Deciphering the Syntax-Semantics Interface of Nominal Classifier Phrases in Mandarin Chinese

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Abstract

This dissertation investigates nominal quantifying expressions in Mandarin Chinese, focusing on numeral classifier phrases. It examines the nature of classifiers and cardinal numbers, drawing evidence from N-CL (noun-classifier) pairs.

N-CL pairs and bare nouns (N) are structurally related: both serve as predicates and arguments, convey similar grammatical meanings (e.g., definiteness, number neutrality), and encode atomic content. I argue that certain classifiers originate in the root domain, where lexical content first arises. Despite the atomicity of N-CL pairs, interpretative variation emerges depending on how lexical content is distributed between noun and classifier. I identify four patterns: $N_{full}CL_{null}$, $N_{half}CL_{half}$, $N_{less}CL_{more}$, and $N_{full}CL_{full}$. These reflect differing degrees of semantic contribution.

To explain both the unity and internal variation of N-CL pairs, I propose they originate within the syntactic domain of nP, where a categoriser (n) determines how lexical content is interpreted. Interpretative patterns result from how primary and secondary projections within nP regulate the merger of roots and inner morphemes.

The dissertation also investigates the syntax and semantics of cardinal numbers. Simplex numerals function as the head of the Number Phrase (NumP) and exhibit polysemy, denoting both degree and quantity. In contrast, complex numerals are constructed from simplex bases and function exclusively as quantifiers. This distinction accounts for the observation that only simplex numerals can combine with degree adjectives in constructions such as NumberAPCLP: their degree-denoting function allows them to participate in degree expressions, while complex numerals, lacking this function, cannot.

The analysis further sheds light on other quantificational elements, particularly the paucal operators *ji* and *xie*, and their interaction with numeral expressions. Taken together, this dissertation presents a comprehensive picture of how absolute quantity and vague quantity are encoded within numeral classifier phrases, and how numerals interact with paucal operators in shaping quantificational meaning in Mandarin Chinese.

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Acknowledgments

Trust me, I want to say a lot about the whole PhD journey, but as I started typing this part, I found it challenging to express those internal scenes that have lingered in my mind using plain and direct language.

I'm a lucky person. I grew up with love and unconditional support from my family, especially my mum Bai LiHong and my dad Jin WenYu. You both provided me with a home and made me feel that even miles and miles away, there are two people in this world who will always be there for me. I'm not a fan of those cringy emotional speeches, and neither are you, but we all know that I can't make it this far without you guys, thank you.

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Completing a PhD is about expertising an area of knowledge, but it's also about seeing more people, seeing the world, and seeing myself. I use linguistics to see the world, and I've met so many amazing people along the way. Most importantly, it's helped me uncover the sensitive, fragile, yet brave true self.

Here's to the past, present, and future.

Declaration

I declare that this thesis is a presentation of original work and I am the sole author. This work has not previously been presented for a degree or other qualification at this University or elsewhere. All sources are acknowledged as references.

Introduction

In Mandarin Chinese, classifiers are known as a quantifying tool to link a cardinal number with a nominal item. The combination of these three elements is usually termed as Numeral classifier phrase, with the word order '*[Numeral-Classifier-Noun]*' and headed by a cardinal number. A numeral classifier phrase can be used as an object or a subject in a sentence. As exemplified in (1), '*san-ben-shu*' (three classifier book) can be either a direct object of the verb-*na* (take) in (1-a) or as the subject for the verb-*diao* (drop) in (1-b). Furthermore, classifiers can also be used adverbially, in which case, the sequence [Numeral-Classifier] positions after a verb, as shown in (1-c) [1].

(1) a. Lao-shi na-zou **san-ben-shu**
Teacher take-away **three-CL-book**
'The teacher took away three books'

b. **San-ben-shu** diao le
Three-CL-book drop par
'Three books are dropped'

c. Lao-shi lai zhe **san-ci**
Teacher come here **three-CL**
'The teacher came here for three times'

The focus of this work is on the *nominal classifiers*, which is the case shown in (1-a) and (1-b). The aim is to explore the intrinsic relation between a classifier and a head noun. To detail, one of the on-going debates about classifiers in Mandarin-Chinese is their initial sta-

[1] If not indicated, all the data of Mandarin-Chinese in this dissertation are from the author

tus and how they are construed into a syntactic projection. Within generative framework, the general idea of syntactic projections is surrounded with lexical elements, as addressed by Chomsky (1981):

> "*Representations at each syntactic level (i.e., LF, and D and S structure) are projected from the lexicon, in that they observe the subcategorisation properties of lexical items*"

Therefore, one of the main questions in syntax theory is to explore what can be processed in the lexicon and how syntactic structures are formed. This inquiry has led to numerous studies focused on defining *lexical categories* and *functional categories*. Researchers such as Abney (1983) and Emonds (1985) (among others) have identified the following characteristics that distinguish *lexical categories* from *functional categories*.

First, *lexical categories convey specific lexical content*, while functional categories do not. For example, the verb *look* (a lexical category) provides specific information about an action, whereas the suffix *-ed* (a functional category) does not convey specific lexical content. Instead, *-ed* provides grammatical information by modifying the tense of a verb by attaching to any word to indicate a past temporal information.

Second, *lexical categories can absorb novel items*, while functional categories are rather fixed. For example, the canonical category-noun is a good example of a lexical category, as nominal items are constantly updating in a language community, but functional items such as tense marker, prepositions are unlikely to change.

Third, within a syntactic projection, *lexical categories can take different categories as their complement*, while functional categories can only take a single category as their complement. For instance, verbs such as the complement for *eat* can be a numeral phrase (2-a), a relative clause (2-b), and even functioning as an intransitive verb (2-c). Whereas to the category Tense, its complement is always a VP.

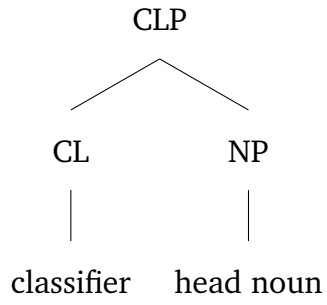
(2) a. I ate *three apples*

b. I ate *what you bought yesterday*

c. I am *eating*

Shifting focus to classifiers, within a numeral classifier phrase, the head nouns are lexical items. Then it is natural to assume that classifiers possess a functional projection higher than the head nouns. With their distribution as shown in (3), this suggests that classifiers are functional categories. Empirically, certain classifiers in MC indeed align with the definition of functional categories.

(3)



'Ge' and 'Xie' exemplify such cases. Both ge and xie generally lack concrete lexical content and instead convey grammatical meaning. Specifically, ge signifies a singular atom, whereas xie denotes a collection of atoms and, in a broad sense, implies plurality. In sentence structures, they function similarly to number morphemes. As illustrated in (4), ge and xie serve solely to indicate numerical contrast without contributing additional semantic content to the sentence.

(4) a. Jia li lai-le *yi ge ren*
Home inside come-Par *one CL people*
'There is a person came to the house'

b. Jia li lai-le *yi xie ren*
Home inside come-par *one CL people*
'There are people came to the house'

However, not all classifiers behave the same as *ge* and *xie*, notably container expressions.

When using container expressions to quantify a nominal, they always provide lexical content to the numeral phrase they are part of. As shown in (5), *Yi xiang shu* (a box of books) emphasises the container word, not the head noun. In other words, when a speaker utters *Yi xiang shu*, the core information comes from the classifier *xiang*. The same condition holds for *ping* (bottle) in (5-b). Based on the definition presented above, container words are more like lexical items rather than functional items.

(5) a. Yi xiang shu
One box book
'A box of books'

b. Yi ping jiu
One bottle wine
'A bottle of wine'

Interestingly, there exists classifiers that cannot be clearly defined as either a lexical item or a functional item. As observed in (6-a), the classifier *ben* performs the function expected of *ge*, indicating number without providing additional content meaning. Similar examples are shown in (6-b) and (6-c). Thus, it is expected that they are functional in the grammar.

(6) a. Wo mai-le *san ben shu*
I buy-Par *three CL book*
'I bought three books'

b. Wo na-le *san duo hua*
I take-Par *three CL flower*
'I took three flowers'

c. Wo xu-yao *san zhi chuan*
I need *three CL boat*
'I need three boats'

However, an essential property of these classifiers suggests that they are actually lexical items, and this property is the *N-CL pair*. Certain classifiers can be positioned after a head

noun to form an N-CL pair, and this process is consistently exhibited in container words, as shown in (7) and (8). In contrast, the functional classifiers *ge* and *xie* cannot form N-CL pairs with the nominals they quantify at all (such as *ren-ge (people-ge), *ren-xie (people-xie)).

(7) a. Yi ping jiu
One CL_{bottle} wine
'A bottle of wine'

b. Jiu-ping
Wine-bottle
'Bottle(s) with wine'

(8) a. Yi guan nai
One CL_{jar} milk
'A jar of milk'

b. Nai-guan
Milk-jar
'Jar(s) with milk'

Continuing the previous discussion, 'ben' in *san ben-shu*, 'duo' in *san duo-hua*, and 'zhi' in *san zhi-chuan* exhibit properties of functional classifiers in terms of their 'contentlessness' and *dependency* on the head noun. If they were functional classifiers, they would be expected to behave similarly to *ge* and *xie*, in that they would not be able to form N-CL pairs with their head noun. However, as shown in (9), these classifiers can combine with a head noun to form an N-CL pair.

(9) a. Shu-ben
Book-CL
'Book(s)'

b. Hua-duo
Flower-CL
'Flower(s)

c. Chuan-zhi
Boat-CL
'Boat(s)'

If N-CL structures are taken as evidence of lexicality in classifiers, a general scale can be established, as illustrated in Fig 1. Container words meet all the criteria of lexical items and therefore belong to the lexical category. In contrast, ge and xie exhibit all the expected properties of functional elements, placing them within the functional domain.

The status of *ben-type* classifiers, however, remains indeterminate. While they function as functional classifiers in numeral classifier phrases by quantifying nominals, they also share characteristics with lexical classifiers, particularly in terms of N-CL constraints. This dissertation, therefore, aims to investigate the initial status of nominal classifiers and the function of N-CL compounds.

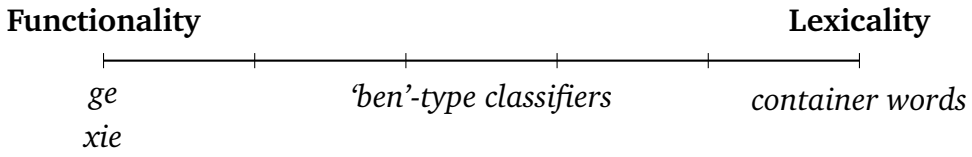


Figure 1: Categorial status of classifiers in MC

In this work, I examine the formation of N-CL pairs. As discussed, these pairs provide evidence for the lexicality of a classifier, as purely functional classifiers do not form N-CL pairs. However, the analysis of N-CL pairs is more nuanced. This structure appears to be closely linked to the phrasal projection of the classifier phrase, particularly in relation to its semantic content.

Specifically, considering the meanings of 'Shu-ben,' 'Hua-duo,' and 'Chuan-zhi,' as addressed earlier, the determinant of the semantic content of these words is the initial nominal elements, namely *'Shu' (book) 'Hua'(flower) and 'Chuan'(boat)*. The attaching classifiers do not contribute any substantial information to these words. Interestingly, this characteristic remains unchanged when these classifiers are placed pre-nominally in a numeral classifier phrase. As exemplified from (10) to (12), a parallel pattern emerges regarding the semantic role of the classifiers

(10) a. Shu-ben
Book-CL
'Book(s)'

b. Yi ben-shu
One CL-book
'One book'

(11) a. Hua-duo
Flower-CL
'Flower(s)'

b. Yi duo-hua
One CL-flower
'One flower'

(12) a. Chuan-zhi
Boat-CL
'Boat(s)'

b. Yi zhi-chuan
One CL-boat
'One boat'

Expanding the scope to include a broader range of classifiers reveals internal variation in their semantic content. As previously discussed, container words consistently form N-CL pairs, as demonstrated in (13) and (14). However, in contrast to (10)(12), where the classifiers are semantically inert, bei and xiang always contribute semantic content, regardless of whether they appear within a phrasal projection of CLP or in the seemingly morphological context of an N-CL structure. Moreover, as seen in (13-b) and (14-b), the semantic core of these N-CL structures originates from the attached classifiers rather than the initial nounlike ben-type classifiers, which behave differently in this respect.

(13) a. Yi bei shui
One CL_{glass} water
'A glass of water'

b. Shui-bei
Water-glass
'Glass(es) with water'

(14) a. Yi xiang shu
One CL_{box} book
'A box of books'

b. Shu-xiang
Book-box

'Box(es) with books'

This variation in semantic interpretation informs my perspective on classifiers. In this dissertation, I adopt a syntactic approach to derive the formation of N-CL pairs, conceptualising N-CL as a hidden 'factory' where syntax selects a 'suitable' classifier for a nominal item. A unified *root* projection is key to explaining why certain classifiers are always silent while others consistently convey semantic content.

This dissertation organises as follows:

Chapter One: N-CL pairs: The hidden storeroom

- The first two sections provide an introduction, outlining the formation of N-CL pairs and examining the various interpretative patterns they exhibit. This is followed by a discussion on the nature of N-CL pairs, considering two competing perspectives: the lexicalist approach and the syntactic approach.

Chapter Two: nP, where N and CL meet

- Building upon the previous analysis, this chapter addresses the initial status of classifiers (specifically, those in N-CL pairs) and assumes that these classifiers function as roots. This is followed by a discussion on how roots are projected in syntax.

- *Section 3-4*. In these sections, the functions of categorisers and the interaction between the n categoriser and roots are specified. After establishing this foundation, explicit syntactic configurations are proposed to capture the four interpretative patterns in N-CL pairs.

Chapter Three: Numerals: between enumerating and partitioning

- *Section 1*. After the discussion of classifiers, this chapter moves to the numerals in MC. In the first section, I focus on the syntactic positions of cardinal numbers in MC, and utilising the position of adjective modifiers, I suggest to choose the *right-branch* template as my base structural template.

- *Section 2*. This section discusses the semantic meanings of cardinal numbers, and meanwhile, I specify the semantic denotations of NP, CLP, and NumberP. Utilising disjointness semantics, NP are considered as predicates of sums, of type $< e, t >$, classifiers are of type $< e, t >< e, t >$.

- *Section 3*. The third section presents my analyses on the numeral meaning of 'paucity', two paucal operators are identified with addressing their syntactic positions and semantic functions.

- *Section 4*. In the final section, I delve into the discrepancies between simplex numerals and complex numerals. By utilising the insertion of adjectives, I differentiate the general number base from simplex numerals. Their distinction lies in both syntactic projections and semantic contributions to the overall meaning of the NumeralP.

Chapter 1

N-CL Pairs: The hidden storeroom

One of the key puzzles surrounding classifiers is their semantic relationship with the nominal domain they classify. To elaborate, as shown in (1), the bare noun 'hua' (flower) can be paired with classifiers such as 'duo', 'ban', 'dui', and even a container word 'xiang'. Correspondingly, these classifiers contribute their inherent meanings to the noun, resulting in diverse interpretations within the [CL-N] sequences shown in (1).

(1) a. San duo hua
Three CL_{duo} flower
'Three flowers

b. San ban hua
Three CL_{petal} flower
'Three petals of water'

c. San dui hua
Three CL_{pile} flower
'Three piles of flowers'

d. San xiang hua
Three CL_{box} flower
'Three boxes of flowers'

However, variation arises when considering the extent of semantic content a classifier contributes. For instance, in (1-a), 'duo' contributes minimal semantic content, resulting

in [duo hua] having a meaning similar to the bare noun hua (flower). Such classifiers are assumed as providing 'imputed' characteristics of the nominal domain they classify (Allan, 1977), as further discussed by Doetjes (1997); Cheng and Sybesma (1999), they name an instance of the nouns classified by them, namely [duo-hua] denotes a subset of [hua] (duo-hua $\in$ hua). In contrast, classifiers such as 'dui', and 'xiang' significantly contribute their semantic content, modifying or even altering the overall meaning of the phrase they reside in, as 'dui' and 'xiang' denote arbitrary counting unit independent of the nominal domain.

Following this logic, a model of meaning transfer from classifiers to nouns can be schematised. As in Fig. 1.1, the lexical entry of a classifier encodes its inherent meanings, which would be imparted to the overall meaning of the classifier phrase. Consequently, referring back to (1), classifiers 'duo', 'ban', 'dui', 'xiang' exhibit diverse semantic effects to the [CL-N] sequence.

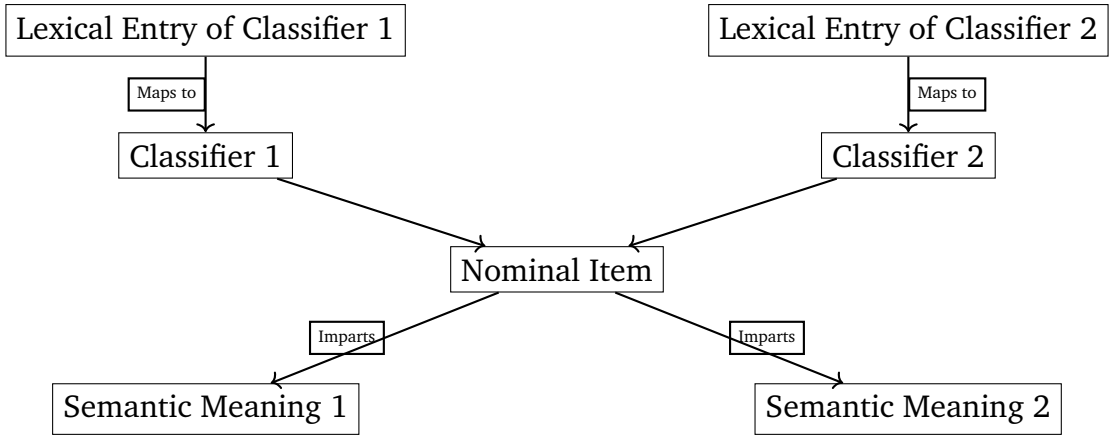


Figure 1.1: How classifiers impart semantic meaning to nominal items.

Regarding this existing model, an important question arises: *Is it effective enough to determine which classifier is the most typical for naming a given nominal domain?* As shown in (1), duo is assumed to be the most typical classifier aligning with the semantic denotation of the noun 'hua' (flower). In other words, there is a significant overlap between the semantic properties expected in hua and those inherent in duo.

Similar examples are provided in (2), where the pre-nominal classifiers are interpreted as

the most natural ones, leading to a [CL-N] sequence that is largely equivalent in meaning to the corresponding bare noun.

(2) a. Yi ben shu
One CL_{ben} book
'A book'

b. Yi pi ma
One CL_{pi} horse
'A horse'

c. Yi zhang zhi
One CL_{zhang} paper
'A paper'

d. Yi zhi chuan
One CL_{zhi} boat
'A boat'

The existing model (Fig. 1.1) offers a general framework for deriving the meaning of classifier phrases, adhering largely to the principle of compositionality, in which the meaning of a classifier phrase (CLP) arises from the combination of a classifier and a noun. However, the model fails to account for the grammatical distinction between duo and classifiers such as ban, dui, and xiang. Additionally, it does not explain why duo, ben, pi, and zhi, as shown in (2), function as the default classifiers for their respective nominal domains.

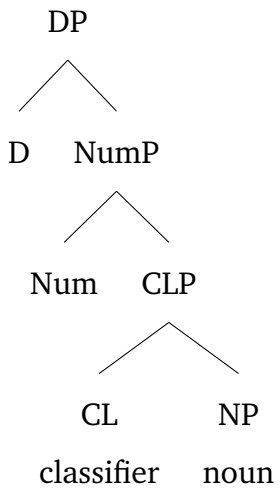
By default, I refer to cases where certain classifiers align with key semantic properties of the noun they accompany. For example, ben for shu (book) and pi for ma (horse) are considered the most natural and economical classifiers for their respective domains. In these cases, the lexical content of ben and pi is effectively embedded within the nouns, meaning the classifiers do not contribute additional meaning [1].

One perspective provided by the literature is considering the categorisation variation in

[1]Regarding duo for hua (flower), I acknowledge that treating duo as the default classifier is not an absolute claimit may vary by individual intuition, and further experimental research is needed to examine perceptual differences among classifiers. Other classifiers, such as *zhi* (branch), can also classify hua, but as shown in the proceeding, while hua-duo can generally substitute for hua, 'hua-zhi' (flower-branch) is not a natural construction and cannot replace hua in a sentence. Therefore, for the purposes of this discussion, I assume duo as the default classifier for hua.

classifiers. Specifically, the framework adopted here aligns with the prevailing consensus in the syntactic literature, which, as illustrated in (3), treats classifiers and nominals as distinct grammatical items with independent syntactic projections-namely, CLP and NP (Cheng and Sybesma, 1999; Gebhardt, 2011; Zhang, 2013) [2]. More broadly, the classifier phrase (CLP) is assumed to form a canonical functional projection of NP (Borer, 2005; Wiltschko, 2014; Hachem, 2015).

(3)



Following this logic, classifiers, base-generated at the CL head, function as selectors for NP, with semantic restrictions arising as a by-product of this structural relationship. For instance, classifiers whose semantic properties align with the nominal domain serve as the head of CLP (such as duo for hua in (1)), whereas those functioning as arbitrary units originate within NP and subsequently move to CLP when classifying substance nouns.

However, this analysis cannot fully explain the formation of N-CL pairs, as the mechanism by which a noun and a classifier combine remains understudied. One of the leading proposals, which will be discussed later in this chapter, is the *NP-external approach*. This approach assumes that N-CL pairs result from movement, whereby the classifier serves as

[2]The structural placement of CLP remains a topic of debate. The right-branch approach posits NumP (Number Phrase), CLP, and NP as independent projections, while alternative analyses suggest a closer syntactic relationship between NumP and CLPoften treating them as a single constituent modifying NP (Her, 2017). This section does not seek to resolve this debate but focuses instead on the NP projection. Nevertheless, given the evidence from N-CL pairs, which highlight a tighter syntactic association between nouns and their corresponding classifiers, I adopt the right-branch approach for expository clarity.

the head, triggering the noun to move from NP to another functional projection-Delimit Phrase, as proposed by Zhang (2013), or Number Phrase, as proposed by Vinet and Liu (2008). However, these analyses fail to capture the semantic denotation of N-CL pairs.

First, N-CL pairs function as kindred expressions to common nouns, a point also noted by Zhang (2013). Specifically, N-CL pairs can serve as nominal arguments or predicates in the grammar, as shown in (4). Moreover, N-CL pairs and common nouns exhibit the same ambiguity in terms of definiteness and numeral interpretation: hua-duo in (4) can mean *the* or *a* flower, and the number of flowers can be interpreted as *one* or *more than one*, which is parallel to the meaning of the bare noun 'hua' (flower) as shown in (5).

(4) a. Zhe shi hua-duo
This be flower-CL
'This/these is/are flower(s)' hua-duo as an nominal predicate

b. Wo mai-le hua-duo
I buy-Par flower-CL
'I bought a/the flower(s)' hua-duo as an argument

(5) a. Zhe shi hua
This be flower
'This/these is/are flower(s)'

b. Wo mai-le hua
I buy-Par flower-CL
'I bought a/the flower(s)'

By considering the semantic interpretation of the N-CL pair *hua-duo* (4) and that of the bare noun *hua* (5), as well as their distribution, it is not obvious that the N-CL structure represents a syntactically distinct projection with a unique grammatical meaning separate from NP.

Before examining the NP-external analysis in detail, it is important to consider a another piece of evidence that has been largely overlooked in the literature: the locality constraints in N-CL pairs. The notion of locality constraints was first introduced by Arad

(2003) in the context of root interpretation, referring to the stability of meaning denoted by roots. Specifically, Arad (2003) compared root-based and word-based meaning derivations within the framework of Distributed Morphology (Marantz, 2000; Harley, 2009), where roots are interpreted in narrow syntax.

Arad demonstrates that in Modern Hebrew, a single root can generate multiple lexical items with distinct meanings under root-based derivation. In contrast, in word-based derivationsuch as *misgeret* (a frame) and *misger* (to frame)the verb is derived from the noun, and the meanings remain closely aligned, with phonological rules applying at this stage. Since the root in word-based derivation has already undergone categorisation, any subsequent categorisation does not alter its core content. This constraint is formalised as the *locality constraints* on content meaning.

Interestingly, N-CL pairs in Chinese exhibit similar locality constraints to those observed in Modern Hebrew. As exemplified in (6), the N-CL pair *hua-duo* and the classifier phrase *duo hua* denote the same lexical content, namely 'flower. A parallel interpretative pattern is observed in (7), where hua-ban and ban-hua both denote 'flower petal'.

(6) a. Wo yao mai [$_{NP}$hua-duo]
I want buy flower-CL$_{duo}$
'I want to buy flowers'

b. Wo yao mai yi [$_{CLP}$duo hua]
I want buy one CL$_{duo}$ flower
'I want to buy a flower'

(7) a. Wo yao mai [$_{NP}$hua-ban]
I want buy flower-CL$_{ban}$
'I want to buy flower-petals'

b. Wo yao mai yi [$_{CLP}$ban hua]
I want buy one CL$_{ban}$ flower
'I want to buy a flower-petal'

Given that NP and CLP are distinct syntactic projections, with CLP hierarchically projected

above NP, it is more plausible to assume that the N-CL structure represents an earlier stage before the classifier moves to CLP. At this stage, lexical content is established and remains stable throughout further syntactic projections, as demonstrated in (6) and (7).

In this dissertation, I propose that N-CL functions as a 'storeroom', where the most suitable classifier is generated and stored. This is particularly relevant in cases such as hua-duo (flower), shu-ben (book), and ma-pi (horse), where the attached classifier is silent, and the core meaning is primarily contributed by the noun. Furthermore, the N-CL storeroom also serves a semantic function. As suggested by the preliminary observations in (6) and (7), N-CL determines the core lexical content, which remains constant even when the classifier moves out of the N-CL domain.

In the following sections, I will examine this hypothesis with further data. As extensively documented in the literature, classifiers exhibit multifaceted properties. Some classifiers, such as those discussed thus far, are conventionally considered functional. Others, however, serve distinction functions, such as collective classifiers (e.g., qun, meaning 'group') that provide an aggregating function, or mensural classifiers, which often correspond to container words.

Thus, a crucial question to address is whether N-CL structures are random combinations that occur only in certain noun-classifier pairs. If this were the case, N-CL pairs could be understood as *ad hoc* lexical innovations, following Bresnan and McHombo (1995). In contrast, if N-CL structures are widespread and exhibit systematic similarities, then their formation is not merely a matter of specific lexical combinations but reflects broader structural patterns.

This chapter is organised as follows. *Section One* expands the dataset by considering more N-CL pairs in Mandarin-Chinese, and most importantly, presenting the interpretative patterns among different N-CL pairs. *Section Two* examines two possible approaches to deriving N-CL pairs: a lexicalist approach and a syntactic approach. *Section There* focuses on the semantics of N-CL pairs, particularly the distinction between content meaning and grammatical meaning. Finally, *Section Four* reviews and critically examines the available

syntactic analysis on N-CL pairs.

1.1 More N-CL pairs

This section expands the dataset by examining whether N-CL functions as an innovative, ad hoc unit or whether N-CL pairs exhibit systematic properties linked to specific structural projections.

The previous section introduced a type of noun-classifier pair and demonstrated its consistent semantic role in both N-CL and CL-N structures. To formally analyse these N-CL pairs, it is crucial to determine how their overall meaning is derived. As illustrated in (8), and exemplified by (8-a) and (8-b), the head noun primarily determines the meaning of these constructions. For instance, in the pairs *hua-duo* (flower-CL) and *shu-ben* (book-CL), the nouns *hua* (flower) and *shu* (book) provide the core semantic content. The attached classifiers contribute minimally to the overall interpretation, resulting in N-CL pairs that are nearly synonymous with their noun counterparts. In other words, *hua-duo* and *hua* are semantically equivalent. To capture this property, I use the notation $N_{full}CL_{null}$ to represent N-CL pairs that exhibit this characteristic.

(8) a. Hua-duo
Flower-CL
'Flower(s)'

b. Shu-ben
Book-CL
'Book(s)'

c. Zhi-zhang
Paper-CL
'Paper(s)'

d. Chuan-zhi
Boat-CL
'Boat(s)'

e. Mi-li
Rice-CL
'Rice'

Expanding the analysis to additional N-CL pairs, it becomes evident that the interpretative pattern of $N_{full}CL_{null}$ is not universal; variation occurs. One such pattern involves both the classifier and the head noun contributing equally to the lexical content of the pair. For instance, in (9-a) and (9-b), meaning arises from the integration of both components into a unified whole. In these cases, *hua-ban* refers to 'flower petal', while *zhi-pian* denotes 'paper slice'.

(9) a. Hua-ban
Flower-CL_{petal}
'Petals of flowers'

b. Zhi-pian
Paper-CL_{slice}
'slices of paper'

Notably, changing the classifier in such pairs leads to corresponding shifts in meaning, as seen in the contrast between *hua-ban* (petals of a flower) and *hua-duo* (flowers). Meanwhile, changing the initial nominal also results in the shift of meaning, such as 'hua-ban', when replaced 'hua' (flower) to 'ye' (leaf), the meaning of the N-CL pair changes to 'leaf-petal' accordingly. Thus, comparing to $N_{full}CL_{null}$ pattern, the overall content of 'hua-ban' involves the equal contribution of the components.

To further elaborate on this comparison, as previously discussed, in $N_{full}CL_{null}$ structures, the semantic role of the attached classifier is minimal. Removing the classifier does not lead to a loss of meaning, as demonstrated in (10-a) and (10-b). Even in the absence of the classifier, the core meaning of flower remains intact.

(10) a. Wo mai-le hua-duo
I buy-Par flower-CL
'I bought flowers'

b. Wo mai-le hua
I buy-Par flower
'I bought flowers'

However, compare (11-a) to (11-b), the meaning of hua-ban is distinct from that of hua, as the two exhibit different ontological properties. Specifically, hua-ban refers to the petal-shaped part of a flower rather than the flower as a whole. Given the non-trivial contribution of the classifier in such cases, I categorise these N-CL pairs under the $N_{half}CL_{half}$ pattern, highlighting the interdependence of both components in constructing meaning.

(11) a. Wo mai-le hua-ban
I buy-Par flower-CL
'I bought flower-petals'

b. Wo mai-le hua
I buy-Par flower
'I bought flowers'

The third pattern differs from the previous ones by positioning the classifier as the primary contributor to the overall meaning. A typical example is substance nouns combined with container classifiers, as illustrated in (12-a) and (12-b). In these cases, classifiers such as wan (bowl) and bei (cup) serve as the semantic core, determining the principal meaning of the N-CL pair. Meanwhile, the noun provides supplementary information, refining the interpretation of the classifier. For instance, in (12-a), the noun shui (water) specifies the content of the container, making the statement in (13) true only if the bowls are filled with water. Considering this interpretative pattern, I use N_{less} CL_{more} to refer to such N-CL pairs.

(12) a. Shui-wan
Water-CL_{bowl}
'bowls filled with water'

b. Shui-bei
Water-CL_{glass}
'glasses filled with water'

(13) Wo na-zhe **shui-wan** jin-wu le
I take-progressive **water-bowl** go-room par
'I am taking the **bowls (filled with water)** in the room'.

The final pattern involves the use of collective classifiers as the attaching classifier in N-CL pairs. In this pattern, the overall meaning of the pair is denote through an implicit coordination of the components. To detail, in (14-a) and (14-b), the N-CL pairs obligatorily encode two layer of meanings, first, the meaning denotes by the initial nominal, 'sheep' in (14-a) and (14-b). Meanwhile, the sense of an 'unspecified quantity' imputed by the classifiers are obligatorily conveyed.

(14) a. Yang-qun
Sheep-CL$_{group}$
'a. Sheep in a group'

'b.uncertain quantity of sheep'

b. Yang-dui
Sheep-CL$_{pile}$
'a.Sheep in a pile'

'b.uncertain quantity of sheep'

As seen in statement (15), two essential components of meaning are conveyed: first, the concept of sheep, and second, the notion of an indeterminate number of sheep within the group. In other words, collective classifiers inherently express a sense of quantity, which is embedded within the N-CL structure they occur in.

(15) Yang-qun zou-san le
Sheep-group walk-spread par
'The sheep-group got separated'

At this point, one might wonder whether these cases align with the previously discussed $N_{half}CL_{half}$ type, as both involve the integration of two meaning components. However, the answer is negative. In $N_{half}CL_{half}$ structures like hua-ban (flower petal), although both components contribute equally to the overall meaning, the N-CL pair remains restricted to a particular kind. In other words, the meaning of hua-ban still falls within the general ontological domain of hua (flower).

By contrast, in yang-qun (sheep-group), the meaning of qun (group) is not constrained by yang (sheep); rather, qun possesses its own ontological status. In this case, the integration of components operates differently. In $N_{half}CL_{half}$ structures, the combination is more abstract, occurring within a participial ontological extension-for instance, hua-ban remains within the broader category of hua. In contrast, for yang-qun (sheep-group), the coordination of components is more external in the sense that both elements provide independent ontological information, and their combination arises from merging these distinct ontologies.

To further elaborate, the assumption that collective classifiers provide independent meaning becomes more evident when they are used as stand-alone nouns. As shown in (16), unlike *qun* in (16-a), which can function independently as a noun, the use of ban in (16-b) results in strong infelicity. This contrast highlights the independent ontological status of collective classifiers. Therefore, I use the notation $N_{full}CL_{full}$ to refer to N-CL pairs with attached collective classifiers.

(16) a. Wo you wu ge qun
I have five $CL_{general}$ group
'I have five groups'

b. (?)Wo you wu ge ban
I have five $CL_{general}$ petal
'(?)I have five petals'

Based on the discussion so far, it is evident that N-CL pairs are not formed through random combination in specific cases. Meanwhile, variation exists in the degree of semantic contribution provided by each component. Summarising the key observations, a descriptive typology of N-CL pairs in Mandarin Chinese can be outlined in Table 1.1.

After addressing the other N-CL combinations, the following question to think of is whether these N-CL pairs share any systematic similarities.

The first and the most obvious one is that they all function as nominals in the grammar.

Pattern	Semantic weight between components	Example	Meaning
1	N_{full}, CL_{null}	*hua-duo*	Flower(s)
2	N_{half}, CL_{half}	*hua-ban*	Petals of flower
3	N_{less}, CL_{more}	*shui-bei*	Glasses with water
4	N_{full}, CL_{full}	*yang-qun*	Sheep in a group

Table 1.1: Descriptive typology of N-CL pairs

Previous evidence have shown the sufficient data about N-CL pairs can serve as nominal predicates and arguments, here I present another crucial evidence, that is, the same functional meaning between N-CL pairs and bare nouns.

N-CL pairs behave like bare nouns in terms of definiteness and numerical interpretation. In Mandarin Chinese, bare nouns can express both definite and indefinite meanings and are number-neutral (Cheng and Sybesma, 1999; Zhang, 2014). For instance, in the sentence *Xue-sheng you shu* (Students have books), both the subject bare noun (xue-sheng, student) and the object bare noun (shu, book) can be interpreted as singular or plural. Additionally, they can convey either a definite or indefinite reading, depending on the context.

The parallel conditions on definiteness and number interpretation are also observed in N-CL pairs, as outlined in (17), all of the previously discussed N-CL pairs can convey both definite and indefinite meanings while maintaining number neutrality.

(17) a. Jie shang you **hua-duo**
Street up have **flower-CL**
'There is/are flower(s) on the street'. $N_{full}CL_{null}$

b. Wo na-zhe **hua-ban**
I hold-pro **flower-CL**
I am holding a flower-petal/flower-petals. $N_{half}CL_{half}$

c. Xue-sheng qu na **shui-bei**
Student go pick **water-cup**
'Students go to pick up the water-cup(s)' $N_{less}CL_{more}$

d. **Yang-qun** sheng-huo zai zao-yuan
Sheep-group live on prairie
(intended)'A group/Many groups of sheep live on the prairie'. $N_{full}CL_{full}$

Further crucial systematic patterns exhibited in N-CL pairs lies in their *atomicity* in lexical content, as well as their association with the phrasal projection, the classifier phrase (CLP). To begin with the atomicity in lexical content, as noted in Table 1.1, while N-CL pairs vary in how their components contribute to meaning, they all ultimately form an atomic lexical unit. For instance, in the $N_{full}CL_{null}$ pattern, a pair like hua-duo (flower) derives its primary lexical meaning from hua (flower). Even in contrastive cases, such as the $N_{less}CL_{more}$ pattern seen in *shui-bei* (cup with water), where both components contribute meaning, the N-CL pair still denotes a unified concept-specifically, cups filled with water, and the same atomicity is exhibited in $N_{full}CL_{full}$, and $N_{half}CL_{half}$ N-CL pairs.

The consistency of atomicity in lexical content relates to *concept atomism* proposed by Fodor (1998), according to which, a simple content is non-compositional. In other words, regardless of how a complex linguistic unit is formed, its content remains indivisible. For example, the meaning of water bottle constitutes a single atomic notion rather than a compositional sum of water and bottle.

Concept atomism offers an insight about deriving the atomicity in N-CL pairs. There may be a mechanism that not only integrates the inherent meanings of a noun and a classifier-yielding a single unified concept-but also accounts for internal variation in N-CL pairs. For instance, as seen in the $N_{full}CL_{null}$ pattern, the classifier's meaning is effectively nullified and absorbed into that of the noun.

In this dissertation, I assume that this mechanism is a particular syntactic domain, which hosts both elements. Before delving into my analysis, it is essential to distinguish between two type of meanings in grammar-*grammatical meaning* and *conceptual content*-each of which requires a distinct framework for interpretation.

1.2 Grammatical meaning and Conceptual content

To begin with a broader background, one of the central topics in linguistic research is the interplay between syntax and semantics. Within the generative grammar framework, syntax is regarded as an autonomous and explanatory system that encodes speakers' tacit

knowledge of language, enabling them to acquire and develop abstract linguistic principles (Chomsky, 1995). Semantics, on the other hand, is understood as a core component of the language faculty, responsible for deriving interpretable linguistic representations. As Chomsky (Chomsky, 1995) has argued, the role of semantic theory is to explain what speakers know about the structure of their language that allows them to interpret and produce meaningful sentences. This includes understanding how syntactic structures interface with conceptual-intentional systems to generate comprehensible utterances.

Since both syntax and semantics contribute to explaining how speakers acquire tacit knowledge of linguistic meaning and structure, research in semantics is inherently linked to syntactic templates and theories. From this perspective, *the rule of construal* serves as a general framework for addressing issues at the syntax-semantics interface (von Stechow, 2012). In its simplest form, syntactic and semantic structures align, with each node directly interpreted according to the *principle of compositionality* (Frege, 1884), whereby complex meanings are derived from the systematic combination of smaller units.

Building on this, recent generative research has distinguished between grammatical meaning and conceptual content (Marantz, 2000; Borer, 2005; Panagiotidis, 2011; Acquaviva, 2014). *Grammatical meaning* follows the rule of construal, whereby new layers of meaning emerge through syntactic projection. *Conceptual content*, by contrast, provides the semantic foundation, defining the base semantic property (Marantz, 2007; Acedo-Matellán and Mateu, 2014), but remains independent of syntactic derivation.

A key question arises: while it is well known that grammatical meaning and its interpretation rely on syntactic computation, what about conceptual content? Given that conceptual content contributes distinct semantic properties, is there a syntactic mechanism that stores or regulates it?

Taking nominal expressions to illustrate. In Alexiadou et al. (2014), nomality encompasses three levels; an nominal expression can be an expression of an argument, an expression of a discourse referent, and an expression of conceptual content (Alexiadou et al., 2014, pp.38). This idea emphases distinct levels of representation within a nominal expression,

with the fundamental level being responsible for hosting the conceptual content. When a nominal expression is used as an argument, its role is determined by a corresponding syntactic projection, which identifies it as an argument.

