sān běn shū	sān xiāng shū
	three CL book	three box book
	'three books'	'three boxes of books'
(52) a.	三粒米	b. 三碗米
	sān lì mǐ	sān wǎn mǐ
	three CL rice	three bowl rice
	'three grains of rice'	'three bowls of rice'

In my system, mass nouns may be associated with either IL- or RL-CUWs, so may count nouns. The classifiers in (51a) and (52a) are RL-CUWs, and the ones in (51b) and (52b) are IL-CUWs.

Even when one realizes the division between the two groups, i.e., the group that is composed of measure terms and container counting words and the group of classifiers, one still needs to formalize the contrast. Otherwise, we remain at the descriptive stage and are away from an explanatory stage. I have formalized the contrast as that of IL- and RL-CUWs, and found that it is an issue whether the counting dimension is semantically independent of the associated NP.

One more problematic classification for CUWs is the following. Yip (2008) lists three

differences between measure terms and other related elements including container CUWs in Mandarin Chinese. However, all three are challenged by systematic counter examples. First, Yip claims that measure terms may not occur with a silent *yī* 'one'. However, the word *jīn* 'catty' in (53a) and the word *mǔ* 'acre' in (53b) are indeed preceded by a silent *yī* 'one'. Second, he claims that measure terms may not follow a demonstrative immediately, however, *jīn* 'catty' follows the demonstrative *nà* 'that' in (54a). Third, he claims that measure terms may not reduplicate, however, (54b) shows that this is not true.

(53) a. Wǒ xiǎng mǎi ~~yi~~ jīn yángròu chī.
I want buy one catty mutton eat
'I want to buy a catty of mutton to eat.'

b. rúguǒ wǒ yǒu ~~yi~~ mǔ dì dehuà
if I have one acre land if
'if I have an acre of land'

(54) a. nà jīn pingguǒ
that catty apple
'that catty of apple'

b. Yì dūn-dūn de pingguǒ bèi yùn-dào-le qián-xiàn.
a ton-ton DE apple PASS transport-to-PRF front-line
'Tons of apples were transported to the front-line.'

Instead of the above three false contrasts, I find one real contrast between measure terms and other CUWs: they may not be modified (see (42)). However, this can be explained semantically. Measure terms do not encode gradable properties and thus may not be modified by adjectives such as *da* 'big'.

5. The low base-position of RL-CUWs

In the previous section, I described the contrasts between two major types of CUWs: IL and RL ones. In this and next section, I address their different base-positions.

5.1 Four classifier constructions

RL-CUWs are classifiers. Classifiers are seen between a numeral (Num) and an NP by default. I label this default word order Default Classifier Construction (DCLC). Zhang (2009b) argues that classifiers may also follow a noun in Mandarin Chinese. We thus find three more classifier constructions: the Bare Cluster Construction (BCLC), Classifier Copying Construction (CLCC), and the *Ge* Complex Classifier Construction (GCLC).

(55)	BCLC	CLCC	GCLC	DCLC
	mǐ-lì	sān lì mǐ-lì	sān ge mǐ-lì	sān lì mǐ
	rice-CL	three CL rice-CL	three CL rice-CL	three CL rice

All classifiers may occur in the DCLC, but not all classifiers may appear in the other three constructions.[4] I list three attested distributional types of classifiers in (56).

[4] I do not think *jiān* in the word *xǐzǎo-jiān* 'bath-room' is a classifier, since it may not occur in the default pre-NP position (**sān jiān xǐzǎo* 'three room bath').

(56)

construction ⇩	distributional types of classifiers ⇨	I. free	II. anti-complex	III. pre-NP only
BCLC: N CL		+	+	-
CLCC: Num CL_i N CL_i		+	-	-
GCLC: Num ge N CL		+	-	-
DCLC: Num CL N		+	+	+
example		*lì*	*pī*	*dǔ*

I. The free type: such classifiers may occur in all of the four constructions, e.g. *lì* in (55). The classifiers in the following instances of BCLC also belong to this type: *miàn-tuán* 'flour-dough', *shuǐ-dī* 'water-CL', and *huā-duǒ* 'flower-CL' (more examples are in (86)).

II. The anti-complex type: such classifiers may not occur in the two complex classifier constructions, CLCC and GCLC, e.g. *pī* in (57):

(57)

BCLC	CLCC	GCLC	DCLC
mǎ-pī	*sān pī mǎ-pī	*sān ge mǎ-pī	sān pī mǎ
horse-CL	three CL horse-CL	three CL horse-CL	hree CL horse

The classifiers in the following instances of BCLC also belong to this type: *zhǐ-zhāng* 'paper-CL', *chē-liàng* 'car-CL', *chuán-zhī* 'boat-CL', *shū-běn* 'book-CL'.

III. The pre-NP only type: such classifiers occur in DCLCs only, e.g. *dǔ* in (58):

(58)

BCLC	CLCC	GCLC	DCLC
*qiáng-dǔ	*sān dǔ qiáng-dǔ	*sān ge qiáng-dǔ	sān dǔ qiáng
wall-CL	three CL wall-CL	three CL wall-CL	three CL wall

The classifiers in the following instances of DCLC also belong to this type: *sān wěi yú* 'three CL fish', *sān zhǎn dēng* 'three CL lamp', *sān bǎ shànzi* 'three CL fan', *sān zhī jī* 'three CL chicken', and *sān gǔ zhēngqì* 'three CL steam'. Classifiers with a modifier also belong to this group, e.g. *dà-zhāng* 'big-CL', *xiǎo-kuài* 'small-CL'.

It is not important which classifier belongs to which type. The classifier *tiáo* acts like Type I when it occurs with nouns such as *bù* 'cloth', but acts like Type III when it occurs with nouns such as *tuǐ* 'leg', *shé* 'snake', *shéngzi* 'rope'. What matters is that all classifiers are in the range of the types.

In these four constructions, classifiers in BCLCs are not CUWs, since there is no numeral, although they still can denote units (e.g. *bù-pī* 'cloth-CL') or represent natural units of entities that show atomicity (e.g. *shū-běn* 'book- CL'). Like bare nouns in Chinese, such constructions can generic (Li & Thompson 1981: 82), definite, or indefinite.

(59) Shí-kuài hěn zhòng.
stone-CL be heavy
'Stones are heavy.' Or 'The stones are heavy.'

5.2 Merging classifiers with their associated NPs: BCLC

5.2.1 Specifying and selecting classifier

I divide classifiers into two types according to their functions: specifying and selecting ones. Specifying classifiers specify certain semantic property of the referent of the associated NP, including shape (Allen 1977) and body part (Tversky and Hemenway 1983, 1984). For instance, when the associated NP is *suàn* 'garlic', the classifier *tóu* is for garlic bulbs but *bàn*

is for garlic cloves, as shown in (60). For rolls of paper, the classifier *juǎn* is used, and for pieces of paper and beds, the classifier *zhāng* is used, as in (61).

(60) a. 三頭蒜
sān tóu suàn
three CL garlic
'three garlic bulbs'

b. 三瓣蒜
sān bàn suàn
three CL garlic
'three garlic cloves'

(61) a. 三卷紙
sān juǎn zhǐ
three CL paper
'three rolls of paper'

b. 三張紙
sān zhāng zhǐ
three CL paper
'three pieces of paper'

c. 三張床
sān zhāng chuáng
three CL bed
'three beds'

For pigs, one can use the classifier *tóu*, which shares its form with the body part noun *tóu* 'head', and for fish, one can use the classifier *wěi*, which shares its form with the noun *wěi* 'tail'.

(62) a. 三頭豬
sān tóu zhū
three CL pig
'three pigs'

b. 三尾魚
sān wěi yú
three CL fish
'three fish'

Since an entity may have different semantic properties, which may be specified by different classifiers, the same NP may occur with different specifying classifiers, as seen in (60). Also, a specific characteristic may be that of an individual, as in (61c), or may individuate a mass in that way, as seen in (61a) and (61b) (see Tai 1994 and Zhang 2007 for more discussions of this type of classifiers).

In contrast, selecting classifiers do not specify any semantic property of the associated NP. Instead, they select certain type of NPs arbitrarily. For instance, for count nouns: *zhǎn* is for lamps, *sōu* for boats, *zhēn* for photos, *fēng* for letters, *zōng* for trade transactions and legal cases, *fù* for paintings, *xí* for sets of clothes, *dòng* for houses, and to a certain degree *pī* for horses (see Tai 1994:490); and for mass nouns: *pāo* is for urine and *pī* is for cloth.

(63) a. 三匹馬
sān pī mǎ
three CL horse
'three horses'

b. 三盞燈
sān zhǎn dēng
three CL lamp
'three lamps'

c. 兩泡尿
liǎng pāo niào
two CL urine
'two units of urine'

As expected from the theory of selection, the correlation between an NP and a selecting classifier is rather strict. The arbitrariness is demonstrated in (64). In (64a), the classifier *sōu* is for ships but not planes; in (64b), the classifier *zhǎn* is for lamps, but not for candles; and in (64c, the classifier *pī* is for cloth, but not for paper.

(64) a. 三艘{船/*飛機}
sān sōu {chuán/*fēijī}
three CL ship/plane

b. 三盞{燈/*蠟燭}
sān zhǎn {dɐng/*làzhú}
three CL lamp/candle

c. 三匹{布/*紙}
sān pī {bù/*zhǐ}
three CL cloth/paper

Note that the division between specifying and selecting classifiers has nothing to do with the division between count and mass nouns. Both types may occur with either mass or count

nouns. The specifying classifier *zhāng* occurs with the mass noun *zhǐ* 'paper' in (61b), and with the count noun *chuáng* 'bed' in (61c). For selecting classifiers, *pāo* occurs with the mass noun *niào* 'urine' in (63c), and *zhǎn* occurs with the count noun *dēng* 'lamp' in (63b).

5.2.2 Deriving BCLCs

Specifying classifiers are intrinsic characteristics-denoting elements. Such elements are relational terms, which must be licensed by a nominal (see de Bruin & Scha 1988, Déchaine 1993: Section 2.4.3.7, among others). A relational term is a predicate and its licensor is its subject (Szabolcsi 1983, Kayne 1994, Hornstein et al. 1994, Castillo 2001, Uriagereka 2008). Specifying classifiers are relational terms (cf. Chierchia 1998:55). Thus, a specifying classifier is a predicate of the associated NP. Accordingly, I claim that such a classifier and the NP are merged initially, expressing a predication relation. In this merger, the predicate is the projecting element. I assume that a classifier is the realization of the functional head Sort, and the predication-denoting projection is a SortP. Since the classifier is a nominal functional element, this SortP can be understood as a nominalized Small Clause (Stowell 1983) or RP (den Dikken 2006).

This SortP can be directly realized by an N-CL cluster, i.e., a BCLC, as seen in (65).

(65) a.	huā-duǒ	b.	suàn-tóu	c.	qì-tuán	d.	shí-kuài
	flower-CL		garlic-CL		air-CL		stone-CL

Unlike a specifying classifier, a selecting classifier does not encode any characteristics of the referent of the associated NP. Therefore, it is not a predicate of the NP. Instead, I claim, it simply takes the NP as its complement, projecting a SortP.

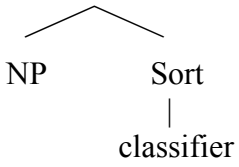
Such a SortP may also be directly realized by a N-classifier cluster, as those in (66).

(66) a.	bù-pī	b.	chuán-zhī
	cloth-CL		boat-CL

We thus have another type of SortP, which is also headed by a classifier.