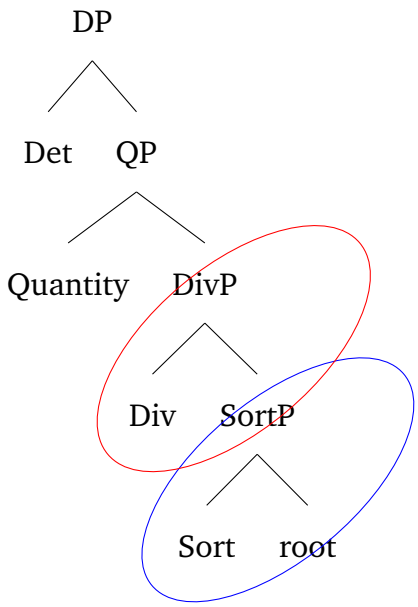
To adopt a more philosophical perspective, Alexiadou et al. (2014) distinguishes between *kind-level* and *object-level* interpretations in nominal expressions. Kind-level refers to how humans conceptualise categories, aligning with the philosophy of language concerning *sense and reference* (Frege, 1884). A kind-level framework involves identifying the sameness of objects, discovering their shared properties, and categorising them under the same 'sort'. In contrast, object-level interpretations come into play once a particular kind is established, linking an object to its corresponding category. Reflected on linguistic structures, kind-level interpretations provide descriptive content (Carlson, 1977; Zamparelli, 2014), in other words, our linguistic system is intrinsically tied to conceptual judgement, such that when we produce linguistic forms like 'water' or 'apple', these forms reflect our cognitive categorisation of real-world entities.

The linguistic domain that hosts the aforementioned *conceptual content* is root, also referred to as the *identification domain* in Borer (2009) and Hachem (2015). However, roots alone are insufficient to convey their inherent conceptual content; they require a grammatical context to become interpretable. As illustrated within the *exoskeletal* framework (Borer, 2005), a well-formed linguistic expression results from the interaction between grammatical structure and the identification domain. According to *exoskeletal*, grammatical meaning arises from syntactic projection, determining mereological properties (i.e., count vs. mass distinction), while content is encoded by roots, determining taxonomic classification.

For instance, in apples, the plural morpheme *s* is introduced at the level of DivP, which follows the root domain (as shown in (18)). Similarly, for the mass noun *water*, its uncountability is not an inherent property of its lexical entry but is determined by the syntactic structure-specifically, the absence of DivP. This distinction underscores how the linguistic system processes *conceptual content* and *grammatical meaning* at different levels. The for-

mer is more closely tied to cognitive processes and fundamental semantic properties, while the latter involves additional functional structure that contributes to morphosyntactic realization.

(18)



It is important to note that roots do not necessarily correspond directly to conceptual representations, as they operate within different networks. While roots are part of the linguistic system, conceptual representations are linked to broader cognitive structures. From a cognitive perspective, *prototype theory* (Osherson and Smith, 1981) suggests that object identification involves a two-way comparison: an object is evaluated against a set of prototypical properties stored in a pre-determined conceptual framework. However, our linguistic system does not always align perfectly with this conceptual set; it may modify or reinterpret certain concepts to fit specific grammatical contexts.

For instance, within a given syntactic structure, the conceptual content derived from a root can shift significantly from its original meaning. As observed by Acquaviva (2009), in certain Italian nouns, pluralisation combined with grammatical gender alternations can yield distinct conceptual interpretations, as illustrated in (19). A similar phenomenon is also attested in Russian (Alexiadou et al., 2014).

(19) a. membro (mas)
'member'

b. membra (fem)
'limbs'

c. membri (mas)
'members'

Building on the discussion so far, two key points emerge. First, while conceptual content is fundamental, it differs from grammatical meaning, as it remains opaque to syntactic projections. Second, the linguistic system provides a domain that interfaces with conceptual contentnamely, the root domain. However, as part of the linguistic structure, the meaning conveyed by roots does not always fully align with conceptual representations. In other words, the interpretation of roots depends on how they are integrated into the linguistic system, requiring specific syntactic and morphological mechanisms to determine their final meaning.

In semantic studies, the idea that linguistic rules modify conceptual content is not novel. As noted by McNally and Boleda (2017), just as grammatical meanings follow a well-documented compositional process, the formation of content meaning also involves a compositional mechanism. Specifically, McNally and Boleda (2017) introduce two types of compositional processes available to the language faculty: Conceptual Affordance Composition and Referential Affordance Composition. The former pertains to conceptual structures and determines content meaning, while the latter is highly context-dependent, involving the application of conceptual content to real-world referents [3].

Shifting back to the targeted structure, N-CL pairs in Chinese. As addressed, N-CL pairs exhibit atomicity in their lexical contents, and meanwhile, there is variation on the extent of contribution that N or the CL contribute in an N-CL pair. Given that N-CL pairs and bare

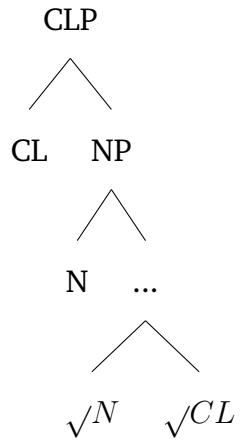
[3]For instance, in the phrase *red box*, Conceptual Affordance Composition governs the combination of the adjective red and the noun box, forming a unified conceptual unit. Once combined, *red box* functions analogously to an unmodified noun, preserving its conceptual integrity. However, in actual discourse, Referential Affordance Composition treats red box as a single referential unit. In certain contexts, the adjective red no longer serves to specify an inherent property of the noun; instead, interlocutors focus on the referent box (See more examples in McNally and Boleda (2017))

nouns denote the same grammatical meaning and the semantic variation mainly exhibited in lexical content, I decide to consider the other side of the story, the formation conceptual content.

The semantic mechanism by which two conceptual contents relate to each other is beyond the scope of this dissertation. My focus, instead, is on the syntactic domain that hosts N-CL pairs and on explaining the correlation between N-CL structure and the phrasal projection of CLP (classifier phrase).

Based on the discussion so far, a preliminary syntactic location for N-CL pairs can be posited, as shown in (20), where the noun and classifier occupy the same syntactic domain. Given that the primary variation in N-CL pairs pertains to lexical content, and that content meaning is determined by roots, I propose that the components of N-CL pairs are initially roots.

(20) Preliminary structure:



However, this assumption presents certain challenges. The existing literature largely treats classifiers as functional categories within the grammar, projecting CLP above NP. The crucial task, therefore, is to further investigate the root status of certain classifiers. At the same time, it is essential to refine the analysis of how classifiers transition from N-CL structure to CLP projection within the syntactic hierarchy.

In the following section, I will examine the correlation between N-CL pairs and CLP. For clarity, I will use the term content meaning to refer to conceptual content, as content meaning is more directly related to linguistic structures, whereas conceptual content extends beyond the realm of linguistics.

1.3 Structural Locality of Lexical Meaning

To briefly recall the concept of locality constraints, as proposed by Arad (2003), roots encode inherent content meaning but must be categorised to become interpretable. The first categoriser assigned to a root plays a crucial role in determining its content meaning, which becomes fixed upon categorisation.

For instance, if a root is assigned a nominal categoriser, as in *misgeret* (frame), the content meaning of frame is established. Even if a second categoriser, such as a verbaliser, is later applied-deriving *misger* (to frame)-the core content meaning of frame remains unchanged. This illustrates how categorisation constrains interpretation, with the initial categorisation being fundamental in determining the roots linguistic realisation.

With regard to N-CL pairs, as introduced earlier, a similar locality constraint can be preliminarily observed in $N_{full}CL_{null}$-type N-CL pairs. Specifically, when the attached classifier is positioned prenominally, the content meaning established within the N-CL pair remains unchanged, as exemplified in (21) and (22).

(21) a. Hua-duo
Flower-CL_{duo}
'Flower'

b. San duo hua
Three CL_{duo} flower
'Three flowers'

(22) a. Shu-ben
Book-CL_{ben}
'Book'

b. San ben shu
Three CL_{ben} book
'Three books'

This section aims to examine whether this semantic restriction holds across all N-CL pairs,

laying the groundwork for a unified and systematic analysis of N-CL structures. To achieve this, I use the general classifier 'ge' as the diagnosis tool.

The classifier ge has been widely analysed as a general classifier in Mandarin Chinese (Myers et al., 1999; Yang, 2001; Chen, 2003; Zhou, 2024). Its general function is evidenced by three key characteristics. First, ge can combine with a wide range of nouns in Mandarin Chinese, irrespective of their semantic content (as demonstrated in (23) - (25)).

(23) Yi ge xiang-fa/gai-nian/you-xi
One CL thought/notion/game
'one thought/notion/game' One+Ge+Abstract nouns

(24) Yi ge shu/bi/lou
One CL book/pen/building
'one book/pen/building' One+Ge+Count nouns

(25) Yi ge ren-qun/huo-dui
One CL people-group/fire-pile
'one people-group/fire-pile' One+Ge+Compound

Second, ge is highly productive among native Chinese (L1) speakers. Specifically, Myers et al. (1999) found that L1 Chinese speakers tend to use ge when certain nouns lack a specific matching classifier. In other words, when a noun-classifier pairing is uncommon, *ge* is used instead. This is especially common with abstract nouns (as shown in (23)), where it is difficult to find a suitable classifier, so ge is employed to classify them.

Third, From a semantic perspective, ge does not impart additional semantic contents. Specifically, the obligatoriness of classifiers in Chinese reflects the 'sum' denotation of NP (Rothstein, 2011; Landman, 2016; Tsoulas and De Vries, 2023): that is, NP functions as a predicate over both atoms and joint-atoms. As suggested by Rothstein (2011); Li (2011b), the classifier phrase acts as a partitioning domain, dividing NP into countable units that

can then be quantified by numerals. Unlike most classifiers, however, ge does not introduce a kind-term [4], as shown in (ii) in the footnote, ge lacks any content-related conjunct, meaning it introduces no additional semantic features beyond individuation. This is reflected in its widespread compatibility with bare nouns across Chinese, confirming that ge functions purely as a counting tool.

Building on this, my analysis proceeds as follows. I adopt the view that ge functions as a placeholder for CLP (Zhang, 2013) and is consistently projected at CLP. Based on this assumption, I compare the structures [ge N-CL] and [CL-N], where the classifier (CL) appears in different positions. The key focus is the lexical content of these two classifier phrases. Given that ge is semantically neutral, if both structures yield identical content meanings, this would suggest that the source of content meaning originates within the lower syntactic domain-specifically, the N-CL pair itself.

1.3.1 N-CL and CL-N

To begin with $N_{full}CL_{null}$ and $N_{half}CL_{half}$ pairs. A strong locality constraint of the content meaning between certain N-CL pairs and the phrasal projection of CLP is observed. As shown in (26), a parallel interpretation holds between the two statements, both referring to the requirement for flowers. The N-CL pair *hua-duo* and the classifier phrase CL-N *duo-hua* each denote the meaning of flower.

(26) a. Wo xu-yao yi ge **hua-duo**
I need one $CL_{general}$ flower-CL_{duo}
'I need a flower'

[4]For instance, as defined in Li (2011b), the classifier juan (roll) contributes additional content information beyond mere individuation. In (i), the capital **K** represents the kind variable (the denotation of NP), while the lowercase k is a contextual variable selecting a specific kind. The classifier juan encodes content meaningspecifically, the notion of rollwhich functions as a contextual kind-term. This added information allows the bare noun to be counted while also establishing a kind-term for it

(i) $|juan| = \lambda\mathbf{K}\lambda x.\pi(x) \in (^{\cup}\mathbf{K} \cap k) \wedge Roll(\pi(x) \wedge \pi_2(x)) = k$

(ii) $|ge| = \lambda\mathbf{K}\lambda x.\pi(x) \in (^{\cup}\mathbf{K} \cap k) \wedge \pi_2(x) = k$

b. Wo xu-yao yi **duo hua**
I need one CL_{duo} flower
'I need a flower'

(27) a. Wo xu-yao yi ge **hua-ban**
I need one $CL_{general}$ flower-CL_{petal}
'I need a flower-petal'

b. Wo xu-yao yi **ban hua**
I need one CL_{petal} flower
'I needs a flower-petals'

A similar pattern is observed in (27), where both [ge hua-ban] and [ban hua] convey the meaning 'a flower petal'. This consistency suggests that the attached classifier serves a specific role, regardless of whether it appears within the NP or is projected as a classifier in CLP. In other words, in these cases, the content meaning of both types of N-CL pairs is determined in accordance with locality constraints.

However, the situation becomes more complex due to the strong application of the *elsewhere condition* in certain N-CL pairs, which prevents the co-occurrence of ge and a specified classifier in these two structures. As noted by Andrews (1990); Poser et al. (1992); Ackema and Neeleman (2001), the *elsewhere condition* describes a scenario in which a general morphological form competes with a more specific one, typically leading to the blocking of the general form. A well-known example from English is the formation of comparative adjectives: the suffix 'er' is preferred over the more general form 'more', which is blocked by the more specific suffix.

In the sequence [ge N-CL], illustrated in (28-a) and (29-a), the combination of ge with the N-CL pairs 'ma-pi' and 'chuan-zhi' results in strong infelicity. To classify the nouns ma (horse) and chuan (boat), one of two options must be followed: they must either take their default classifiers-pi for ma (28-b) and zhi for chuan (29-b)-or be directly classified by ge (28-c), (29-c).

(28) a. *Wo yao yi ge ma-pi
I want one $CL_{general}$ horse-CL
'I want a horse'

b. Wo yao yi pi ma
I want one $CL_{default}$ horse
'I want a horse'

c. Wo yao yi ge ma
I want one $CL_{general}$ horse
'I want a horse'

(29) a. *Wo yao yi ge chuan-zhi
I want one $CL_{general}$ boat-CL
'I want a boat'

b. Wo yao yi zhi chuan
'I want one $CL_{default}$ boat'
'I want a boat'

c. Wo yao yi ge chuan
I want one $CL_{general}$ boat
'I want a boat'

Examples like these form a minimal pair with N-CL pairs such as *hua-duo* and *hua-ban*, where the co-occurrence of *ge* and a specified classifier is permitted, as shown in (30). Thus, apart from the locality constrains, this variation also needs to be addressed.

(30) a. Wo yao yi ge hua
I want one $CL_{general}$ flower
'I want a flower'

b. Wo yao yi ge hua-duo
I want one $CL_{general}$ flower-$CL_{default}$
'I want a flower'

c. Wo yao yi duo hua
I want one $CL_{default}$ flower
'I want a flower'

Turning to N_{less} CL_{more} and N_{full} CL_{full} pairs, these structures can consistently combine with the general classifier ge without triggering the elsewhere condition, as illustrated in (31-a)

and (32-a).

(31) a. Wu li you san ge shui-bei
Room in have three $CL_{general}$ water-cup
'There are three cups (with water) in the room'

b. Wu li you san bei shui
Room in have three CL_{cup} water
'There are three cups of water in the room'

(32) a. Wu wai you san ge yang-qun
Room out have three $CL_{general}$ sheep-group
'There are three sheep-groups outside the room'

b. Wu wai you san qun yang
Room out have three CL_{group} sheep
'There are three groups of sheep outside the room'

When it comes to locality constraints, however, the content meaning of N_{less} CL_{more} and N_{full} CL_{full} pairs collapses when the classifier is placed prenominally. For instance, in the N-CL pair *shui-bei*, the nominal items meaning is coerced into the meaning denoted by the classifier, leading to a situation where the classifier carries greater semantic weight within the N-CL pair, as shown in (31-a). However, when the N-CL sequence is reversed into the CL-N order, the unified meaning established in N-CL no longer holds. As seen in (31-b), both the classifier and the noun independently contribute substantive information.

Similarly, in *yang-qun* (32-a), the inherent meaning of the N-CL pair is lost when the classifier phrase is reordered as [qun yang] (32-b), where the components contribute independent semantic content. In (32-a), san ge yang-qun forms a phrase in which ge classifies *yang-qun* (sheep-group), and the numeral san (three) quantifies the entire classifier phrase. Here, the phrase refers to three distinct groups of sheep. However, when qun functions as a classifier, as in (32-b), its inherent content meaning is no longer tied to the N-CL pair but instead functions independently. As a result, 'san qun yang' quantifies only the noun yang (sheep), rather than the N-CL pair as a whole.

To summarise the characteristics of N-CL pairs, as presented in Table 1.2, these structures exhibit systematic grammatical patterns, particularly in terms of their consistency and atomic content meanings. Additionally, N-CL pairs maintain a semantic relationship with the functional projection of CLP, as the content meaning established within N-CL pairs remains unchanged in the CLP. This reinforces the idea that N-CL is not merely an innovative lexical combination but instead follows systematic principles.

Type	Interpretative pattern	Example	Content meaning	Locality constraints
1	N_{full}, CL_{null}	*hua-duo*	Flower(s)	✓
2	N_{half}, CL_{half}	*hua-ban*	Petals of flower	✓
3	N_{less}, CL_{more}	*shui-bei*	Glasses with water	✗
4	N_{full}, CL_{full}	*yang-qun*	Sheep in a group	✗

Table 1.2: Descriptive typology of N-CL pairs

However, internal variation exists within N-CL pairs. In certain cases, the elsewhere condition applies strongly, preventing the sequence [ge N-CL] from occurring. Meanwhile, in other cases, locality constraints do not hold. Specifically, in N_{full} CL_{full} and N_{less} CL_{more} pairs, the content meaning of the N-CL pair is disrupted when the classifier is placed prenominally.

Thus, in the following analysis, adopting a unified approach to the formation of N-CL pairs is essential, while also accounting for the underlying reasons behind their internal variations. In the next section, I will present the two main approaches to deriving N-CL pairs-the lexical approach and the syntactic approach-followed by an examination of existing analyses of Chinese N-CL pairs.

1.4 Deriving N-CL pairs: previous analyses

The first attempt was resembling N-CL pairs to nominal compounds in Li (2011b). As previously discussed, N-CL pairs complicate the categorisation of classifiers. If the functional/lexical division were accurate, functional classifiers-which are conventionally assumed to serve a counting function (Cheng and Sybesma, 1999)-should not combine directly with a noun. This is evident in the case of the general classifier *ge*, where the form '*N-ge*' is unattested.

However, as previously exemplified, this prediction is not borne out. Presumed functional classifiers, such as duo, ben, and pi, can all form N-CL pairs, challenging the expected functional-lexical distinction. In response to this issue, Li (2011b) interprets N-CL pairs as reflecting the nominal nature of classifiers.

More specifically, classifiers are assumed to possess nominality, though the degree of nominality varies. Three categories are identified. First, classifiers with high nominality, typically container words, as they can be used independently as nouns (33-a). Second, classifiers with minimal nominality, which cannot be used as nouns in the grammar; typical examples include the classifiers ge, mei, and zhi, which always function as pre-nominal classifiers. Third, classifiers with intermediate nominality, which retain less nominality than container words but more than ge; these classifiers typically combine with another morpheme to form a compound, as illustrated in (33-b) and (33-c).

(33) a. Yi ge bei/wan/ping
One $CL_{general}$ cup/bowl/bottle
'A cup/bowl/bottle' Classifier with high nominality

b. Yi ge hua-duo
One $CL_{general}$ flower-CL_{duo}
'A flower' Classifier with intermediate nominality

c. Yi ge shu-zhi
One $CL_{general}$ tree-CL_{branch}
'A tree-twig' Classifier with intermediate nominality

This analysis proposes a solution for deriving N-CL pairs by treating them as lexical compounds. The underlying rationale is that classifiers inherently possess nominal properties-specifically, the more nominal a classifier is, the more likely it is to combine with a noun to form a compound. However, this explanation is overly simplistic, as it neither specifies the precise mechanism by which a classifier integrates with a noun nor accounts for the compounding process in Chinese.

1.4.1 Compounds in Chinese

Compounding is a productive in Mandarin Chinese [5]. A Chinese compound consists of two or more *zi* (a monosyllabic element that conveys a specific meaning). Previous research have attempted to analyse MC compounds through different lenses, such as using syntactic approach to derive compounds in Huang (1998), using categorial grammar to address the categorial status of compounds in Liu (1986), and typological generalisation from Ceccagno and Basciano (2007).

Ceccagno and Basciano (2007) generalise three macro types to classify compounds in MC: *subordinate compounds*, *attributive compounds*, and *coordinate compounds*. Each of these macro types can further be categorised as either *endocentric* or *exocentric* compounds.

First, the components within *subordinate compounds* exhibit a head-argument(or argument-head) relation. For example, in *zhi-yao* (produce-medicine), *zhi* (produce) is the head element, as indicated by the semantic meaning of (34-a), 'to produce something'. If the argument *yao* (medicine) is replaced with a different item, such as *yi* (cloth), the base meaning 'to produce' would remain constant, while the overall meaning changes to 'cloth-producing'. The same pattern exhibits in (34-b) and (34-c).

(34) a. Zhi_V-yao_N
Produce-medicine
'Produing-medicine' (Verbal head-nominal argument)

[5]For example, in the investigation from Zhou et al. (1999), nearly 70% words in Mandarin-Chinese result from compounding. In another study from Xing (2006), the number raises to 80%

b. Shang$_N$-pin$_N$
Business-item
'Commodity' (Non-verbal head-nominal argument)

c. Deng$_V$-gao$_{Adj}$
Climb-high
'Rising' (Verbal head-adjective argument)

The second type of compounds, *attributive compounds*, present a modifier-modifiee relation between the components, see (35), in **Da-dan**, **Xin-xian**, **Cha-se**, the initial components serve as the modifier to the second components.

(35) a. Xue-sheng zhen **Da-dan**
Student real **Big-gall**
'Students are really **brave**'

b. Zhe shi ke zhen **Xin-xian**
This thing such real **New-fresh**
'This is such a **new** thing'

c. Wo bu xi-huan **Cha-se** de bao
I no like **Tea-colour** Mod bag
'I don't like the bag with the **colour of tea**'

Components in *coordinate compounds* reveal a *logical coordination*, meaning that there is a hidden '*and*' meaning between two components. As shown in (36), in the examples, there is no clear semantic head in each example, and the overall meaning is derived from the combination of both components.

(36) a. Zhan-sheng
Beat-victory
'Beat and win'

b. Bian-geng
Change-update
'Change and reform'

c. Hu-xi
exhale-inhale
'exhale and inhale, breathing'

Building upon a corpus analysis of these three macro types, Ceccagno and Basciano (2007) contend that the headedness in MC compounds are parallel to that of phrasal projections. Subordinate compounds are left-headed, aligning with the general word order in Mandarin-Chinese,SVO. The word order between modifier and modifiee in attributive compounds is also line with the MC phrases, in which the modified element is preceded by a modifier [6].

A similar argument is proposed by Huang (1998), who also adopts a syntactic analysis of Mandarin Chinese (MC) compounds. He assumes that the Chinese lexicon aligns with general structural principles, whereby any two lexical items concatenated by syntactic rules can form well-formed compounds.

Specifically, unlike languages with a clear categorial head in compoundssuch as Romance languages, where most compounds are right-headed (Scalise, 2011; Corbin, 2012)Mandarin Chinese lacks a distinct morpheme that determines the category of a compound. This is particularly evident in the productivity of exocentric compounds in Mandarin.

As shown in (37) and (38), the lexical category of which are not determined by the components inside the compounds. In the combination of [verb-noun] in (37-a), neither the verb nor the noun defines the category of the compound, since the category for (37-a) is an adjective [7]. Analogously, *da* and *xiao* are adjective modifiers when used independently, while the compound *da-xiao* serves as an nominal item, as indicated in the sentence (38-b).

(37) a. kai-xin
open$_V$-heart$_N$
'happy$_{Adj}$'

b. Wo xian-zai **kai-xin**
I right-now **open-heart**
'I am **happy** now'

[6] See detailed analysis in Ceccagno and Basciano (2007), in which more sub-classifications of these three macro types are attested.

[7] See more statistic analyses in Huang (1998), in which different patterns of compounds in Mandarin-Chinese were analysed. To sum up, Chinese compounds results from 'syntactic compounding', meaning that each component within a compound is a phrase, and the combination of components are actually phrasal combinations, conforming to syntactic requirements

(38) a. da-xiao
big$_{adj}$-small$_{Adj}$
'Size$_n$'

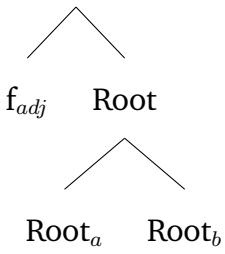
b. Xie **da-xiao** he-shi
Shoe **big-small** correct
'The **size** of the shoes is correct'

In the meantime, the meanings of them are not a result of composing each element nor is there an element that contributes the core meaning for the compounds. Rather, as shown in the glossaries of (37-a),(38-a), idiosyncratic meanings arise. Based on these evidence, Huang (1998) suggests that Chinese yields a headless morphological structure.

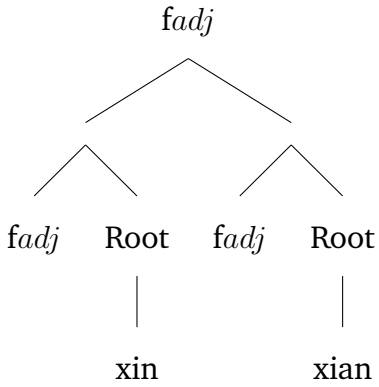
Building upon the data and analysis from Huang (1998), Zhang (2007) uses the tool '*root merger*' to explain how compounds are formed in. Generally, before they acquire any categorial feature like N, V, or A, lexical elements are considered roots. Compounding occurs when two roots combine, a process known as root merger. Initially, roots exist in their simplest forms without any syntactic features. They need to merge with a categorial head to become a valid element in the grammar.

Referring back to compounds *kai-xin (happy)* and *da-xiao (size)*. Kai-xin is not a result of combining a verbs with a noun, but it is a functional head-*f* merges with the root merger, see (39). The same template is present for *da-xiao (size)*, only in which case, the functional head is N.

(39)



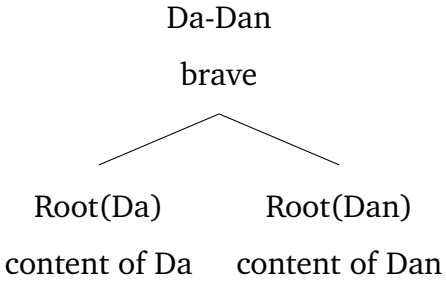
(40)



The proposal of (39) is also transparent to other type of compounds, such as the modifiee-modifier type, *Xin-xian (new fresh)* in (35). In this case, the merger is projected by the modifiee. As shown in (40), both a modifier and a modifiee within a compound are pre-categorised. The categorial feature of such a compound is inherited from the modified component, the f_{adj} from *xian (fresh)*.

Therefore, following the structure from Zhang (2007) that MC compounds result from root merging, there is a solution for the idiomatic meaning in attributive compounds. Schematically see (41), da and dan convey their content information, and these two segments are combined through root merger, culminating the complex roots- *Da dan*. At this point, the idiomatic meaning-*brave* is assigned.

(41)



On the contrary, for those compounds without idiomatic meanings, such as *subordinate compounds*, and *coordinated compounds*, they are combined after assigned with categorising heads. For instance, the compound '*Deng-gao*(climb up)', it consists of a verb-*deng* and an adjective-*gao*. As addressed previously, an idiosyncratic meaning is assigned within the root level, since the roots (deng and gao) are already categorised, the meaning of the compound is a simple combination of the components.

Shifting the focus to N-CL pairs, if N-CL pairs were merely a subclass of compounds in Mandarin Chinese, we would expect them to exhibit similar patterns in meaning formation and syntactic roles.

However, N-CL pairs present a mismatch: while they encode *non-compositional* content meaning, they exhibit compositional behaviour in terms of their syntactic distribution.

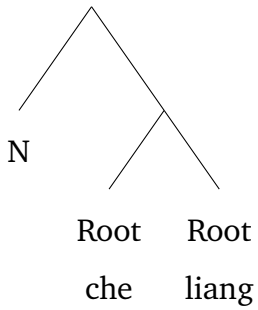
This distinguishes them from the compounds discussed thus far.

First, as addressed, N-CL pairs are nominal items, as they share the same argument position with Chinese bare nouns, as shown in (42). Following the discussion of compounding so far, there are two possible structures for N-CL pairs. Using the N-CL pair '*che-liang*' as an example, the first structure (as shown in (43-a)) involves two uncategorised roots merging first, and then being categorised by the N head. This is similar to the attributive compound discussed in (41). In the second structure (as shown in (43-b)), each root receives a categorising head before they merge together.

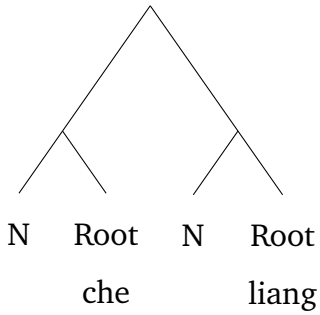
(42) a. Lu shang mei you **che**
Road up Neg have car
'There are no cars on the street'

b. Lu shang mei you **che-liang**
Road up Neg have car-CL
'There are no cars on the street'

(43) a.



b.



Neither structure is ideal for 'che-liang'. The main issue with the first structure (43-a) is

the flexible position of the attached classifier. In N-CL pairs, the classifier can precede the head noun, functioning as the classifier for that noun (as shown in (44)). If N-CL pairs form a unified construction where two roots are merged before being categorised as a noun, it becomes problematic to move a single root out of the established domain, since an uncategorised root is not sufficient to undergo syntactic operations (Marantz, 2000; Borer, 2009; Panagiotidis, 2011).

(44) a. Che-liang
Car-CL
'Cars'

b. San liang che
Three CL car
'Three cars'

In the coordinated structure shown in (43-b), the issue lies with the semantic content. If the components are arranged as shown in (43-b), both *che* and *liang* are expected to contribute equally to the meaning of the compound *che-liang*, analogous to the compound '*hu-xi*' (exhale-inhale), wherein both hu and xi contribute equal lexical content for the compound. However, this expectation is not met, as *che-liang* simply means *che* (car), where only the head noun provides substantive information, while the attached classifier remains semantically silent.

Therefore, a key difference between the nominal compounds and N-CL pairs lies in how their meanings are formed. In compounds, meaning often emerges through a clear compositional process with an insertion of idiomatic meaning (if applicable). For instance, in 'kai-xin' (happy) and 'da-dan' (brave), the idiomatic meaning emerges from the combination of individual morphemes. Such a pattern is also evident in subordinate compounds, attributive compounds, and coordinate compounds [8]. More importantly, these compounds are non-decomposable both in form and meaning. In other words, removing one mor-

[8]For instance, for the subordinate compound 'zhi-yao' (producing-medicine), the lexical content is built upon the combination of 'zhi' and 'yao'. Similarly in hu-xi (exhale-inhale), a coordinate compound, the concept of breathing is conveyed by combining exhaling and inhaling.

pheme from ‘kai-xin’ would result in the collapse of the intended lexical meaning.

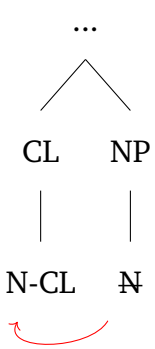
In N-CL pairs, however, there are instances such as ‘che-liang’ (car), ‘hua-duo’ (flower), where only one morpheme contributes to the lexical content. Conversely, in some cases, the classifier provides the core meaning, as seen in ‘shui-bei’ (water-cup), which denotes *a cup filled with water*. Despite the fact that the noun and classifier together form a unified semantic unit in N-CL pairs, they remain decomposable in form.

Consequently, treating N-CL pairs as nominal compounds is not ideal. This leads to the second available analysis in the literature: the NP-external approach, which posits that N-CL pairs arise from a functional projection.

1.5 NP-External Approach

Following the consensus on the functional status of classifiers, the NP-external approach accounts for N-CL movement. As illustrated in the general template (45), this approach maintains that N-CL retains a distinct semantic meaning, separate from both CLP and NP. Specifically, the N_bP proposal from Vinet and Liu (2008), and DelP analysis from Zhang (2013).

(45)



1.5.1 N-CL as N_bP

Vinet and Liu (2008) proposed that N-CL words represent a different type of plurality, *group plural*. Generally, in in formal semantics, the denotation of plurality, mass, and

count is one of the essential issues, the leading approaches are *atomicity* approach (Link et al., 1983; Chierchia, 1998; Krifka, 1995), *disjointness-based* approach (Rothstein, 2011; Landman, 2016).

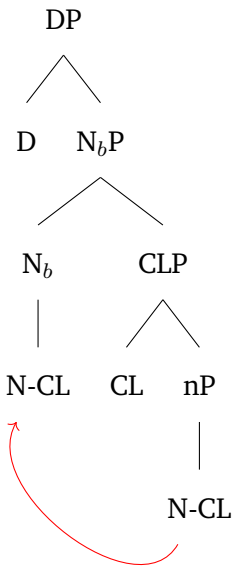
Vinet and Liu (2008) utilise the atomicity-based model to analyse nominal denotations in Mandarin Chinese, identifying four noun classes: *Kind, Individual, Mass, Group*. This four-way typology is based on the feature [$\pm atom$, $\pm singulative$].

Under this analysis, N-CL words encode the feature: [+atom, ∅ singulative], making them a group-denoting predicate. The feature [+atom] is reflected by the fact that N-CL compounds denote the meaning '*a collection/group of*'. The [-singulative] feature makes them lack the indication of part-whole relation. In other words, N-CL pairs denotes a non-cumulative atom.

When it comes to syntax, N-CL pairs are formed within NP domain, and then moved to the Number Phrase (notated as N_bP). See (46), the Number Phrase is above the CLP. Notably, the number phrase here is distinctive from the position for cardinal numbers. Cardinal numbers are assumed as Num head, while a Number Phrase hosts plural affixes. A key challenge for this analysis, however, is the empirical issue of accounting for the co-occurrence of a general classifier alongside an N-CL pair.

Specifically, as enclosed in the previous section, the general classifier *ge* can precede most of the N-CL pairs and form a classifier phrase. Which challenges the structure (46). Since in (46), an N-CL pair is higher than the CLP, disallowing the constituent '[ge N-CL]'. Second, the elimination of cardinal number remains untouched. Under this analysis, a numeral classifier phrase and a N_bP are in the complementary distribution, they represent two types of plurality in the grammar. '[Numeral-Classifier-Noun]' is cumulative, while [N-CL] in non-cumulative.

(46) N_bP analysis



If, as they assert, N-CLs are non-cumulative, then they should be infelicitous with measuring phrases. In Mandarin Chinese, a measuring phrase typically follows the word order *Numeral-Classifier-(de)-Noun*, where de acts as a crucial marker to distinguish measuring phrases from counting classifier phrases, as noted by Rothstein (2010); Li (2011b).

(47) San ke/wan/*ge (de) shui
Three gram/bowl/*ge (de) water
'Three gram/bowl of water.'

The key difference between counting phrases and measuring phrases is that substance nouns, such as 'shui' (water), can only be classified by container words or measuring units, as illustrated in (47). Furthermore, a substance noun can consistently accommodate the insertion of de, while other nominal may not (e.g. *san duo de hua, meaning three CL de flower).

A common semantic property shared by mass nouns and plural nouns, as discussed in Quine (1960), is their allowance for cumulative inference. For instance, a portion of water is still considered water, and similarly, a portion of apples is still apples. Given this, if

N-CL pairs belong to a different semantic class, we would expect them to be infelicitous in measuring contexts.

However, as shown in (48), both the mass noun 'shui' (water) and the group plural 'N-L 'hua-ban' (petals of flowers) are felicitous in measuring contexts. This suggests that hua-ban behaves similarly to mass-denoting nouns like 'shui' (water).

(48) a. Hai-zi he-le **san jin de shui**
kid drink-Par **three CL de water**
'the kid drank fifteen grams of water'

b. Hai-zi mai-le **san jin de hua-ban**
kid buy-Par **three CL de flower-CL**
'the kid bought fifteen hundred grams of petals [9] '

1.5.2 N-CL as DelP

Zhang (2013) uses a similar approach but decomposes the N-CL pair into N and CL, under which, the internal noun of the N-CL is derived from NP, whereas the attached classifier places at the functional projection-Delimitable Phrase (DelP). This analysis is built upon the two essential features-*numerability* and *delimitability* in Chinese nouns.

A numerable noun can combine with a cardinal number directly (such as English-type languages), and a non-numerable noun needs a classifier system between a cardinal number and an nominal item (such as Chinese, Japanese). The novelty of the proposal lies in the focus on the feature-delimitability. Delimitability defines the shape, size, or dimension of an entity. Typically, the container classifier- *bei* 'glass' is delimitable, and it has the [+delimitable] feature. Morpho-syntactically, see (49), nouns with [+Delimitable] feature can be modified by shape/size-relating modifiers. On contrary to [-Delimitable] nouns (49-b), which shape/size-relating modifiers are not allowed to combine with.

(49) a. Chang/Yuan zhuo
long/round table

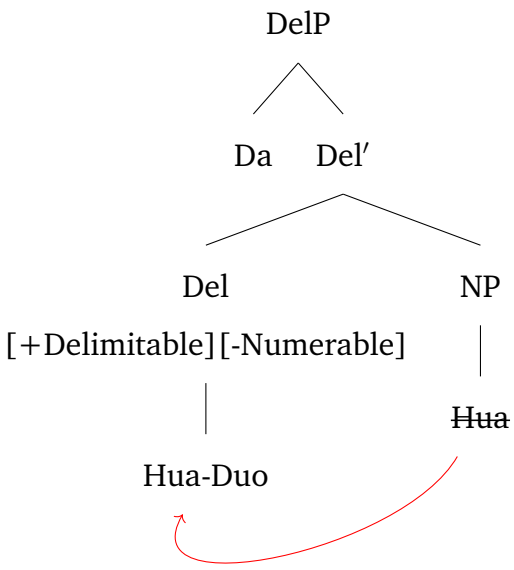
[9] Jin a measuring unit in MC, one jin roughly equals to five hundred grams

'a long/round table' delimitable modifier+delimitable noun

b. *Chang/Yuan jian-yi
long/round advice
'a long/round advice' delimitable modifier+non-delimitable noun

Applying the feature variation into phrasal projection, classifiers are fundamentally expressions of unit [10], and there is variation about the encoding of [+Delimitable] feature, some unit words are delimitanle while some units are non-delimitable. N-CL compounds are assumed as intrinsic delimitable lexical items with [+Delimitable] [-Numerable] features, based on the fact that all N-CL compounds can be modified by a delimitable modifier and are not compatible with numerals. Consequently, N-CL pairs are placed at DelP. Schematically, for the N-CL pair *Hua-Duo*, as shown in (50), the internal classifier is the Del head, and it selects for an NP as its complement. After this, the nominal moves from NP to the Del head, forming an N-CL pair. A delimitable modifier merges at the specifier position of the Delp, functioning as an intersective modifier.

(50) Syntactic position for N-CL compounds and delimitable modifiers

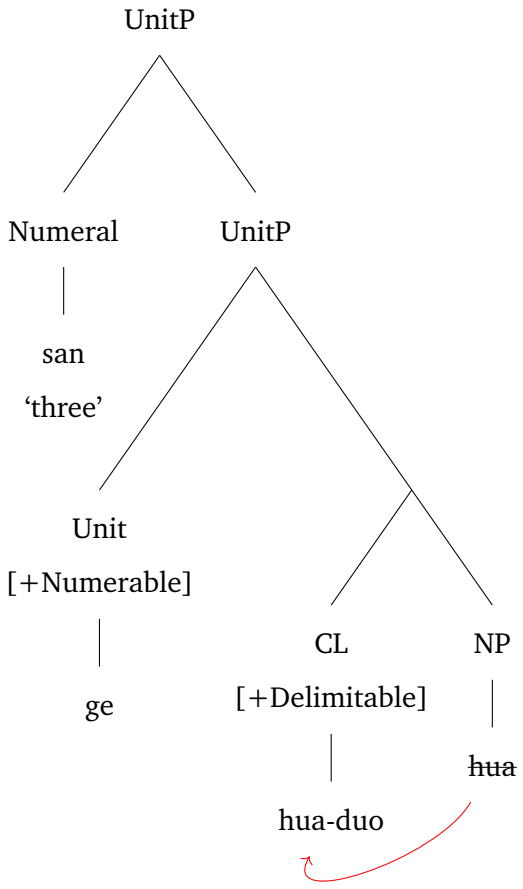


[10]A different syntactic analysis is made for Numeral Classifier Phrases, in which classifiers are heads of UnitP, and numerals are specifiers of UnitP

Moreover, her analysis explains the co-existing between *ge* and an N-CL pair. As outlined in the previous paragraph, N-CL pairs cannot combine with numerals to form an numeral expression, implying their encoding of [-Numerable] feature. In order to enumerate an N-CL pair, the general classifier *ge* is required, as in the phrase '*san ge hua-duo*'.