We now conclude that for both types of classifiers, they are directly merged with the associated NPs in their base-positions, and SortP is the structure of a BCLC.

(67)

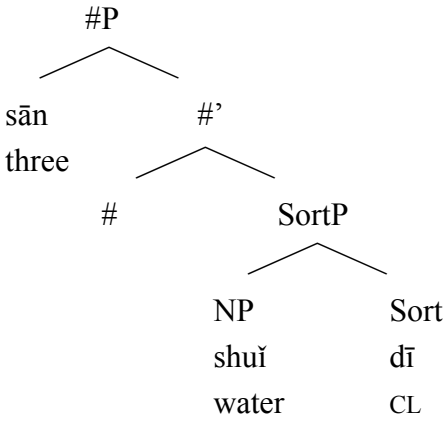


(BCLC)

5.3 Raising classifiers to #: DCLC

In 3.2, I claimed that a numeral is at Spec of #P. I now further claim that # takes SortP as its complement, as shown in (68):

(68)

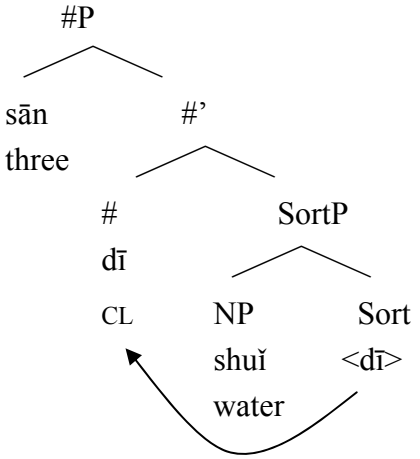


In this structure, an element that realizes # is a semi-functional element. It can satisfy the s-selection of a c-commanding verb (see 2.2). However, it does not have its own s-selection restrictions, and it is therefore able to take SortP, which can denote a predication relation, as its complement.

I assume that a DCLC is derived by the raising of a classifier from Sort to #. The structure of (69a) is (69b).

(69) a. sān dī shuǐ
three CL water
'three drops of water'

b. (DCLC)



In this analysis, classifiers are consistently base-generated at Sort, and they may move to #. The motivation of the movement correlates with the generalization that a numeral is licensed by a local overt CUW in Chinese (Section 3.1).[5]

5.4 Realizations of chain links: CLCC and GCLC

We now turn to the CLCC and GCLC. Each has two overt classifiers. These two constructions are exchangeable in communication. The GCLC in (70a), and the CLCC in (70b) mean the same.

[5] This movement is somehow similar to Corver's (1998) DP-internal predicate raising for English container measure constructions. However, in my analysis of container measure constructions in Chinese, such raising does not occur. See Section 6.

(70) a. 三個水滴 ⇔ b. 三滴水滴

sān ge shuǐ-dī — sān dī shuǐ-dī

three CL water-CL — three CL water-CL — Both: '3 drops of water'

The alternation is by no means accidental. Some other examples of such alternation are listed in (86).

Moreover, the correlation between the two double classifier constructions is systematic. If a classifier may not occur in one of them, it may not occur in the other.

(71) a. *三個馬匹 ⇔ b. *三匹馬匹

*sān ge mǎ-pī — *sān pī mǎ-pī

three CL horse-CL — three CL paper-CL

The table in (56) shows that the distributions of the classifiers in these two constructions are the same. Pending evidence to the contrary, I assume that the two constructions involve identical syntactic structures.

Theoretically, in a copying X construction, if one copy of X c-commends the other copy of X, it is possible that the two copies form a movement chain, in the absence of any semantic trigger for the copying (see Quer & Vicente 2009). Then the two copies are just phonological realizations of the two occurrences of a single element that undergoes the movement. Since the upper copy of a CLCC is at #, which c-commands Sort, i.e., the position of the lower copy of the classifier, it is possible that the upper copy and the lower copy form a movement chain.

Since a GCLC may alternate with a CLCC, in which the classifier undergoes movement, *ge* in the GCLC acts like a generalized PF realization of the upper link of the movement chain. In other words, it is possible that a CLCC and its corresponding GCLC are syntactically derived in the same way, and they are different only in the PF form of the upper link of the movement of the classifier. Theoretically, two different audible forms do not have to be syntactically different. This is parallel to the fact that two silent forms (e.g. trace and PRO) do not have to be syntactically the same. It is thus possible that *ge* in a GCLC and the upper copy of a classifier are syntactically the same.

Recall that a DCLC is also derived by the raising of a classifier (see (69b)). Thus, syntactically, GCLC, the CLCC, and DCLC are derived in the same way. The first two constructions are different from the last construction in their overt phonological realization of the lower link of the classifier movement, and the first construction is different from the latter two constructions in that the phonological realization of the upper link of the movement is *ge*.

Although the alternation between a DCLC and the two double classifier constructions is not productive, its existence gives us a clue for the possible raising of classifiers. Like any other types of syntactic operations, idiosyncratic restrictions on certain operation exhibited by certain elements do not mean the non-existence of the operation.

5.5 More on *ge*

I have claimed that when the classifier *ge* occurs with another classifier, it is the upper link of a movement chain. This is seen in three facts. First, *ge* can be replaced by a copy of the classifier, as mentioned before. Second, the positions of the two classifiers are fixed: *ge* must precede the associated NP and the classifier must follow the NP.

(72) a. sān ge shuǐ-dī
three CL water-CL
'three water-droplets'

b. *sān dī shuǐ-ge
three CL water-CL

Third, *ge* neither specifies nor selects its associated NP, and thus it is less specific than any other classifier (see Barbiers et al. 2008 for the theory that the upper link of a movement may not be more specific than the lower link).

When *ge* occurs without another classifier, it is always between a numeral and an NP, as in (73a). It never follows a noun and thus there is no N-*ge* cluster, as shown by (73b).