Under this view, classifiers can have a upper copy and a lower copy, ge is located at the higher position, as the head of a UnitP. The compound-internal classifier resides at the lower position. Therefore, the distribution of each element in '*san ge hua-duo*' is shown in (51), the upper classifier contribute minimally to the semantics, its primary function is to link the N-CL compound to a cardinal number.

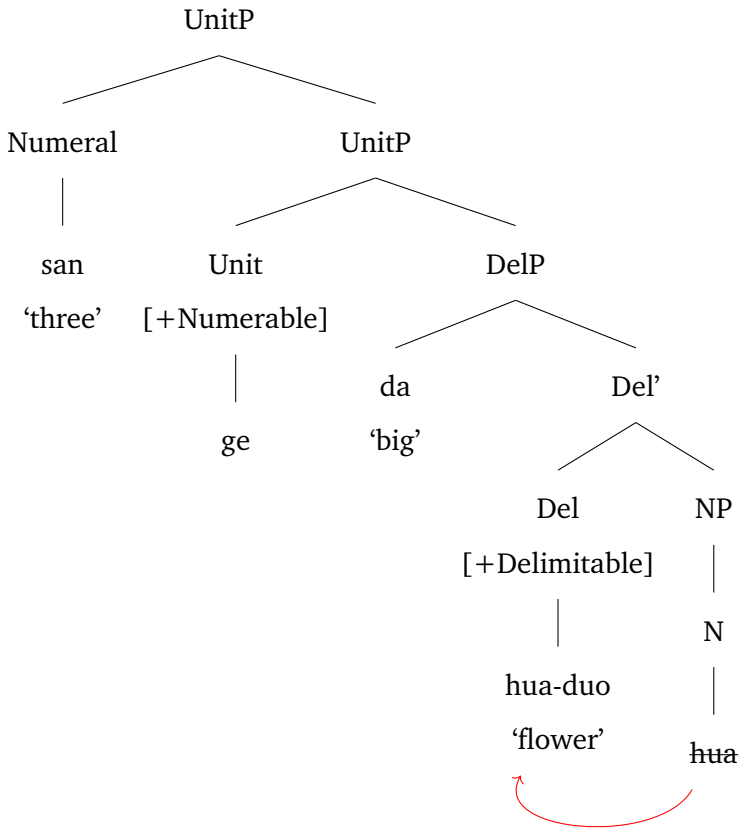
(51) Derivation of 'san ge hua-duo'



The two classifiers mainly differ in the features encoded in them. Consequently, when

merged a degree modifier such as *da* 'big', only the lower classifier is the possible to accept it due to the [delimitable] feature, and the phrase *san ge da hua-duo*' is schematised as shown in (52).

(52) Derivation of 'san ge da hua-duo'



Regarding this analysis, the first question arises is the property of the delimitable modifier. On contrary to other type of modifiers, delimitable modifiers are unsaturated, defining a property of a modifiee. Moreover, the syntactic position of a delimitable modifier is determined by the Del head, in a way that only the modifiers with the same semantic class are selected. Therefore, an N-CL compound can be modified by a delimitable adjective. However, empirical data exhibit a more complicated picture such that a non-delimitable adjective is also possible to precede an N-CL.

As evidenced in (53), a colour adjective *fen* 'pink' can be seamlessly placed between the

compound '*hua-duo*' and the higher classifier '*ge*', functioning as an attributive modifier to the compound. According to the established framework, '*fen*' is expected to be the specifier of DelP as a delimitable modifier, but this cannot be the case.

(53) san ge **fen** hua-duo
three ge **pink** flower-CL
'three pink flowers'

To begin with the definition of *delimitability*, Jespersen (1924) defines delimitable words as those that always involve a specific shape or clear boundaries, such as words for shape or size. Non-delimitable expressions lack concrete or physical boundaries, typical examples are abstract nouns and mass nouns such as water, happiness. In other words, delimitable words convey a sense of **determinacy**, whereas non-delimitable ones do not.

Revisiting the denotation of the adjective *fen*. It is evident that, as a colour-defining adjective, it inherently embodies a degree of **indeterminacy**. Consider, for instance, the statement '*the flower is pink*'; its truth condition is contingent upon contextual factors. In a scenario where a single pinkish flower is amidst a cluster of predominantly green ones (illustrated in Figure 1.2), the assertion holds true, even if the pink hue is present only to a minimal extent on the particular flower.

Figure 1.2: 'The flower is pink' is true

However, if the same flower is situated among a group of fully pink blooms (as depicted in Figure 1.3), the statement becomes false. Therefore, colour adjectives, as argued by Rothschild and Segal (2009); Kennedy and McNally (2010), are indeterminate and context-

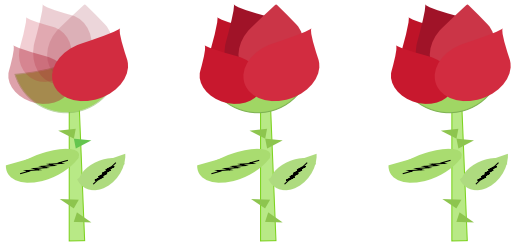


Figure 1.3: 'The flower is pink' is false

dependent predicates. Owing to their lack of determinacy, colour adjectives do not qualify as delimitable modifiers. Consequently, the structural configuration exemplified in (51) presents challenges; it appears that the presence of the feature [+delimitable] serves as the driving force for the incorporation of a preceding modifier when a colour adjective intervenes in between.

(54) san ge **da fen** hua-duo
three CL **big pink** flower-CL
'three big pink flowers'

Second, the condition of 'adj+adj' before an N-CL posits another challenge to the proposal of DelP shown in (52). Using the adjective *da* to illustrate, as shown in (54). There are two modifiers before the compound, and the delimitable adjective *da* precedes the non-delimitable colour adjective '*fen*'.

This condition causes controversies to the the proposal that the del head triggers the adjoinment of delimitable modifiers as its specifier. If this were the case, a non-delimitable modifier cannot intervene between Spec and the Del head due to the feature mismatch. This is also pointed out by Zhang, 2013, pp.16, in which certain delimitable modifiers can also be used an intensifying modifiers. But the derivation for the duel usage is not clear. In other words, what triggers the intensifying use and what triggers the delimitable use?

Furthermore, the condition of 'adj+adj' prompts another inquiry regarding the head of the N-CL pair. The ordering of *size* $\succ$ *colour*, as depicted in (54), aligns with the proposed adjective hierarchy Scott (2002); Cinque et al. (1994), where the co-occurrence of pre-

nominal adjectives adheres to a predetermined sequence (see (55)). This phenomenon has been explored in Chinese by Paul (2005), who found that Chinese pronominal adjectives also conform to this pattern ((55)). The focal point of discussion here pertains to the head element within an N-CL compound.

(55) $\text{Adj}_{quantity} \succ \text{Adj}_{size} \succ \text{Adj}_{shape} \succ \text{Adj}_{colour} \succ$ Head Noun Scott (2002)

Zhang (2013) posits, as outlined in (52), that the del, or the internal classifier within the N-CL structure, serves as the head of the compound. The del head requires an NP as its complement, and the functional projection of *DelP* primarily denotes the shape or size of an NP. If this hypothesis were accurate, and given that sequential modifiers apply to the head noun, it would be reasonable to infer that the N-CL internal classifier constitutes the head element. However, empirical evidence does not support this assertion.

See (56). Before forming an N-CL pair, the order of each item is specified in (56-a), where the classifier precedes the nominal. With the introduction of adjectives, two distinct patterns emerge regarding their placement. First, as shown in (56-b), each constituent accommodates an adjective. Alternatively, as illustrated in (56-c), both adjectives appear before the nominal element. In contrast, positioning both adjectives before the classifier is not permitted, as shown in (56-d).

(56) a. San duo hua
Three CL flower
'three flowers'

b. San **da** duo **fen** hua
Three **big** CL **pink** flower
'three pink flowers'

c. San duo **da fen** hua
Three CL **big pink** flower
'three pink flowers'

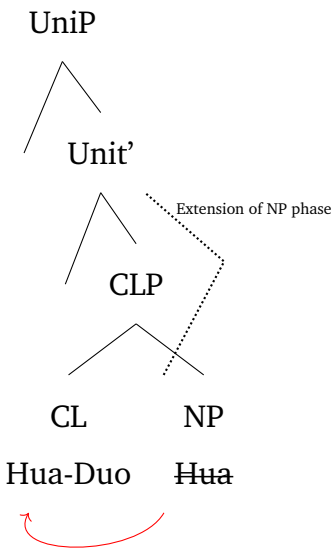
d. *San **da fen** duo hua
*Three **big pink** CL flower

Since, as discussed in the previous paragraph, multiple adjectives are typically positioned before the head noun, this suggests that the internal nominal within the N-CL pair functions as the headcontrary to the assertion by Zhang (2013). Furthermore, given that adjective interpretation in N-CL structures parallels that in simple NPs, the delimitable meaning associated with N-CL pairs is more plausibly derived from the nouns denotation rather than being structurally encoded in the classifier.

1.5.3 N-CL as an NP extension

In a more recent study, Hsu and Syed (2020) treats N-CL pairs as extensions of the NP domain. As illustrated in (57), N-CL pairs arise from head movement, where the noun moves and adjoins to the CL head. Crucially, this approach assumes a layered structure within the CLP. After the formation of the N-CL pair, the resulting unit can undergo further classification, as seen in the sequence [Num-CL2-N-CL1]. Here, CL_2 is derived from the UnitP projection, which primarily indicates a countable unit (a similar assumption is made in Zhang (2013)), as in the phrase san wan shui-di (three bowls of water-drops).

(57)



The analysis in (57) more effectively captures both the semantic relationship between nouns and their associated classifiers and the fact that N-CL pairs function as common nouns. However, a closer examination of the interpretive patterns of content meaning in

N-CL pairs reveals limitations in the layered structure of CLP.

Specifically, the NP-extension analysis (see (57)) still treats the classifier as the head, which triggers movement of the noun. The main challenge with this approach lies in the semantics. Under this account, the meaning of N-CL pairs is assumed to arise compositionally from their components. However, as previously discussed, the meaning of N-CL pairs is often non-compositional, with their lexical content formed through an internal mechanism. This suggests that the N-CL pair functions as a single common noun. Consequently, the combination of N and CL should remain within the NP, allowing the non-compositional lexical content to be established before any further syntactic operations.

Put together, based on the discussion, the proposed grammatical meanings fail to account for a broader range of empirical data. In this study, I assume that N-CL pairs share the same grammatical meaning as their simpler counterpart, N. The semantic difference instead lies in their content meaning, which emerges from the interaction between the noun and the classifier at a deeper stage of narrow syntax. This distinction explains why N-CL pairs behave syntactically like common nominals while exhibiting non-compositional interpretive patterns.

1.6 Summary

To summarise the discussion so far, three key generalisations can be made regarding the status of N-CL pairs:

- **Systematic consistency**: N-CL pairs are formed consistently within the grammar, exhibiting two key aspects of uniformity: (i) their grammatical meaning aligns with that of bare nouns, and (ii) their atomic content meanings remain stable. Given these properties, I argue that N-CL pairs are driven by systematic operations rather than by innovative lexical combinations.

- **Association between N-CL and CLP**: Locality constraints are observed in N-CL pairs. Specifically, the content meaning conveyed by N-CL pairs remains consistent within the phrasal projection (CLP), suggesting that classifiers in N-CL pairs originate within the NP and are associated with another phrasal projection.

- **Variations among N-CL pairs**: Despite the general tendency of N-CL pairs to encode atomic content meanings, variation exists in how their components contribute to interpretation, giving rise to four distinct patterns. Furthermore, locality constraints are evident in $N_{full}CL_{null}$ and $N_{half}CL_{half}$ pairs but not in $N_{full}CL_{full}$ and $N_{less}CL_{more}$ pairs.

Additionally, the discussion on the limitations of the NP-external approach makes the assumption that classifiers within N-CL pairs originate within the NP structure more plausible. Therefore, in the preceding chapter, I will begin with an analysis of roots. As previously discussed, language faculty provides a framework for linking conceptual judgments to the linguistic system. Borer (2009); Marantz (2000); Panagiotidis (2011) (among others) treat roots as the linguistic elements that fulfil this function. Given that the primary distinction among N-CL pairs lies in their content meaning, I will explain the aforementioned characteristics of N-CL pairs by examining the root domain and addressing the syntactic operations that underlie the uniformity observed in these structures.

Chapter 2

nP,where N and CL meet

Building on the previous chapter, this chapter presents my analysis of the formation of N-CL pairs. The central idea is that N-CL pairs result from syntactic projections, with variations in content meaning determined by the structural projections within nP. **nP** is assumed to be the initial projection for nominal expressions, establishing their lexical content. This chapter is organised as follows: first, I will present my initial assumption that both components in N-CL pairs are roots. This will be followed by a detailed analysis of the four types of N-CL pairs in Mandarin Chinese.

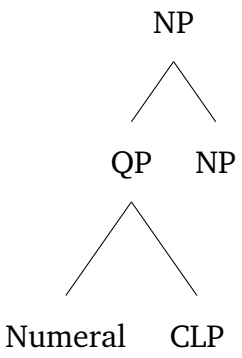
2.1 Classifiers as roots

In the literature, ongoing debates persist regarding the semantic roles of classifiers. For instance, Cheng and Sybesma (1999) assert that classifiers function as *singularising tools*, while Zhang (2013) posits that classifiers serve as *units for counting*. Additionally, Rothstein (2011); Li (2011a) argue that classifiers possess a dual semantic role, either for *counting or measuring*.

Despite this debate, classifiers have generally been regarded as a distinct syntactic category. It has been commonly agreed that classifiers own a separate syntactic projection, known as the Classifier Phrase (CLP). However, there is variation in how the CLP is syn-

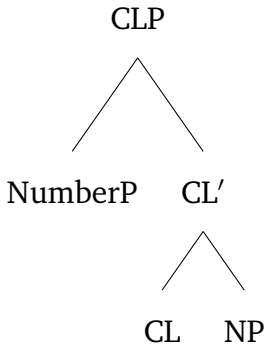
tactically distributed. One perspective considers classifiers as an extension of numerals (Li and Thompson, 1989; Tang, 1990b; Croft, 1994; Lin, 1997; Hsieh, 2008). In this view, numerals select for classifiers to form a quantifying phrase (QP), such as in (1), where the QP functions as a modifier of the noun phrase.

(1)

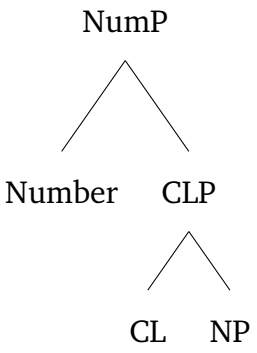


Another perspective treats CLP as an independent functional projection, with the classifier selecting for an NP as its complement, while numerals are positioned at the specifier of the CLP (2). An alternative variation of this approach, as proposed by Cheng and Sybesma (1999); Doetjes (1997) involves numerals as functional items projected higher than CLP, as schematised in (3).

(2)



(3)



Alongside these syntactic analysis, all classifiers in Mandarin Chinese converge at the terminal node-the CL head of CLP. However, Mandarin Chinese embodies a rich classifier system, in which certain classifiers may contain idiosyncratic semantic information. Accordingly, classifiers have been divided into different categories. For example, the division of *sortal* and *mensural* classifiers has been widely discussed (as in Tang (1990a); Doetjes (1997); Cheng and Sybesma (1999).

The rationale of this division is in line with theoretical framework distinguishing between functional and lexical categories. Functional categories often convey meaning opaquely, whereas lexical categories directly convey meaning (Emonds, 1985; Corver and Van Riemsdijk, 2001). In this case, the 'pure' classifiers are base-generated at the CL head, contributing minimal semantic contents, and *sortal* classifiers are such cases, as they consistently select the most semantically congruent nouns as their complements (such as *ben* selects *shu*, and *duo* selects *hua*) . In contrast, mensural classifiers originate at NP, a lexical category, then moving to the CL head to quantify a nominal (such as *bei* 'glass' quantifying the non-countable noun *shui* 'water').

One controversy arises regarding this division, in particular on the semantic content and syntactic features encoded in classifiers. First, before merging in a terminal node, the initial status of a lexical item is as a *root*($\sqrt{}$). Recalling the discussion in the previous chapter, roots encode certain semantic contents, such contents are also termed as encyclopedia knowledge or general cognition information (Hachem, 2015). In order to differentiate functional items from lexical items, Klockmann (2017) suggests a dichotomy in lexical

entry in roots.

A functional item lacks content meanings and solely contains syntactic features, while a lexical item exclusively contains content meanings without syntactic features. Following this division, the lexical entries for the sortal classifier *ben* and the mensural classifier *bei* are as depicted in (4). Herein, the sortal classifier *ben* has to merge in the CL head, and the CLP is the functional projection above NP. While the mensural classifier *bei* should be generated in NP, since it contains content meaning without syntactic features, thus it should be functioning as the lexical item in the grammar [1].

(4) a. lexical entry for sortal classifier ben:
$\sqrt{}$ben: [+CL].
b. lexical entry for mensural classifier bei:
$\sqrt{}$bei: content.

Following this, one might anticipate that sortal classifiers are syntactically fixed, rigidly positioned as the CL head. However, this expectation is not supported by empirical evidence. As outlined in the previous chapter, sortal classifiers can consistently be positioned after the head noun, forming a nominal compound (as in *shu-ben*, *hua-duo*, etc..). Moreover, the assumption that sortal classifiers are functional items implies they are content-less roots (based on the proposal from Klockmann (2017)), devoid of any substantive information in their lexical entry, which also presents challenges.

Consider the pairs in (5). As introduced earlier, the general classifier-*ge* can precede the majority of bare nouns in Mandarin Chinese, allowing (5-b) to express the same quantifying meaning with (5-a). However, when *ge* is used, *yi ge shu* can yield different interpretations (as shown in the glossary). In contrast, for *ben*, only one meaning is conveyed, which restricted the phrase a counting phrase without alternative meanings.

[1]This general analysis is based on the fact that sortal classifier fails to function as common nominal items, while mensural classifiers can, for instance, 'san ge bei' (three ge glass), the mensural classifier can be classified by the general classifier ge

(5) a. Wo yao du yi ben shu
I want read one CL_{sortal} book
'I wanna reread a book (a counting meaning)'

b. Wo yao du yi ge shu
I want du one $CL_{general}$ book
'a. I want to read a book (a counting meaning)'

'b. I want to study (generic reading [2])'.

This may suggest that *ben* encodes certain content meanings that restrict the head noun within the denotation of an entity of *book*. Moreover, considering evidence from first language acquisition, Li et al. (2010) investigated how children (aged 2 to 5) acquire numeral expressions in Chinese. The results suggest that children recognise the information of shape or size encoded by sortal classifiers before they recognise numerals. This finding implies that the semantic content of sortal classifiers is not absent. Notably, children perform better when there is a clear conceptual association between a sortal classifier and a noun. In other words, acquiring numeral expressions may begin with recognising noun-classifier pairs, which precedes the acquisition of cardinal numerals. Thus, concluding that sortal classifiers are purely functional items without any content meaning is not a plausible assumption.

Furthermore, unlike purely functional items, classifiers in Mandarin Chinese are not part of a closed category; instead, the classifier system continually absorbs novel items. This characteristic is unexpected for functional categories, given the clear distinction between functionality and lexicality outlined by Emonds (1985).

Specifically, as investigated in Wu (2017), Chinese classifiers generally encode a sense of '*meaningfulness*', which makes them analogous with Chinese nominals. As exemplified in (6), the pre-nominal classifiers specify meanings and references. When a speaker utters (6-b), it exclusively refers to paper rolls, whereas uttering (6-c) refers solely to paper slices. Therefore, this ability to provide descriptive content renders classifiers similar to Chinese nouns rather than functional elements, such as the universal quantifier *dou* 'all', it solely

[2]This reading implies that I want to keep reading books, generally equivalent to 'I want to study'

serves as a distributive quantifier but lacks a content meaning.

(6) a. San zhang zhi
Three CL paper
'Three paper'

b. San tong zhi
Three CL_{roll} paper
'Three paper rolls'

c. San pian zhi
Three CL_{slice} paper
'Three paper slices'

This characteristic leads to the assumption that classifiers are fundamentally *semi-lexical* items. According to van Riemsdijk (1998); Emonds (2001), semi-lexicals are lexical elements that also carry syntactic features. For example, van Riemsdijk (1998) examines the structural effects of semi-lexicals. Like lexical heads and functional heads, semi-lexical heads are projected in the syntax. When lexical items are projected as semi-lexical heads, specific morpho-syntactic changes occur. One example is the obligatory presence of an article in German *Restrictive Elliptic Appositives*, as shown in (7).

(7) **Eine** Unterhose *(**eine**) dreckige solltest du nicht wieder anziehen
an underpant **a** dirty should you not again put-on
(van Riemsdijk, 1998)

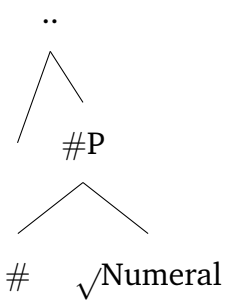
Considering the possibility of semi-lexicals, the status of sortal classifiers and mensural classifiers should be redefined, with a proposed spectrum placing sortal classifiers closer to functional items and mensural classifiers nearer to lexical items. However, this analysis remains primarily descriptive and does not attempt to explain the derivation of the observed variation. Furthermore, applying the root structure from Klockmann (2017) reveals several issues with this analysis.

As reviewed earlier, Klockmann (2017) differentiates functional items from lexical items

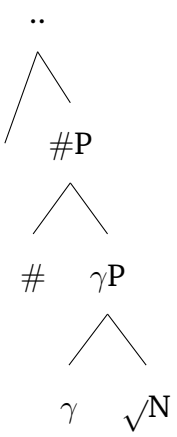
based on their lexical entries. Following this path, semi-lexical items are conceived as roots that encompass both *syntactic features* and *semantic content*, but semi-lexicals are deficient of certain features, separating them from lexical items. Reflecting on syntactic projections, a semi-lexical projection imposes certain restrictions, either requiring or lacking a structural layer.

For example, Polish numerals illustrate this in cases where a structural layer is missing, as shown in (8-a). Compared to the nominal projection in (8-b), the corresponding structural layer for the N feature is absent, making Polish numerals semi-lexical.

(8) a. the projection for Polish numerals



b. the projection for lexical nominals

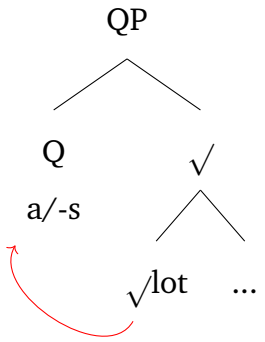


Furthermore, a semi-lexical projection blocks any further functional projection. This is evidenced by English semi-lexical constructions such as *lot of*. Lot functions as a quantifying element in pseudo-partitive phrases like *a lot of people*, conveying a meaning similar to *many*. Morphologically, lot can be pluralised as lots, but despite this change, lots does not

denote the plural form of lot; both lots and lot convey the meaning of many. This distinguishes it from typical nominal elements, where the suffix *-s* clearly marks the distinction between singular and plural forms.

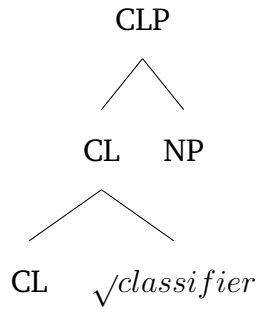
Klockmann (2017) attributes this to the semi-lexical nature of lot. As mentioned previously, a semi-lexical item is feature-deficient, which impacts its syntactic structure. In the case of lot, it projects a QP (Quantifier Phrase) but lacks a #P (the projection responsible for plurality). Thus, the *-s* in lots is not a plural marker but rather functions as a quantifier, as illustrated in (9). Furthermore, this QP is the highest functional projection in phrases involving lot. For example, for 'a lot of people', any additional projections are blocked, as evidenced by the ungrammaticality of phrases like '*three lots of people' or '*these lots of people'.

(9)



Based on the above analysis, adopting the proposal that classifiers are semi-lexicals leads to certain controversies. If classifiers were semi-lexicals, the projection of CLP would be the semi-lexical domain, hosting all classifiers. Accordingly, their syntactic distribution would resemble what is shown in (10), with an expected parallelism between CLP and the QP shown in (9). However, this is not supported by empirical data. CLP is not the only functional projection for a nominal item; for example, in '*zhe wu ben shu*' (this five CL book), both a NumP and a DP can project above CLP, contradicting the syntactic projection expected of semi-lexicals. Instead, CLP appears to be part of the canonical projection, serving as the classification domain of a lexical item (the similar suggestion is made by (Borer, 2005)).

(10)



To sum up, upon reviewing previous studies on Chinese classifiers, two key questions emerge. First, there is controversy regarding the functional/lexical division of classifiers. Chinese classifiers exhibit both syntactic features and semantic content, suggesting they might be more appropriately categorised as semi-lexical items. However, this assumption raises further issues, as the projection of CLP does not qualify as a semi-lexical projection. Seemingly, a lexicon-based analysis of roots cannot adequately address the aforementioned controversies, indicating that the initial status of classifiers requires further examination. To address these questions, I will adopt a more syntactic approach to the formation of N-CL compounds, following the '*syntax-all-the-way-down*' principle in Distributed Morphology to propose the internal structures within N-CL compounds.

2.2 Roots and Syntax

To begin with the analysis on roots ($\sqrt{}$). Prescriptive grammar treats roots as descriptive elements of words, serving as a morphological foundation or a phonological foundation to establishing a word. In generative framework, the study of roots moves from the surface structure to the deep grammar, aiming at exploring how roots integrate into syntactic template and receive morphosyntactic features.

In the literature, there are mainly two ways of analysis regarding the initial status of roots. The lexicon-based approach, in which roots are components in Lexicon. Within this approach, lexicon was assumed as word-formation factory (Kiparsky, 1982; Jackendoff, 1975a; Scalise and Guevara, 2005), and syntactic operations are available after words are formed. While, building upon Government and Binding, Baker (1988) suggests that

word-formation is also a result of syntactic rules. As a component of language faculty, syntactic constraints are transferable into lexicon, resulting in phenomenon such as noun incorporation, wherein noun-verb incorporation requires sub-theories of general syntactic rules. This type of analysis has been expanded to cover a broader range of data, such as changes in transitivity (which will be discussed later), discussed by Pesetsky (1996); Hale and Keyser (1998).

Since Minimalist Program (MP) (Chomsky, 1995), the function and components of Lexicon have changed. In MP, lexicon includes lexical items with features, including phonological features, semantic features, and formal syntactic features, such that they can be identified by UG. However, in the late version of MP, the applying of valuation model altered how features are encoded in lexical items.

In general, feature valuation and feature checking are fundamental syntactic operations. A successful syntactic computation requires the features encoded by a lexical item to be valued first by a syntactic head, followed by the processes of agreement and feature checking (Adger, 2003). Compared to the early MP, where the lexicon comprised complete lexical forms, including phonological realisations and nuanced semantic information (for example irregular plural forms in English like *sheep* and *geese*), the late version of MP posits that phonological realizations occur post-syntactically. This shift implies that irregular phonological forms and semantic meanings are not determined within the lexicon, making it impossible to build these elements into lexical items from the outset before feature valuation.

Recalling the N-CL pairs in Mandarin Chinese, they are kindred items with bare nouns, but exhibiting nuanced patterns concerning their combining with the general classifier *ge* (see table 2.1). Assuming that *ge* is the head of CLP functionally projected above NP, a unified combining condition with *ge* would be expected. But this is not borne out, diverse patterns are exhibited (repeated below as Table 2.1), which may suggest two possibilities.

First, different N-CLs project differently outside NP, resulting in varying semantic functions of N-CL pairs, which further causes different combining constraints with *ge*, this generally

	bare N	N-CL
ge	✓ma (horse)	✗ma-pi(horse)
ge	✗shui (water)	✓shui-bei (water-cup)
ge	✓hua (flower)	✓hua-duo(flower)

Table 2.1: N-CL pairs with *ge*

aligns with the late version of MP, the feature-driven analysis. Second, there may be an internal mechanism that either fuses or diverges different semantic features, leading to distinct combining conditions with *ge*. As discussed in the previous chapter, a consistent controversy about syntactic projections and semantic contents appears when applied the NP external approach. Therefore, I propose an *NP-internal* approach to address the different patterns about the combining of *ge* in N-CL pairs. In other words, classifiers, particularly those can form N-CL pairs, are lexical roots.

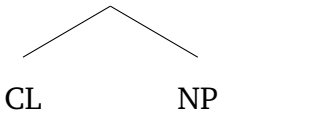
The role of roots has been explored extensively within the framework of Distributed Morphology (DM). Alongside the development of the Minimalist Program, DM emphasises that syntactic rules extend all the way down to morphological structures (Halle and Marantz, 1994; Marantz, 2007; Harley, 2014). In the early version of DM (Halle and Marantz, 1994), lexicon is defined in its simplest form, consisting only of roots and feature bundles. The merging of roots is determined by specific mechanisms, *under-specification* and *impoverishment* integrate morphosyntactic features with syntactic features, and *Vocabulary insertion* provides the phonological segments for an established syntactic structure.

To operate, there are three lists of items that operate within DM: List One contains syntactic atoms, commonly understood as syntactic nodes, with each node potentially containing a bundle of features. List Two consists of vocabularies used for Vocabulary Insertion (occurring post-syntactically); these vocabularies include morphosyntactic features and phonological exponents. Finally, List Three is where idiomatic meanings are encoded [3]

[3]However, the process of Vocabulary Insertion can become complex, as discussed in Bobaljik (2017). There are cases where a single vocabulary item can be associated with multiple syntactic features, a situation termed 'many-to-one', as seen in Russian predicative adjectives. Conversely, a 'one-to-many' situation can occur, where a single syntactic feature is realised through multiple vocabulary items, as in German plural markers, where -(e)n, -e, -er, -s, and even ∅ can all indicate plurality. The current data do not present concerns regarding mismatches between vocabulary features and syntactic features, so I will leave this discussion aside for now.

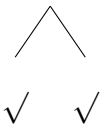
Linking to Table 2.1 and following the DM framework, there are two possible ways to derive an N-CL pair. The first is through root merger, where the formation of the N-CL pair occurs independently based on a syntactic template. In other words, as shown in (11), the syntactic structure of (11-a) is built, determining the syntactic position of the N-CL compound under the NP node. After this, the morphological process in (11-b) takes place, forming the pair, followed by the operation-*Vocabulary Insertion*.

(11) a.



N-CL compound

b.

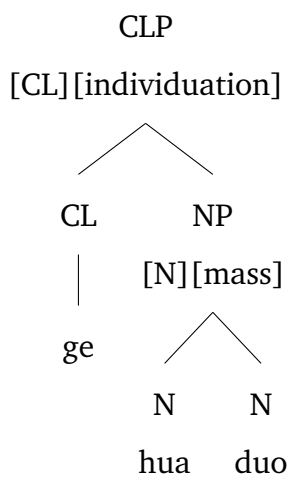


In this view, N-CL pairs, like compounds, are formed through merger. However, as discussed in previously, there is sufficient evidence to suggest that N-CL pairs in Mandarin Chinese require a different mechanism from compounds. Therefore, this approach is ruled out.

The alternative analysis involves merging the components of the N-CL structure directly under the NP node. This approach entails the *fusion* of nodes and morphosyntactic features. For instance, in *hua-duo*, as illustrated in (12), the rule of *impoverishment* comes into play, eliminating the morphosyntactic features of both hua and duo, and unifying them under the NP node, which encodes the features [N] and [Mass] [4].

[4]These features in the template are merely illustrative of how an N-CL is derived under DM, following the discussion from Chierchia (1998) regarding Mass-denoting in Chinese bare nouns, and Gebhardt (2009) concerning 'individuation' as a feature encoded in the CLP node. Specific semantic analyses of classifiers and NPs will be addressed in Chapter Three.

(12)



However, this approach is not ideal either, as discussed repeatedly in Chapter One. Not all N-CL pairs can be preceded by the general classifier *ge*, as exemplified by **ge ma-pi*, which raises questions about the status of N-CL pairs as NPs, as shown in (12). Additionally, the analyses in (12) and (11) fail to capture the variation in content meanings of N-CL pairs. In these analyses ((11) and (12)), the components of N-CL pairs are viewed merely as roots with certain morphosyntactic features and specific encyclopedic information. However, the process by which two pieces of encyclopedic information (referred to as *content meaning* in this dissertation) are fused into a unified meaning remains unexplored. Moreover, as previously demonstrated (reiterated in Table 2.2), variation arises in how content meaning is established in N-CL pairs, necessitating a deeper analysis of the derivational processes involved.

Pattern	Semantic weight between components	Example	content meaning
1	N_{full} CL_{null}	*hua-duo*	Flower(s)
2	N_{half} CL_{half}	*hua-ban*	Petals of flower
3	N_{less} CL_{more}	*shui-bei*	Glasses with water
4	N_{full} CL_{full}	*yang-qun*	Sheep in a group

Table 2.2: (Repeated) Decomposition of N-CL pairs

Therefore, the issues surrounding the combination with *ge* and the relative contribution of meaning in N-CL pairs are interconnected. These questions suggest that there may be structural configurations occurring prior to the NP node, which play a crucial role in de-

termining the content meaning of an N-CL pair, as well as its compatibility with combining with *ge*.

2.3 Categoriser and nP

In this dissertation, I propose that there is a projection before NP, which consists solely of the categoriser and roots. Given the nature of N-CL as an nominal exponent within the grammar, I use **nP** to represent the phase responsible for forming N-CL pairs, where n stands for the nominal categoriser.

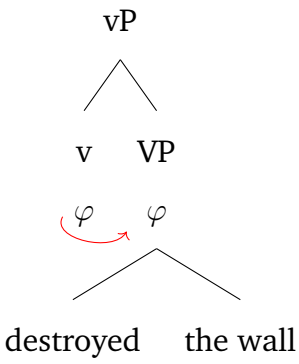
As previously discussed, the role of categorisers has been extensively examined within the Distributed Morphology (DM) framework, beginning with Marantz (2000) and further developed by Arad (2003, 2005), Harley (2003, 2011, 2014), and Ramchand (2008). In DM, roots are understood as the grammatical elements that link our conceptual representations to the language faculty. Crucially, roots are category-neutral within the linguistic system and require category-defining elements-categorisers-to become part of a well-formed linguistic expression.

Categorisers, as discussed in Panagiotidis (2011), are a special type of syntactic head that merely introduce categorial features, such as [N] from the n categoriser or [V] from the v categoriser. A key distinction between categorisers and other functional heads is the interpretability of their features. Whereas features like φ-features are uninterpretable and require feature valuation, categorial features are interpretable and do not necessitate further syntactic operations in narrow syntax.

Baker (2003a) elaborates on the interpretive effects of these categorial features, [V] imposes an 'extending-over-time' interpretation at LF, while [N] frames interpretation in terms of 'sortality'. This distinction stems from the fact that verbal predicates inherently involve temporal dimensions, whereas nominal predicates are fundamentally interpreted as sorts. Thus, unlike functional features such as Number, or Tense, categorial features are inherently interpretable at LF.

Notably, the feature introduced by v categoriser is a bit more complicated, requiring v introduces more than just the categorial feature. Generally, v need to introduce functional features due to the argument structure of verbal predicates. For example, in *John destroyed the wall*, if v were solely a categorising tool, the expression would not receive proper interpretation at LF due to the unchecked features from 'the wall'. Thus, studies such as Richards (2007) stress that v must introduce functional features in addition to the categorial feature, and there is feature-inheritance, such that the φ feature in v passes down to its complement, as depicted in (13).

(13)



Shifting the focus back to n categoriser, the situation becomes more straightforward, it only introduces a categorial feature, and its complement domain consists of roots. In other word, v takes syntactic structures as its complement (such as John destroyed the wall), while n takes 'conceptual structure' as its complement.

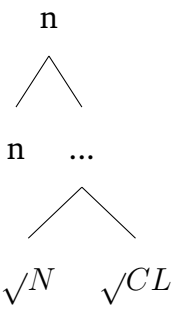
Recalling the targeted structure of this study-the N-CL pairs in Mandarin Chinese-one key challenge is understanding the shift in the contributor of content meaning. Assuming that content meaning is derived from roots, projecting N-CL pairs with the n categoriser presents a viable solution. Since the n categoriser is not a functional head, its role is to provide an interpretive perspective on the content meaning generated by the roots.

Following this approach, once the content meaning is established, the n categoriser merges, forming an interpretable nominal element in the grammar. This process also aligns with the observation that N-CL pairs function as nominal arguments. Therefore, in the fol-

lowing discussion, I assume that the formation of N-CL pairs stems from nP, where the n categoriser and roots form a projection.

Accordingly, the derivation of N-CL pairs should proceed as outlined in (14). Initially, two roots merge. Subsequently, the n categoriser is introduced, projecting nP. Once this structure is established, the next issue to address is how syntax processes the content meaning generated at the nP level.

(14)



The realisation of content meaning in syntax remains a central theoretical issue. In the literature, the semantic interpretation of lexical items continues to fuel ongoing debates. According to the *Marantz-Arad* approach, content meaning is established in the first phase (a categoriser phrase). Once formed, this meaning remains fixed as the lexical item merges with other functional heads. In contrast, an alternative view proposes a strict division of labour between the language faculty and human conceptual judgments. This view argues that there is no intersective region in our linguistic system that preserves or reflects conceptual judgments. Instead, the two independent systems are linked via a separate search device.

Specifically, as mentioned in Chapter One, the first approach is supported by Arad (2003), who, based on evidence from Modern Hebrew, argues that the initial phase establishes both semantic idiosyncrasies through comparisons between root-based and word-based meanings. Beyond semantic interpretation, the locality constraint also determines the phonological shape of a lexical item. A specific phonological rule is set up within the first phase; for instance, the root consonants (b, x, n) in Table 2.3 are always inserted at

spell-out.

Phonological pattern	Lexical item	Semantic meaning
a. CaCaC(v)	baxan	test,examine
b. hiCCiC(v)	hixin	discern
c. miCCaC(n)	mivxan	an exam
d. CoCaC(n)	boxan	a quiz
e. maCCeCa(n)	mavxena	a test-tube
f. aCCaCa(n)	avxana	a diagnosis

Table 2.3: Words derived from $\sqrt{bxn}$(Arad, 2003, pp.743)

An alternative model is explored by Borer (2014), in which there is no initial phase that places roots and a categoriser. Rather, roots are treated as absolute free atoms that receive general syntactic rules. The categorial status of a lexical item is related to the functional domain it resides in, and it is not assigned by a categoriser but through the cooperation between a functional head and an integrator-*C-functor*.

(15) a. [$_T$ WILL [C=V $\sqrt{Coast}$] ..will coast]
b. [$_T$ PAST [C=V $\sqrt{Coast}$] ..coasted] Borer (2014)

For instance, merging the root $\sqrt{Coast}$ within the TP domain, the T head dictates its complement to be V materials. More precisely, in the TP domain, the complement space relative to the T head is '*V-equivalent*'. Since roots are category-less atoms, they cannot directly merge into the TP domain without assistance. This is where the *C-functor* intervenes. *C* receives the command from the functional head and transfers the information to the roots, transforming a bare root into a V-equivalent. Consequently, as exemplified in (15), when a T head is '*will*', merging a root $\sqrt{Coast}$ yields the phrase *will coast*. While when the T head is 'PAST', the output of the domain becomes *coasted*.

More crucially, under this account, content meaning and formal semantic information arise from distinct systems. Semantic meaning is encoded by the C functor, while content meaning is not confined to a specific linguistic domain or phase. Instead, it is regarded as atomic encyclopedic knowledge that exists outside the linguistic system. A reading device

in linguistic system (referred as 'reader' in Borer (2013)) finds a mapping content. This process is termed as '*Encyclopedic search*'. This search mechanism operates bidirectionally, the reader spots a particular content, and in the meantime, the content returns the information onto the linguistic form only if there is a determined linguistic environment(as shown in the gist (16)).

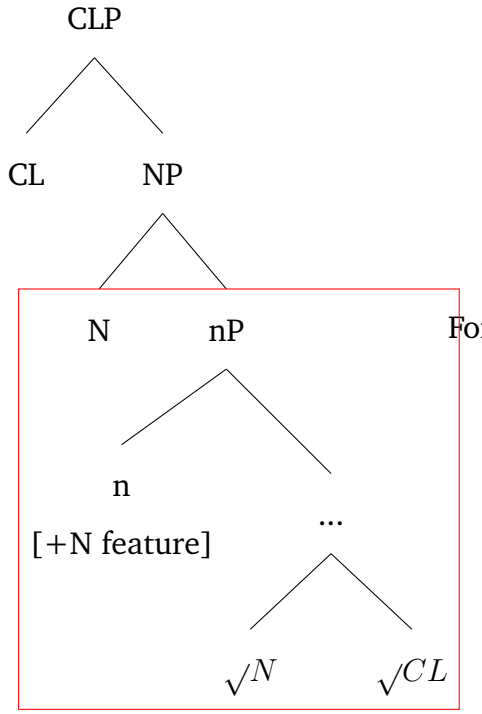
(16) $\Big[FunctionalDomain_N\Big] \leftrightarrow \Big[Content\Big]$.

Regarding N-CL pairs, the first-phase approach is better suited to capturing their interpretive patterns. As shown in Table 1.1, in certain N-CL pairs, the content meaning of the N-CL pairs is transferred to the functional projection of CLP (as seen in 'hua-duo' and 'duo-hua', 'hua-ban' and 'ban-hua'). Since NP and CLP belong to distinct functional projections, one would expect *Encyclopedic search* to occur independently for the classifier and the noun, resulting in two separate content meanings. However, as previously discussed, this expectation does not hold for N-CL pairs in Chinese. This reinforces the need to rely on syntactic structure, supporting the first-phase approach.

In summary, the previous sections systematically examined the initial status of classifiers in N-CL pairs. The central assumption is that classifiers capable of forming N-CL pairs function as roots. The formation of N-CL pairs originates in nP, a categoriser projection that introduces the categorial feature [N]. The primary function of nP is to render the content meaning of roots interpretable in syntax, which is subsequently realised at the interface levels.

Accordingly, the domain that hosts the N and CL roots can be specified, as highlighted by the red square in (17). To clarify the role of each component within nP, the n categoriser functions as the head of the projection, encoding only the categorial feature [N]. Semantically, the n categoriser establishes the nominality required in nominal expressions. This is further reflected in the relationship between N-CL pairs and their simpler counterpart N, both of which can function as common nouns.

(17) Preliminary structure:



Forming the content meaning

Building on this analysis, the following sections will focus on addressing the puzzling variation in meaning contributors within N-CL pairs. The internal projection (termed as secondary projection in the following) within nP is key. Certain nP domains contain a secondary projection that hosts one of the roots, and then resulting in the condition where the content of one root is prioritised over the other, while some nP domains lack this secondary projection, leading to content meaning contributions from both roots.

2.4 Main analyses: the internal structure of N-CL

In this section, I propose four structural configurations to account for the variation in interpretation patterns observed in N-CL pairs. As previously discussed, the distribution of content meaning within these pairs can differ: the main content may be contributed by the noun (N), the classifier (CL), or jointly by both. Attributing these differences solely to the lexical properties of N or CL is inadequate, as it does not explain why the same nominal element can behave differently across N-CL pairs-for instance, hua contributes the main content in *hua-duo* but not in *hua-ban*. To address this, I adopt a syntactic approach to derive the content meaning in N-CL pairs.

2.4.1 N_{full} CL_{null}, dependence of x-morpheme and n

Revisiting the data on N-CL pairs, the first pattern reveals cases in which the noun (N) contributes most of the semantic content, while the classifier (CL) plays a minimal rolewhat I refer to as the $N_{full}CL_{null}$ pattern. For example, in hua-duo (flower) and shu-ben (book), the classifier contributes little to the overall meaning. As a result, these N-CL pairs are semantically near-equivalent to the bare nouns *hua* and *shu*, respectively, in terms of their referential or conceptual content. As shown in (18), both accept ge as their classifier, and yielding a phrase with implying the meaning of an individual flower.

(18) a. Yi ge hua
One CL flower
'A flower'

b. Yi ge hua-duo
One CL flower
'A flower'

To describe the semantic extensions of $N_{full}CL_{null}$ pairs, we can draw on prototype theory (Osherson and Smith, 1981), which holds that category membership involves a two-way comparison. First, there is a pre-established conceptual set defined by a cluster of prototypical properties. Second, there is the extension of the object under consideration.

For an object to be included in a conceptual category, it must share a sufficient number of these prototypical properties with the conceptual set. For instance, in the case of the category 'flower', an object qualifies as a flower if it substantially overlaps with the prototypical properties associated with that concept.

Applying this to $N_{full}CL_{null}$ pairs such as hua-duo, recall that both hua-duo and hua generally denote the same conceptual content-flower. It is therefore reasonable to assume that the linguistic structure combining the noun and classifier treats them as referring to the same set of real-world entities. In other words, both hua-duo and hua successfully link the prototypical concept of 'flower' to their referents. As illustrated in Figure 2.1, their semantic extensions exhibit a substantial degree of overlap.

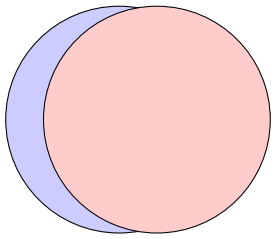


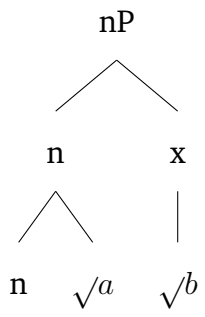
Figure 2.1: Prototypical properties projected by hua-duo and hua

As discussed previously, various terminologies have been used to describe these types of classifiers, including *sortal classifiers* (Doetjes, 1997; Cheng and Sybesma, 1999; Tang, 2005) and *individuating classifiers* (Zhang, 2013). However, the underlying reason for their functioning in this manner remains unexplored. What defines them as individuating or sortal classifiers, particularly when all classifiers syntactically converge at a single landing site, the head of the classifier phrase (CLP)?

Therefore, in what follows, I propose that sortal or individuating classifiers initially merge in the position of an inner morphemelabelled here as xunder the assumption that classifiers are lexical roots. The x morpheme refers to a silent, internal projection within the nP domain and serves as a placeholder for structural representation, rather than denoting a specific morpheme. This inner position forms a secondary projection within nP, establishing a distinct structural relationship.

As discussed in the previous section, the n categoriser is a syntactic head and projects nP, and its complement is 'conceptual elements', namely roots. Building upon this role of n categoriser, I follow Acquaviva (2009); Panagiotidis (2011), the nP only forms the content meaning of a lexical item. It does not encode any formal semantic features such as *definiteness* and *number*. Accordingly, the distribution of the categoriser and the inner morpheme x should be depicted as (19).

(19)



The root $\sqrt{a}$ merges adjacent to the n categoriser, whereas the root $\sqrt{b}$ merges at the x-morpheme position. The general plan is to build up a dependence between two roots. The role of the x-morpheme is analogous to that of an inner morpheme (which will be addressed later), imparting a specific meaning to the nP. In this case, the specific meaning involves making the content from $\sqrt{b}$ dependent on the content from $\sqrt{a}$.

Two questions need to be specified, first, what determines the relative position of the two roots? Second, how does $\sqrt{a}$ relate to the n categoriser? Understanding how the roots are integrated into the template through merge is essential to addressing these questions. But before delving into the merging theory, I utilise the telicity of verbs to support my proposal, in which roots are structurally defined and structural configuration yields diverse interpretative patterns for a construction.

The role of Inner Morpheme

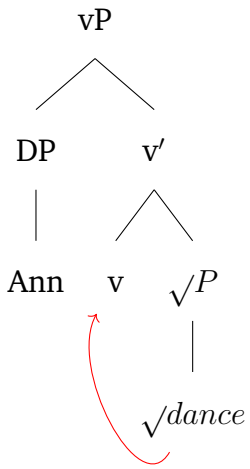
The role of inner morphemes can be traced back to the analysis of unergative verbs and their shift of telicity. In surface structure, unergative verbs do not select for direct objects

as their complements. Correspondingly, these verbs express the verbal events or actions achieved by the agent (Cuervo, 2014). In the semantic research, unergative verbs are also categorised as atelic predicates, as they lack a natural endpoint for the action they denote (Dowty, 1972; Marín and McNally, 2011). Therefore, they can be modified by a *for-PP* (20-a), which emphasises the duration of time without specifying its endpoint. However, by inserting a goal into an unergative verb, as shown in (20-b), the verb becomes telic. In such cases, they are compatible with *in-PP*, which describes a duration of time with an indication of an endpoint.

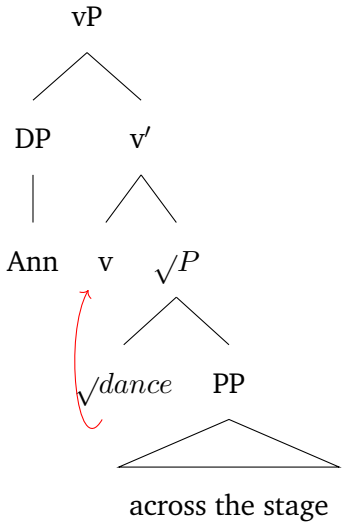
(20) a. Ann danced for an hour/*in an hour (atelic)
b. Ann danced across the stage *for an hour/in an hour (telic)

Lexical relational structures proposed by Hale et al. (1993) addresses this phenomenon based on internal structure of lexical items and heads incorporation in the sense of Baker (1988). Unergative verbs are fundamentally transitive verbs, an empty light verb head selects for an internal subject and an internal object. For example, for the verb 'dance', the semantic meaning of the sentence 'Ann danced' is generally the same with a paraphrased version- 'Ann did a dance', in which dance is a count noun rather than a verb. Drawing on this parallel, Hale et al. (1993) analysed such verbs as follows (21), where in a light verb projection positions the subject, the light verb head, and an non-overt nominal complement in the form of a root.

(21) Ann danced (atelic).



(22) Ann danced across the stage (telic)



Then the root incorporates into the v head, resulting in the sentence 'Ann danced'. Moreover, the nominal root carries extra semantic function. As further discussed in Harley (2003), roots can carry particular semantic information. When a root is a bounded *thing*, the vP it resides in denotes *accomplishment*. While if the root is a bounded event, the vP denotes an event completed at a certain point, namely a telic predicate. In other words, the telicity of a verb is associated with the root complement in the light verb projection.

Consequently, the shift the telicity in (20-b) can be explained. The complement of the light verb '$\sqrt{dance}$' and the PP '*across the stage*' form a projection '$\sqrt{P}$'. This projection

has a crucial semantic role, it encodes an abstract information that shifts dance into a telic predicate. The shift happens due to *homomorphism* effects [5], which makes the event-*dance across the stage* a sub-event of *dance*. In other words, the selection of the PP complement '*across the stage*' transfers dance from ateic predicate into a telic predicate. Thus, in (20-b), the *in-PP* is compatible with the verb *dance*.

Building on Lexical Relational Structures, as explored in the works of Harley (2003), Harley (2011), Harley (2014), and Marantz (2000, 2007), the term 'inner morpheme' was used to refer to category-less, sub-categorial elements. In this context, 'inner morpheme' is understood as a structural concept that accounts for hidden or implicit meaning within syntactic configurations. For instance, in the previously mentioned example, the complement of the light verb (v), which projects with a root projection. Within the root projection, a head-complement is reserved between the verb root (dance) and the PP root (across the stage), resulting in a shift towards telicity in the originally atelic verb *dance* [6].

Based on the aforementioned review, the literature offers two crucial insights pertinent to the derivation of N-CL compounds. First, a root can exhibit internal projection, such as selecting for an internal complement. Second, a root projection can convey specific semantic content. In the following, I focus on how can a root be derived into a syntactic template.

Merging n categoriser and roots

Continuing with the question, *How can a root be derived into a syntactic template?* First, based on the substantial evidence presented so far, it is clear that roots are merged before they enter a functional domain. For example, consider the DP structure in (23), where *DP-NP-nP-Root* is hierarchically arranged. The essential task is to determine how roots combine with the n categoriser. I have assumed that roots are projected within the *nP*.

[5] Krifka (1998) uses a hormomorphism model to explore telicity in verbal predicates. Generally, *event* can be bounded or unbounded, unbounded events do not preserve natural endpoints, making them atelic. However, when an unbounded event is quantised, such that the duration of one time period is a sub-part of another, it becomes telic.

[6] Other than telicity, other phenomena such as small clause are also investigated through the lens of the projection of inner morpheme, see details in Harley (2003)

In this part, I examine how roots are merged according to the proposed template shown above in (19).

(23) [D[N[nP[Root]]]]

Since the inception of the Minimalist Program (Chomsky, 1995), merge has been recognised as a fundamental mechanism to build structures in natural languages. Chomsky (2005, 2013) have further elaborated on the processes of internal and external merge.

To function, merge combines two syntactic objects, say α, β and yields a set that includes them, namely {α, β}. Merge encompasses two properties, first, merge is a binary operation, and second, merge is recursive, which enables an output of merge submitted to merge with other objects.

Numeration is a list that includes the items that submit to Merge (Chomsky, 1995). Numeration is a set of pairs, each pair includes a lexical item, and an index that indicates how many times the lexical item will be selected for. Merge applies onto the set once all the items are exhaustively selected. The process of applying Merge is building a syntactic structure.

Labelling algorithm is necessitated while Merge. Chomsky (1995) posits the following rule of labelling:

> Chomsky (1995)
> "Target two syntactic objects α and β, form a new object τ { α β }, the label LB of τ (LB(τ))=LB(α) or LB(β)"

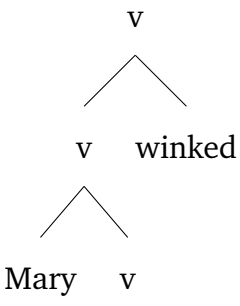
Since merging is process of building up a structure, *labelling algorithm* determines the head of a projection based on a merged syntactic object, such as the previous case { α β }, *labelling algorithm* uses is as an input and identifies a label through Minimal search, and selecting the simplex item as the label.

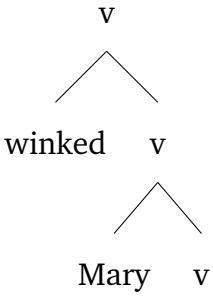
The identification of label is a theoretical issue. Chomsky (2013) exemplifies the configu-

ration that can be labelled and the one that fails to be labelled. Labelling algorithm cannot identify the label from (24-a), since both X and Y have the equal access to minimal search, in other words, they are both the simplex items in the input set. In contrast, X in (24-b) will be identified as the label, since the other component '{..}' is underspecified, it requires another minimal search to set up a label (Kruger, 2023).

(24) a. { X Y }
b. { X {...} }

One crucial question is the initial step of merge, based on the description above, merge is a symmetric step that combines two syntactic objects. This causes certain empirical issues, as exemplified in De Belder and Van Craenenbroeck (2015), assuming that *Mary, v, winked* are the items in the Numeration, as shown in (25-a). If two of the items are merged freely, it is possible to derive ill-formed structures, such as (25-b), which fails to capture the thematic relation between Mary and the verbal predicate, or (25-c), in which the word order is wrong.

(25) a. { {Mary,i} {v, i} {winked,i}}
b.


c.


Facing cases shown above, studies such as Di Sciullo and Isac (2008); Zwart (2009, 2011a); De Belder and Van Craenenbroeck (2015) (among others) suggest that Merge is *asymmetric*, and the *first merged* item is of crucial to build up a structure, in Zwart (2009, 2011b), the first merge operation is termed as '*primary merge*'.

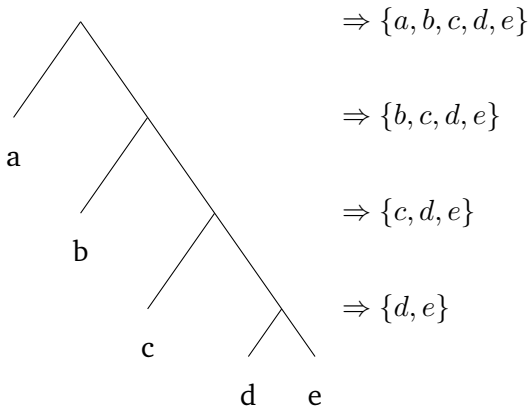
Specifically, in Zwart (2009, 2011b), merge is seen as a *unary operation* that organises the available items of a resource set in an ordered fashion. Assuming a resource set in the condition of (26-a), if the item *a* is the target, *merge* directly operates on *a*. Concurrently, the item *a* is removed from the original set (as shown in (26-b)), and this process happen recursively until all the elements are merged exhaustively.

(26) a. $\{a, b, c, d, e\}$

b. $< a, \{b, c, d, e\} >$

c. $< a, < b, \{c, d, e\} >>$

(27)



Notably, the selected items such as *a*,*b*, are placed into a syntactic position, while the remaining elements serve as input for subsequent iterations of the merge process (as illustrated in diagram (27)).

Furthermore, the structural position of an item and a set, as shown in (27), reveals their syntactic relation. To illustrate, consider the pair *a* and $\{b, c, d, e\}$. Here, *a* is an atom, and $\{b, c, d, e\}$ constitutes a set for the second merging. Consequently, *a* initially receives a syntactic function, and at this point, a syntactic environment is established. After this, the elements of the set $\{b, c, d, e\}$ are merged into the established syntactic projection.

Meanwhile, it is possible for $\{b, c, d, e\}$ to have a different syntactic structure from the one where hosts the atom '*a*', but it can only be realised at the sound interface level,

not affecting the main syntactic structure. In other words, merging *a* determines a main syntactic environment, which cannot be changed.

Empirically, this is supported through a particular head-final condition in Dutch, where head-final constructions occur in embedded clauses while the main clause maintains a head-initial word order. As exemplified in (28), all elements in bold precede the clause-final verbs.

(28) a. ..dat Jan die dingen niet **op** schrijft
COMP John DEM:PL thing:PL NEG **up** write:3SG
'that John does not write those things down'

b. ..dat Jan het hek niet **rood** verft
COMP John the fence NEG **red** paint:3SG
that John does not paint the fence red.

c. ..dat Jan zelden **een boek** leest
COMP John rarely **a book** read:3SG
that John rarely reads a book. Zwart (2011b)

Under this account, the v head is primarily merged into a syntactic template (analogous to selecting *a* in (26-a)). Following this step, the remaining elements of the set undergo a separate derivation, in other words, building up a different syntactic structure. Therefore, in (28-c), the head-final environment is established after merging the verb *leest*.

Subsequently, *een boek* is derived separately, where a **head-initial** structure forms as the D head merges with its complement. After forming these two derivations, the ultimate word order *een boek leest* is determined at PF. In this process, *een boek* is treated as a single lexical item adhering to the head-final signal established at the primary merge, resulting in the word order *een boek leest* 'a book read' in the embedded clause.

A slightly different analysis is employed by De Belder and Van Craenenbroeck (2015). Specifically, assuming a resource set $\{a, b, c, d, e\}$, the object a is targeted and selected into the primary merge. However, upon this step, the main syntactic template is **not** established, hence $\{b, c, d, e\}$ would not function as an input for the second merge. Rather,

an empty set merges with a (as shown in (29)). Furthermore, between a and $\varnothing$, the former has to be the label of this constituent, considering that an empty set is incapable to project and pass its information to a mother node.

(29)

Notably, the principal distinction between the framework proposed by Zwart (2009) and that of De Belder and Van Craenenbroeck (2015) lies in the sequencing of the secondary template. By 'secondary template', I refer to the syntactic template that is embedded within the major syntactic template (such as **een boek** in **een boek leest**, where the head final is the major template, head initial is the secondary template).

(30) a. $_A < templateA\{templateB\} >$

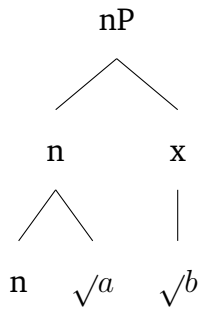
b. $_A << templateB > templateA >$

In this context, As illustrated in example (30-a), template A determines the primary syntactic environment and selects an object as a head. Subsequently, template B is formed, which is derived from the remaining elements of the resource set, with this derivation occurring at the sound interface. The contrasting approach begins by forming the secondary template. For instance, in example (30-b), *template B* is constructed prior to *template A*. In this scenario, template B initially contains an empty set, which is later given phonological realisation at sound interface.

Now shifting the focus back to the N_+CL_- compounds in MC. I proposed a general template to host the n categoriser and the inner morpheme-x, as repeated below (31). Revisiting this proposal, n and x are merged together, and the categoriser n is the phase head, as the labelling of this derivation. The outcome is spell-out at the sound interface, where lexical insertion occurs, corresponding lexical realisations are inserted for the categoriser and the

inner morpheme, as in (31) $\sqrt{a}$ for n, $\sqrt{b}$ for x.

(31)



However, the mechanism by which this relation is established has not been thoroughly addressed. The assumption that any terminal nodes adjacent to *n* inherently provide this particular structural relation is insufficient. If Merge functions binarily in the initial step, and forming {n,x}, x is not a unique position that provides the 'dependent' relation between N and CL in $N_{full}CL_{null}$ pairs.

In other words, the step of merging {n,x} is no different from merging {n,n}, in which the outcome is expected as a common nominal compound. Such as the coordinated one 'hu-xi' (exhale-inhale), wherein the semantic content of both components are needed. But this not how the content meaning is conveyed in $N_{full}CL_{null}$ structures.

To account for the interpretative pattern ($N_{full}CL_{null}$), the resource set and the merging process are essential to be specified. I follow the proposal from De Belder and Van Craenenbroeck (2015) about the role of the *primary merge*. In a given resource set (32-a), *primary merge* targets one item in the resource set and forming a syntactic projection (32-b). But at this point, the projection (32-b) does not determine the major syntactic projection.

(32) a. Resource set: { n,x, $\sqrt{}$, $\sqrt{}$ }

b.

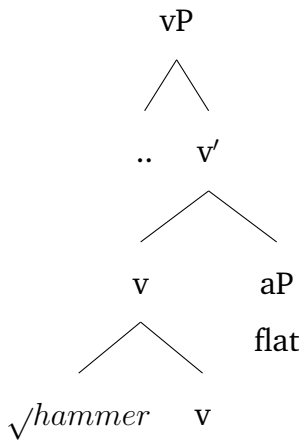
c. Updated resource set: { n, $\sqrt{}$ }

Specifically, I assume that x is selected as the first element to merge, with its merging partner being a root. Once x is merged, it is removed from the resource set, while the remaining elements stay within the resource set, as shown in (32-c). Subsequently, merge operates on n, establishing the main syntactic template, the nP. At this stage, a dependency is formed between the nP and the projection of x.

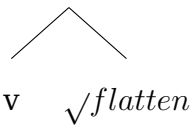
Notably, n and x serve different roles in this derivation: n functions as the head of nP, while x acts as the inner morpheme. The role of the x morpheme is to embed the content inherited from the root into the nP projection. This is similar to the case discussed in Embick (2004); Alexiadou and Lohndal (2017), where semantic effects arise when a root merges directly with a phase head.

According to their analysis, the inherent content of roots determines where they merge within a syntactic projection. For instance, manner roots (such as hammer, as shown in (33-a)) cannot directly merge with a categoriser; instead, they merge as modifiers adjacent to the v categoriser. In contrast, state/result roots can merge directly with the v categoriser (such as flatten, as shown in (33-b)).

(33) a. hammer flat (manner root):



b. flatten (resultative root): vP



Referring back to the case of the x morpheme, I assume here that the projection it generates is *secondary*, with its realisation depending on the primary projection, which is nP. In other words, during the step of primary merge, a bare root cannot be targeted due to its inherent deficiency; to express its content meaning, a label is required-herein, the x morpheme. Once x merges, the content of the root (corresponding to the CL in the N-CL pair) is interpreted within the syntax, the process is schematised in Figure below.

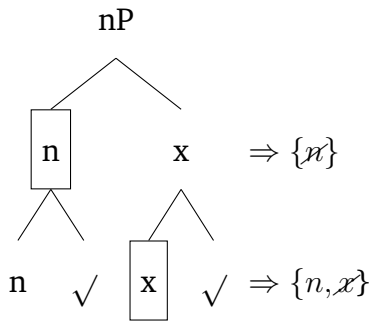


Figure 2.2: (Revised)Template for N_+ CL_- Compounds

After establishing the positions of the categoriser and the inner morpheme, the subsequent steps are straightforward. The nP phase spells out at the sound interface, where n and x receive their lexical realisations at this point. However, a question arises regarding the insertion site, at the sound interface, how does x and n receive their phonological realisations?

Here, I adopt the *Late Insertion* model (Harley and Noyer, 1998; Embick, 2004; Bobaljik, 2012; Bonet and Harbour, 2012). Within DM, Late Insertion refers to the process by which phonological content is inserted into syntactic structures on the way to Phonological Form (PF). Prior to this point, hierarchical structures are specified solely in terms of morphosyntactic features and lack any phonological material. Thus, Late Insertion ensures that each phonological exponent is inserted into a designated syntactic position. Crucially, phono-

logical realisation presupposes the existence of a pre-established syntactic slot.

The analysis of $N_{full}CL_{null}$ presented thus far satisfies this requirement. As shown in Figure 2.2, vocabulary insertion occurs independently within each syntactic projection. The lexical realisation of both n and x proceeds in a straightforward manner: the root in the n projection surfaces as the initial noun in an N-CL pair, while the root in the x projection is realised as the attached classifier.

Consequences

Finally, the internal structure of the first interpretation pattern of N-CL is formed. First, I propose that the semantic content of N-CL pairs is an outcome of the projection-nP. nP is the initial structural projection that hosts the following objects: n categoriser, x-morpheme, roots. Additionally, the nP includes a projection headed by the categoriser. Most importantly, the dependency between n and x is established within this projection, and this structural dependency generates the semantic content of $N_{full}CL_{null}$.

Empirical evidence for this can be seen in table 2.4, which demonstrates the recurring pattern regarding the content meaning of $N_{full}CL_{null}$. Based on the proposed structure, this pattern is due to the dependency between n and x. To illustrate with compounds *hua-duo* 'flowers', *shu-ben* 'books', and *zhi-zhang* 'papers'.

N-CL	content meaning
Hua$_{flower}$-Duo	Flower(s)
Shu$_{book}$-Ben	Book(s)
Zhi$_{paper}$-Zhang	Paper(s)
Chuan$_{boat}$-Zhi	Boat(s)
Ma$_{horse}$-Pi	Horse(s)
Shu$_{tree}$-Zhu	Tree(s)
Mi$_{rice}$-Li	Rice(s)

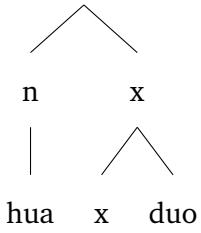
Table 2.4: $N_{full}CL_{null}$ pairs

As shown in (34), and in line with the analysis developed so far, the implicit status of attached classifiers arises from their structural position within a secondary projection of the nP. This secondary projection is headed by an inner morpheme which, as argued by Ac-

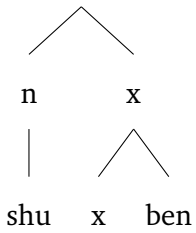
quaviva (2014), is a UG-sanctioned element that is sub-categorial and capable of merging directly with roots. However, due to its categorial deficiencyit does not carry sufficient information to yield an interpretable category on its ownits realisation depends on the main projection, namely the nP.

As a result, such N-CL pairs follow the $N_{full}CL_{null}$ pattern in terms of content realisation. At the same time, the N-CL compound functions as a nominal argument in the grammar, a status determined by the presence of the categoriser n.

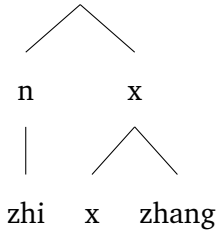
(34) a.



b.



c.



This analysis also provides insight into the nature of sortal classifiers. As previously discussed, distinguishing between sortal classifiers and mensural classifiers based on their categorial nature is problematic. However, one argument for this distinction is that some sortal classifiers contribute minimal semantic content to the phrases they reside in. For

instance, the phrases in (35) contain sortal classifiers, which are semantically inert. In contrast, the phrases in (36) contain classifiers that contribute to the overall meaning of the phrases.

(35) a. San duo hua
Three CL flower
'Three flowers'

b. San ben shu
Three CL book
'Three books'

(36) a. San ban hua
Three CL flower
'Three petals of flowers'

b. San ye shu
Three CL books
'Three pages of books'

The template presented in figure 2.2 offers an explanation for this characteristic. These classifiers are initially dependent on the n categoriser, merging at the inner morpheme position. They function as internal semantic supplements to the n categoriser, and this relationship remains unchanged even after spell-out, and even when they move to a functional projection such as CLP, aligning with the locality constraints observed in Arad (2003).

However, a key question that remains is how the classifier in N-CL constructions moves to the CLP position. In the following sections, I address the remaining three types of N-CL pairs, before returning to the issue of how NP associates with CLP.

2.4.2 N_{half} CL_{half}, interdependence of N and CL

The second pattern to be examined involves the content meaning derived from both the noun (N) and the classifier (CL). In this pattern, to convey the complete content meaning, the semantic contributions from both N and CL are essential and carry equal semantic weight. For instance, in *hua-ban* 'petals of flowers', although the meaning is related to the initial noun *hua* (flower), *hua* and *hua-ban* belong to different ontological categories.

Employing the same test with N_{half} CL_{half}. As discussed in the previous section, the insights of Carlson (1977); Baker (2003b) were considered, which indicate that nominal items typically denote either an *entity* or a *kind*. However, entities exhibit distinct ontological properties. For instance, the entity *petal* is ontologically different from the entity *flower* due to the variations in their extensions, which project different prototypical features.

As mentioned earlier, prototypical features play a crucial role in determining which members can be included in a conceptual set (Rosch and Mervis, 1975; Osherson and Smith, 1981). In other words, members that are similar within a concept share an internal relationship, rendering them equal members of that specific conceptual set.

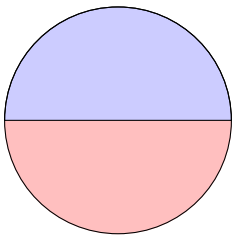


Figure 2.3: Extension of N_{half} CL_{half} pairs

In this context, we can represent the extension of N_{half} CL_{half} pairs using a simple set diagram, as illustrated in Figure 2.3. One half of the circle represents the ontological properties derived from the nominal component, while the other half reflects the ontological properties associated with the classifier. Therefore, for *hua-ban*, the attached classifier 'ban' provides dimensional information essential to the N-CL pairs. Meanwhile, the nominal component plays a crucial role as well, serving as the foundational set for the expression.

If the initial noun is altered, for instance, to *ye-ban* ('petals of leaves'), the extension of the compound changes accordingly. This highlights the importance of both components in N-CL compounds: the noun (N) supplies the base content, while the classifier (CL) shapes this content. Thus,yielding the **interdependence** of N and CL.

Notably, the internal relationship between the noun and classifier in $N_{full}CL_{null}$ pairs differs from that in $N_{half}CL_{half}$ pairs. In the former, as previously illustrated, the classifier root is positioned within a secondary projection formed by an inner morpheme. This inner morpheme is dependent on the main projection (nP), resulting in a hierarchical structure in which the classifier is both semantically and syntactically subordinate to the noun.

By contrast, $N_{half}CL_{half}$ pairs exhibit interdependence rather than dependence. In these cases, neither the noun nor the classifier functions as the primary semantic contributor. This is reflected syntactically by the fact that both roots merge at the same projection level, suggesting that neither is independently compatible with an inner morpheme projection.

In other words, the key is to construct a syntactic projection within the nP domain that simultaneously hosts both the noun root and the classifier root. Only under such a configuration can a unified lexical content be derived, with the noun and classifier contributing equally to the overall meaning. To implement this structure, I propose that the particle *de* functions as a linking device that facilitates this joint projection.

De within numeral classifier phrases

De can serve various roles in Chinese grammar: as a modifier marker (37-a), a complementiser (37-b), and a genitive marker (37-c). It can also be inserted within a numeral classifier phrase, as shown in (37-d)

(37) a. Hong **de** hua
Red de flower
'red flowers' — de as a modifying marker

b. Wo xiang wan-cheng **de** shi
I want accomplish de thing

'Things that I want to accomplish' de as a complementiser

c. Ming **de** che
Ming de car
'Ming's car' de as a genitive marker

d. San wan **de** shui
Three bowl **de** shui
'Three bowls of water' de after a classifier

Concentrating on the most relatable case, de within numeral classifier phrases. First, the particle *de* is sensitive to the type of classifiers that precede it. Typically, *de* is used appropriately with container classifiers, as demonstrated in (37-d). In such cases, de appears between a container classifier and a non-countable noun. Semantically, the presence of *de* emphasises a measuring interpretation.

Specifically, as shown in (38-a) and (38-b), two interpretations are possible. The first is a counting interpretation, where the individual container classifier is counted. In this case, the statement in (38-a) is true if I drank three separate cups of water. However, inserting *de* reinforces a measuring interpretation, so the statement in (38-b) is true if I drank three cups of water considered as a cohesive whole, and in this case, the measuring meaning overrides the counting meaning.

(38) a. Wo he-le san bei shui
I drink-Par three cup water
a.'I drank three cups of water (counting)'

b. 'I drank three cups of water, which as a cohesive whole (measuring) '

b. Wo he-le san bei de shui
I drink-Par three cups de water
a. 'I drank three cups of water, which as a cohesive whole (measuring)'

b. 'I drank three cups of water (counting).'

In Li (2011b), *de* is considered as a marker for measurement; depending on the feature inherited in classifiers [7], the sequence [Numeral-Classifier-De-N] has two interpretations.

[7]In this analysis, the feature $[\pm Counting, \pm Measuring]$ determines the function of a classifier, a counting

When the classifier is a counting unit, [Numeral-Classifier-De-N] denotes the meaning 'as many as' (39-a), while when the classifier is a container word, the sequence means 'as much as'.

(39) a. Ta-men zhong-le shi lai ke de shu
They plant-Par ten around CL de tree
'They planted around 10 trees'

The aforementioned analysis emphasis that *de* is a functional item that possesses an independent semantic role, and structurally, it links the sequence [numeral-classifier] with a nominal item. This linking functions infers my analysis of N_ CL_ compounds, in this section, I argue the duality of de, apart from being a functional item, it also links two contents into a unified one.

To elaborate, the analysis presented thus far suggests that classifiers and nouns share a structural relationship that contributes to the construction of coherent content, as seen in examples like *duo-hua* (CL flower) and *ben-shu* (CL-books). In these cases, an intrinsic relationship is evident.

Now, considering the role of *de* in numeral classifier phrases, it is noteworthy that *de* can only be positioned between the classifier (CL) and the noun. Given the previously mentioned relatedness between the classifier and the noun, it is plausible to suggest that *de* can also be formed within the nP projection, thereby facilitating the intrinsic relationship between a noun and its matching classifier.

Fortunately, empirical data supports the possibility of including *de* in N-CL pairs, which aligns with my proposed typology. Generally, among the four types of N-CL pairs, $N_{full}CL_{null}$ do not permit the insertion of *de*. In contrast, $N_{half}CL_{half}$ pairs consistently allow *de* to be placed between the components. For the other two types, a mixed condition emerges; however, inserting *de* in $N_{full}CL_{full}$ or $N_{less}CL_{more}$ alters the meanings of the constructions.

classifier combines with countable nouns, while measuring classifiers combine with non-countable nouns

Specifically, refer to table 2.5, all $N_{half}CL_{half}$ pairs permit the insertion of the particle *de* in the middle, resulting in the formation of *N de CL* (as shown in the column for Formation 1). Notably, the word order is flexible. As shown in the column for Formation 2, *N de CL* can be restructured to *CL de N*, and crucially, both formations retain the same content meaning as the original N-CL compound [8].

N_ CL_/*Meaning*	Formation 1/Meaning	Formation 2/Meaning
Hua-Ban ('petals of flowers')	Hua de Ban/=Hua-Ban	Ban de Hua/=Hua-Ban
Mu-Pian ('pieces of woods')	Mu de Pian/=Mu-Pian	Pian de Mu/=Mu-Pian
Rou-Kuai ('chuncks of meat')	Rou de Kuai/=Rou-Kuai	Kuai de Rou/=Rou-Kuai
Zhi-Tiao ('slices of paper')	Zhi de Tiao/=Zhi-Tiao	Tiao de Zhi/=Zhi-Tiao

Table 2.5: De within N_ CL_

As further exemplified in (40) based on the search from CCL corpus, two formations-'*N de CL*' and '*CL de N*' denote the same content meanings when using them in sentences. In contrast, this flexibility in word order and the consistency in content meaning are not observed in other types of N-CL pairs.

(40) a. ..xiang-xiang zhong lian-cheng de **hua-de-ban**...
..imagination inside smelt de **flower-de-petals**...
'(intended) imagination is limitless, it can form **petals of flowers**'

b. ..ru xiang-ri-kui bian-yuan bu-fen da **ban-de-hua**
..like sunflower side part big **petal-de-flower**
'(intended) it is like the big **petals** of the side part of a sunflower'

c. ..yi-fu shang zhan-shang se **zhi-de-tiao**..
..clothing on stick-on colour **paper-de-slice**..
'(intended) we decorate our clothing with **slices of colourful paper**'

d. ..yuan-wang xie-zai yi tiao **tiao-de-zhi** shang
..wishes write-on one slice **slice-de-paper** top
'(intended) writing the wishes on the **slices of papers**'

Refer to the column for Formation 1 in Table 2.6[9]. Among the three types of N-CL con-

[8] In the table, if any altered formation conveys the same content meaning with the unaltered N-CLs, I use the form '= repeated compound' to indicate their same content meanings

[9] In this table, '✗' indicates the impossibility of an altered formation. Δ indicates a different semantic meaning

structions, none permit the insertion of *de* while preserving the original content meaning of N-CL. Specifically, $N_{less}CL_{more}$ can transition to Formation 2 with the sequence *CL de N*. However, in these cases, *CL de N* conveys a different content meaning compared to the original form, the N-CL.

Pattern	N-CL/Meaning	Formation 1	Formation 2/Meaning
N_+ CL_-	Shu-Ben/'books'	✗Shu de Ben	✗Ben de Shu
N_+ CL_+	Ren-Qun/'People in a group'	✗Ren de Qun	✗Qun de Ren
N_- CL_+	Shui-Bei/'Cups with water'	✗Shui de Bei	✓Bei de Shui/△

Table 2.6: De within other N-CL compounds

For instance, consider the compound *shui-bei* means 'cups filled with water', where the classifier is the semantic core. In contrast, *bei de shui* functions more as a measuring phrase, indicating that the water is quantified by cups, differing from 'cups filled with water'.

Given these variations, it is plausible to argue that $N_{half}CL_{half}$ pairs necessitate a distinct syntactic projection within nP, where an interdependence between N and CL is established. Based on their unique acceptance of de, it is reasonable to assume that *de* serves as the linking device that constructs the internal relationship.

Furthermore, the comparison above supports my proposal concerning the role of nP. As posited, the root projection nP is responsible solely for determining content meaning, whereas formal semantic features-such as definiteness and number-are processed in higher functional domains. Referring back to the data presented in Tables 2.5 and 2.6, in $N_{half}CL_{half}$ constructions, the particle de merges within the nP domain, effectively uniting the two roots into a single lexical unit. In contrast, in other types of N-CL pairs, the insertion of de is disallowed, indicating that de does not merge at the nP level in those cases.

To illustrate this distinction more precisely, consider the expression *Bei de shui* (cup of water). This construction conveys semantic content beyond the nP domain-specifically, it expresses a measuring interpretation. As extensively discussed in the literature, the notion of 'measuring out' is not lexically driven but arises from complex structural configurations involving the measuring operator μ (Nakanishi, 2003; Rothstein, 2011). Such measuring

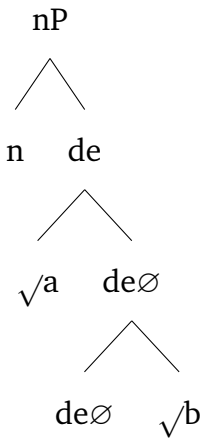
readings can be derived from various syntactic configurations, including degree phrases and prepositional phrases (Jackendoff et al., 1977), as well as pseudo-partitive and partitive structures (Schwarzschild, 2002). Accordingly, the measuring function observed in *Bei de shui* appears to stem from higher functional domains capable of hosting μ. This suggests that *Bei de shui* is not formed at the nP level, as the nP domain does not yet have access to formal semantic features.