(73) a. liang ge píngguǒ
two CL apple
'two apples'

b. *píngguǒ-ge
apple-CL

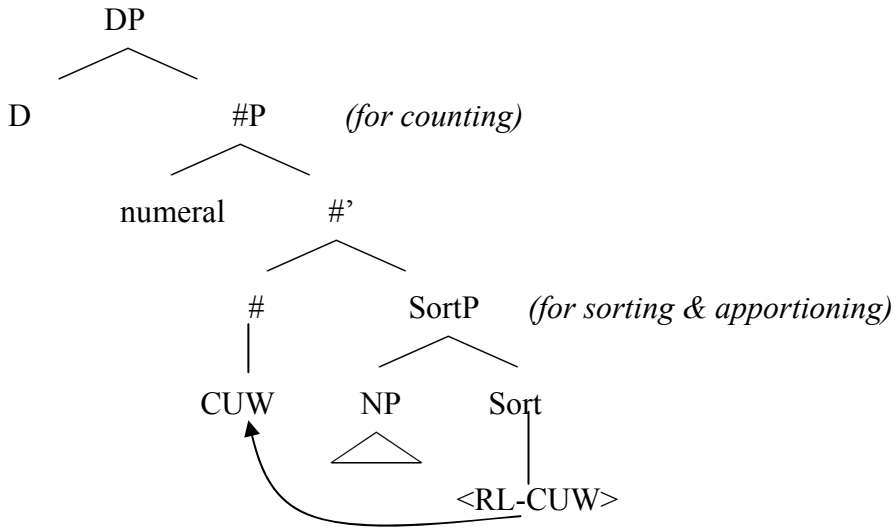
One might assume that for examples like (73a), *ge* behaves like a Type III classifier (e.g. *dǔ*), which moves to # obligatorily. However, *ge* is not sensitive to the semantic classification of NPs (Myers 2000, among many others). It never has a predication or selection relation with the associated NP. Thus there is no reason for *ge* to be merged with the associated NP in the first place. This fact falsifies the above assumption. It also falsifies the assumption that (73a) is a GCLC, with a silent lower link of the movement of a classifier. The second assumption has an additional problem. As correctly pointed out by Barbiers et al. (2008: 8), this kind of analysis inevitably creates a recoverability problem. We have no way to find out what the classifier is.

A more plausible assumption is that in data like (73a), *ge* is base-generated at #, although it is a RL-CUW (i.e., it has no counting dimension independent of the associated NP). It may be the unique RL-CUW that is base-generated at #.

5.6 Summary and discussion

Summarizing, I have argued in this section that, with the exception of *ge*, a classifier is always merged with an NP, projecting SortP, and SortP is the complement of #. Semantically, SortP is for sorting and apportioning, since a classifier has both sorting and apportioning functions. The Spec of # is realized by a numeral, and the projection of #P is for counting. I also argued that a classifier may move from Sort to #, and thus it may surface at either Sort or #. My proposed structure is in (74):

(74)



The configuration of this structure is similar to the nominal structure proposed in Borer (2005, 2009), Saito et al. (2008: 262 fn. 10), and Svenonius (2008). There are differences in the labels of the projections in the studies, though. The projection between NP and #P is called

SortP in (74) and in Svenonius (2008), whereas it is CL^{max} in (Borer 2005, ClP in Saito et al. 2008: 262 fn. 10) and Div^{max} in Borer (2009). Borer (2005:96 fn.8) states that "no theoretical implications are intended" for the label CL rather than DIV. The projection between DP and SortP is called #P in (74) and in Borer (2005, 2009), whereas it is called UnitP in Svenonius (2008), and NumP in Saito et al. (2008: 262 fn. 10).

My study shows that a classifier may occur at a high or a low position, and *ge* always occurs at a high position. Therefore, any unique projection, such as ClP (Tang 1990b, Cheng & Sybesma 1999), is not enough to host classifiers.

My analysis also captures the correlation that if a classifier moves to #, it has a local Spec-Head relation with a numeral and thus is able to function as a counting unit. If a classifier remains at Sort, it is not a counting unit. More will be said about this in 6.3.1.

6. The high base-position of IL-CUWs

6.1 Against a movement analysis

In Section 4, I concluded that all CUWs in Chinese surface at #. In this section, I claim this is also the base-position of IL-CUWs (i.e., measure terms and container measure words, in contrast to classifiers). This claim is supported by the following facts.

First, measure words have neither predication nor selection relation with their associated NPs. Therefore, there is no reason for them to have the same base-position as classifiers. It is thus plausible to assume that they are not raised from a position lower than #. Accordingly, no measure word follows a noun. In other words, there is no counterpart of BCLC for IL-CUWs.

(75) a. 三磅肉
sān bàng ròu
three pound meat
'three pounds of meat'

b. *肉磅
*ròu-bàng
meat-pound

Another fact, which is related to the above fact, is that although certain classifiers may have a CLCC, as in (76a), no measure word may have this kind of copying construction, as shown in (76b) and (76c), since a measure word never follows a noun.

(76) a. 三卷行李卷
sān juàn xíngli-juàn
three CL luggage-CL
'three rolls of luggage'

b. *三瓶酒瓶
*sān píng jiǔ-píng
three bottle wine-bottle

c. *三米布米
*sān mǐ bù-mǐ
three meter cloth-meter

Third, a measure word may not be replaced by a copy of a post-N classifier. (77a) and (77b) have different readings. In other words, although an IL-CUW and *ge* surface at the same position, there is no counterpart of the alternation between a GCLC and a CLCC in IL-CUW constructions.

(77) a. sān gōngjīn shí-kuài
three kg stone-CL
'three kgs of stones'

≠

b. sān kuài shi-kuài
three CL stone-CL
'three chunks of stone'

The above three facts show that the arguments for the movement analysis of RL-CUWs can be established for IL-CUWs.