In contrast, constructions such as *hua de ban* and *ban de hua* primarily encode content meaning, and align closely with the fixed N-CL pair hua-ban. I propose that the flexibility in word order, along with the unified interpretation seen in $N_{half}CL_{half}$ pairs, is determined at the nP level, where a silent de merges with the two roots. If this proposal is correct, then the role of this silent element must be further defined. Specifically, it is essential to account for why and how de merges with two roots within the nP domain.

Structure

I propose the structure of (41) for $N_{half}CL_{half}$ pairs, positing that the interdependence is due to the structural projection, *de* projection. Here, *de* is a silent morpheme that links $\sqrt{b}$ to $\sqrt{a}$.

(41)



Regarding the structure in (41), the *de* projection functions as an inner morpheme, aligning with the discussion in Marantz (2000, 2007), which conceptualizes an inner morpheme as

more of a structural notion than a lexical one. In this context, the *de* projection and the *x* projection are fundamentally similar; the key difference lies in their internal structures. The *x* projection hosts a single root, while the *de* projection accommodates two roots.

The role of silent de

To begin with the function of silent head in a formed constituent. Cross-linguistically, there is evidence suggesting that a silent head can intervene within a constituent and deliver a linking function, known as *mixed projections*.

According to the investigation of Greek and Hebrew gerunds in Panagiotidis (2010), a mixed projection of gerunds is proposed. Specifically, he posits a null P head before Greek gerunds, encoding a specific temporal value. For instance, in (42), the temporal value encoded by the matrix clause '*he came*' and that of the embedded gerund '*singing*' are distinct, with *'he came'* referring to a past event and '*singing*' indicating a progressive aspect.

(42) irthe $_{PP}\varnothing$ **traghudh-ondas**
he.came $_{PP}\varnothing$ **singing**
'He came singing' Panagiotidis (2010)

This is where the null P involves; it links these separate temporal events, allowing the event of *he came* to be included within the event of 'singing' and making them a unified whole. This template is similarly applicable to Korean and Japanese verbal-nominal phenomena. For instance, in (43) and (44), *yenkwa* (research) in Korean and *ryokoo* (travel) in Japanese are nominals functioning as verbal elements to assign case features within a specific syntactic context, where they reside in a phrase embedded within a main clause, and this idiosyncratic ability to assign case features can be rooted in the silent P head.

(43) **[Kim-pakasa-ka woncahayk-ul yenkwu]**-cwung-ey cencayng-i
[Kim-Dr-NOM atom.nucleus-ACC research]-midst-LOC war-NOM
ilena-ss-ta
broke.out-PST-DECL
'The war broke out while Dr.Kim was researching the atom nucleus.' Yoon and

Park (2004)

(44) **[Sensei-ga kaigai-o ryokoo]**-no sai...
[teacher-NOM abroad-ACC travel]-GEN occasion...
'On the occasion of the teacher's travelling abroad...' Shibatani (1990, PP:247)

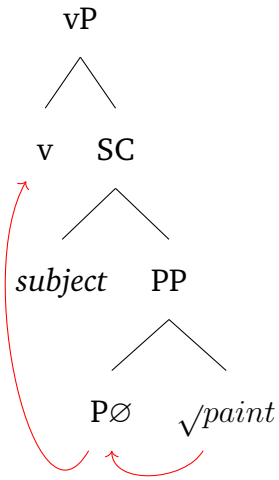
Tracing back to the previous proposal regarding N_ CL_ compounds, by considering the aforementioned cases, it is not surprising that a silent element-*de* can merge inside the N-CL construction, and given the general assumption-N and CL are roots, the emergence of *de* becomes more plausible, as the projection of roots is still trivial to syntax, a marker or a label-able item is needed.

Consequently, in this context, *de* is such a label-able item, such that it establishes an interdependence between N and CL. This interdependence is reflected in the surface structure, where the overt realisation of *de* does not alter this relationship, and the both formations-*hua de ban* (flower de CL_{petal}) & *ban de hua* (CL_{petal} de flower) are interchangeable without affecting their content meanings. After addressing the role of *de* in N_ CL_, the next question to consider is the syntactic template that host all the elements, given that N and CL are initially roots, they depend on a syntactic template for their realisation.

If *de* merges with $\sqrt{b}$, then *de* becomes the label of that projection (similar to the relationship between x and $\sqrt{b}$ in figure 2.2). The challenge lies in determining how $\sqrt{a}$ integrates into the projection to maintain the interdependence and ensure the projection's success at the interface level. I assume the $\sqrt{}$ projection is a small clause projection, wherein the two roots merge around *de*.

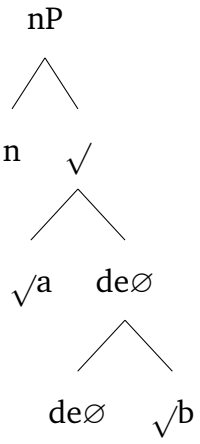
A similar framework has been utilised in Marantz (2000, 2007); Harley (2003), a categoriser merges with a small clause composed of roots. The small clause contains specific semantic information inherent in certain verbs. For example, the verb *paint* as a locatum verb is due to the small clause projection shown in (45), where the root $\sqrt{paint}$ incorporates with an empty P node, thereby occupying the locatum theta-role in P.

(45) Small clause with v categoriser in Harley (2003)



Linking to $N_{half}CL_{half}$ constructions, I propose the structure (repeated below as (46)) to account for the interpretation pattern and the interdependence of N and CL. By considering small clause projection shown in(45), the rationale of the $\sqrt{}$ projection in (46) can be detailed. First, *de* possesses a projection akin to a small clause, wherein two roots merge separately: one as the complement of *de* and the other in the subject position. *De* is a null element within this projection, similar to the null P observed in Greek, Japanese and Korean. This terminal node encodes a particular information, such that $\sqrt{a}$ and $\sqrt{b}$ are mutually dependent.

(46)



In terms of the merging process, by following the proposal that N-CL is formed uniformly at nP, the merging process of $N_{half}CL_{half}$ pairs is expected to be the same with that of $N_{full}CL_{null}$ pairs. As schematised in figure 2.4,the initial resource set consists of n, de. The syntactic object *de* is first selected and merged into a syntactic template. This initiates the establishment of a syntactic environment where the projection of *de* forms a small clause, necessitating the insertion of two additional syntactic objects to occupy the two slots. Based on the structure, $\sqrt{b}$ and $\sqrt{a}$ are inserted and phonologically realised at the sound interface. After building *de* projection, the categoriser *n* merges, forming an nP.

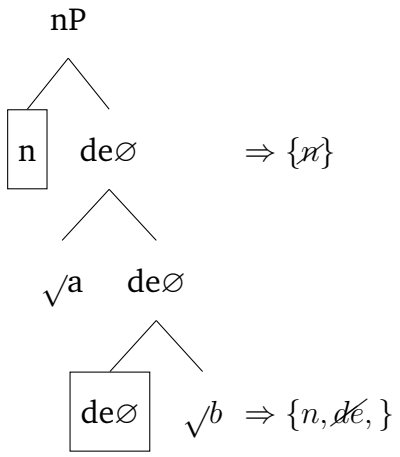


Figure 2.4: Merging de and n in nP

Notably, the underlying rationale behind the use of the x morpheme in $N_{full}CL_{null}$ constructions (Figure 2.2) and the particle de in $N_{half}CL_{half}$ constructions (Figure 2.4) is consistent: both require an initial step of primary merge to establish a syntactic template. The key distinction, however, lies in the nature of the projection each element introduces. In $N_{full}CL_{null}$, the projection headed by the x morpheme is designed to host a single root. In contrast, in $N_{half}CL_{half}$ constructions, de introduces a projection that accommodates two syntactic slots, allowing for the simultaneous merger of both the noun root and the classifier root.

Consequences

Consequently, the interdependence between the noun and classifier can be accounted for within this analysis. As shown in Figure 2.2, the classifier corresponds to the root $\sqrt{b}$,

while the noun corresponds to the root $\sqrt{a}$. These two roots are syntactically linked by the silent element de, and both are essential for expressing the full content meaning of the N-CL pair. Empirical support for this interpretative pattern is provided in Table 2.7, where all examples exhibit the interpretative pattern of $N_{half}CL_{half}$ constructions.

N-CL	content meaning
Hua$_{flower}$-Ban$_{petal}$	Petals of flower
Shu$_{book}$-Ye$_{page}$	Pages of Book
Zhi$_{paper}$-Pian$_{Piece}$	Pieces of Paper
Rou$_{boat}$-Kuai$_{Chunk}$	Chunks of meat
Ye$_{leaf}$-Ban$_{petal}$	Petals of leaf

Table 2.7: Other $N_{half}CL_{half}$ pairs

Second, the analysis explains the interchangeability of *N de CL* and *CL de N*. In this case, the overt *de* is just a phonological realisation at the sound interface, the underlying relation between N and CL is determined internally at nP, thus, both *N de CL* and *CL de N* convey the same meaning with the unaltered form, the N-CL.

2.5 $N_{full}CL_{full}$ and $N_{less}CL_{more}$

In the preceding analyses, I have detailed the derivation of content meaning in $N_{full}CL_{null}$ and $N_{half}CL_{half}$ constructions. I attribute this variation to differences in the internal projections within the nP domain. Although both constructions involve a secondary projection, the structure projected in $N_{full}CL_{null}$ differs from that in $N_{half}CL_{half}$. This structural distinction is further supported by locality constraints, which stipulate that root-oriented meaning is confined to the domain in which it is formed. Both types of N-CL pairs conform to this locality condition: as illustrated in (47) and (48), the content meaning remains consistent even when the classifier moves out of the N-CL pair and appears in a pre-nominal position.

(47) a. Wo ge hua-duo
Give $CL_{general}$ flower-CL_{duo}
'Five flowers'

b. Wo duo hua
Five CL_{duo} flower
'Five flowers'

(48) a. Wo ge hua-ban
Give $CL_{general}$ flower-$CLCL_{ban}$
'Five flower-petals'

b. Wo ban hua
Five CL_{ban} flower
'Five flower-petals'

However, as previously discussed, locality constraints are not universally applicable across all N-CL pairs. As shown in the repeated Table 2.8, $N_{full}CL_{full}$ and $N_{less}CL_{more}$ constructions do not preserve their original content meaning when the classifier is repositioned to a pre-nominal position.

To clarify this characteristic, it is important to examine how the classifiers in $N_{full}CL_{full}$ and $N_{less}CL_{more}$ constructions differ from those in the other two types. I begin with $N_{full}CL_{full}$ pairs. Typically, only collective classifiers are compatible with this type of N-CL construc-

Type	Interpretative pattern	Example	Content meaning	Locality constraints
1	N_{full}, CL_{null}	*hua-duo*	Flower(s)	✓
2	N_{half}, CL_{half}	*hua-ban*	Petals of flower	✓
3	N_{less}, CL_{more}	*shui-bei*	Glasses with water	✗
4	N_{full}, CL_{full}	*yang-qun*	Sheep in a group	✗

Table 2.8: (Repeated)Descriptive typology of N-CL pairs

tion. For example, as shown in (49), the collective classifiers qun (group) and dui (pile) can combine with the noun ren (people) to form N-CL pairs. In both cases, the resulting expression conveys the unified content meaning of people in a group.

(49) a. Ren-Qun
People-CL_{Group}
'People in group'

b. Ren-Dui
People-Pile
'People in a pile'

However, when the N-CL structure is decomposed and the classifier is placed in a pre-nominal position, the atomic content meaning of 'people in a group' breaks down. As illustrated in (50), the phrase [san ge ren-qun] (three CL people-group) treats ge as the classifier for the noun 'ren-qun'. Here, the numeral san 'three' quantifies the entire unit 'ren-qun'(people-group).

(50) a. San ge ren-qun
Three $CL_{general}$ people-CL_{group}
'Three people-groups'

b. San qun ren
Three CL_{group} sheep
'Three groups of people'

In contrast, when qun functions directly as the classifier, as in (50-b), its inherent content is no longer compositionally tied to the N-CL pair. Instead, it acts independently as a

classifier for the noun *ren*. As a result, *san qun ren* quantifies only the noun ren (people), and the integrated meaning of the N-CL pair is lost.

The same pattern is observed in $N_{less}CL_{more}$ constructions, where N-CL pairs typically consist of a substance noun followed by a container classifier, as illustrated in (51). In such cases, as shown in (51-b), the N-CL shui-bei (water-cup) functions as the head noun. Shui-bei is classified by the general classifier ge and quantified by the numeral san (three).

(51) a. Shui-bei
Water-cup
'Cups with water'

b. Zhuo-shang you san ge shui-bei
Table-up have three $CL_{general}$ water-cup
'There are three cups (with water) on the table'

However, when the N-CL pair is decomposed and the classifier precedes the noun, the atomic meaning 'cups with water' is no longer preserved. In example (51), both the classifier and the noun contribute substantive semantic content. As further shown in (52-b), the phrase fundamentally quantifies the noun shui (water) via the classifier bei (cup).

(52) a. San bei shui
Three CL_{cup} water
'Three cups of water'

b. Zhuo-shang you san bei shui
Table-up have three CL_{cup} water
'There are three cups of water on the table'

In other words, In N-CL structure like shui-bei, the classifier contributes more heavily to the overall meaning, effectively characterising the N-CL pair. In contrast, when bei is used in CLP position (preceding the noun), the phrase expresses a measuring interpretation-partitioning the mass noun shui (water) into discrete units (in (51-b), the cups). In this context, the meanings of bei and shui are more evenly balanced, unlike in the N-CL struc-

ture where the classifier dominates the interpretation.

Based on the illustration, what distinguishes the $N_{full}CL_{full}$ and $N_{less}CL_{more}$ constructions from the other two N-CL pairs primarily concerns the semantic roles associated with different structural positions. In $N_{full}CL_{full}$ and $N_{less}CL_{more}$, when the classifier appears in the classifier phrase (CLP), it functions as an independent element, contributing semantic content separately from the noun. This contrasts with the other types of N-CL pairs, where the classifier and noun form a unified lexical unit in N-CL construction, which remain unchanged when the classifier is placed pre-nominally. Such variation poses a challenge for the current analysis of N-CL pairs, as it suggests that classifier behaviour is not uniform across structural contexts.

To briefly recall the analysis of the other two constructions-$N_{full}CL_{null}$ and $N_{half}CL_{half}$-I proposed that these involve complex projections within the nP domain. Specifically, the inner morpheme occupies a secondary projection, while the primary projection is associated with the n categoriser. Due to the categorial deficiency of the inner morpheme, it requires support from the n categoriser for proper syntactic realisation. This structural dependency gives rise to the interpretative patterns observed in the $N_{full}CL_{null}$ and $N_{half}CL_{half}$ constructions.

However, assuming that the attached classifiers in $N_{full}CL_{full}$ and $N_{less}CL_{more}$ constructions occupy the secondary projection within nP is not plausible, as they do not exhibit dependency on the noun. Given this, it is reasonable to assume that the formation of these constructions involves a distinct process. The first aspect to consider, then, is the status of the classifiers themselves.

In what follows, I propose that the classifiers in $N_{full}CL_{full}$ and $N_{less}CL_{more}$ function as full nouns-specifically, they merge directly with the n categoriser, rather than serving as inner morphemes requiring additional structural support.

2.5.1 $CL_{collective}$, $CL_{container}$ as full nouns

By full nouns, I refer to the capacity of a morpheme to function as a stand-alone noun within the grammar. Recalling the proposal by Li (2011b), certain classifiers are argued to lack sufficient nominal status, and thus must compound with another noun in order to function properly. While the problems with this analysis need not be reiterated here, its relevance lies in the insight it offers for distinguishing collective and container classifiers from other types.

As evidenced in (53-a) and (53-b), collective classifiers and container classifiers can function as nominal items, and both can be classified by the general classifier *ge*. By contrast, as shown in (53-c), count classifiers such as *duo* and *ban* cannot be used as common nouns on their own; instead, they must form N-CL constructions in order to function nominally, as illustrated in (53-d).

(53) a. Wu ge ping/bei/wan
Five $CL_{general}$ glass/cup/bowl
'Five glasses/cups/bowls'

b. (?)Wu ge qun/dui/zu
Five $CL_{general}$ group/pile/set
'Five groups/piles/sets'

c. *Wu ge duo/ban
Five $CL_{general}$ CL_{duo}/CL_{ban}

d. Wu ge hua-duo/ban
Five $CL_{general}$ N-CL_{duo}/CL_{ban}
'Five flowers/flower-petals'

The second piece of evidence lies in the loose semantic relatedness between the noun and classifier in both cases. Recalling the previous analyses of $N_{full}CL_{null}$ and $N_{half}CL_{half}$ pairs, a close relationship was observed between the initial noun and the attached classifier-such that only a specific classifier can combine with a given noun to form a unit conveying a particular semantic content. I proposed corresponding structural configurations to account for this property.

(54) $N_{full}CL_{null}$

a. $_{n}$Shu-$_{x}$Ben
Book-CL
'Books'

b. Yi Ben Shu
One CL Book
'A book'

(55) $N_{half}CL_{half}$

a. $_{n}$Hua-$_{de}$ban
Flower-CL
'Petals of flower'

b. Yi Ban Hua
One CL flower
'A petal of flower'

As exemplified in (54), the strong association between Shu and Ben is attributed to the structural position between the categoriser n and the inner morpheme x. Similarly, in (55), Hua and Ban are linked via a silent inner morpheme de. Even when these elements are placed in a different syntactic context-such as within a classifier phrase (CLP)-the internal relationship between the noun and classifier remains intact. Accordingly, in (54-b) and (55-b), the interpretive patterns characteristic of $N_{full}CL_{null}$ and $N_{half}CL_{half}$ pairs are preserved.

However, in the case of $N_{full}CL_{full}$ and $N_{less}CL_{more}$ pairs, the noun and the classifier each contribute distinct semantic content, resulting in a greater degree of independence between the two elements. Empirical data in (56) show that collective classifiers can combine with a wide range of nouns to form N-CL pairs, with the independent meanings of both components consistently preserved. The same pattern holds for container classifiers, as illustrated in (57), further supporting the view that these classifiers exhibit looser semantic restrictions and contribute independent descriptive content in N-CL pairs.

(56) a. Shu-Dui
Book-pile
'Books in a pile'

b. Cao-Dui
Grass-pile
'Grass in a pile'

c. Hua-dui
Flower-Pile
'Flower in a pile'

(57) a. Shui-bei
Water-cup
'Cups with water'

b. Cha-bei
Tea-cup
'Cups with tea'

c. Jiu-bei
Wine-cup
'Cups with wine'

These differences may reflect a deeper underlying principle. As noted in the introduction, the categorisation of classifiers can be informed by the classic distinction between functionality and lexicality proposed by Emonds (1985); van Riemsdijk (1998). According to this view, the ability of a morpheme to function as a common noun or verb is indicative of its full lexical status.

Building on this, a scale of categorial status for classifiers can be established, as repeated below in 2.5. On this scale, general classifiers such as ge are treated as functional morphemes, whereas container classifiers represent fully lexical morphemes.

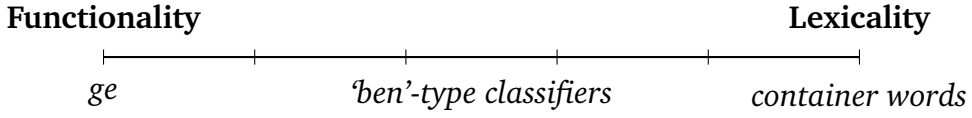


Figure 2.5: Categorial status of classifiers in MC

In light of my analysis of the other two N-CL pairs, a more fine-grained distribution can be proposed, as shown in 2.6.

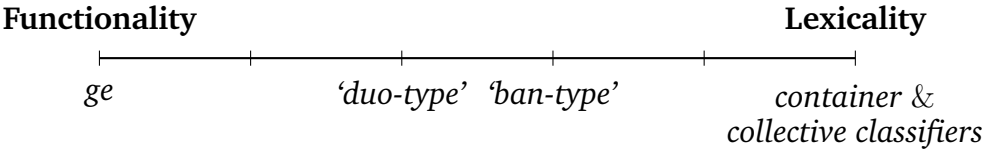


Figure 2.6: Categorial status of classifiers in MC

'Duo' corresponds to classifiers that are always semantically inert, as analysed in the configuration $N_{full}CL_{null}$, with examples like *Shu-ben* (book), *Hua-duo* (flower), *Zhi-zhang* (pa-

per). These classifiers rely on nominals to function within the grammar. As a result, they tend to lean towards the fully functional side of the scale.

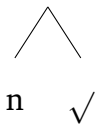
'Ban'-type classifiers are more lexical, as reflected in their semantic contribution to N-CL pairs. In *hua-ban*, for example, the full content meaning is conveyed by both components. These classifiers are less restricted than 'duo'-type classifiers, yet they still hold a dependency on a nominal item to provide a semantic base upon which they can project their content meaning. In this regard, they occupy a middle position on the scale between being purely functional and fully lexical.

For the collective classifiers and container classifiers, based on fact that both can serve as nominals, it is plausible to assume they are full lexical items.

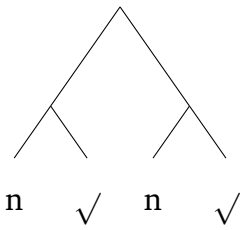
The estimated positions on the scale, along with the comparison shown in (53), shed light on why collective and container classifiers behave differently in N-CL constructions. Given the variation in categorial status among classifiers, I propose that collective and container classifiers directly project as nP, reflecting their full lexical status. In contrast, other classifiers are embedded projections within an nP, which accounts for their comparatively reduced lexicality.

Schematically, the structure for collective and container classifiers can be represented as shown in (58). Under this assumption, N-CL$_{\text{collective/container}}$ constructions result from the combination of two nP projections, as illustrated in (59) [10].

(58)



(59)



The diagrams above reveal that merging with the n categoriser is key to distinguishing

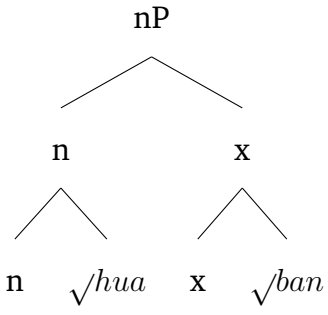
[10]However, this structure presents certain problems, which will be addressed in the next subsection.

collective and container classifiers from other types. To elaborate on the role of categorisers. As addressed previously in this chapter, categorisers are crucial for the interpretation of roots. This analysis follows the work of Baker (2003b); Panagiotidis (2010, 2011), which posits that categorisers encode categorial features. These features, such as [N] for nouns and [V] for verbs, allow the content of roots to be accessible at the interface levels of grammar. As Baker (2003b) illustrates, regardless of the specific content encoded in words like 'rock', 'scissor', or 'paper', they all share the same grammatical category, *noun*. In Panagiotidis (2010, 2011), this categorisation is attributed to the presence of an 'n' categoriser.

Based on the current analysis and the role of the n categoriser, the breakdown of unified meaning established at the N-CL stage in $N_{full}CL_{full}$ and $N_{less}CL_{more}$ pairs-when the classifier appears before the nouncan be explained as follows. When a container or collective classifier precedes the noun in a CL-N sequence, both the classifier and the noun project as independent nPs and are each capable of conveying complete lexical content. As a result, within the CLP structure, both elements contribute distinct descriptive meanings.

In contrast, in N-CL pairs such as Hua-ban (flower petal), the position of ban suggests that it is embedded within the nP and confined to the projection of an inner morpheme, as shown in (60). This structural position prevents it from projecting as an nP on its own; its content meaning cannot be independently realised but instead depends on the broader nP projection for interpretation.

(60)



From a semantic perspective, the current analysis remains valid. As repeatedly noted, N-CL

pairs denote atomic lexical content; however, the classifiers involved vary in the extent to which they contribute semantic content. The proposed role of the n categoriser effectively accounts for the interpretative patterns observed in these N-CL pairs.

As illustrated in the scale (Fig 2.7), the fully functional classifier *ge* does not contribute any lexical content and is therefore excluded from forming N-CL pairs. In contrast, classifiers such as the *duo-type* and *ban-type* do encode some lexical content. However, since they merge with inner morphemes rather than directly with the n categoriser, they cannot function as common nouns and cannot serve as the primary semantic contributors in N-CL pairs. By comparison, collective and container classifiers merge directly with the n categoriser, enabling them to function as common nouns and to contribute more substantial lexical meaning in N-CL pairs.

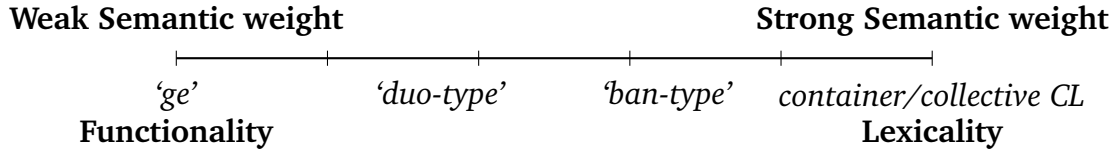


Figure 2.7: The semantic weight of classifiers in N-CL

Thus, referring back to the question of *why there is internal variation in the semantic weight contributed by components in N-CL pairs*, the key lies in the effects attributed to the n categoriser: when classifiers merge directly with n, they form fully lexical nouns and carry strong semantic weight. In contrast, when classifiers are embedded within an nP, they are not independently recognised by the grammar and must rely on the larger nP projection for interpretation, resulting in a weaker semantic contribution within the structure.

Having established this, the remaining task is to derive the nP structures of $N_{full}CL_{full}$ and $N_{less}CL_{more}$ pairs. Before turning to the structural analysis, it is worth noting that collective classifiers-when used as stand-alone nounsare generally less acceptable than container classifiers. For example, see the repeated examples (61), wu ge qun (five groups) is only marginally acceptable, whereas wu ge yang-qun (five sheep-groups) sounds far more natural. I attribute this contrast to the inherent content information carried by collective classifiers, which appears to require contextual anchoring via a noun to achieve full inter-

pretability.

(61) a. Wu ge ping/bei/wan
Five $CL_{general}$ glass/cup/bowl
'Five glasses/cups/bowls'

b. (?)Wu ge qun/dui/zu
Five $CL_{general}$ group/pile/set
'Five groups/piles/sets'

c. *Wu ge duo/ban
Five $CL_{general}$ CL_{duo}/CL_{ban}

d. Wu ge hua-duo/ban
Five $CL_{general}$ N-CL_{duo}/CL_{ban}
'Five flowers/flower-petals'

In other words, at the nP level, the grammar only assigns the n categoriser to the collective classifier root. This structural property explains why qun is significantly more acceptable as a common noun than classifiers like duo and ban (as shown in (61-b) and (61-c)). However, the content meaning encoded by collective classifiers differs from that of container nouns. I propose that the inherent semantic content of collective classifiers is best characterised as *range* (to be discussed in the following subsection). Due to this semantic property, the use of a collective classifier as a noun is more context-dependent than that of a container word.

2.5.2 Range, the core of collective classifiers.

Continuing from the previous section, I now turn to clarifying the lexical content associated with collective classifiers. As previously discussed, collective classifiers inherently introduce a sense of unspecified quantity into the phrases they are part of. This is evident in examples such as those in (62). When a speaker utters the sentences in (62-b), two pieces of information are conveyed.

First, expressions like ren-qun (people-group) and ren-dui (people-team) specify both the extension and the ontological category of the referent, in the sense of Carlson (1977); that

is, they identify a kind or group entity composed of people. Second, the attached classifiers contribute an additional semantic layernamely, the notion of an uncertain quantity. This dual contribution underscores the semantic complexity of collective classifiers within N-CL pairs.

(62) a. Ta zou-zai **Ren-Qun** zhong
She/He walk-Progressive **People-Group** middle
'She/He is walking with a group of people'

b. Ji ge hai-zi, zuan-zai **Ren-Dui** li
Few CL children, plunge-Progressive **People-Pile** inside
'Few children are plunging into a group of people'

Previous studies on classifiers have offered rich discussions regarding the denotation of number and quantity in collective classifiers. For instance, such classifiers are often subsumed under the broader category of mensural classifiers. As noted by Zhang (2013); Jin (2013), collective classifiersalong with standard measure words and container wordscombine with numerals to form a [Num+CL] constituent, in line with a left-branch syntactic analysis. In this configuration, collective classifiers serve to group individual entities into aggregates.

However, if this grouping or aggregating function is indeed a core characteristic of all collective classifiers, a question arises: How do speakers distinguish among different collective classifiers? For example, the classifiers *qun* (group), *bang* (group), and *huo* (group) all appear to convey a similar meaning, roughly equivalent to group. What then guides the speakers selection of one specific classifier over another within the [Num+CL] structure?

To address this question, it is essential to clarify that collective classifiers convey more than just number or quantity. Their semantic contribution extends into more nuanced dimensions of meaning.

Olsen (2001) provides a helpful framework for understanding semantic complexity by distinguishing between two types of coordinated expressions: coordination apposition and

copulative compounds. Coordination apposition functions attributively, modifying a referent by providing additional properties. As shown in example (63-a), the phrase poet and translator attributes both roles to Austin Thomas, enriching the referential content.

(63) a. Austin Thomas, poet and translator, was present at the lecture.
b. The poet and translator was present at the lecture. Olsen (2001)

In contrast, true coordinated compoundscopulative compounds-involve a deeper level of semantic integration. These expressions combine two distinct referential contents into a single coherent individual that satisfies both predicates. In (63-b), the expression the poet and translator denotes an individual who is simultaneously both a poet and a translator.

Olsen further proposes a constraint on the formation of such compounds: the Principle of Ontological Coherence. According to this principle, a complex morphological unit must denote a coherent individual; that is, the semantic extensions of its components must be compatible. This explains why compounds like banker-businessman are acceptable, while combinations such as artist-instrument are ruled out as incoherent.

> **Principle of Ontological Coherence**
> "A complex content as the denotation of a morphological object picks out a coherent individual from one of the domains of individuals." (Olsen, 2001)

Turning now to $N_{full}CL_{full}$ pairs, I argue that their semantic content is likewise a complex construction involving both the noun and the classifier, making them structurally and semantically analogous to copulative compounds. If this analogy holds, $N_{full}CL_{full}$ pairs should also conform to the Principle of Ontological Coherence. That is, a meaningful internal relation must exist between the semantic extension of the noun and that of the classifier.

To establish this internal coherence, the first step is to identify the semantic content contributed by the classifier. Given that quantity-as discussed earlier-does not constitute a content meaning in this context, I propose that the primary lexical content encoded by

collective classifiers is that of *range*. In other words, as illustrated in (64), the meaning of a collective classifier can be decomposed into two components: the classifier contributes the encyclopedic notion of range, while the interpretation of 'uncertain quantity' or 'a collection of' arises from functional domains and syntactic operations.

(64) $<< Range > \ Quantity >$

Empirical support for this assumption is from Adjective-Classifier (A-CL) compounds in Taiwanese by Liu (2010), classifiers are conceptualised as tools to indicate *dimension* within the specific construction of A-CL compounds. Specifically, in Taiwanese, A-CL compounds serve as adjective modifiers, commonly appearing in comparative constructions. As illustrated in example (65), the compound *tua-king* 'big-CL' modifies the subject noun phrase '*tshu*' (house).

(65) a. Tsit-**king** tshu kha **tua-/se-king**
This-CL house more **big-/small-CL**
'This house is bigger/smaller in the size.'

b. Tsit-**king** tshu kha **tshim-/tshen-king**
This-CL house more **deep-/shallow-CL**
'The depth of this house is greater/less.'

c. *Tsit-**kin** biNhun kha tua-**kin**.(Measuring unit)
This-kilogram flour more big-kilogra

d. *Tsit-**tiam**-a tsui kha tua-**tiam**. (Partitive CL)
This-a-little water more big-some

Liu (2010, PP.183)

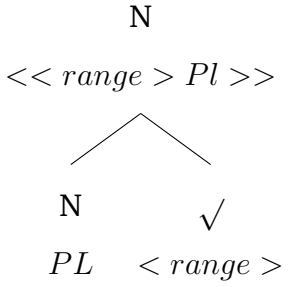
Interestingly, there is an echoing phenomenon in which the classifier in the clause-final A-CL repeats the classifier found in the subject position (see the bolded text in (65-a), (65-b)). Liu (2010) interprets this echoing of classifiers as an agreement on the physical dimensions of the entities involved. The classifier within the subject DP delineates the dimension of the head noun, which is then mirrored by the modifier A-CL. In this case, classifiers function as providers of dimensional information. Crucially, not all classi-

fiers are permitted to form A-CL compounds; only container classifiers, group classifiers, and measure words for actions exhibit this particular usage. Conversely, other classifiers, such as those denoting measuring units (example (65-c)) and partitive classifiers (example (65-d)), are excluded from this construction.

Based on the A-CL data discussed above, it is evident that collective classifiers can convey information related to physical dimensions. Building on this observation, I propose that collective classifiers originate as roots, and that range constitutes their encyclopedic information (or content meaning, as previously termed) inherent to these roots. In this framework, the notion of uncertain quantity does not arise from the root itself, but is instead introduced by a higher functional projection.

Revisiting the structural proposal mentioned earlier, we may assume that an N head merges with a range root. This configuration can be schematised as in (66), where the N head consistently encodes the semantic feature [Plural], while the range component introduced by the root remains variable. As a result, although classifiers such as *qun, dui*, and *bang* all convey a general sense of quantity on the surface, their internal semantic content-i.e., their respective ranges-differs, thereby distinguishing them from one another.

(66)



To be more specific about the variable status of range; the idea is inspired by the division of *skeleton* and *body* in content meanings from Lieber (2004). Skeleton is a constant structural template, which establishes the primitive content meaning. For example, the skeleton for the noun 'chair' is MATERIAL in (67). The root 'Chair' is the *Body* in this context, it groups the skeleton with the features that can exemplify the primary content,

and in the case of (67), *Chair* means a concrete object, it is a subclass of the content 'material'.

(67) *Skeleton* and *Body* of *Chair*:
$_{\text{MATERIAL}}$: [Chair] Adopted from Acquaviva (2014)

The skeleton and body proposed by Lieber (2004) relies on a full function in lexicals, in other words, the template above (67) encompasses not only the semantic content but also the function-argument relationships inherent in certain lexical items. For example, for the verb 'break', its underlying skeleton is the following (68), in which the skeleton implies the theta-relation associated with 'break'.

(68) *Skeleton* and *Body* of *Break*:
y $_{\text{BECOME}}$: [BROKEN] Adopted from Acquaviva (2014)

However, such a strong view of lexical semantics fails to account for cross-linguistic variation. As demonstrated by Arad (2003, 2005), the meaning conveyed by a root is highly flexible and deeply influenced by its syntactic environment. Consequently, a single root can give rise to multiple, seemingly unrelated meanings.[11] Similarly, collective classifiers reflect abstract syntactic structures in a way comparable to the Hebrew root *SBR* (shown in the footnote).

One particularly notable feature of collective classifiers is their ability to combine with the numeral *yi* one, forming a quantifier-like expression. This behaviour is exemplified in the comparison below. In example (69-a), the collective classifier *qun* incorporates with the numeral *yi* to function as a quantifier preceding a noun. This construction conveys the meaning of a singular collective entity, roughly equivalent to a lot of. However, this interpretation does not hold when a different numeral is used. In example (69-b), the phrase

[11]For example, the Hebrew lexical root **SBR** can generate lexical items with divergent meanings, such as *savar* to break and *sever* fraction.

liang qun xue-sheng means two groups of students, where the numeral *liang* two explicitly determines the cardinal value, rather than functioning through classifier incorporation.

(69) a. **Yi-Qun** xue-sheng
One-Group student
'A lot of students'

b. Liang Qun xue-sheng
Two group student
'Two groups of students'

A detailed analysis of how *yi* incorporates with *qun* falls beyond the scope of this discussion. However, the key observation from example (69) is that collective classifiers can appear in distinct syntactic configurations. In this instance, *qun* is situated within the quantity domain, and it is precisely this syntactic context that transforms its inherent lexical contentfrom denoting range to expressing an approximate quantity, akin to a lot of. This shift highlights the need for a syntactic template that can unify both the root-based interpretation (range) and the derived formal semantic contribution (a lot of), rather than attributing such variation solely to lexical semantics, as suggested by the strong lexicalist view in (67).

Accordingly, the earlier analysis remains tenable: the semantic content encoded by collective classifiers is not inherently concerned with quantity or number, but with range. Interpretations involving indeterminate or approximate quantity do not arise from the lexical properties of the classifier itself, but rather emerge from the syntactic context in which it is embedded. It is this richer syntactic structure that licenses the shift in interpretation, reinforcing the need for a syntactic rather than purely lexical account.

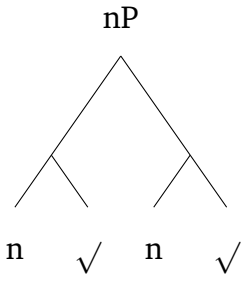
So far, I have established the following points: first, collective classifiers and container classifiers form nPs, based on the fact that they can serve as stand-alone nouns. Second, the content meaning of collective classifier is range.

These characteristics render the previous syntactic template-specifically, the projection of

an inner morpheme-unsuitable for analysing $N_{full}CL_{full}$ and $N_{less}CL_{more}$ pairs. The inner morpheme is typically associated with the n categoriser, either as a dependent (in the case of $N_{full}CL_{null}$) or in a mutually interdependent relationship (in the case of $N_{half}CL_{half}$).

Given the full lexicality of these classifiers, it is natural to derive $N_{full}CL_{full}$ and $N_{less}CL_{more}$ pairs-repeated in (70)-as instances of coordination. Under this analysis, these N-CL pairs are treated as a coordination structure, in which the noun is coordinated with the classifier.

(70)



In the following, I elaborate on $N_{less}CL_{more}$ pairs by drawing on the analogous Container-Content constructions in Russian, which help to explicate the semantic mechanisms underlying the interpretation of N_{less} CL_{more} expressions.

2.5.3 *Container-Content* constructions in Russian

In Russian, there is a similar construction with N_{less} CL_{more} pairs in MC, termed as '*container-content*' constructions in Partee and Borschev (2012). Generally, such constructions are initiated by a container word followed by a genitive NP, which is usually a noun for substance, as shown in (71). Interestingly, container-content expressions in Russian is parallel with N−CL+ in Mandarin-Chinese, both express a predicate of a container, which is filled with a specific substance, in other word, the container word is the semantic centre.

(71) a. stakan moloka
glass-NOM.SG milk-NOM.SG
'glass of milk'

b. korzina gribov
basket-NOM.SG mushroom-NOM.PL

'basket of mushrooms Partee and Borschev (2012)

Distinguishing between the meanings of *measuring* and the meaning of a simple *container* noun is challenging because container words can be used interchangeably with measuring units (as illustrated in example **??** and further discussed in Rothstein (2009)). According to Partee and Borschev (2012), this dual function lies in the ambiguity between *relational nouns* and *sortal nouns* in container words. In general terms, a sortal noun refers to a category inherent in the lexical item (Löbner, 1985). For example, 'man' is a sortal noun because it defines a specific category of individuals. In contrast, relational nouns describe a relationship between two sortal contents. For instance, 'husband' is a relational noun because it defines a role in relation to another sortal content. Container words can shift between representing a sortal content and a relational content. In container-content constructions, the container typically functions as a relational noun.

Specifically, there is an inherent relationship where the container and its substance are directly linked, in which the content of the substance is included within the content of the container expression. In contrast, in measuring expressions, this inclusive relationship is transformed into a representational one. In other words, in a measuring context, a container word like 'glass' serves as a lexical representation of the *quantity* of substance being measured, based on the container's volume. Therefore, a measure phrase is fundamentally a predicate of a *quantity*.

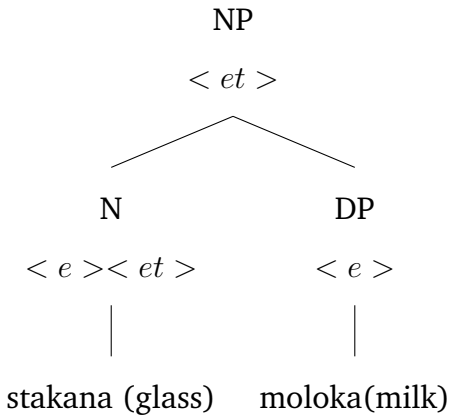
(72) a. ??My razbili pol-butylki šampanskogo
we broke half-bottle-ACC.SG champagne-GEN.SG
'??We broke half a bottle of champagne'

b. On vypil dva s polovinoj stakana moloka
He drank two-ACC with half glass-GEN milk-GEN
'He drank two and a half glasses of milk'

Reflecting on the empirical data, a container-content reading is unlikely to combine with portioning quantifier like 'half' (72-a), which is contrast to a measuring reading, as shown

in (72-b), *half* can seamlessly combine with '*stakana moloka*' (glass milk). Furthermore, a corresponding syntactic structure was proposed for container-content constructions, see (73-a), the relational container word selects for a DP to form a constituent.

(73) a. Container-content construction:



The analysis from Partee and Borschev (2012) provides two crucial insights about the internal structure of N-CL$container$ in MC. First, the non-linguistic meaning, in other words, the ontological properties, are essential in the full semantic interpretation of a lexical item, as stated below.

> "*(container words) their shifting potentials, together with the non-linguistic compatibility restrictions account for the possible interpretation*
> (Partee and Borschev, 2012, pp.453)"

Second, a container-centered meaning in *container-content* constructions is due to a structural projection (as in (73-a)), in which the container word functions as a head.

Unlike the approach taken by Partee and Borschev (2012), my aim is to establish the relationship between a container and a substance noun through root projection. The reasoning is straightforward, the combination of 'container-content' yields an integrated content, where a container is understood to be filled with a certain substance. This content meaning should be formed prior to any grammatical domains such as DP or NP.

Considering '*concept atomism*' from Fodor (1998), he suggests that a simple content is non-compositional. In other words, regardless of how it is formed, the content information of a lexical item is indivisible. For example, the content of 'water bottle' is an atomic notion, rather than a combination of the contents 'water' and 'bottle'.

Referring back to the Russian data presented previously, one of the specialties of *container-content* constructions is their content -'*a container is filled with a substance*'. This distinguishes them from other prepositional meanings, such as '*with*' or '*in*', where a corresponding preposition is explicitly inserted (74). Under the lens of *content atomism*, it appears that *container-content* constructions convey an atomic content, while prepositional phrases (74) convey two independent contents linked by a preposition. Consequently, the syntactic analysis shown in (73-a) is not ideal, as it fails to capture the semantic difference between *stakana moloka*' (glass milk) and '*stakan s molokom*' (glass with milk). Theretofore, it is plausible to build up the unified content meaning prior to a functional domain.

(74) a. stakan s molokom
glass with milk
'glass with containing milk'

b. moloko v stakane
milk in glass-PREP
'milk in a glass' Partee and Borschev, 2012, pp.460

Turning back to the case of $N_{less}CL_{more}$ pairs in Mandarin Chinese, these expressions exhibit semantic patterns parallel to the ContainerContent constructions in Russian. Building on the discussion of the atomicity of content, it is reasonable to assume that the same structural analysis applies to these pairs as to other NCL combinationsnamely, that the nP projection provides the content component within the NCL structure.

As addressed, in this N-CL structure, the lexical content established in the N-CL stage disappears when the classifier is positioned prenominally within a numeral classifier phrase. In the repeated example below, (75-a) conveys the meaning of *cups filled with water*, where the container classifier determines the core content of the N-CL. But when this is trans-

formed into a numeral classifier phrase, as in (75-b), the unified content from the N-CL is decomposed, with both the classifier and the head noun contributing separate descriptive contents.

(75) a. Shui-bei
Water-bei
'Cup filled with water'

b. Wu bei shui
Five CL_{cup} water
'Five cups of water'

Taken together, the semantic content of both container classifiers and collective classifiers can be analysed as full nPs, as both contribute full lexical meaning. On this basis, I initially proposed a coordinated structure in which two nPs are conjoined. However, this proposal proves problematic, as it fails to capture the atomicity of lexical content. If the structure involves two separate n categorisers, it becomes unclear how the grammar determines which one contributes the primary semantic content-particularly in cases of $N_{less}CL_{more}$ pairs, which are interpreted as a container filled with a substance. In such cases, the classifier appears to function as the semantic centre, yet the mechanism by which it assumes this role remains theoretically puzzling. For this reason, I argue that the two-nP coordination analysis is insufficient.

In the following, I propose that one of the nPs should be reanalysed as a sub-projection within the other-effectively downgrading its syntactic status within the larger nP domain, while preserving the overall semantic integrity of the structure.

2.5.4 Two in one, integrating two nPs

In this section, I specify the structure for N_{full} CL_{full} and N_{less} CL_{more} pairs. As addressed so far, among all of the N-CL cases, an integrated notion is attributed to the ordering of merging between the n categoriser and other objects in a resource set.

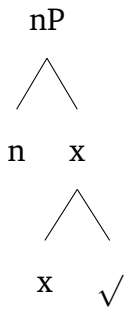
As repeated below, the initial resource set for $N_{full}CL_{null}$ consists of n categoriser and the

inner morpheme x (76), x is primarily selected and formed a secondary syntactic projection, then the categoriser n is merged to fulfil the nP projection, the interpretative pattern noun-led lexical content results from the structural dependency of between x and n.

(76) $N_{full}CL_{null}$:

a. Resource set: { n,x,$\sqrt{}$ }

b.

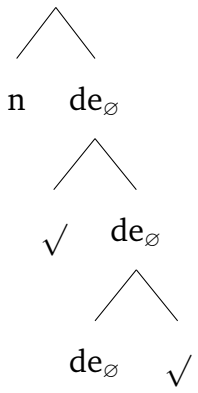


For the $N_{half}CL_{half}$, n and the inner morpheme *de* form the resource set (77). de is targeted and formed a projection analogously with a small clause, allowing the insertion of two roots, and then the n categoriser merges in. The silent de serves as a linking item to build up the interdependence between two roots.

(77) $N_{half}CL_{half}$:

a. Resource set: {n, de,$\sqrt{}$ }

b.



Considering the fact that both N and CL in $N_{full}CL_{full}$ and $N_{less}CL_{more}$ are full nouns, the initial resource set for these cases is expected as shown in (78)

(78) {n,n}

In order to align with the semantic pattern of both N-CL pairs, as well as the assumption that one nP links to one lexical content, the step of *readmittance* is adopted to build up the structure for $N_{full}CL_{full}$ and $N_{less}CL_{more}$. Before delving into this step, it is worth noting the concept of *opacity* in syntactic derivation.

According to Zwart (2009), *opacity* means that a complex syntactic structure is treated as a single, indivisible unit within a particular syntactic context. These syntactic items have a dual nature: they are complex because they are the result of a derivation, yet they are also considered simplex, or atomic, when involved in a subsequent syntactic derivation. For instance, for a phrasal compound, a *far-from-simple matter*, the phrasal component '*far from simple*' has undergone a derivational process before inserted into the DP ' a *far-from-simple matter*'. In this case, 'far from simple' is opaque to any further derivations once it is locked within the DP domain.

As further illustrated in De Belder and Van Craenenbroeck (2015), opacity effects indicate the step of *readmittance* of a derivation back to a resource set. Linking to the previous instance, the derivation of 'far from simple' is readmitted back into the resource set. To make this point clearly, the derivational process of '*The child eats the cookie*' is specified in De Belder and Van Craenenbroeck (2015).

First, the resource set contains three objects, as illustrated in (79-a). The next step involves selecting one of these objects and forming a syntactic projection. The order in which objects are merged is crucial: the first object to be merged is reintroduced into the resource set as an opaque derivation. In the sentence '*The child eats the cookie*', the object is not an island, but the subject is. Therefore, the subject DP is the first to be merged and readmitted to the resource set. As shown in (79-b), the object [+def] is selected, projecting a syntactic

derivation. This derivation is subsequently reintroduced into the resource set, as depicted in (79-c).

(79) a. Resource set: { v,[+def]],[+def]] }

b. +def

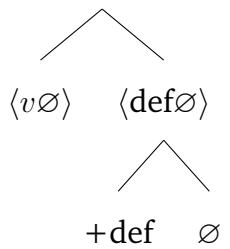
+def ∅

c. Modified Resource set: { v,< $+def, \varnothing$ >,[+def]] }

After forming the first sub-derivation, the next step involves targeting the syntactic object *v* and constructing a corresponding syntactic derivation. This derivation is then reintroduced into the resource set. After this step, the resource set contains two sub-derivations and a syntactic object, as referenced in (80-a). While the object [+def] generates a derivation, the two sub-derivations merge, forming the vP template, as shown in (80-b). In this template, $\langle$def, $\varnothing\rangle$ represents the subject DP 'The child' and $\langle v, \varnothing\rangle$ represents the verb 'eats'. The final step merges the last [+def] derivation into (80-b), resulting in the complete sequence 'The child eats the cookie'.

(80) a. Modified Resource set: { $< v, \varnothing >$,< $+def, \varnothing$ >,[+def]] }

b. $\langle v\varnothing\rangle$



$\langle v\varnothing\rangle$ $\langle$def$\varnothing\rangle$

+def ∅

Therefore, based on the demonstration above, the step of *readmission* is introducing two sub-derivations into a complete syntactic derivation, which is helpful for tackling the dilemma in $N_{full}CL_{full}$ and $N_{less}CL_{more}$ pairs. Recalling the theoretical complication in both occasions, coordinating two nPs fails to build up an integrated semantic content. Facing

this, I adopt the step of readmission in the process of deriving $N_{full}CL_{full}$ and $N_{less}CL_{more}$ pairs.

The merging step go as follows:

Initially, the resource set is as shown in (81), consisting of two n categorisers and roots.

(81) {n,n, $\sqrt{}$, $\sqrt{}$}

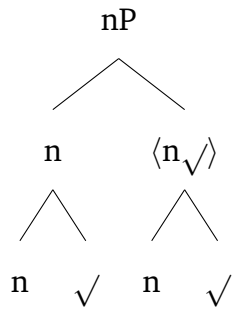
The first merged item produces an opaque derivation. In both occasions, it is the attached classifier that creates this opacity, and the classifier contributes to an atomic interpretation only within the N-CL pair. Once placed in a different syntactic context, such as in a CLP, this atomicity is lost. In other words, the classifier becomes syntactically opaque outside of the N-CL structure, reinforcing its dependency on that specific configuration for interpretation. Therefore, in both cases, the classifier is targeted first, generating a derivation, as shown in (82-a).

(82) a.

b. Resource set: { n, $< n, \sqrt{} >$, $\sqrt{}$ }

After this step, the process of readmission takes place, where derivation (82-a) is reintroduced into the resource set, as shown in (82-b). Next, Merge operates on this updated resource set, following the same steps as with other N-CL structures. As shown in (83), a sub-derivation is targeted and projected into the main structure. Afterward, the remaining elements in the resource set are merged, specifically the n categoriser and a root. The n categoriser acts as the phase head of this projection, scoping over the $\langle n, \sqrt{} \rangle$. During spell-out, the root adjacent to n is where the noun in N-CL is realised, while the attached classifier is realised as the internal root of the sub-derivation.

(83)



Consequently, the puzzles surrounding $N_{full}CL_{full}$ and N_{less} CL_{more} can be resolved. The interpretive patterns are attributed to the step of *readmission*. Given the uniqueness of the resource set, which includes two n categorisers, readmission occurs to ensure that the final outcome of the resource set produces a single nP, conveying an atomic lexical content. In other words, the step of transferring n into the sub-derivation $\langle n, \sqrt{}\rangle$ functions as an imprint: it emphasises its semantic significance while constraining its structural role, as it does not generate the main structural projection.

The structural proposal in (83) successfully accounts for all the characteristics seen in $N_{full}CL_{full}$ and N_{less} CL_{more} configurations. First, both collective classifiers and container classifiers function as common nouns, which is evident in the formation of the sub-derivation where an n merges with a root. Second, the interpretive pattern of $N_{full}CL_{full}$ and N_{less} CL_{more} does not hold when the classifiers are placed pre-nominally. This is straightforward, as previously explained: within the projection of N-CL, the classifier (CL) forms a sub-derivation that undergoes the steps of *select-readmit-select*. This process makes the derivation opaque to other syntactic structures, which is why the established pattern breaks down in the CL-N sequence.

Summing up, this section investigated the internal structure of $N_{full}CL_{full}$ and $N_{less}CL_{more}$ constructions. Building on the typology established in earlier sections, I argue that the classifier's semantic contribution depends on its lexical status and structural position. Specifically, container and collective classifiers behave as full lexical items that project as independent nPs, unlike more functional classifiers (e.g., duo- or ban-type), which are structurally embedded and semantically dependent.

A key observation is that these full classifiers contribute rich encyclopaedic content-such as range for collective classifiers and the inherent meaning in container classifiers. This distinguishes them from other classifier types and explains why their semantic content is not preserved when they appear pre-nominally within CLP.

Having clarified the source of interpretive variation in NCL pairs, it is plausible the NCL structure represents an earlier syntactic stage that precedes the projection of CLP. At this stage, the noun and classifier enter into an intrinsic lexical relationship, allowing the language faculty to select a classifier that is ontologically appropriate or semantically compatible. This selected classifier is later displaced to CLP.

I assume that the transition from NCL to CLN occurs post-syntactically, at PF. While CLP itself is a canonical functional projection of NP formed in narrow syntax, the decision as to which morpheme surfaces as the CL head is determined by competition at PF.

Specifically, when a classifier is intrinsically linked to a noun-as in $N_{full}CL_{null}$ and $N_{half}CL_{half}$ constructions-it is prioritised and surfaces as the default classifier. In contrast, when no such intrinsic link exists, the classifiers semantic contribution is made overt.

In the following section, I offer a more detailed account of PF competition, examining the mechanisms and constraints that govern classifier realisation within CLP.

2.6 Competition while Spell-out

Having addressed the four patterns observed in N-CL pairs, the next step is to examine the variation in how the general classifier ge combines with N-CL pairs. As discussed previously, certain N-CL pairs trigger an 'elsewhere condition', as illustrated in (84), where the general classifier ge is blocked by the specific classifier pi when it occurs with the noun ma ('horse').

(84) a. *San ge ma-pi
*Three CL horse-CL
(intended) Three horses.

b. San pi ma
Three CL horse
'Three horses'

In contrast, for hua-duo (flowers) (85), the elsewhere condition does not apply, allowing the pair to be classified by the general classifier ge.

(85) a. San ge hua-duo
Three $CL_{general}$ flower-CL
'Three flowers'

b. San duo hua
Three CL flower
'Three flowers'

Furthermore, for the majority of the N-CL pairs (the four types I discussed thus far), they accept the general classifier 'ge' to precede them, as shown in (85) about the $N_{full}CL_{null}$, and from (86) to (88), the examples reveal that the elsewhere condition does not apply.

(86) ge and $N_{half}CL_{half}$ pair

a. San ge hua-ban
Three $CL_{general}$ flower-CL

'Three petals of flower'

b. San ban hua
Three CL flower
'Three petals of flower'

(87) ge and $N_{full}CL_{full}$ pair

a. San ge yang-qun
Three $CL_{general}$ sheep-group
'Three sheep-groups'

b. San qun yang
Three CL sheep
'Three groups of sheep.

(88) ge and $N_{less}CL_{more}$ pair

a. San ge shui-bei
Three $CL_{general}$ water-cup
'Three water-cups'

b. San bei shui
Three cup water
'Three cups of water'.

However, it is important to note the subtle difference in meaning between [Num ge N-CL] and [Num CL N], particularly as illustrated in (87) and (88). Specifically, when ge is used to form a numeral classifier phrase with 'shui-bei' (water-cup), the phrase refers to counting three individual cups, each filled with water. In contrast, when the N-CL sequence is shifted to CL-N, as in 'san bei shui' (three CL water), the phrase emphasises the division of the substance (water) into cups, which are then counted by the numeral three. In other words, the unified lexical meaning of the N-CL pair is split into two components, each carrying descriptive content.

Similarly, in the case of $N_{full}CL_{full}$ pair as shown in (87), san ge yang-qun (three ge sheep-group) refers to counting three individual sheep-groups. However, in san qun yang (three CL sheep), the phrase first divides the sheep into groups, which are then counted using a cardinal number.

Interestingly, in contrast, this semantic difference does not arise in $N_{full}CL_{null}$ pair and $N_{less}CL_{more}$ pairs. As shown in (86), both 'san ge hua-ban' (three ge flower-petals) and 'san ban hua' (three CL flowers) refer to counting the concept of 'hua-ban' (flower-petal),in other words, in both cases, N-CL and CL-N serve a non-decomposable unit.

Based on the variation, even ge can consistently combine with N-CL pairs, but it cannot substitute the function of the attached classifier in certain N-CLs, particularly in the cases of $N_{full}CL_{full}$ and $N_{less}CL_{more}$. In this section, I first confirm the syntactic position for the general classifier ge, and then addressing the dilemma triggered by 'ge N-CL' and the different meaning between 'ge N-CL' and 'CL-N', generally, I attribute it to the competition in spell-out.

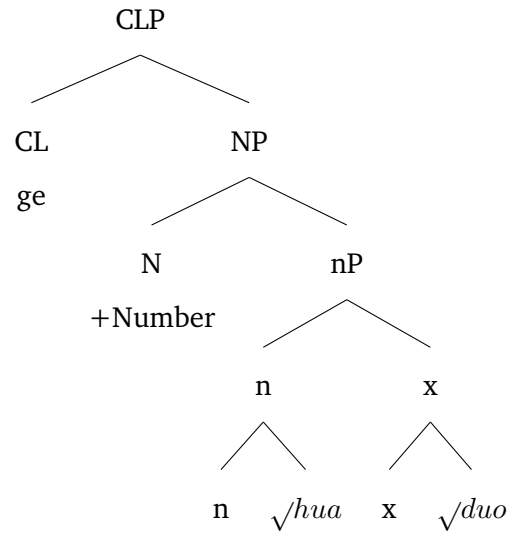
Starting with the status of the general classifier ge, all the evidence-its inability to form N-CL pairs and its lack of inherent content-supports the suggestion that ge is base-generated at the CL head, with CLP functioning as a projection of NP (aligning with the assumptions in Cheng and Sybesma (1999); Gebhardt (2009) and others).

Following the assumption that nP functions as a lexical domain, it is reasonable to posit the existence of a functional NP layer that enriches the descriptive content of nP. Empirically, evidence shows that bare nouns in Chinese can serve as arguments and introduce functional features, such as [$\pm D$][Number], as discussed in Cheng and Sybesma (1999). As illustrated in (89), the bare nouns xue-sheng (student) and shu (book) exhibit general number (Corbett, 2000), encoding both singular and plural. Additionally, these bare nouns can convey either definite or indefinite meanings.

(89) Xue-sheng na-le shu
Student take-Par book
'A/The student/students took a/the book/books'

Consequently, the syntactic position of the general classifier ge and an N-CL compound can be schematised, as shown in (91).

(90)



After addressing the status of ge and NP, the following step is to demonstrate the puzzling regarding the semantic variation in [ge N-CL] and [CL-N]. To begin with the first pattern, wherein the meaning of [ge N-CL] is the same with [N-CL], as illustrated in table 2.9.

Type of N-CL	Form	Meaning	Form	Meaning
N+ CL-	San ge hua-duo	three flowers	san duo hua	three flowers
N- CL-	San ge hua-ban	three petals of flowers	san ban hua	three petals of flowers

Table 2.9: Comparison between [ge N-CL] and [CL-N]

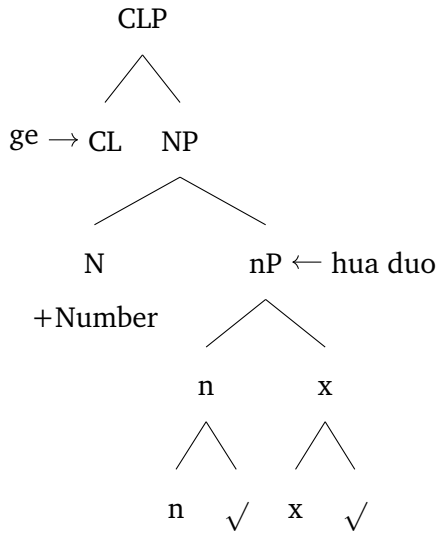
The analysis presented thus far accounts for the semantic equivalence between the two forms discussed above. In both types of N-CL compounds (N+CL- and N-CL-), the attached classifier roots emerge from a secondary projection within nP (specifically, the projection of x and the projection of de), resulting in strong locality constraints. This means that the descriptive content of the attached classifier depends on the categoriser for its realisation. Therefore, whether the classifier is used as an attached classifier within an N-CL compound or as a pre-nominal classifier does not alter the outcome, as illustrated in Table 2.9.

Despite having the same meaning, the simpler [CL-N] form is preferred during spell-out. To elaborate, spell-out refers to the process of inserting morphophonological information into syntactic terminal nodes. As discussed earlier, a phase receives its phonological information at PF, which necessitates a specific procedure during spell-out. According to Bobaljik (2017) and Gouskova and Bobaljik (2020), vocabulary insertion operates on each

terminal node individually, starting with the most embedded syntactic node and continuing until all nodes have received their vocabulary realisations. After vocabulary insertion, language-specific rules may govern which forms are prioritised. For example, in English, plural markers can vary-such as -en, ∅, -i, -z, or [back, +tense] (as in foot and goose). Given these options, rules like the 'elsewhere condition' favour more specific forms, such as -en for ox.

Referring back to the case of the same meaning between [ge N-CL] and [CL-N] mentioned above. Following the steps in spell-out mentioned in the last paragraph, in the process of vocabulary insertion, as drawn in (91), the nP receives their morphophonological forms first, then the classifier receives its vocabulary content, which is ge. In the meanwhile, the attached classifier 'duo' substitutes the general classifier due to the elsewhere condition, wherein a more specific morphological form blocks the general context-free form.

(91)



In other words, the formation of the classifier phrase san duo hua (three CL flower) follows a clear derivational process. First, the nP projection is formed, establishing the intrinsic relationship between hua (flower) and duo (CL). This is followed by the functional projections, where NP, CLP, and NumP are generated layer by layer. This process occurs in narrow syntax before being sent to PF, where nP and CLP receive their phonological forms. Finally, a morphological rule is triggered, allowing duo to compete with the general classi-

fier ge. Duo is selected as the more specific morphological form due to its dependency on the nP in the initial derivation. Thus, even though *san ge hua-duo* and *san duo hua* exhibit the same interpretive pattern, the simpler form 'san duo hua' is preferred to spell out.

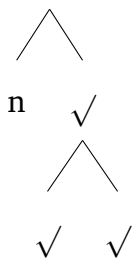
In comparison, as introduced previously, the N+ CL+, N- CL+ compounds exhibit a different interpretive pattern when encountered with the general classifier 'ge'. As seen in table 2.10, for both N+ CL+ and N- CL+, the meaning of the phrase 'san ge N-CL' differs from the meaning from 'san CL N'.

Type of N-CL	Form	Meaning	Form	Meaning
N+ CL+	San ge yang-qun	three people-groups	san qun ren	three groups of people
N- CL+	San ge shui-bei	three cups (filled with water)	san bei shui	three cups of water

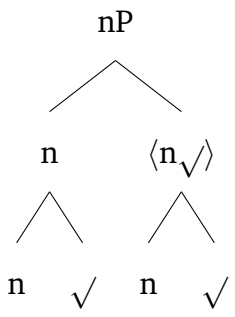
Table 2.10: Comparison between [ge N-CL] and [CL-N]

This difference in spell-out rules aligns with the analysis I presented earlier. Compared to N+CL- and N-CL-, the N-CLs in 2.10 have distinct internal projections. Rather than a dependent relationship, the N and CL in these structures maintain independence, resulting in a less close connection compared to N+CL- and N-CL- structures. Recalling the N+CL+ compounds, they arise from a headless root projection, as shown in (92-a), while the N-CL+ compounds result from the coordination of two nPs with an additional step of 'readmission' (92-b). Consequently, in both cases, the two roots contribute equally to the overall configuration, meaning no root can be viewed as the more specific term. As a result, there is no competition with the general classifier during spell-out.

(92) a.

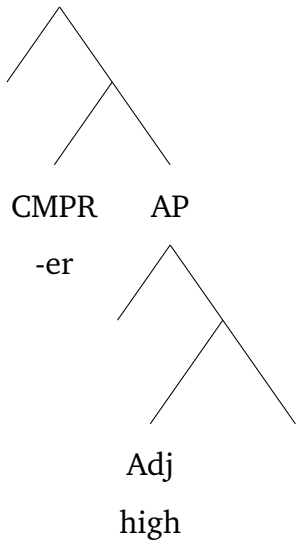


b.



To address this, I consider the step of 'rebracketing' before Vocabulary insertion (Noyer, 1992). Rebracketing is an operation that occurs after a terminal node is formed. Generally, either a fusion or fission condition may apply. A typical fusion process involves merger, where two syntactic heads are combined into one. As shown in (93), the comparative head and the adjective head are regrouped, resulting in a complex head structure that is spelt out as 'higher'.

(93) a.



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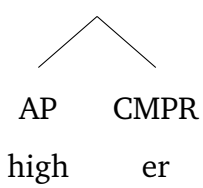


In contrast, the fission condition involves splitting a terminal node into two nodes, with both nodes sharing the same features as the original unsplit terminal node, in other words, the process of fission can be seen as reforming a syntactic projection into morphological units. Notably, this condition differs from the lexicalist approach (Aronoff and Anshen, 2017), where that morphology is separate from and precedes syntax. Instead, the fission condition here is formed post-syntactically, and yet inherent the key syntactic features.

For instance, as discussed in Oltra-Massuet and Arregi (2005), the vowels in Spanish, as shown in (94), are linked to a complex syntactic derivation, indicating that they are not governed by the root element (i.e., they are not selected by the verbs) and have no connection to the adjacent element 'r'. To clarify their nature, Oltra-Massuet and Arregi (2005) proposes that theses vowels are theme vowels, which are inserted corresponded to a functional head.

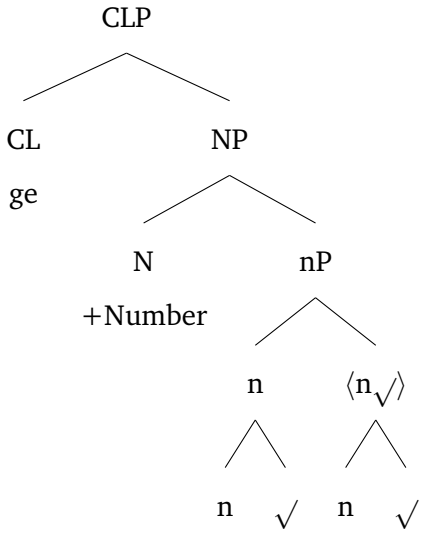
(94) a. cant-a-r
sing-TV-INF
to sing'

b. tem-e-r
fear-TV-INF
to fear

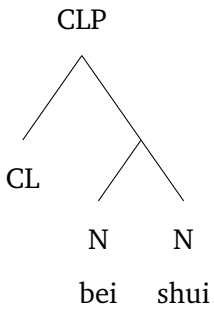
c. part-i-r
leave-TV-INF
to leave

The aforementioned case exemplifies how vocabulary items can carry syntactic features. By utilising this operation, we can address the issues associated with N+CL+ and N-CL+ compounds. Generally, I propose that after forming the NP, an additional fission step transforms the N-CL into independent morphemes, each encoding features from the NP. This is illustrated in (95), where (95-a) represents the structure for the phrase 'ge N-CL' as in 'san ge shui-bei' (three cups filled with water). In contrast, (95) shows the outcome after the fission of NP, resulting in two nominal elements.

(95) a.



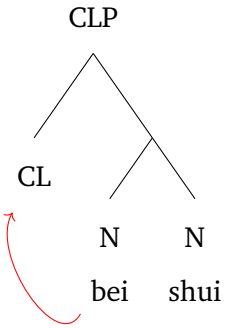
b.



Notably, the two structures call for different spell-out results. For (95), the same process shown previously is expected, wherein the nP first receives its phonological realisations, and phasing up till the end of the derivation, resulting the phrase 'san ge shui-bei' (three cups filled with water) and 'san ge ren-qun' (three people-groups).

However, in the case of (95), after fission, continuous syntactic operations are anticipated, including feature checking and agreement. This process results in the noun 'bei' moving to the classifier (CL) position, as illustrated in (96).[12]

(96)



[12]One might question the necessity of this entire process, starting from the formation of nP, explaining its projection, and ultimately splitting the N-CL into two nouns. Why not assume they are like (96) from the outset and avoid these complications? The reason for this bottom-up approach lies in the properties of N-CL compounds. Evidence suggests that N-CL forms a unified descriptive content initially; however, this fundamental property cannot be achieved through mere combinations. Thus, a complex derivation is proposed.

In this case, the spell-out of (96) results in 'bei shui,' with no competition from the general classifier, as the CL head is already filled.

In summary, this section addresses the variation in the combination of the classifier 'ge'. The previous analysis of the internal nP structure elucidates the interpretive differences between [ge N-CL] and [CL N]. I attribute these differences to the rules governing the spell-out domain. For $N_{full}CL_{null}$ and $N_{half}CL_{half}$ pairs, there are no interpretive differences between [ge N-CL] and [CL N] due to the fact that the classifier roots in both cases are merely secondary projections within nP, rendering them semantically inert. Nevertheless, the simpler form [CL N] is preferred during spell-out because the classifier provides a more specific form than the context-free classifier 'ge'.

However, for $N_{full}CL_{full}$ and $N_{less}CL_{more}$ pairs, the situation becomes more complex, as different interpretive patterns emerge between [ge N-CL] and [CL N]. This is expected, given that there is no dependency between N and CL at the nP stage in both cases. Therefore, I introduce an additional operation, 'rebracketing', to split the NP node into two nominal elements. In this case, one of the nominals moves to the CL head, functioning as the classifier and adopting a corresponding interpretive property, as seen in 'san bei shui' (three cups of water). Conversely, when 'ge' is merged as the classifier, the N-CL pairs function as a cohesive nominal unit within the classifier phrase, resulting in the entire projection being spelled out as 'san ge shui-bei' (three cups filled with water), which conveys a different interpretive property.

2.7 Summary

This chapter has provided a structural and interpretative analysis of four distinct types of NCL configurations in Mandarin Chinese: $N_{full}CL_{null}$, $N_{half}CL_{half}$, $N_{full}CL_{full}$, and $N_{less}CL_{more}$. I have argued that the variation in content meaning across these types arises from differences in their syntactic derivation within the nP domain, specifically in terms of how the classifier is integrated and the extent to which it contributes semantic content.

For $N_{full}CL_{null}$ and $N_{half}CL_{half}$, the classifier is structurally dependent on the categoriser and realised via an embedded projection (x or a silent morpheme de). These configurations exhibit strong locality effects, with the content meaning preserved even when the classifier surfaces pre-nominally in a CLN sequence. In these cases, the classifier contributes little to no independent semantic content and is best treated as semantically inert.

By contrast, $N_{full}CL_{full}$ and $N_{less}CL_{more}$ involve classifiers that function as full lexical items. These classifiers can serve independently as common nouns and merge directly with the categoriser, projecting their own nP. Their semantic contribution is thus more substantive and less tightly bound to the noun, resulting in a looser interpretive relationship. Importantly, these NCL configurations lose their unified content meaning when the classifier is placed in a pre-nominal position, indicating that their atomicity is structurally confined to the NCL configuration.

To capture this structural asymmetry, I proposed that $N_{full}CL_{full}$ and $N_{less}CL_{more}$ configurations involve a process of readmission, whereby one nP derivation is reintroduced into the syntactic workspace and merged with another. This creates a single nP that preserves the interpretive integrity of the NCL structure while explaining the asymmetry in pre-nominal contexts.

I further examined the interaction between these configurations and the general classifier ge. While ge can co-occur with all four types of N-CL expressions, only in the first two types does it compete with the attached classifier, triggering elsewhere effects during spell-out. In the latter two types, no such competition arises due to the interpretive independence of

N and CL. I proposed a post-syntactic rebracketing operation to account for these contrasts, allowing for feature-driven movement and spell-out variation between [ge N-CL] and [CL N] sequences.

Overall, this chapter has shown that although nP is the domain in which both N and CL are hosted, the internal structure of N-CL expressions is not uniform. Crucially, the syntactic status and lexical weight of classifiers play a central role in shaping both the interpretation and surface realisation of these forms. The analysis supports a model in which lexical content is established early in the derivationwithin nPand the realisation of a particular morpheme as a classifier at PF is determined by structural constraints and competition.

A crucial question remains regarding the framework we proposed, as addressed, N-CL formation is not universal in Mandarin Chinese. For certain nouns, the preceding classifier is semantically compatible, yet the N-CL formation is disallowed, as illustrated below:

(97) a. Yi **zhi** hua
One CL_{branch} flower
'A flower'

b. *Hua-**zhi**
Flower-CL_{branch}

(98) a. Yi **ke** shu
One CL_{ke} tree
'A tree'

b. *Shu-**ke**
Tree-CL_{ke}

(99) a. Yi **gen** bi
One CL_{gen} pen
'A pen'

b. *Bi-**gen**
*Pen-CL_{gen}

(100) a. Yi **dong** lou
One CL_{dong} building

'A building'

b. *Lou-dong
Building-CL$_{dong}$

This may involve semantic operations such as the composition of lexical content, as proposed by McNally and Boleda (2017). According to this view, the language faculty can select and combine conceptual contents to form complex meaningsa process known as Referentially Afforded Composition. One way to approach this is by considering the strong contradiction between the content meanings of certain classifiers and nouns, as illustrated in (97)(100). Such a mismatch prevents the formation of a unified atomic meaning, thereby blocking the formation of an NCL pair. However, this remains a preliminary observation; a more detailed analysis is left for future research.

In the following chapter, I will focus on numerals. As previously mentioned, numeral elements are essential for enumerating classifier phrases. Similar to the complexities observed with classifiers, numerals present a multifaceted picture, with various meanings emerging. Generally, numeral elements exhibit polysemy on multiple levels, with both simplex and complex numerals serving roles beyond mere enumeration. Furthermore, approximate quantities are conveyed within this context, and I will discuss two paucal operators that encode meanings related to approximate quantities.

Chapter 3

Numerals: between enumerating and partitioning

This chapter explores the syntactic distributions and nuanced semantic interpretations of cardinal numbers in Mandarin Chinese. Based on their morphosyntactic formations, I divide Chinese cardinal numerals into *Simplex numerals* and *Complex numerals*. A Simplex numeral is associated with a specific cardinal value and has a corresponding monomorphemic form. These numerals range from *ling* (zero) to *shi* (ten) in Mandarin Chinese (see (1)).

(1) Ling/Yi/Er/San/Si/Wu/Liu/Qi/Ba/Jiu/Shi
'Zero/One/Two/Three/Four/Five/Six/Seven/Eight/Nine/Ten'

Complex numerals are polymorphemic and the cardinal values from which are composed through two primary operations: *addition* and *multiplication*. Each of these operations corresponds to a distinct morphosyntactic formation. Additive numerals are formed by combining a *general number base* with simplex numerals (as shown in (2-a)). The general number base can be one of the following: *shi (ten), bai (hundred), qian (thousand), wan (ten-thousand), yi (hundred-million)*.

(2) a. **Shi**-Yi/Er/San/Si/Wu/Liu/Qi/Ba/Jiu
Ten-One/Two/Three/Four/Five/Six/Seven/Eight/Nine
'Eleven/Twelve/Thirteen/.....Nineteen'

b. Yi/Er/San/Si/Wu/Liu/Qi/Ba/Jiu-**Shi**
One/Two/Three/Four/Five/Six/Seven/Eight/Nine-**Ten**
'Ten/Twenty/Thirsty/.....Ninety'

Multiplicative numerals exhibit a converse pattern with the following word order: *Simplex numeral-General number base*', in which the general number base follows a simplex numeral as shown in (2-b). Furthermore, simplex numerals and complex numerals can combine to convey a numeral value. In such cases, these numerals are formed based on the ordering shown in (3).

(3) **Multiplicative-Additive**

This is parallel to English complex numeral expressions. For example, the equivalent numeral expression for 'three hundred thirty-three' in Mandarin Chinese is '*San-Bai San-Shi-San*', where multiplicative numerals are primarily formed, which are *san-bai(three hundred)* and *san-shi(thirty)*, then combined together conforming to the ordering shown in (3).

In the following, I will examine the syntactic distributions and semantic interpretation of both *simplex numerals* and *complex numerals* within the syntactic context of numeral classifier phrase, in which numerals precede classifiers. I will focus on how *absolute number* and *vague number* from both type of numerals are integrated into the syntactic slot.

3.1 Syntactic distribution of numerals

The syntactic position of both types of numerals is generally rigid, typically appearing before a classifier phrase (as exemplified in (4)). Due to this distribution in the surface structure, the consensus in the literature is that numerals in Mandarin Chinese are a functional projection of NP. This is due to properties of NP in Mandarin-Chinese, since they denote *kind* or *sets of individuals* (Chierchia, 1998; Cheng and Sybesma, 2012), a classifier phrase is obligatory to measure out or singularise the NP. This CLP then combines with a cardinal number (as discussed in Borer (2005); Cinque (2006); Zhang (2014); Snyder (2017), among others) to form a constituent known as Numeral Phrase.

(4) a. Wo mai-le **San** ben shu
I buy-Past **Three** CL book
'I bought three books' Simplex numeral

b. Wo mai-le **Shi-San** ben shu
I buy-Past **Ten-Three** CL book
'I bought thirteen books' Additive Complex Numeral

c. Wo mai-le **San-Shi** ben shu
I buy-Past **Three-Ten** CL book
'I bought thirty books' Multiplicative Complex Numeral

d. Wo mai-le **San-Shi-San** ben shu
I buy-Past **Three-Ten-Three** CL book
'I bought thirty three books' Multiplicative with Additive Numeral

Also, due to their combination with demonstratives, the structure of numerals are treated as subsumed under the DP template (Longobardi, 2001). Demonstratives in Mandarin Chinese at least contain the following functions: *anaphoric function*-referring to something in a given linguistic context, *deictic function*-referring to something in a non-linguistic context (Deng, 1981). With encoding these general functions, syntax literature agrees that demonstratives are D elements and positioning at the DP layer, either as D head or as the specifier of DP (Sybesma and Sio, 2008)

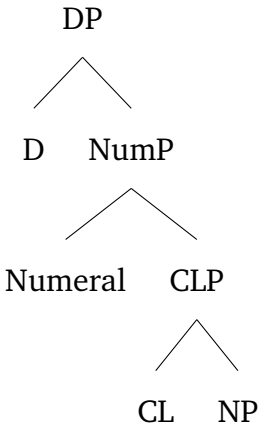
(5) a. Wo mai-le **Zhe/Na San ben shu**
I buy-Past **This/That Three CL book**
'I bought these/those thirty three books'

b. **Zhe/Na San ben shu** Wo mai-le
This/That Three CL book I buy-Past
'These/Those three books, I bought'

c. Wo xiang mai **Zhe/Na San ben shu**, ta ye xiang mai **ta-men**
I want buy **These/Those Three CL book**, she/he too want buy **them**
'I wanna buy these/those three book, and she/he want to buy them too'.

A numeral phrase, as shown in (5), generally follow the demonstratives *zhe/na (this/that)* to form a constituent, and the sequence [Demonstrative-Numeral-Classifier-Noun] can pass the classic constituency tests, such as *topicalisation* (5-b), *pronoun substitution* (5-c), therefore, numeral phrase in Chinese has been treated as a syntactic complement of demonstratives. Diagrammatically represented in (6), the prevailing theoretical framework, known as the *right-branch* analysis, posits that numerals are situated at the Numeral Phrase (NumP) layer. Here, numerals serve as quantifying tools that specify the number of individuals denoted from the NP. Each syntactic projection in (6) correlates with a distinct semantic function: the NP provides the type of entities, the CLP encodes the number feature, which can denote either a single entity or a set of entities, and the NumP specifies the exact quantity, and finally the DP is for anchoring a specific referent.

(6) Right branch analysis:



Empirically, the *right-branch* analysis is supported by the positioning of adjective modifiers within a numeral classifier phrase. First, as shown in (7), the adjective *da (big)* can only precede the classifier. Positioning *da* before the head noun or the numeral results in ungrammaticality [1]. Other than 'da (big)', other types of adjectives, such as the shape adjective '*chang (long)*' in (8-a) and '*zheng (whole)*' in (8-a) also align with this pattern. These adjectives can precede the classifier and semantically modify it.