The following fact directly supports my claim that IL-CUWs are base-generated at their surface position, #. If a measure word and a classifier are base-generated at different positions,

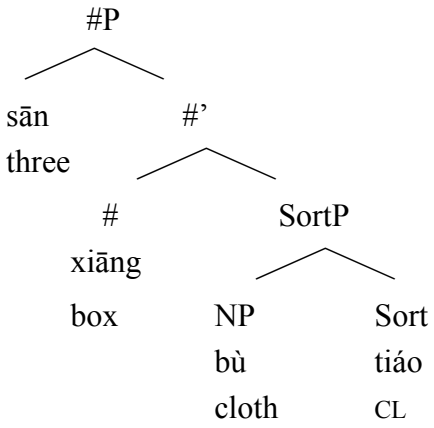
they may co-occur. This is true, as seen in (78).

(78) a. sān xiāng bù-tiáo
three box cloth-CL
'three boxes of cloth-strips'

b. sān gōngjīn bù-tiáo
three kg cloth-CL
'three kgs of cloth-strips'

In this analysis, both a measure word and a classifier remain in situ, i.e. at # and Sort, respectively. The structure of (78a) is (79).

(79)



6.2 Container CUWs and container noun roots

As we know, most of classifiers are developed from nouns or verbs, and many still share forms with nouns and verbs. Similarly, container CUWs share forms with container noun roots. The container counting word *wǎn* 'bowl' in (80a) and the container noun root *wǎn* 'bowl' in (80b) and (80c) have the same form.

(80) a. sān wǎn tāng
three bowl soup
'three bowls of soup'

b. sān ge wǎn
three CL bowl
'three bowls'

c. sān ge tāng-wǎn
three CL soup-bowl
'three soup-bowls'

I claim that container CUWs, such as *wǎn* 'bowl' in (80a), are not raised from the position of container noun roots, such as *wǎn* 'bowl' in (80c). Three arguments support this claim.

First, the construction in which a container word follows the noun is semantically different from the construction in which a container word precedes the noun. We can see that (80a) means three bowls of soup, whereas (80c) means three soup bowls. CUWs are not substantial nouns. This difference does not support the chain relation between the two positions.

Second, unlike noun roots, CUWs may not be coordinated. A container noun root may be coordinated with another container noun root, as shown in (81a); however, no two CUWs may be combined, as shown in (81b). Semantically, no counting operation may have two combined counting units.

(81) a. Nàlǐ yǒu jǐ ge [wǎn gēn pánzi].
there have several CL bowl and plate
'There are several bowls and plates.'

b. *Nàlǐ yǒu jǐ [wǎn gēn pánzi] tāng.
there have several bowl and plate soup

Third, unlike noun roots, CUWs may not take part in question formation. Nouns can be referential, whereas CUWs as semi-functional elements are not referential. One can ask a WH question about the properties of the referent of the former, as in (82), whereas such a question is impossible for the latter, as seen in (83).

(82) Speaker A: Wǒ mǎi-le wǔ ge wǎn. Speaker B: Dōu shì shénmeyàng de wǎn?
I buy-PRF five CL bowl all be how DE bowl
'I bought five bowls.' 'How do they look?

(83) Speaker A: Wǒ hē le wǔ wǎn tāng. Speaker B: *Dōu shì shémeyang de wǎn?
I drink-PRF five bowl soup all be how DE bowl
'I ate five bowls of soup.'

These three differences of IL-CUWs from noun roots mean that there is no chain relation between the surface position of IL-CUWs and another lower position (contra Cheng & Sybesma 1998:407).

We conclude that like classifiers, measure words are semi-functional elements, whereas container noun roots are purely lexical elements. It is common that a certain (semi)-functional item and a lexical item have the same morphological form, and the sharing of the form gives the illusion that they are syntactically identical (see Aboh 2009:30 for more clarifications of the issue). I have shown in this section that container measure words are not derivationally related to container noun roots.

6.3 Representing the contrasts between the two types of CUWs

I have argued that IL-CUWs are base-generated at the head of #P, whereas RL-CUWs are base-generated at the head of SortP. This claim captures the contrasts between the two types of CUWs: measure words and classifiers.

6.3.1 Measure words as intrinsic CUWs

Measure words intrinsically establish counting units, containing information about how the referent is measured (Zhu 1982:49, Tai & Wang 1990, Croft 1994:162, Cheng & Sybesma 1998:388, 2005, Aikhenvald 2003:115; 2006:466). The intrinsic CUW status of measure words is captured by my claim that the surface position of such words is also their base-position, and the unique position always has a head-Spec relation with a numeral. Therefore, their semantic function remains the same.

In contrast, classifiers do not intrinsically encode counting units. Classifiers function as counting units only when they appear at #. If a classifier does not move to #, it does not have the function of a counting unit. In (84a), for instance, there is neither numeral nor CUW. In (84b), the measure word *gōngjīn* 'kilo' is the unique CUW, whereas the classifier *kuài* is not. The classifier in these two examples individuates the mass, or apportions the stuff (see Borer 2005:90,120), but has nothing to do with counting. This is expected from a locality consideration: only the elements that are in a Spec-head relation with a numeral may function as counting units.

(84) a. Shí-kuài hěn zhòng. (= (59))
stone-CL be heavy
'Stones are heavy.' Or 'The stones are heavy.'

b. sān gōngjīn shí-kuài (= (77a))
three kg stone-CL
'three kgs of stones'

Consequently, we see that different surface positions of classifiers correspond to different semantic functions. In other words, the interpretations of a numeral expression are decided by the syntactic context (see Borer 2005:6, 16 for a general theory along this line). In Mandarin Chinese, if and only if an element has a Spec-Head relation with a numeral in #P, the element may be interpreted as a counting unit.

Technically, following Borer (2005:ch. 2), we assume that #P is the locus of counting. # is headed by an open value, call it $<e>_q$. A measure word is an f-morph, which assigns range to $<e>_q$ directly. However, $<e>_q$ may also be assigned range by a head feature, necessitating the head movement of a classifier from Sort to #. The distinct structures are the result of these distinct modes of range assignment.