(7) a. Wo chi-le ***da** San **da** wan ***da** fan
I eat-Par ***big** Three **big** bowl ***big** rice
'I eat three big bowls of rice'

b. Wo du-le ***da** San **da** ben ***da** shu
I read-Par ***big** Three **big** CL ***big** book
'I read three big books'

(8) a. Wo you Yi **Chang Tiao** Yi
I have One **long CL** chair
'I have a long chair'

b. Wo sao-le Yi **Zheng pian** jie-dao
I sweep-Par One **Whole block** street
'I have swept a whole block of street'

Also, the modifying scope of the internal adjective reveals the relatedness between classifiers and nouns within numeral classifier phrases, aligning with the right-branch analysis. For instance, for the shape adjective-*Chang* in (8-a), if one places it after the classifier and before the noun, as shown below in (9-b), the interpretation '*a long chair*' still holds.

[1] However, this is not a clear cut. For certain nominals, it is possible to insert da before them. For instance, the nominal 'shu (book)', the CCL corpus recorded the possibility of 'da shu (big book)'. See examples below, the adjective da (big) precede the nominal not the classifier, expressing a 'quality' reading, indicating the content of the book is grand.

(i) a. "....sheng-huo ben-shen jiu-shi Yi ben **Da Shu**..."
.....Life itself is One CL **Big Book**....."
'Life is a big book'
b. "....Shi-Ji shi Yi ben **Da Shu**..."
.....*Historical Records* is One CL **Big Book**....
'*Historical Records* is a big book'.

Identically, for the adjective *Da(big)* in (9-c) and (9-d), it fundamentally modifies the head noun-shu (tree) even when it is placed before the classifier in (9-c).

(9) a. Wo you Yi **Chang Tiao** Yi
I have One **long CL** chair
'I have a long chair'

b. Wo you Yi Tiao **Chang Yi**
I have One CL **long chair**
'I have a long chair'

c. Wo zhong-le Yi **Da ke** shu
I plant-Par One **big CL** tree
'I planted a massive tree'

d. Wo zhong-le Yi ke **Da shu**
I plant-Par One CL **big tree**
'I planted a massive tree'

Therefore, utilising this syntactic distribution and the aforementioned modifying scope of adjective modifiers, Cheng and Sybesma (1999); Gebhardt (2011) assume that certain classifiers are base-generated at NP and then move to CLP. In other words, accepting an adjective modifier in classifiers is a sign of nominality. Under right-branch analysis, classifiers can be either 'full' nouns or 'half' nouns. By 'full nouns', I refer to those classifiers that denote complete lexical meanings, typically, mensural classifiers such as 'wan (bowl)' in (10), which can be used as an nominal in a numral classifier phrase (10-b). In contrast, 'half nouns' are those classifiers that denote certain properties related with the head noun. As defined by Allan (1977), these classifiers denote "*some salient perceived or imputed characteristic of the entity to which the associated noun refers*" (Allan, 1977, pp.285). For instance, *ke* in (9-c) cannot be used as an independent nominal (as shown in (10-c)). Thus, under the *right-branch* analysis, the CLP and the NP contain internal correlations without involving the Numeral Phrase, necessitating a higher position of the Numeral phrase than the CLP.

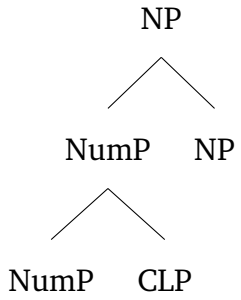
(10) a. Wo he-le Yi **da wan** tang
I drink-Par One **big bowl** soup
'I drank a big bowl of soup'

b. Wo mai-le Yi ge **da wan**
I buy-Par One CL **big bowl**
'I bought a big bowl'

c. *Wo zhing-le Yi ge ke
I plant-Par One CL CL

An alternative analysis, known as *left-branch analysis*, treats Numerals a phrasal item, positioning at the specifier of NP. This is favoured by studies from Li and Thompson (1989); Tang (1990b); Croft (1994); Lin (1997); Hsieh (2008). Under this analysis, a numeral and a classifiers form a syntactic constituent, functioning as a quantifying unit adjacent to the NP. Notably, comparing to the *right-branch* analysis, in which the semantic relatedness between CL and the head noun is emphasised, the *left-branch* analysis (GAO, 1994; Li, 2013; **?**; Her, 2017) posits that classifiers are projected for numerals.

(11) Left branch analysis:



The syntactic distribution of standard measuring words, as well as the ellipsis condition are the main empirical evidence for the left-branch analysis (GAO, 1994; Li, 2013). Standard measuring words, as illustrated in bold in (12), introduce a specific measuring value. To express a precise numerical value using measuring words, the inclusion of a numeral is mandatory. For example, the numerical value conveyed by '*Liang Jin*' in (12-b) equals one thousand grams; in this case, the numeral '*Liang*' (two) and the measuring unit '*Jin*' (500 grams) function as multiplicands, requiring multiplication between these two elements.

(12) a. Yi **ke** yao-cai
One **gram** medicine
'A gram of medicine'

b. Liang **jin** shui-guo
Two Jin fruit
'Two **jin**[2] of fruits'

c. Yi **dun** jin-shu
One **ton** metal
'A ton of metal'

d. Yi **mi** bu
One **meter** cloth
'A meter of cloth'

Based on the implicit multiplication between numerals and measuring words, studies such as Tang (2005); Her and Hsieh (2010) extend the concept of multiplicands to encompass all classifiers in Mandarin Chinese. According to this perspective, the fundamental role of classifiers is to act as multiplicands, necessitating that a numeral and a classifier to project together and satisfy the multiplication requirement.

Therefore, contrary to the *right-branch* analysis, classifiers are viewed as extensions of numerals in the *left-branch* approach. The sequence [Numeral-Classifier] forms a coherent quantifying unit that modifies an NP. Under this view, classifiers function as measuring terms. Similar suggestions are made in Krifka (1995); Bale and Coon (2014). Specifically, the presence of an obligatory classifier system in some languages is attributed to the deficiency of numerals in these languages, as they do not inherently encode the measuring function (denoted as 'μ' in the literature). Conversely, numerals in languages like English, which directly combine with NPs, serve as μ operators themselves, eliminating the need for an additional classifying system to mediate between nouns and numerals.

Aside from the implicit multiplication between numerals and classifiers, the ellipsis of the NP further demonstrates that a numeral and a classifier form a constituent. As shown in (13), when a numeral-classifier phrase functions as a direct object in a sentence, the head noun can be elided without resulting in ungrammaticality (*Yi ben* in (13-a) and *Yi mi* in (13-b)). But as revealed in (13-c) and (13-d), omitting the sequence [classifier-noun] results in ungrammarticality.

(13) a. Wo mai-le Yi ben shu, ta ye mai-le Yi ben
I buy-Past One CL book, she/he also buy-Past One CL

[2]Jin is a Chinese measuring unit, it is equivalent to 500 grams, or approximately 1.1 pounds

'I bought a book, she/he also bought one'

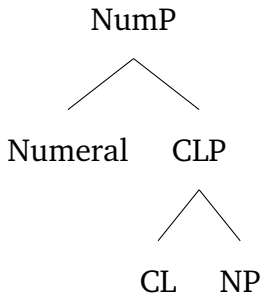
b. Wo mai-le Yi Mi bu, ta ye mai-le Yi Mi
I buy-Past One meter cloth, she/he also buy-Past One Meter
'I bought 1 meter-long cloth, she/he also bought it'

c. *Wo mai-le Yi ben shu, ta ye mai-le Yi
I buy-Past One CL book, she/he also buy-Past One

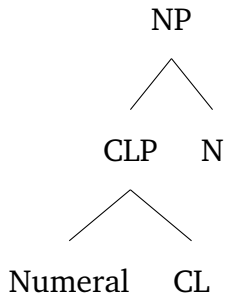
d. *Wo mai-le Yi Mi bu, ta ye mai-le Yi
I buy-Past One meter cloth, she/he also buy-Past One

Compare to the two leading divisions regarding the syntactic positions of numerals and classifiers, a hybrid approach is favoured by Rothstein (2011); Li (2011b). As exemplified in (14), the hybrid approach suggests that there is no unified template for hosting numerals, classifiers and nouns. Rather, the establishing of a syntactic template aligns with a semantic interpretation; the right-branch structure is for a counting phrase, in which counting classifiers are used, such as *San ben shu* (three books). While a left-branch structure is for measuring phrase, where mensural classifiers are merged, such as the phrase *San wan tang* (three bowls of soup).

(14) a. The counting structure:



b. The measuring structure:



Recalling the previous review, the ellipsis of the NP in example (15-a) within a numeral classifier phrase has been considered evidence for a *left-branching* structure, where the numeral and classifier form a phrasal constituent that modifies the NP. However, two pieces of evidence suggest that the NP ellipsis may actually support a **right-branching** analysis, in which the NP functions as a complement to the classifier.

(15) a. Wo yao san ping shui, ta ye yao san ping (shui)
I want three CL shui, she/he also want three CL
'I want three bottles of water, she/he also wants them.'

The first piece of evidence comes from the insertion of *de* in numeral classifier phrases. As addressed in Chapter two, *De* can serve various roles: as a modifier marker (16-a), a complementiser (16-b), and a genitive marker (16-c). Despite these different functions, they all share a common semantic feature: a *definite* interpretation [3].

(16) a. Hong **de** hua
Red de flower
'red flowers' de as a modifying marker

b. Wo xiang wan-cheng **de** shi
I want accomplish de thing
'Things that I want to accomplish' de as a complementiser

c. Ming **de** che
Ming de car
'Ming's car' de as a genitive marker

For instance, when we place (16-a) into a sentential context, as in (17-a), the phrase '*hong de hua*' conveys the meaning 'the red flower.' The definiteness implied by this phrase is also evident in other contexts, such as (17-b) and (17-c). Therefore, as proposed by Simpson (1997) and Saito et al. (2008), the particle *de* in Mandarin Chinese functions as a D head, which accounts for the implicit definiteness associated with *de*.

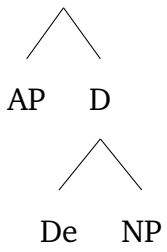
(17) a. Hong **de** hua bi lan **de** piao-liang
Red de flower compare blue de beautiful
'The red flower is more beautiful than the blue one'

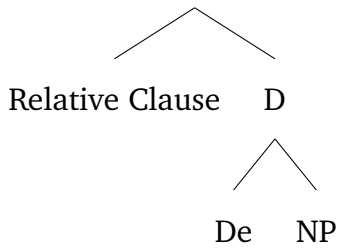
b. Wo xiang wan-cheng **de** shi he ta xiang wan-cheng **de** yi-yang
I want accomplish de thing with she/he want accomplish de same
'The things that I want to accomplish are the same as what he wants'

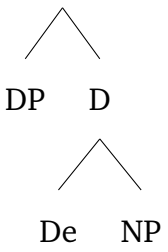
[3]It is worth noting that the function I am discussing in this section is different from that of de in N-CL. De in these cases are a functional projection, whereas de in N−CL− is a silent linking device, linking two descriptive content into a unified whole.

c. Ming **de** che bi wo **de** gui
Ming de car compare I de expensive
'Ming's car is more expensive than mine'

Consequently, the general syntactic positions for the instances mentioned above are illustrated in (18). The elements that precede *de* are considered the specifier of the projection, while those that follow *de* function as complements. After establishing the head status of *de*, we can now turn the attention to its insertion in numeral classifier phrases.

(18) a.


b.


c.


The standard assumption, as noted in Tang (1990a) and Saito et al. (2008), is that *de* cannot be inserted within a numeral classifier phrase[4], as shown in (19-a). If the left-branch analysis were accurate, where the [numeral-classifier] sequence modifies the NP, there would be no reason to prevent the insertion of *de* between them, resulting the same projection as the ones shown in (18). However, if classifiers are viewed as having a functional projection above the NP, then the insertion of *de* is naturally blocked, which supports the *right-branch* analysis

(19) a. Wu ben (*de) shu
Five CL (*de) book
'Five book'

[4]However, this is not an agreed statement in the literature. De can be inserted in a numeral classifier phrase when the classifier is a container word, such as *san bei de shui* (three glasses of water). But there is variation in the semantic meaning, using a container word can yield a measuring meaning, as noted in Li (2011b), and the measuring overdrives a counting meaning when de is inserted. Therefore, it is possible to insert de before the CLP, but this move comes with semantic influences. Due to the current scope is the counting structure, I will leave the container words for a moment

Turning to the case of *NP-ellipsis*. NP-ellipsis is not sufficient as an evidence for the left-branch analysis, the ellipsis of NP may result from a separate projection, a *focus* projection. In example (20), the sentence conveys the meaning of *contrastive focus*. Generally, *focus* refers to information that is not shared between the hearer and the speaker (Jackendoff, 1975b). The realisation of focus can occur through syntactic markers or phonological variations, where a focused word exhibits a higher pitch and longer duration than its unfocused counterpart (Cooper et al., 1985; Xu, 1999; Wu and Xu, 2010).

(20) Wo you **wu ben shu**, ming you **qi ben**
I have **five CL book**, ming have **seven CL**
'I have five books, ming has seven.'

Referring back to example (20), there is no overt syntactic cue to indicate the focus marker. Instead, the focus meaning is conveyed through phonological realisation. In the coordinated clause of (20), the numeral 'qi (seven)' must be stressed, as illustrated in (21-a), where qi is marked with a stress symbol. By stressing the numeral, a contrastive meaning is introduced in the sentence, highlighting the difference in quantities: *'I have five books, but Ming has seven books*'. However, as shown in (21-b), stressing the classifier is not permissible. This particular phonological requirement links to a hidden syntactic projection.

(21) a. ming you q̂i ben
ming have seven CL
'ming has seven books'

b. *ming you qi b̂en
ming have seven CL
'ming has seven books'

As discussed in Corver and Van Koppen (2009), focus stress plays a crucial role in NP ellipsis in Dutch. For example, in (22-a), omitting the embedded complement '*boeken*' results in ungrammaticality. However, NP ellipsis becomes possible if either the wh-word or the preposition is stressed, as demonstrated in (22-b) and (22-c).

(22) I have bought two books, but I do not know...

a. wat voor *(boeken) ik heb gekocht
what for books I have bought

b. wat **voor** (??boeken) ik heb gekocht
what **for**$_{stress}$ books I have bought

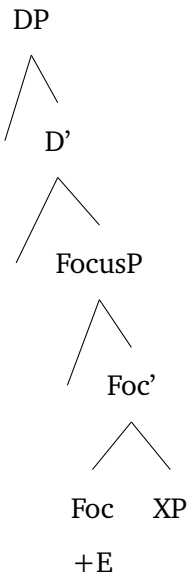
c. **wat** voor (boeken) ik heb gekocht
wat$_{stress}$ for books I have bought

Colloquial Dutch from Corver and Van Koppen (2009)

Accordingly, Corver and Van Koppen (2009) assume that the projection of focusP, with its distribution roughly as shown in (23) [5]. Generally, this analysis is feature-driven. The focus head encodes a [+E] feature, where [+E] stands for ellipsis. This feature is strong and uninterpretable, necessitating movement to check it. Furthermore, the [+E] feature requires its complement to be recoverable, meaning that there must be an antecedent available to track once the complement is elided. Thus, in the previous instances, the embedded complement 'boeken' can be elided due to the presence of FocusP, wherein the [+E] feature is checked by the wh movement, and the wh word is stressed.

[5]The FocusP is projected within the DP domain, based on the association between the focus marker e/en and NP ellipsis. While further details are beyond the scope of this section, the key point is that NP ellipsis in the CLP in Mandarin Chinese is likely due to a distinct syntactic projection, rather than being solely explained by constituency test.

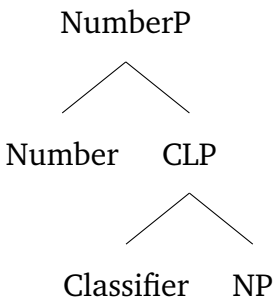
(23)



Consequently, reconsidering the NP ellipsis in MC, the stressing pattern on the numeral suggests that a FocusP is projected within the DP structure. This FocusP triggers movement and the omission of the NP. In other words, NP ellipsis alone is not sufficient to confirm that the [numeral-classifier] directly modifies the NP; instead, it indicates the presence of a separate syntactic projection.

In the following sections, I adopt the *right-branch* template (repeated as (24) as the base syntactic structure for conveying the counting interpretation, as it can better capture the semblance and discrepancies between simplex and complex numerals in MC.

(24)



In the surface structure, although both simplex and complex numerals precede classifiers, the insertion of degree adjectives like *'da'* (big) and *'xiao'* (small) highlights the potential

differences between them.

(25) a. Wo zhong-le **da** san-bai ke shu
I plant-Par **big** three-hundred CL tree
'I planted big three hundred of trees'

b. *Wo zhong-le **da** san ke shu
I plant-Par **big** three CL tree
'I planted big three trees'

c. *Wo zhong-le **da** shi-san ke shu
I plant-Par **big** ten-three CL tree
'I planted big thirteen trees'

As evidenced in (25), da can precede the multiplicative numeral-'*san-bai*' (three-hundred), whereas placing da before the simplex numeral 'san' (25-b) and the additive numeral 'shi-san' (25-c) result in ungrammatical expressions. In order to insert *da* in a simplex or an additive numeral phrase, *da* must be placed after the numeral, as exemplified in (26), or after the classifier, as in (26-b).

(26) a. Wo zhong-le san **Da ke** shu
I plant-Par three **Big CL** tree
'I planted three big trees'

b. Wo zhong-le shi-san **ke da** shu
I plant-Par ten-three **CL big** tree
'I planted thirteen big trees'

Based on the preceding review of the syntactic distribution of classifiers in Mandarin Chinese, numerals function as an independent projection that selects a classifier phrase to form a numeral phrase. However, the formation of complex numerals imposes restrictions on the position of degree adjectives. This variation suggests that there should be internal projections within the syntactic structure of NumP, where the attachment of a general number base can block or alter the role of the degree adjective. Before delving into the syntactic analysis, the ensuing question pertains to the semantic interpretation of numerals: under these distinct syntactic configurations, what do numerals denote?

3.2 Semantic interpretations of Numerals

As recorded in the literature, cardinal numbers can convey three types of semantic interpretations. First, numerals as *names of numbers*. In this case, regardless of their complexity in their formations, numerals denote numeral values. For instance, the number '*three*' would have the denotation shown in (27), in which the numeral concept of 'three' is conveyed. Rothstein (2012) categorises this usage of numerals akin to proper names due to their same semantic classes.

(27) $[[Three]] = 3$

Specifically, both numerals and proper names can be used as singular arguments in sentences. As demonstrated in (28), a simplex numeral can serve as an argument within a sentence. Furthermore, the grammaticality of (28-b) indicates that simplex numerals behave similarly to proper names, necessitating identical number agreement conditions on the verbs.

(28) a. Two plus two is four
b. Two is the only even prime number
c. Nine hundred is nine hundred
d. Nine hundreds are nine hundred Rothstein (2012)

With no exceptions, complex numerals, such as *hundred* and *thousand*, functions the same with simplex numerals. As illustrated in (28-c), where 'nine hundred' is treated as the name of the numerical value and necessitates singular verbal agreement when used in the subject position. Additionally, 'nine hundred', as shown in (28-d), can be pluralised by the suffix *s*, requiring plural verbal agreement. In this context, numerals (both simplex and complex numerals) denote the semantic type of $< n >$, interpreted as the names of numbers and representing individual entities.

The second type of analysis focuses on the predicative use of numerals, treating them as *quantifiers* of type $<< e,t >< e,t > t >$. Using an extensional model, Keenan and Stavi (1986) consider cardinal numeral expressions to be a type of determiner. In the extensional model, every common noun phrase denotes a set of individuals, and these individuals possess the properties defined by the nominal predicate. For example, the noun *student* denotes a set of individuals who have the property of being students.

According to their analysis, a determiner combines with a common noun phrase to form a full noun phrase, such as '*every student*'. Semantically, a determiner denotes a function that relates one set of properties to another set. For instance, in the noun phrase *every student*, the noun *student* has an extension, which is the set of all individuals with the property of being students. In the sentence *Every student is a winner*, the determiner *every* maps the set of students to the set of winners. This function is formally denoted in (29), in which s and t represent properties, therefore for the sentence '*Every student is a winner*', *s* corresponds to the nominal predicate '*student*', and linking back to the sentence, it means that the property of being students is less or equal to the property of being a winner.

(29) every(s)= $_{df}$ $\left\{t : s \leq t\right\}$ Keenan and Stavi (1986)

Analogously, the same semantic denotation applies to cardinal numeral expressions, since cardinals also indicate an 'at least' interpretation. For example, the meaning of the sentence '*Four attendants are doctors*' entails the meaning- '*At least four attendants are doctors*'. This entailment indicates that the cardinal number introduces a set such that the number of individuals that have both the property of being attendants and the property of being doctors is equal to or greater than four.

However, treating bare cardinal numbers (such as *four*) and modified numbers (such as *at least four*) as having the same interpretation is not ideal. The latter does not trigger the scalar implicature that bare cardinals do, nor does it convey the *exactness* that bare numerals do. As discussed in Horn (1972), the lexical meaning of numerals is subsumed under implicatures, and using a bare number word can trigger a scalar implicature.

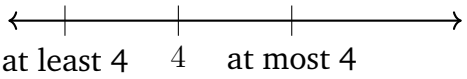


Figure 3.1: Scalar implicature triggered by *Four*

See figure 3.1, the scale contains a lower-bound that asserts an *at least n* meaning, referring to any numeral lower than a stated number. Also, there is an upper-bound on the scale, implying an *at most n* reading, in which larger quantity than a stated number is implied. These two implicated meanings are further negated due to the cooperative principle (Grice, 1975). Specifically the *maxim of quantity and quality*, the information provided by an utterance should be as informative and true as necessary. Thus, a speaker utters a bare numeral indicates that the information of the uttered sentence is true, making any quantity less or greater than the uttered number false alternations, which yields a sense of exactness in bare numerals. In contrast, a modified numeral such as *at least four* does not implicate an upper bound, and no scalar implicature is triggered from it.

Due to this variation of implications, Krifka (1999) redefines the denotation of bare cardinal numbers, which is of type $< e, t >$, interpreted as predicates of groups consisting of atomic members. Specifically, Krifka (1999) investigates how the scalar implicatures from numerals arise. The lower-bound and upper-bound implicatures are alternative meanings of an intended meaning. Alternatives are derived based on the compositional rules suggested by Rooth (1985), where alternative interpretations stem from the application of the function-*f*. When *f* is applied to a complex expression, say [$\alpha\beta$], the function applies to all parts of [$\alpha\beta$]. As formally depicted in Figure 3.2, where $[\alpha\beta]_A$ represents an alternative of [$\alpha\beta$], this alternative meaning is obtained by applying *f* to the alternatives of both α and β.

$$\text{If } \Big[\Big[[\alpha\beta]\Big]\Big] = f([\alpha],[\beta]), \text{ then } \Big[\Big[[\alpha\beta]\Big]\Big]_A = \{f(X,Y) \mid X \in [\alpha]_A, Y \in [\beta]_A\}.$$

Figure 3.2: Derivation of an alternative meaning in Krifka (1999)

Under this account, a bare numeral word conveys both the proposition intended by the speaker and an alternative proposition that implies a different numerical value. In other words, for the sentence 'Four attendants are doctors', the intended meaning is shown in

(30-b), where the precise quantity four is conveyed. Additionally, there exists an alternative interpretation, depicted in (30-c), where the quantity of doctor attendants can be any number different from four, represented by the formula '$n \in N$', with N encompassing all possible numerals.

(30) a. Four attendants are doctors.

b. Four(attendant)=$\lambda x[Four(x) \wedge ATTENDANT(x)]$

c. Four(attendant)$_A$=$\{\lambda x[n(x) \wedge ATTENDANT(x)] \mid n \in N\}$

In contrast, a modified numeral does not give rise to alternative interpretations. A modifier such as '*at least*' does not participate in the process of generating alternative meanings; rather, it is appended after the primary meaning is established. In other words, '*at least*' functions as a union operator, amalgamating all possible alternative interpretations of an NP into a singleton, a unified meaning. Consequently, a modified numeral does not project alternative interpretations.

The last mainstream perspective considers cardinal numbers as *modifiers*, denoting the semantic type of $< e,t >< e,t >$ (Carpenter (1994); Landman (2003); Ionin and Matushansky (2006), among others). The previous analysis, cardinal numbers as *quantifier* and as *predicate*, neglect the condition of complex numerals, which results in contradictions in the compositional process when formed a complex numeral such as '*two hundred*'. As pointed out by Ionin and Matushansky (2006), if cardinal numbers have a unified semantic denotation, it is expected that simplex numeral and complex numeral denote the same semantic type. However, it is not possible to compositionally combine two quantifiers ($<< e,t >< e,t > t >$) or two predicates ($< e,t >$).

To elaborate, this issue arises from the compositional analysis of numeral expressions. Consider, for instance, two hundred books. Suppose that the simplex numeral two and the complex numeral hundred are treated as independent items and are combined compositionally. If both are assumed to be determiners of type $<< e,t >< e,t >,t >>$, and hundred first combines with the NP books, the result is of type $< e,t >,t >$. The problem

arises when attempting to combine this $< e, t >, t >$ expression with two, which is of type $<< e, t >< e, t >, t >>$. Functional application fails in this case because two requires an argument of type $< e, t >$a predicate of individualsnot a generalized quantifier. As a result, the composition is semantically ill-formed.

Thus, Ionin and Matushansky (2006) propose a unified lexical entries for simplex cardinal numbers and complex cardinal numbers through combining a built-in *partitioning* function. This is due to the meaning of numeral phrases such as '*four trees*', '*four hundred trees*' is a sum of atoms, in other words, '*four trees*' means a sum of four individual trees. Such an indication is also noted by Krifka (1999), but in which the interpretation of 'sum' was assumed as a default function without detailed derivational illustrations. Ionin and Matushansky (2006) formalise this by integrating the partitioning function into the lexical entries of cardinal numbers, as formally addressed below.

> " Partition Function (notated as Π):
> S is a cover of x, and $\forall z, y \in S[z = y \vee \neg\exists a[a \leq z \wedge a \leq y]]$
> A set of individuals C is a cover of a plural individual X iff X is the sum of all members of C: $\bigcup$C = X" (Ionin and Matushansky, 2006, pp.318)

In this case, numerals covers a sum of individuals with a particular numeral value, and forming new sets that contain non-overlapping members. For example, for the phrase '*two hundred books*', its denotation can be informally illustrated as follows: 'two hundred books' denotes a sum of two groups, each containing one hundred non-overlapping members, where each member is a book. Crucially, under this view, a numeral phrase is always semantically singular, denoting a singular atomic set.

To warp up the semantic denotations of cardinal numbers discussed so far. First, they are terms of numbers. Under this denotation, numerals are usually used as arguments and denote individual entities. Second, numerals are quantifiers, which relate two sets into a unified set. Third, numerals are nominal modifiers that denote a partitioning function in their lexical entries.

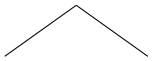
Shifting focus to cardinal numbers in Mandarin-Chinese. As reviewed previously, in order to quantify an nominal item with a numeral, a classifier is mandatory between the numeral and the noun, forming a constituent termed as Numeral Phrase (NumP) with the word order '*Numeral-Classifier-Noun*'. Therefore, to understand the semantic roles of numerals in a NumP, it is essential to determine the meanings of both the classifiers and the bare nouns.

3.2.1 Numeral meanings of NP

To begin with numeral meaning conveyed by bare nouns. In Chapter one, I discussed how roots are merged with n categoriser to form nP. nP denotes encyclopedic information, rather than formal semantic meanings. Therefore, the bare nouns referred in this section are NPs, a functional projection that can convey numeral meanings.

In his study, Corbett (2000) investigates cross-linguistic expressions of numeral meanings and morphological variations among three numeral meanings-*general number, singularity* and *plurality*. The first typology includes languages without *general number*, and the singular meaning and plural meaning are morphologically distinguishable (as in (31)). Empirically, English matches with this pattern, where the singularity is in form of bare noun, while the plural meaning aligns with the mandatory suffix-*s*, as in the comparison between *dog* and *dogs*.

(31)



Singular Plural

However, bare nouns in certain languages can express '*general number*', in which the numeral information is not specified as singular or plural. As illustrated below (32), in Bayso language, the bare noun-*luban* indicates either one lion or more than one lion. To clearly express a singular or plural meaning, a suffix (as *titi* in (32-b) and *jaa* in (32-c)) is attached after the bare noun.

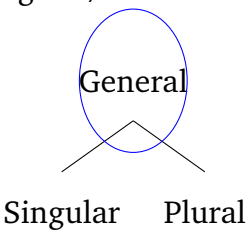
(32) a. luban foofe
lion.GENERAL watched.first.SG
'I watched lion(one lion or more than one lions)

b. luban-TITI foofe
lion-SG watched.first.SG
'I watched a lion'

c. luban-JAA foofe
lion-PAUCEL watched.first.SG
'I watched a few lions' (Corbett, 2000, pp.11)

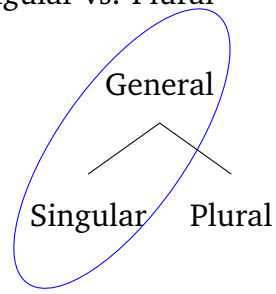
Based on this, the second numeral system embraces *general number*. As depicted in (33); general number is distinguished from singular and plural, as the latter requires a suffix, while the former is non-suffixed, and one of the typical examples is the aforementioned case, the Bayso language.

(33) General vs. Singular/Plural



In the third pattern, the meaning of general number and the meaning of singularity can be expressed through the same formation (as indicated in (34-a), where the general number and singularity are circled together), while plurality is expressed by different morphological requirements. Bare nouns in Japanese align with this pattern. See (34-b), the bare noun 'inu (dog)' is ambiguous, it can imply a singular meaning-*a dog*, or a general meaning-*more than one dog*. Notably, if the speaker wants to express the meaning of plurality, a plural suffix is to be used '*inu-tati* (dogs)'. Therefore, in this pattern, the bare noun is ambiguous between a general number meaning and a singular meaning.

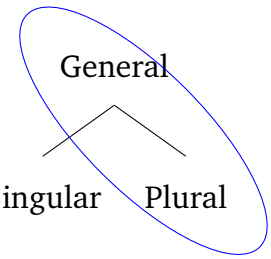
(34) a. General/Singular vs. Plural



b. Kooen-ni-WA inu-GA iru rasii
Park-in-TOPIC dog-SUBJ be seems
'It seems that there is a dog/are some dogs in the park' Corbett (2000)

In the last pattern, as illustrated in (35), the meanings of a general number and plurality are conveyed through the same morphological form, distinct from singularity. However, as noted by Corbett (2000), there is currently no empirical evidence supporting the existence of this pattern. This absence may be partially attributed to the convergence of morphosyntactic unmarkedness. Specifically, as suggested by (Corbett, 2000, 17), cross-linguistic data indicate that singular and plural represent opposite numeral meanings, with singularity generally being unmarked and plurality marked. If there is a third option-the meaning of *general number*, then this third option tends to be unmarked.

(35) Singular vs. General/Plural



The underlying reasons for this generalisation are beyond the scope of the current study. However, the lack of evidence for pattern three ((35)) seems to be consistent with '*Universal morphosyntactic asymmetries*', in which "*more frequent patterns are encoded within less materials*" (Haspelmath, 2008). In other words, if singularity is expressed without morphological marking and the meaning of *general number* encompasses the meaning of singularity, then the economy principle of language dictates that the expression of the general number remains unmarked or identical to the form for singularity, aligning with the observed data presented by Corbett (2000).

Now turning back to the numeral meaning encoded by bare nouns in Mandarin-Chinese. The literature has well-documented that Mandarin-Chinese does not have affixation to

mark the changes of numeral meanings (Greenberg et al., 1963). For instance, the numeral meaning from bare noun '*shu(book)*' in (36-a) is ambiguous between a singular meaning (*a book*) and a plural meaning (*books*). To clearly express a singular meaning-'a book', the numeral one and a classifier are needed, as shown in (36-b). Analogously, conveying the plural meaning necessitates the use of the plural classifier-*xie* [6], as exemplified in (36-c), [one-xie-book] indicates the plural meaning- *more than one book*.

(36) a. Wo mai-le **Shu**
I buy-Par **book**
'I bought a book/books'

b. Wo mai-le **yi ben Shu**
I buy-Par **one CL book**
'I bought a book'

c. Wo mai-le **yi xie Shu**
I buy-par **one CL book**
'I bought some books'

This pattern matches with the second typology described by Corbett (2000), where the meanings of *general number, singularity,* and *plurality* each correspond to distinct morphological forms. In light of the data exemplified by (36), studies such as Rullmann and You (2006) and Zhang (2014) have further investigated and concurred that bare nouns in Mandarin Chinese denote *general number*, with the meanings of singular and plural conveyed through the classifier system.

Rullmann and You (2006) systematically compared the semantic interpretation of bare nouns with numeral classifier phrases, identifying scope ambiguity and discourse anaphora as direct evidence of the *general number* encoded by Chinese bare nouns. Specifically, bare nouns in Mandarin-Chinese always take a narrow scope, whereas a classifier phrase can take take either narrow or wide scope. As exemplified in (37-a), under an opaque context,

[6]Notably, the post-nominal suffix-'*men*' is assumed as a plural marker. However, *men* is generally compatible only with animate bare nouns(*Ren-Men(Persons)*,*Gou-Men(Dogs)* Vs. **Shu-Men(Books)*, **Hua-Men(flowers)*) and pronouns *(Wo/Ni/Ta-men(we/you/them))*. Given that the correlation between animacy and plurality is not the focus of this study, I chose to use the more consistent plural form, plural classifiers, to illustrate the expression of plurality in Mandarin-Chinese

the bare noun '*lao-shi* (teacher)' can only take the narrow scope. In contrast, a singular indefinite classifier phrase, as shown in (37-b), can be interpreted with either a narrow scope or a wide scope.

(37) a. Wo xiang he **lao-shi** jiang-hua
I want with **teacher** talk
'I want to talk to a teacher' (Narrow Scope)

b. Wo xiang he **yi wei lao-shi** jiang-hua
I want with **One CL teacher** talk
'a. I want to talk to a teacher' (Narrow scope)

'b. There is a teacher who I want to talk to' (Wide scope)

Second, the anaphoric conditions. In languages without *general number*, such as English (38), a singular pronoun can only refer back to a singular phrase, while a plural pronoun refers back to a plural phrase. However, in Mandarin Chinese, bare nouns exhibit different behavior, wherein both singular and plural pronouns can refer back to a bare noun. As shown in (39), both the singular pronoun '*ta (it)*' and the plural form '*ta-men (they)*' can refer back to the bare nouns '*shu (book)*' and '*zuo-ye (homework)*'.

(38) a. I bought *a book*, but I forgot to read *it/*them*

b. I bought *some books*, but I forgot to read *them/*it*

(39) a. Zuo-tian wo mai-le **shu**, dan wo wang-ji du **ta/ta-men** le
Yesterday I buy-Par **book**, but I forgot read **it/them** Par
'Yesterday I bought a book/books, but I forgot to read it/them'

b. Wo na-le **zuo-ye**, dan wo mei-you da-kai **ta/ta-men**
I take-Par **homework**, but I not open **it/them**
'I took the homework with me, but I didn't open it/them'

Furthermore, building on the analyses from Rullmann and You (2006), Zhang (2014) specifies how *plurality* and *singularity* are expressed in Mandarin Chinese. In her analysis, there is a clear division of labour regarding the interpretation of numeral meanings in Mandarin

Chinese: bare nouns encode *general number*, while classifiers handle the meanings of *singularity* and *plurality*. Singular classifiers (termed *simple unit words* in Zhang's analysis) do not necessarily require the numeral 'one' to form a singular expression, as shown by the sequence [CL + bare noun] in (40). For expressing *plurality*, the plural marker is formed by reduplicating a classifier (termed *reduplicated unit word*). As shown in (41), compared to '*yi ping jiu (one bottle of wine)*' in (41-a), the reduplicated classifier in (41-b) functions as a plural marker and signifies a plural meaning, '*bottles of wine*'

(40) Singular marker in Mandarin-Chinese:

a. Wo xu-yao **ge li-you**
I need **CL reason**
'I need a reason'

b. Wo chi **ge ping-guo**
I eat **CL apple**
'I eat an apple'

(41) Plural marker in Mandarin-Chinese:

a. Ming he-le **Yi ping jiu**
Ming drink-Par **One bottle wine**
'Ming drank one bottle of wine'

b. Ming he-le **Yi ping-ping jiu**
Ming drink-Par **One bottle-bottle wine**
'Ming drank many bottles of wine'

c. *Ming he-le San ping-ping jiu
Ming drink-Par Three bottle-bottle wine

Notably, under this analysis, singularity and plurality are assigned within the classifier phrase, independently of cardinal numbers. Although it appears that the plural marker, as shown in (41-b), combines with the cardinal number *Yi (one)*, it is not a 'real' numeral item but rather an indefinite article [7]. Other true cardinal numbers are incompatible with the double classifier construction, as illustrated in (41-c).

[7]This dual function of the cardinal number-one in Chinese is also suggested by Zhang (2019)

Based on the analyses and data discussed earlier, it is evident that bare nouns in Mandarin-Chinese express *general number*, while singularity and plurality are either attributed to classifiers or the combination of a numeral and a classifier. The distinct numeral meanings may arise from their distinct semantic denotations. In the subsequent sections, I will discuss the semantic denotation of NP and CLP in Mandarin Chinese.

3.2.2 Semantic denotation of NP

It is an on-going debate if Chinese bare NPs are predicative or argumental. One of the leading perspective posits that Chinese bare nouns as arguments, denoting the semantic type '$< e >$' (Krifka, 1995; Chierchia, 1998; Yang, 2001), interpreted as a *kind*. Specifically, the denotation of *kind* is derived from the denotation of *property*. People identify a particular kind based on certain prototypical properties, for instance, the intuition of *dog kind* stems from the properties people presume dogs should have. In this case, a kind is set of instances of a property.

(42) a. Property$< s, < e, t >> ^{\cap} \rightarrow$ Kind $< e >$

b. Kind $< e > ^{\cup} \rightarrow$ Property $< s, < e, t >>$ Chierchia (1998)

Chierchia (1998) proposes an up operator (notated as '$\cup$') and a down operator (notated as '$\cap$') to shift between *property* and *kind*. See the gist (42), the down operator-$\cap$ converts a set of property into a set of kind, while the up operator $\cup$ transforms a set of kinds into a set of properties.

Under this view, the denotation of *kind* is a totality of certain properties. There is cross-linguistic variation how a *kind* is lexically realised, which is influenced by the features [$\pm$argument] and [$\pm$predicate]. In languages where NPs are [-argument][+predicate], it is necessary to use $\cap/\cup$ operators to denote kind. This can be explained as follows:

First, a bare noun denotes both atoms and the joint of atoms, as illustrated in Figure 3.3. Due to the parametric features [-argument][+predicate], a bare noun cannot function in

an argument position. Consequently, it requires the use of the operator $\cup$ to transform a *kind* into a *predicate*. Pluralisation serves as a good example of this transformation. As shown in Figure 3.4, the domain of plurality consists of joint atoms within a quantification domain, derived from atoms (*a, b, c*). Linguistically, the process of forming the plural *lions* from the singular *lion* exemplifies the transition from the representation in Figure 3.3 to that in Figure 3.4.

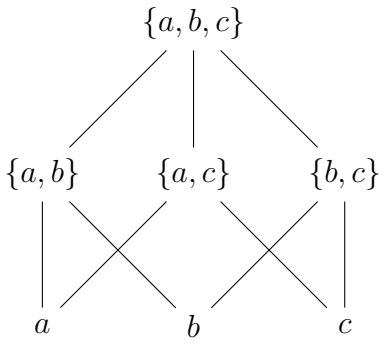


Figure 3.3: Domain of bare nouns

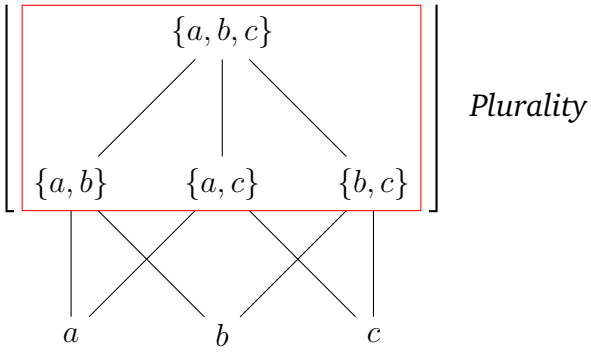


Figure 3.4: Domain of Plurality

An analogy can be drawn between the denotation of plurality and that of kind: both domains are constructed from joint atoms. In other words, an individual is not a *kind*. This distinction is explained by the pre-established concept of *kind*, which is derived from a set of properties. Although an individual may possess certain properties within a domain, it does not represent all individuals within that domain sufficiently.