In this analysis, the same classifier may have different semantic functions depending on its syntactic positions. Parallel situation can be seen in the specific and non-specific indefinite readings of numerals in English. According to Borer (2005:145), when a numeral remains in #P, it does not have a specific reading; but when it moves to DP, it has a specific reading.

6.3.2 Interactions with the associated NPs

Recall that IL-CUWs are blind to the semantics of the associated NP. Semantically, any NP can occur with any IL-CUW, subject to pragmatic conditions (Section 4.4). Syntactically, in our proposed (79), the IL-CUW is merged with SortP, rather that the NP directly. Thus the lack of interactions of IL-CUWs with the NP is captured. This situation is in contrast to RL-CUWs, which interact with the associated NPs directly. The interaction is represented by their direct merger with the NPs (see (74)).

6.4 Summary

RL-CUWs are moved from Sort to #, whereas IL-CUWs are base-generated at #. Thus the two types of nominal auxiliaries are syntactically different, which correlates with their different semantic properties presented in Section 4.

7. Conclusions

In this paper, I have identified a new type of nominal auxiliaries, CUWs, which include measure terms, container measure words, and classifiers. They surface in the same syntactic position, exhibit the same dual dependency on numerals and NPs, may satisfy s-selection of verbs, and have a general apportion function. However, such auxiliaries can be divided into IL and RL ones. The former group is base-generated and surfaces at #, whereas the latter group is raised from Sort to #, except the classifier *ge*, which is base-generated at its surface position. Thus the movement of classifiers is attested. The proposed structure of a numeral expression is (85):

(85) $[_{DP}\ [_{\#P}$ Numeral $[_{\#'}$ CUW $[_{SortP}$ NP $[_{Sort'}$ <RL-CUW>]]]]]

I have also argued that although such nominal auxiliaries exist cross-linguistically, classifier languages such as Chinese are different from non-classifier languages such as English in the function of the auxiliaries. Auxiliaries may represent the natural units of entities that show atomicity in Chinese, but not in English.

Appendix

(86) The alternation between simple and complex classifier constructions

DCLC	GCLC	CLCC	translation
三滴水 sān dī shuǐ three CL water	三個水滴 sān ge shuǐ-dī three CL water-CL	三滴水滴 sān dī shuǐ-dī three CL water- CL	‘three drops of water’
三條布 sān tiáo bù three CL cloth	三個布條 sān ge bù-tiáo three CL cloth-CL	三條布條 sān tiáo bù-tiáo three CL cloth-CL	‘three strips of cloth’
三團面 sān tuán miàn three CL flour	三個面團 sān ge miàn-tuán three CL flour-dough	三團面團 sān tuán miàn-tuán three CL flour-dough	‘three pieces of dough’
三條線 sān tiáo xiàn three CL line	三個線條 sān ge xiàn-tiáo three CL line-CL	三條線條 sān tiáo xiàn-tiáo three CL line-CL	‘three lines’
三頭蒜 sān tóu suàn three CL garlic	三個蒜頭 sān ge suàn-tóu three CL garlic-CL	三頭蒜頭 sān tóu suàn-tóu three CL garlic-CL	‘three garlic bulbs’
三粒米 sān lì mǐ three CL rice	三個米粒 sān ge mǐ-lì three CL rice-CL	三粒米粒 sān lì mǐ-lì three CL rice-CL	‘three grains of rice’
三項獎 sān xiàng jiǎng three CL award	三個獎項 sān ge jiǎng-xiàng three CL award-CL	三項獎項 sān xiàng jiǎng-xiàng three CL award-CL	‘three awards’
三朵花 sān duǒ huā three CL flower	三個花朵 sān ge huā-duǒ three CL flower-CL	三朵花朵 sān duǒ huā-duǒ three CL flower-CL	‘three flowers’
三束花 sān shù huā three CL flower	三個花束 sān ge huā-shù three CL flower-CL	三束花束 sān shù huā-shù three CL flower-CL	‘three bunches of flowers’
三塊冰 sān kuài bīng three CL ice	三個冰塊 sān gè bīng-kuài three CL ice-CL	三塊冰塊 sān kuài bīng-kuài three CL ice-CL	‘three ice chunks’
三片玻璃 sān piān bōli three CL glass	三個玻璃片 sān gè bōli-piān three CL glass-CL	三片玻璃片 sān piān bōli-piān three CL glass-CL	‘three pieces of glass’
三層樓 sān céng lóu three CL floor	三個樓層 sān gè lóu-céng three CL floor-CL	三層樓層 sān céng lóu-céng three CL floor-CL	‘three floors’
三卷行李 sān juàn xíngli three CL luggage	三個行李卷 sān gè xíngli-juàn three CL luggage-CL	三卷行李卷 sān juàn xíngli-juàn three CL luggage-CL	‘three rolls of luggage’
三堆土 sān duī tǔ three CL dirt	三個土堆 sān gè tǔ-duī three CL dirt-CL	三堆土堆 sān duī tǔ-duī three CL dirt-CL	‘three piles of dirt’

References

Aboh, Enoch Gladé. 2009. Clause Structure and Verb Series. *Linguistic Inquiry* 40: 1-33.

Aikhenvald, A. 2003. Classifiers: a typology of noun categorization devices. Oxford University Press.

Aikhenvald, A. 2006. Classifiers and noun classes: semantics. *Encyclopaedia of Language and Linguistics*, 2nd ed. K. Brown (ed.) Elsevier: Oxford, 463-470.

Alexiadou, et al. 2007. *Noun Phrase in the Generative Perspective*. Mouton de Gruyter, Berlin.

Allan, Keith. 1977. Classifiers. *Language* 53: 285-311.

Barbiers, Sjef, Olaf Koeneman, Marika Lekakou. 2009. Syntactic doubling and the structure of wh-chains. *Journal of Linguistics*, To appear.

Borer, Hagit. 2005. *In Name Only*. Oxford University Press.

Borer, Hagit. 2009. Syntax for Kinds? Paper presented at Mass/Count Workshop, University of Toronto, Feb. 7-8, 2009.

Bruin, Jos de, & Remko Scha. 1988. The interpretation of relational nouns. *Proceedings of the 26th Annual Meeting of the Association for Computational Linguistics*, 25-32. Buffalo: State University of New York.

Bunt, H.C. 1985. Mass Terms and Model-Theoretic Semantics. Cambridge: Cambridge University Press.

Castillo, Juan Carlos. 2001. *Thematic Relations between Nouns*. College Park: University of Maryland dissertation.

Chao, Y.R. 1968. *A grammar of spoken Chinese*. University of California Press, Berkeley.

Cheng, L.-S. & R. Sybesma. 1998. Yi-wan tang, yi-ge tang: classifiers and massifiers. *Tsing-Hua Journal of Chinese Studies* 28 (3): 385-412.

Cheng, L.-S. & R. Sybesma. 1999. Bare and not so bare nouns and the structure of NP. *Linguistic Inquiry* 30 (4): 509-542.

Cheng, L.-S. & R. Sybesma. 2005. Classifiers in four varieties of Chinese. In G. Cinque & R. Kayne (eds) *Handbook of Comparative Syntax*, 259-292. Oxford University Press.

Chien, Y-C., Lust, B., and Chiang, C-P. (2003). Chinese children's comprehension of count-classifiers and mass-classifiers. *Journal of East Asian Linguistics, 12,* 91–120.

Chierchia, G. 1998. Plurality of mass nouns and the notion of semantic parameter, in S. Rothstein (ed.) *Events and Grammar*, Dordrecht: Kluwer, 53-103.

Chomsky, Noam 2000. Minimalist inquiries: The framework, in Roger Martin, David Michaels, and Juan Uriagereka (eds.), *Step by step: Essays on minimalist syntax in honor of Howard Lasnik*, Cambridge, MA: MIT Press, 89-155.

Corbett, Greville. 1991. *Gender*. Cambridge: Cambridge University Press.

Corver, Norbert. 1998. Predicative movement in pseudopartitive constructions. In Artemis Alexiadou and Chris Wilder (eds.), *Possessors, predicates and movement in the Determiner Phrase*, volume 22 of Linguistik Aktuell/Linguistics Today. Amsterdam: John Benjamin, 215-257.

Corver, Norbert & Henk van Riemsdijk. 2001. Semi-lexical categories: the function of content words and the content of function words, Berlin; New York: Mouton de Gruyter.

Corver, N. & J. Zwarts. 2006. Prepositional Numerals. *Lingua* 116(6): 811-835.

Croft, William. 1994. Semantic universals in classifier systems. *Word* 45: 145-171.

Déchaine, Rose-Marie A. 1993. *Predicates Across Categories: Towards a Categoryneutral Syntax*. Amherst: University of Massachusetts.

Dikken, Marcel den. 2006. *Relators and Linkers: The Syntax of Predication, Predicate Inversion and Copulas*. Cambridge: MIT Press.

Doetjes, Jenny. 1996. Mass and count: syntax or semantics? *Proceedings of Meaning on the HIL*. 34-52.

Doetjes, Jenny 1997. Quantifiers and Selection. On the distribution of quantifying expressions in French, Dutch and English. PhD dissertation, Holland Institute of Generative Linguistics, Leiden University, Holland Academic Graphics.

Givón, Talmy. 1970. The resolution of gender conflicts in Bantu conjunction: when syntax and semantics clash. *Papers from the Sixth Regional Meeting*, Chicago Linguistic Society, April 16-18, 1970, Chicago: Chicago Linguistic Society, 250-61.

Graham, A. C. 1989. Disputers of the Tao. Open Court, La Salle, Ill.

Hansen, C.D. 1972. Philosophy of language and logic in ancient China. Doctoral dissertation, University of Michigan.

Hornstein, N., S. Rosen and J. Uriagereka. 1994. Integrals. *University of Maryland Working Papers in Linguistics* 2:70-90.

Hsieh, M.L. 2008. *The internal structure of noun phrases in Chinese*. Crane Publishing Co., LTD.

Hsieh, M.L. 2009. Quantifiers as topic/focus in the nominal domain? Paper presented at the Mini Workshop on Cartography, National Tsing Hua University, July 23, 2009.

Huang, Chu-Ren & Kathleen Ahrens. 2003. Individuals, kinds and events. *Language Sciences* 25 (4): 353-373.

Huang, Chu-Ren. 1989. *Mandarin Chinese NP de -A Comparative Study of Current Grammatical Theories*. Nankang, Taipei (PhD thesis, Cornell University 1987).

Kayne, Richard S. 1994. *The Antisymmetry of Syntax*. Cambridge: MIT Press.

Krifka, M. 1995. Common nouns: a contrastive analysis of Chinese and English, in G.N. Carlson & F. J. Pelletier (eds.), *The Generic Book*, Chicago University Press 1995, 398-411.

Li, C.N. and S.A. Thompson. 1981. *Mandarin Chinese. A functional reference grammar*. University of California Press, Berkeley.

Li, Jinxi (黎锦熙). 1924. Xinzhu Guoyu Wenfa (《新著国语文法》) [A new study of the grammar of Mandarin Chinese], reprinted in 1992, Beijing: Shangwu Press.

Li, Xu-Ping. 2008. Semantics of pre-classifier adjectives, *Proceedings of ConSOLE XVI*, 117-134.

Li, Yen-hui Audrey. 1998. Argument Determiner Phrases and Number Phrases, *Linguistic Inquiry* 29**:** 693-702.

Lu, Zhiwei. 1951. *Beijinghua danyinci cihui* [Monosyllabic words in Beijing dialect]. Renmin Chubanshe.

Lü, Shuxiang. 1942. Zhongguo Wenfa Yaolue (《中国文法要略》) [An outline of Chinese Grammar], reprinted in 1982, Beijing: Shangwu Press.

Lyons, J. 1977. *Semantics*. Vol. 2. Cambridge: Cambridge University Press.

Ma, Qingzhu. 1990. Shuci, Liangci de Yuyi Chengfen he Shuliang Jiegou de Yufa Gongneng [The semantic elements of numerals and classifiers and grammatical functions of numeral-classifier constructions], *Zhongguo Yuwen* 1990 (3), 161-173.

Myers, J. 2000. Rules vs. analogy in Mandarin classifier selection. *Language and Linguistics*

1 (2), 187-209.

Ōta, Tatsuo. 1958. *Chūgokugo rekishi bunpo* [A historical grammar of modern Chinese], [Chinese translation by S. Jiang and C. Xu, *zhōngguóyǔ lìshǐ wénfǎ*, 2003. Beijing University Press: Beijing].

Pelletier, Francis Jeffry. 1975. Non-Singular Reference: Some Preliminaries. *Philosophia* 5: 451-465.

Quer, J. & L. Vicente. Semantically triggered verb doubling in Spanish unconditionals. 19th Colloquium on Generative Grammar, Vitoria-Gasteiz, Spain, April 1-3, 2009.

Ritter, E. 1991. Two functional categories in Noun Phrases: evidence from Modern Hebrew. *Perspectives on Phrase Structure*. (ed.) Susan Rothstein (Syntax and Semantics 25). New York: Academic Press. 37-62.

Roehrs, Dorian. 2009. *Demonstratives and definite articles as nominal auxiliaries*. Amsterdam / Philadelphia: John Benjamins.

Rothstein, Susan. 2007. Counting and the Mass-Count Distinction. Ms.

Saito, Mamoru, T.-H. Jonah Lin, Keiko Murasugi. 2008. N'-ellipsis and the structure of noun phrases in Chinese and Japanese. *Journal of East Asian Linguistics* 17: 247-271.

Schwarzschild, Roger. 2006. The role of dimensions in the syntax of noun phrases. *Syntax* 9: 67-110.

Selkirk, Elisabeth. 1977. Some remarks on noun phrase structure". In P. Culicover, T. Wasow and A. Akmajian (eds.), *Formal Syntax*, New York: Academic Press, 285-316.

Stowell, T. 1983. Subjects across categories, *The Linguistic Review* 2:285-312.

Svenonius, P. 2008. The position of adjectives and other phrasal modifiers in the decomposition of DP. Adjectives and adverbs: syntax, semantics, and discourse, ed. L. McNally and C. Kennedy,16 – 42. Oxford: Oxford University Press.

Szabolcsi, Anna. 1983. The possessor that ran away from home. *The Linguistic Review* 3: 89-102.

Tai, James H-Y. 1994. Chinese Classifier Systems and Human Categorization. *In Honor of Professor William S-Y. Wang: Interdisciplinary Studies on Language and Language Change*, Matthew Chen and Ovid Tseng, eds. Pyramid Publishing Company, 479-494.

Tai, James H-Y. and L.Q. Wang. 1990. A semantic study of the classifier *tiao*. *Journal of the Chinese Language Teachers Association* 25/1:35-56.

Tang, Chih-chen Jane. 1990a. A note on the DP analysis of the Chinese noun phrase. *Linguistics* 28: 337-354.

Tang, Chih-chen Jane. 1990b. Chinese phrase structure and extended X'-theory. PhD thesis, Cornell University.

Tang, Chih-chen Jane. 2005. Nouns or classifiers: a non-movement analysis of classifiers in Chinese. *Language and Linguistics* 6: 431-472.

Tversky, Barbarai & Kathleen Hemenway. 1983. Categories of Environmental Scenes. *Cognitive Psychology* I5: 121-149.

Tversky, Barbarai & Kathleen Hemenway. 1984. Objects, Parts, and Categories. *Journal of Experimental Psychology* 113: 169-193.

Uriagereka, Juan. 2008. *Syntactic Anchors*. Cambridge & New York: Cambridge University Press.

Wiltschko, Martina. 2005. Why should diminutives count? *Organizing Grammar*, H. Broekhuis, N. Corver, R. Huybregts, and U. Kleinhenz (eds.), Mouton de Gruyter,

Berlin & New York, 669-678.

Wu, Yicheng & Adams Bodomo. 2009. Classifiers ≠ Determiners. *Linguistic Inquiry* 40 (3): 487-503.

Yang, Henrietta Shu-Fen. 2005. Plurality and modification in Mandarin Nominal Phrases. Doctoral dissertation, The University of Texas at Austin.

Yang, Rong. 2001. Common nouns, classifiers and quantification in Chinese. Doctoral dissertation, Rutgers, The State University of New Jersey.

Yip, Chak-Lam Colum. 2008. Complicating the Oversimplification: Chinese Numeral Classifiers and True Measures. *Proceedings of the 20th North American Conference on Chinese Linguistics* (NACCL-20). 2008. Volume 1. Marjorie K.M. Chan and Hana Kang (eds.). Columbus, Ohio: The Ohio State University. 285-295.

Zhang, Hong. 2007. Numeral classifiers in Mandarin Chinese. *Journal of East Asian Linguistics* 16: 43-59.

Zhang, Niina Ning. 2009a. Syntactic Properties of Numeral Classifiers in Mandarin Chinese. Manuscript, National Chung Cheng University.

Zhang, Niina Ning. 2009b. Representing the Contrasts between Simple and Complex Classifier Constructions. Manuscript, National Chung Cheng University.

Zhu, Dexi. 1982. *Yufa Jiangyi* [Lectures on grammar], Beijing, Shangwu Press.