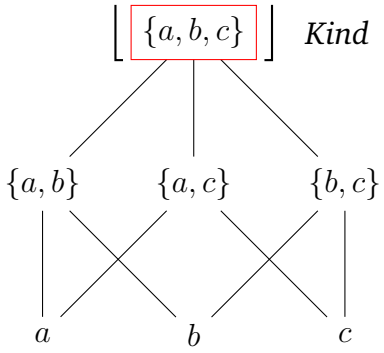


Figure 3.5: Domain of Kind

Referring to Figure 3.5, it is evident that the properties in atom *a* may not be fully included in atom *b*. Consequently, a *kind* is represented by a collection of joint atoms. Additionally,

the domain denoted by a *kind* must be broad enough to encompass all relevant atoms. Thus, the denotation of a kind is a superset of the quantification domain. As illustrated in Figure 3.5, a, b, c represents the denotation of a *kind*. In linguistic representations, adding a determiner to a plural noun, such as in the phrase '*the lions*', corresponds to this step and denotes *kind*.

The transition described above applies to languages that are $[+predicate]$. However, Mandarin Chinese is a $[+argument][-predicate]$ language, where bare nouns can function directly as arguments. For example, in the sentence '*Wo mai-le Shu* (I bought book)', the bare noun '*Shu* (book)' appears in the direct object position. Consequently, the denotation of bare nouns in Mandarin Chinese is represented as shown in Figure 3.6. In this representation, a bare noun is interpreted a *kind*, its domain denotes both *atoms* and *joints atoms*, thus functioning as mass-denoting arguments.

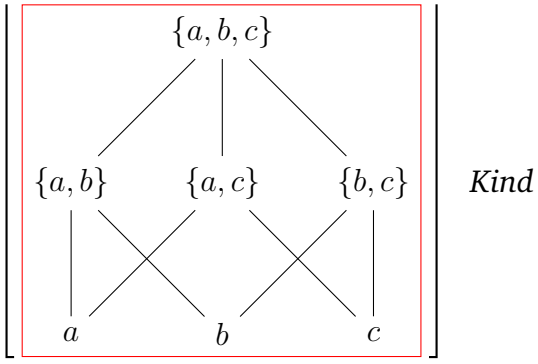


Figure 3.6: Denotation of bare nouns in Chinese

On the other hand, another perspective posits that NPs in Mandarin-Chinese are predicative. This is rooted in the debate about mass/count semantics in the literature. The aforementioned analysis is based on the atomicity approach of distinguishing the denotation of mass and count (Link et al., 1983), in which the denotation of mass and that of plurality are both derived from atoms. If one follows this approach, all Chinese bare nouns would have the same denotation, which is a mass domain composed of atoms and joints of atoms. Reflecting on linguistic expressions, there would be no mass/count distinction at the NP level, in other words, the denotation of a substance such as *shui (water)* is the

same as the denotation of an entity such as *Shu (book)*. If this were the case, a unified way of using classifiers is expected.

However, classifiers for substances differ from those for entities. As noted by Cheng and Sybesma (1999), when classifying a substance, the choice of classifiers is more flexible, known as *massifiers*. As exemplified in (43-a), most container expressions can be used as massifiers for substances. In contrast, for entities such as *Shu* (book), there is a matching classifier, termed as *count classifiers*, as shown in (43-b). Count classifiers are semantically inert, when used in a numeral classifier phrase, they do not contribute their lexical meaning to the phrase, which is not the case for massifiers (as indicated in the glossary of (43-a)).

(43) a. San bei/tong/wan/chi **Shui**
Three glass/bucket/bowl/pool **Water**
'Three glasses/buckets/bowls/pools of water'

b. San ben **Shu**
Three CL **book**
'Three books'

c. San tong/xiang/pool **Shu**
Three bucket/box/pool **book**
'Three buckets/boxes/pools of books.

One can argue that the distinction mentioned previously between massifiers and count classifiers is not definite. Massifiers can also classify an entity, as seen in example (43-c), where container words like *tong* (bucket), *xiang* (box), and even *chi* (pool) precede the bare noun *shu* (book). This presents a pattern similar to that of the mass noun *shui* (water). However, possibility does not imply necessity, while it is possible to use various classifiers for entities, there are default classifiers for entities, but not for substances.

Specifically, the examples in (43-b) and (43-c) have different interpretations. When used in sentences, the sentence in (44-a) is true only if there are exactly three books, which sets it apart from the truth condition for (44-b). The statement in (44-b) can be true even if I have bought three hundred books, as long as they are packed into three buckets/boxes/pools.

Therefore, the use of a count classifier yields a counting phrase, where a specific number is indicated by the numeral. In contrast, when using a container expression for a countable entity, the phrase does not denote a specific quantity.

(44) a. Wo mai-le san ben shu
I buy-Par three CL book
'I bought three books' (specified quantity)

b. Wo mai-le san tong/xiang/chi shu
I buy-Par three bucket/box/pool book
'I bought three buckets/boxes/pools of books' (unspecified quantity)

The second difference lies in the morphological level, the content meaning of N-CL pairs. As discussed in Chapter 1, certain default classifiers are closely linked to specific nouns, such as *ben* for *shu* (book) and *duo* for *hua* (flower). Their default status is reflected in the lexical meaning of their corresponding noun-classifier (N-CL) pairs. Such count classifiers do not add any meaningful content when used as attaching classifiers in N-CL pairs. As shown in (45-a) and (45-b), *Shu-ben* and *Hua-duo* convey the same lexical meaning with the bare nouns *Shu(book)* and *Hua(flower)*.

(45) a. **Shu-Ben** li you zhi-shi
Book-CL inside have knowledge
'Books contain knowledge'

b. **Hua-Duo** shi mei de
Flower-CL be beautiful mod
'Flowers are beautiful'

c. **Shui-Bei** bei wo na-zou le
Water-Bottle being I take-away par
'The water-bottle was taken by me'

In contrast, massifiers, when used in N-CL pairs, always contribute full lexical meaning to the word they are part of. As shown in (45-c), the N-CL pair conveys the meaning mainly from attaching massifier-*bei*, while the bare noun-*shui (water)* only provides additional meaning to the word.

The variation discussed above provides compelling evidence that count classifiers and massifiers are selected under different conditions. Count classifiers are somehow '*default*' classifiers for certain nouns, and they exhibit a consistent behaviour: they are always semantically inert at both the morphological level and within a functional projection (using as the head of CLP). In contrast, massifiers do not serve this default function; they operate as common nominal items. This fundamental difference between the two types of classifiers is closely related to the denotation of bare nouns. It appears that nominals for entities and nominals for substances have distinct systems for choosing classifiers, which challenges the notion of a unified denotation for all Chinese nouns.

The similar question has received attentions in the semantics literature, particularly on the puzzle of countable mass nouns. As discussed in Landman (2016), there is a contradiction when attempting to count a mass noun such as *coffee* under an atom-based framework (as shown in Figure 3.3). On one hand, *coffee* can be considered a countable mass noun because it can be quantified using cardinal numbers, as in the sentence, '*I drank three coffees*'. In this case, we are counting three atoms of coffee (in a loose sense). On the other hand, the denotation of coffee indicates that it is non-distributive, in other words, three atoms of coffee is still a coffee. In this case, how we get a distributive meaning in '*I drank three coffees*' remains puzzling.

This issue leads to the development of the *disjointness semantics* framework, which seeks to clarify the distinction between the denotations of mass nouns and count nouns (Landman, 2016). According to this framework, the quantification domain is divided into a *base* and a *body*, with their relationship illustrated in Figure 3.7. The nature of the base is crucial for distinguishing between mass and count denotations: count nouns are associated with a *disjoint base*, while mass nouns are associated with a *mass-base*.

Furthermore, the denotation of count and mass nouns is no longer derived solely from atoms. The complete denotation of a count noun consists of a body and a count-base, formally represented as an i-set $< body, base >$ (Landman, 2016). The count-base includes atoms, and meanwhile the set is a disjoint, ensuring the base is countable. In terms of

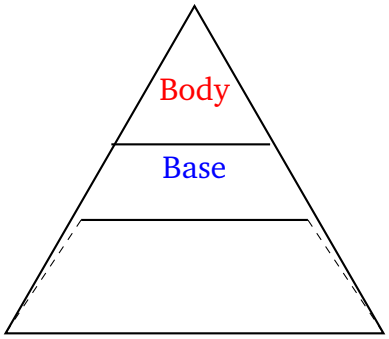


Figure 3.7: Iceberg Semantics (adopted from Landman (2016))

the definition of disjointness, as shown below in the quotation, if variable *x* and *y* have no sharing parts, they are considered disjoint; otherwise they overlap. Put it differently, it is not atoms that determines the countability of a domain, but the property of '*disjointnness*' of atoms determines the count denotation.

> The notion of disjoint and overlap:
> "x and y overlap iff x $\cup$ y $\neq$ 0, otherwise x and y are disjoint. (x and y overlap if they have a non-null part in common)
> **X** overlaps iff for some x,y $\in$ X, x and y overlap, otherwise X is disjoint"
> (Landman, 2016, pp.3)

A mass-base, based on the definition above, is an overlapping set in which some variables share common properties within the set. As expected from this definition, the loose requirement (some, not all) of overlap inevitably leads to borderline cases where a denotation can have both overlapping and disjoint parts. Consequently, mass denotations are subclassified into *neat mass* and *mess mass*. A neat mass base includes these borderline cases; in other words, neat mass builds on a disjoint base (as depicted in Figure 3.8). In contrast, a mess mass base is a purely overlapping base with no intersection with a disjoint base.

NPs under this framework have a unified semantic category, $< e, t >$, interpreted as predicates over sums, and the sums can be overlapping or disjoint (as indicated by the relation between body and base in figure 3.7). Tsoulas and De Vries (2023) utilise this framework

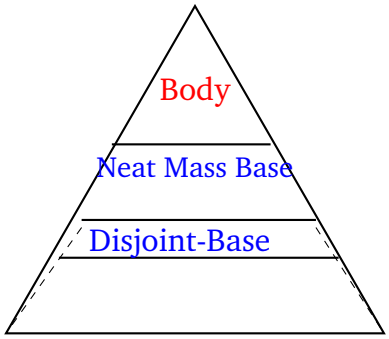


Figure 3.8: Neat-Mass Base

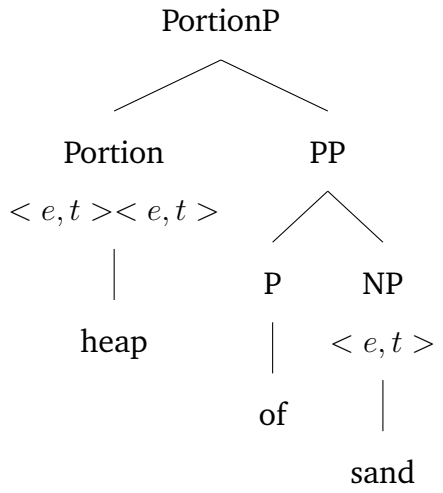
to explain portioning phrases across various languages. Specifically, a portioning construction typically consists of a unit word followed by a nominal element. However, the selection of some unit words is not arbitrary. For instance, in the cases of *heaps* in (46-a) and *portions* in (46-b), these unit words individuate a substance in an abstract manner, making the semantic core the nominal item rather than the unit word. Conversely, in the case of *carts* in (46-c), the unit word is used arbitrarily, and the core information is conveyed through the unit word (carts) rather than the nominal element.

(46) a. Three heaps of sand
b. Three portions of soup
c. Three carts of fruit

The main research question in Tsoulas and De Vries (2023) concerns the structural differences between *count portion-out* and *mass portion-out*. The lexical choice of portioning units remains an open question. However, their study provides insights into the nature of bare nouns in Mandarin Chinese. Tsoulas and De Vries (2023) employs the *disjointness-based* framework to define both a portioning word and a bare noun. For example, the bases for *sand* and *soup* in (46-a) and (46-b) are overlapping, namely the '*mess mass base*'. To be counted by numerals, a unit word is needed, such as *heap* or *portion*, which are *disjointness-based* NPs. Syntactically, a phrase like *three heaps of sand* originates from the

projection of a Portion Phrase headed by the unit word (see (47)[8]).

(47) Syntactic projection of *heap of sand*



Tsoulas and De Vries (2023)

Therefore, *three heaps of sand* is countable due to the portion head *heap*, which shifts the sand-sum into a sum of sand-heaps, enabling counting. Since the compositional relation between *heap* and *sand* is not arbitrary, correspondingly, counting *heaps* is a non-arbitrary choice.

Shifting focus back to NPs in Mandarin Chinese, the disjointness framework can better capture the selection of classifiers for NPs. As mentioned previously, a count classifier is semantically inert and closely linked to the head noun, while a massifier functions as a full nominal and imparts lexical meaning to the phrase it is part of. Thus, I follow that NPs in Mandarin Chinese are predicates of type $< e,t >$. If the base is disjoint, it is possible to have a count classifier combine with it within a numeral classifier phrase (as in the case of *ben* for *shu*). However, if the base is a mass base, such as in the case of *shui* (water), it is not countable. Therefore, a new classifier is needed to quantify a mass base NP, aligning with the arbitrariness of massifiers.

[8]See detailed analyses on the status of the preposition *of*; in a count portioning phrase, the preposition is semantically inert and does not contribute to the compositional process

3.2.3 Semantic denotation of CLP

In the previous section, I have stated that NPs in Mandarin Chinese denote the semantic category of predicate, $< e, t >$. To confirm the semantic roles of cardinal numbers, the subsequent step is to confirm the denotation of the classifier phrase (CLP).

In Chapter one and Chapter two, I used a different lens to observe the properties of classifiers, their lexical content. Other than *ge*, the other classifiers more or less encode certain lexical information, fulfilling the semantic restrictions stipulated from a noun. For example, the lexical meaning from the classifier *duo* serves as a segment, such that the corresponding unit *hua-duo* equates to the bare noun *hua (flower)*.

However, *ge* can combine with a wide range of nouns without any semantic restrictions, I attribute this to its full 'functionality', meaning that it is not derived from nP as a lexical root, rather, it should be base-generated at a functional projection, aligning with the fact that they are contentless and their incapability of forming N-CL pairs.

Despite the difference in lexical content, the classifier phrase in general has a unified semantic role, which divides the semantic denotation from NP and serves as a *partitioning domain* (Rothstein, 2010, 2011; Li, 2011b; Zhang, 2013; Tsoulas and De Vries, 2023). Based on the previous discussion about the NP denotation, I follow this mainstream semantic analysis of classifiers.

As addressed in the previous section, NP in MC denotes *general number*, and a cardinal number cannot combine with an NP. In order to generate a phrase with a specific numeral value, the CLP emerges. As shown in examples (48), the numeral meaning of the bare noun '*wan-ju*' is ambiguous, it can be interpreted as 'a toy' or 'toys'. In comparison, inserting the general classifier-*ge* forms a singular counting expression, as indicated in (48-b), wherein '*yi ge wan-ju*' can only mean '*a toy*'.

(48) a. Wo mai-le **wan-ju**
I buy-Par **toy**
'I bought 'toys/a toy'

b. Wo mai-le **yi ge wan-ju**
I buy-Par **one ge toy**
'I bought **a toy**'

Continuing on the 'partitioning' function in classifiers, it refers to the function that divides a stuff into an object (Bale et al., 2019). The divided object can be concrete or abstract. For instance, the typical concrete partitioning phrase involves a container word preceded a non-countable substance (Rothstein, 2011), such as '*three glasses of wine*', this is furthermore discussed in Tsoulas and De Vries (2023), wherein the concrete partitioning involves a more 'arbitrary' partitioning item, which provide certain lexical content . While for the abstract partitioning phrase, the partitioning word is less arbitrary and provides a more abstract notion rather than a concrete lexical notion, such as *slice* in *slice of cheese*, *piece* in *piece of information*.

The use of classifiers in MC is consistent with the partitioning process mentioned earlier. As discussed in Chapter 1, apart from the general classifier *ge*, other classifiers are often linked to specific characteristics of the nouns they accompany. This phenomenon is referred to as 'natural instances of the domain denoted by the NP' in Cheng and Sybesma (1999). For example, as shown in (49), the NP 'shu' (book) can be classified using the classifiers 'ben', 'juan', and 'dui'. Despite the differences in the specific content meanings conveyed by these classifiers, they all share a consistent internal part-whole relationship. As a result, 'ben-shu', 'juan-shu', and 'dui-shu' each represent different a set of instances within the domain of 'shu' (book).

(49) a. Yi ben shu
One CL book
'A book'

b. Yi juan shu
One CL_{roll} book
'A roll of book'

c. Yi dui shu
One CL_{pile} book
'A pile of book'

Therefore, we can roughly assert that using *ge* represents an abstract partitioning process, whereas using other classifiers leads to a more concrete partitioning process.

Based on this general idea, the semantic function of classifiers can be understood as follows (illustrated in (50)): classifiers select an NP to form a constituent (where X represents an NP), and the meaning of the resulting classifier phrase corresponds to a portion of the denotation of NP.

(50) $\|Classifier\|$(X)={y ∈ X | y is a set of atoms}

A similar suggestion is formed in Li (2011b), where the partitioning process in a classifier phrase is achieved through two operations: *counting* and *measuring*. His analysis builds on the analyses of counting and measuring in nominal expressions discussed by Rothstein (2011). In Rothstein (2010, 2011), the semantic notion of 'countability' is attributed by the variable 'COUNT', and it is context-dependent. For example, the noun 'books', which is typically considered a count plural, but it can be interpreted as a mass noun in contexts like '*Thirty boxes of books were stolen*'. Therefore, when we say a count noun, it actually refers to a particular context, wherein an nominal domain is considered as atomic entities. In other words, the atomic entities selected from a context is a part of the whole nominal domain, formalised as (51).

(51) $A_k = \{\langle d, k\rangle : d \in k\}$ Rothstein (2010)

Therefore, by considering the variable context (k), the semantic meaning of counting is formalised as shown in (52), and M refers to the a mass domain, assumed as the default denotation of NP. The $^{\cap}$ K refers to a shifting process, shifting the N to a kind-denoting argument (a similar function with the down operator from Chierchia (1998)).

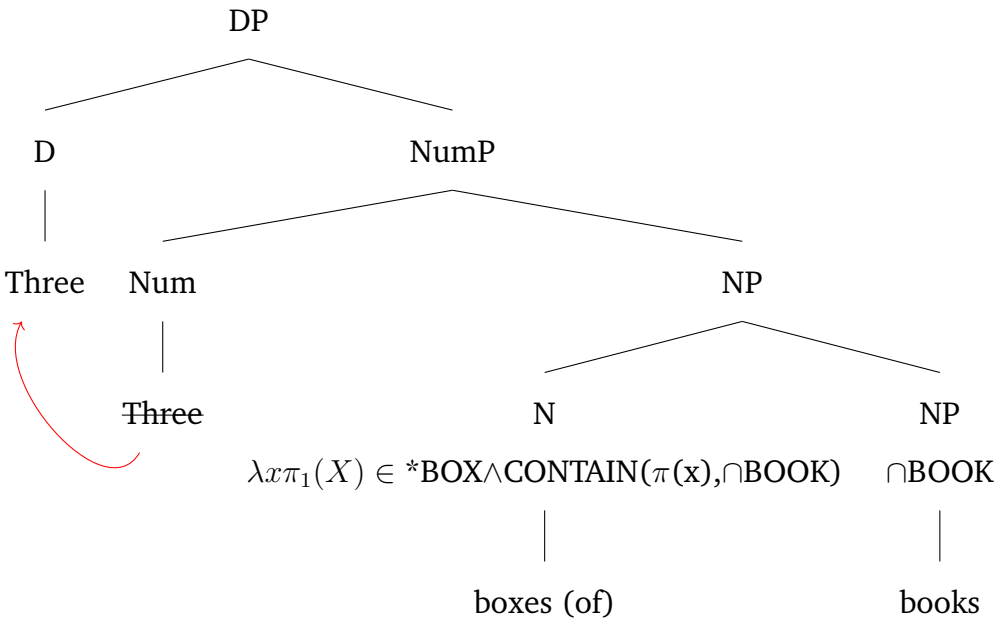
(52) For any X ∈ M, COUNT (x)={$\langle d, k\rangle : d \in X^{\cap}K$} Rothstein (2011)

For plural count nouns, the plural operation (*) applies to a count noun. In other words, the plural operation works on a set of atomic entities, which is after a nominal domain has undergone the count operation shown in (52). Accordingly, the process of pluralisation is formalised as in (53).

(53) PL(N_{count})=*N_K= $\{\langle d, k\rangle : d \in *\pi_1(N_K)\}$ Rothstein (2011)

All of these steps are prepared for the count/mass shifting in nominal expressions. Two syntactic structures are proposed for realisation of these semantic meanings, for the phrase 'three boxes of books', the counting meaning has its corresponding structure, illustrated as in (54-a), wherein the plural count noun 'boxes' functions as a classifier that selects for the NP 'books'. Due to this position, the plural count noun 'boxes' serves as a relational noun that carries the thematic role of CONTAIN.

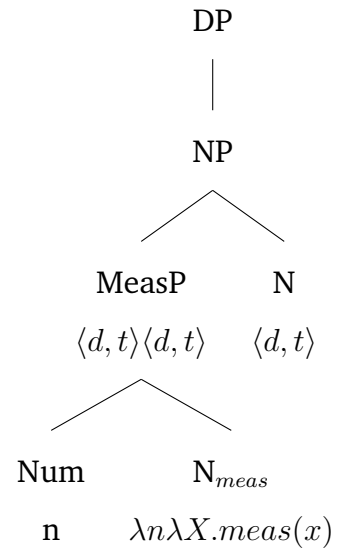
(54) a.



A different syntactic structure is generated (55) when books is interpreted as a mass noun in 'three boxes of books'. In this case, the cardinal number and the container noun combine through predicate modification (Heim and Kratzer, 1998) to form a measuring unit.

Afterward, the [Num-CL] sequence modifies the noun phrase books.

(55)



It is worth noting that the measuring unit is headed by the container noun, and a silent '*ful*' takes the role of transforming the container noun into a measuring term [9]. Additionally, another shifting process occurs with the head noun books. Since the measuring unit is a modifier of type $\langle d,t\rangle\langle d,t\rangle$ (where d stands for 'kind'), the argument of type $\langle d\rangle$ must be shifted to type $\langle d,t\rangle$. In other words, in the structure shown in (55), the head noun undergoes an additional transformation, converting the kind denotation of 'books' into a mass-denoting predicate.

Li (2011b) adopts this semantic analysis and applies on classifier phrases in MC. He integrates the content meaning of classifiers with the default partitioning function from the CL head. Under this analysis, a classifier provides two functions: the more obvious function of counting (in the sense of Rothstein (2011)) and a second function of providing a *kind-term* associated with the NP, formalised as (56).

(56) Classifier(NP)=$\|Classifier\|(^U\|NP\|) = COUNT_k(^U\|NP\|) = \{\langle d,k\rangle : d \in^U \|NP\| \cap k\}$
Li (2011b)

[9] As illustrated in Rothstein (2011), the suffix form *ful* can be consistently combines with container words, as in boxful, glassful.

By '*kind-term*', it means the content information that a classifier provides, as demonstrated earlier of the classifiers for 'shu' (book) in (49), and the specific analysis in chapter one. Therefore, the classifier 'juan' (meaning 'roll') functions as shown in (57), where the capital **K** represents the kind variable, which is the denotation of the NP. The lowercase k represents the context variable, used to select a specific kind. Additionally, the classifier adds specific content information-such as *juan*, which conveys the content meaning of 'roll', and this information serves as the contextual kind-term. Ultimately, the classifier allows the bare noun to be counted and also establishes the kind-term for the bare noun.

(57) $\|juan\| = \lambda\mathbf{K}\lambda x.\pi(x) \in (^{\cup}\mathbf{K} \cap k) \wedge Roll(\pi(x) \wedge \pi_2(x)) = k$

(58) $\|ge\| = \lambda\mathbf{K}\lambda x.\pi(x) \in (^{\cup}\mathbf{K} \cap k) \wedge \pi_2(x) = k$

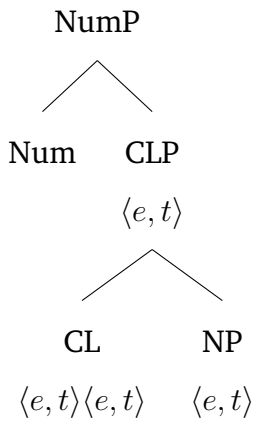
Under this analysis, the general classifier *ge* lacks the conjunction of the content information, as formalised in (58). Reflected through the fact that ge contains no content meaning and is felicitous with most of the bare nouns in MC.

The semantic analysis outlined above effectively captures the intrinsic relationship between classifiers and the nouns they precede, as well as the non-trivial content meanings that classifiers contribute. Therefore, I adopt this approach and interpret the core semantic function of the classifier phrase as mapping the domain of a noun onto a specific set of individual instances (atoms), repeated below as (59).

(59) $\|Classifier(NP)\|$=$\|Classifier(X)\|$={y ∈ X | y is a set of atoms}

Therefore, the semantic denotation of classifier is clear; classifiers are of type $\langle e,t\rangle\langle e,t\rangle$. With this understanding, we are now closer to resolving the puzzle regarding the semantic role of numerals in Numeral Classifier Phrases, as demonstrated by the distribution in (60).

(60)



Before delving into the semantic functions of numerals, it is important to examine two classifier-like elements, xie and ji. These elements play a key role in distinguishing between simplex numerals and complex numerals. Generally, inserting xie or ji within a numeral classifier phrase creates two distinct numeral interpretations. Xie indicates an approximate quantity without a specific numerical boundary, while ji marks a small, paucal quantity, typically greater than 'a couple' but less than 'ten'. This variation potentially highlights the difference between simplex numerals and the number bases (as introduced previously, shi, bai, qian, wan).

3.3 Xie and Ji, the paucal operators

Recalling the data introduction, *xie* is a classifier-like item in MC. Analogously with *ge*, *xie* can be applied onto a wide range of nouns without providing any content meaning, as exemplified in (61). Furthermore, both ge and xie allow the omission of their preceding numerals, particularly the omission of the numeral one 'yi'. As shown in (61-c) and (61-d).

(61) a. Yi xie ren/shi/xue-sheng
One xie people/thing/student
'Some people/things/students' Yi+Xie+bare noun

b. Yi xie tang/jiu/niu-nai
One xie soup/wine/milk
'Some soup/wine/milk' Yi+Xie+non-countable noun

c. Wo mai-le (yi) ge shui-bei
I buy-Par (one) ge water-cup
'I bought a water-cup'

d. Wo mai-le (yi) xie shui-bei
I buy-Par (one) xie water-cup
'I bought some water-cups'

But comparing to *ge*, which can combine with both simplex and complex numeral expressions (62-a), *xie* can only be preceded by the numeral one (62-b).

(62) a. San/San-shi/Shi-san ge xue-sheng
Three/Thirty/thirteen ge student
'Three/thirty/thirteen students' simplex/complex numeral+ge

b. Yi/*Er/*San-Shi xie xue-sheng
One/*Two/*Thirty xie student
'Some students' one+xie

Due to the consistent interpretation of plural, *xie* has been analysed as a plural classifier in MC (Iljic, 1994a; Zhang, 2013; Wu, 2019). Specifically, Wu (2019) outlines the semantic role of *xie* as a classifier that restricts the meaning of a complete lattice domain (denoted

by NP) to a set of plural entities, as formalised in (63). This suggests that *xie* inherently carries a default pluralising function.

(63) $\|xie\| = \lambda\mathbf{P}\lambda x[PL(P)(x)] = \lambda\mathbf{P}\lambda x[P(x) \wedge \exists y \in P[y \prec x]]$ Wu (2019)

When it comes to the restriction of its preceding numeral, Wu (2019) attributes this to the semantics-mismatch between cardinal numbers and *xie*. Specifically, numerals are felicitous with a set of atoms, but cannot combine with an non-atomic set. The sequence [xie-NP] denotes a set of plural entities, in which includes joint atoms, excluding atoms, thus cardinal numbers are infelicitous with [xie-NP]. When the numeral one (yi) combines with [xie-NP] however, it provides an '*identity*' function rather than an '*enumerating*' function. Put it differently, Yi in the sequence [Yi-ge-NP] is ambiguous between a cardinal number and an identity marker (64-a), while when Yi precedes [xie-NP], it only functions an empty shell without providing a specific cardinal value (64-b).

(64) The duality in Yi:

a. Yi-Ge-NP
   One-Ge-NP
   a. Yi provides the cardinal value of 'one'
   b. Yi provides an identity function

b. Yi-Xie-NP
   One-Xie-NP
   Yi provides an identity function

However, a key characteristic of xie distinguishes it from classifiers: its compatibility within the [Xie-ge] sequence. Generally, in a numeral classifier phrase, a reduplicated classifier is permissible, as demonstrated in (65-a) and (65-b), which is another pluralisation mechanism assumed by Zhang (2014). However, it is not possible to use two different classifiers consecutively, as shown in (65-c) and (65-d). Ungrammaticality arises when the CL1 and

CL2 are different classifiers preceding the same noun.

(65) a. Yi **ke-ke** shu
One **CL-CL** tree
'Trees'

b. Yi **tiao-tiao** he
One **CL-CL** river
'Rivers'

c. *Yi **ge-pian** he
One **CL1-CL2** river

d. *Yi **ge-juan** shu
One **CL1-CL2** book

In the case of xie, it can precede the general classifier to form a complex classifier construction, as demonstrated in (66-a). The meaning of the [xie-ge] sequence is still derived from xie, as [xie-ge-ren] in (66-a) indicates a plural meaning. The co-occurrence of xie and ge challenges the assumption that xie is a classifier.

(66) a. Wo ling-zhe zhe **xie-ge** ren qu gan-huo
I take-progressive this **xie-ge** people to work
'I'm taking these people to work'

b. Wo ling-zhe zhe xie ren qu gan-huo
I take-progressive this xie people to work
'I'm taking these people to work'

Another approach is to treat 'xie' as a quantifier, drawing on its parallel pattern with the cluster 'Yi-dian' in Mandarin Chinese. As discussed in Iljic (1994b); Zhang (2013), the phrase 'Yi-dian' carries a meaning similar to 'a little' or 'some' and is commonly used before non-countable and abstract nouns, as illustrated in (67). According to the analysis in Zhang (2013), 'dian' does not convey any specific content information, unlike other classifiers (termed as unit words) that represent delimitable attributes such as size or shape. Therefore, 'dian' should be considered a quantifier rather than a classifier.

(67) a. Wo chi-le **yi-dian** shui-guo
I take-par one-dian fruit
'I ate a little/some fruit'

b. Wo you **yi-dian** jian-yi
I have one-dian suggestion
'I have some suggestions'

Although both 'xie' and 'dian' share a restriction in terms of content meaning, it is still problematic to group them together because they differ in how they combine with numerals. Unlike 'xie', which can only combine with 'Yi' (one) (62-b), 'dian' can be paired with other numerals besides 'one'. As exemplified in (68), both simplex numeral and complex numeral can precede 'dian' to form a common numeral classifier phrase.

(68) Lao-shi ti-chu **san/san-shi dian** yao-qiu
teacher put-forward **three/thirty dian** requirement
'The teacher put forward three/thirty requirements'

Another crucial evidence lies in the compatibility with the numeral quantifier Ji. Terming Ji as a numeral quantifier is due to its indication of a specific numerical range. Unlike other quantifiers, which imply a vague quantity or 'a part of something', ji implies a precise boundary about its numerical value, which is greater than one and less than ten, functioning similarly to a 'paucal quantifier' as described in Corbett (2000).

As illustrated in (69-a), Ji can function as a cardinal numeral and precede the sequence [CL-N], in which case, the statement is true if fewer than ten students came by. Additionally, as shown in (69-b), ji can be attached after a general number base to function as an addend, the resulting numeral value from 'shi-ji' is greater than ten but less than twenty. Based on its distribution, 'ji' appears to serve as an alternative to simplex numerals.

(69) a. Lai-le **Ji ge** xue-sheng
Come-Par **Ji Ge** student
'**A few** students came by'

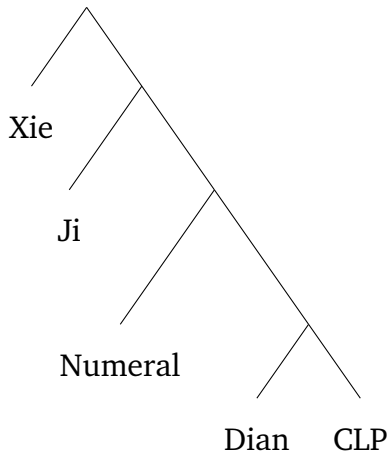
b. Lai-le **Shi-ji** ge ren
Come-Par **Ten-Ji** CL people
'**More than ten (and less than twenty)** people came by'

c. Lao-shi ti-chu Ji-Dian/*Xie yao-qiu
Teacher put-forward Ji-Dian/*Xie requirement
'The teacher put forward a few requirements'

The reason for discussing 'ji' is due to the sequence '[Ji-dian-N]' shown in (69-c). Ji, as addressed, serves as simplex numerals to enumerate the sequence [CL-N]. The contrast between '[Ji-dian-N] and the ungrammatical [*Ji-xie-N] highlights two key differences between 'xie' and 'dian' : first, 'dian' behaves more like a classifier than 'xie', and second, 'xie' functions more as a quantifier than 'dian'. Therefore, the assumption that 'dian' and 'xie' function the same in the grammar is not accurate.

More crucially, based on the comparison above, the syntactic position of the three quantifying devices-*xie, ji, dian,* should be generated hierarchically, as in $Xie \succ Ji \succ Dian$. Dian should be positioned lowest due to its compatibility with numerals and Ji. Ji should be positioned nearby numerals. For Xie, considering its incompatibility with numerals and the possibility of [xie-ge] sequence, I assume it is positioned above Ji. Schematically, they are distributed as shown in (70).

(70)



Based on the general distribution of xie, ji, and dian, a plausible assumption is that these terms are lexical realizations of semantic operators. Specifically, I propose that both ji and xie function as paucal operators. Ji operates as a paucal operator with a defined upper boundary on its quantity, while xie functions as a broader paucal operator without a clearly defined upper limit to its quantity.

Dian, however, differs fundamentally from Ji and Xie. Previous comparisons suggest that dian functions more like a classifier, in contrast to ji and xie. Specifically, dian exhibits a distributional pattern similar to collective classifiers. As shown in (71), when dian combines with the numeral one, it conveys the meaning of 'a part of' or 'an unspecified number' (71-a). On the other hand, when the numeral changes to other cardinals, such as 'two', dian expresses a typical counting function with a specified quantity (71-b). This pattern aligns with dian's semantic behavior depending on whether it is preceded by the numeral one or by other numerals (71-c), (71-d).

(71) a. Wo you **yi dui** yi-fu yao xi
I have **one CL**$collective$ clothing to wash
'I have **a lot of** clothing to wash' One-Collective CL

b. Wo you **liang dui** yi-fu yao xi
I have **two CL**$_{collective}$ clothing to wash
'I have **two piles** of clothing to wash' Two-collective CL

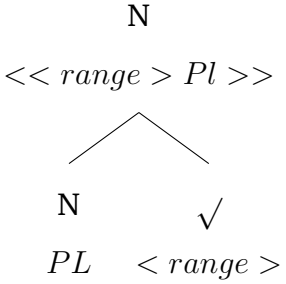
c. Wo you **yi dian** jian-yi
I have **one dian** suggestion
'I have **some** suggestion' One-dian

d. Wo you **liang dian** jian-yi
I have **two dian** suggestion
'I have **two** suggestions' Two-dian

Given this, I propose that 'Yi-dian' is not a quantifier. Contrary to the assertions of Iljic (1994a); Zhang (2013), I argue that the special 'some' or 'part of' meaning conveyed by 'Yi-dian' arises from the content meaning of dian itself. Recalling the analysis on collective classifiers, repeated as (72) , I assumed that collective classifiers are derived at nP with encoding specific content meanings, namely range. Due to this core content, speakers

are able to distinguish the subtle difference between '*Yi-dui*', '*Yi-qun*', '*Yi-zu*' when they all express the meaning of 'a group of something'. Drawing on the parallelism shown in (71), I suggest that dian belongs to the collective classifier cohort.

(72)



Accordingly, dian is not generated at the numeral layer but at the nP stage. Its core meaning is 'range,' though the range specified by dian is different from classifiers like qun or dui, which is not surprising, since the content meaning 'range' is a variable. For instance, when a speaker uses 'Yi-dui' (73-a), it conveys the meaning of 'a pile of fire,' generally implying 'some fire.' In contrast, Yi-dian (73-b) shifts the meaning to 'a little fire.' Therefore, dian is not a quantifier, the sequence yi-dian results from the same syntactic process observed with 'yi-collective classifiers'. Thus, dian is fundamentally different from ji and xie. In the following, I will focus on the two numeral materials, ji and xie, exploring the subtle variations in their numeral range.

(73) a. Wo-men xu-yao yi-dui huo
I-PL need one-CL$_{collective}$ fire
'We need a pile of fire'

b. Wo-men xu-yao yi-dian huo
I-PL need one-CL$dian$ fire
'We need a little fire'

To begin with Ji, as mentioned before, it serves as an alternative to simplex numerals to quantify a classifier phrase, with its upper boundary of the quantity is nine. Also, it can serve as an addend or a multiplicand in complex numeral constructions, as shown in (74).

(74) a. **Ji** ge xue-sheng
Ji CL_{ge} student
'**A few** students' Ji as a simplex numeral

b. **Shi-ji** ge xue-sheng
Ten-ji CL_{ge} student
'More than ten (less than twenty) students' Ji as an addend

c. **Ji-shi** ge xue-sheng
Ji-ten CL_{ge} student
'**A few tens** of students' Ji as a multiplicand

The indication of 'small' quantity has been defined as a paucity in Corbett (2000), indicating the meaning of a small number of individuals. Harbour (2014); Martí (2015) make systematic analyses of the paucal interpretation, mainly on the semantic role of overt paucal markers.

Specifically, Harbour (2014) uses atom-based analysis to distinguish the semantic denotation of *plural* and that of *paucal*. As demonstrated at the section of semantic denotation of NP, plural denotes a set of joint atoms, as shown below in figure 3.9. Plainly speaking, the lattice domain of plural is a closed region, in which the addition of any elements is still within the domain. Referencing the fig 3.9, the elements {a,b }, {a,c}, {b,c} is associated to the topmost element {a,b,c }.

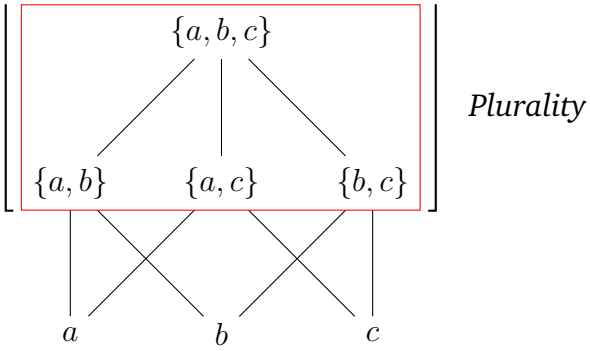


Figure 3.9: Domain of Plurality

Harbour (2014) formalises this property as 'join-complete', formally defined as below:

"P is join-complete iff $\forall x\ \forall y$ ((P (x) $\wedge$ P(y) $\rightarrow$ P(x$\cup$ y)" Harbour (2014)

Join-complete is key to distinguish between plural and paucel; plural denotes a join-completed subregion, while paucel denotes a join-incomplete subregion, by subregion, it refers to the fact that a numeral domain, either plural or paucal, is based on a given predicate (such as in *three dogs*, plurality is applied onto the predicate of dog). This distinction can be further observed through linguistic evidence.

As shown in (75), the Spanish sentences depict a dialogue in a restaurant context. In (75-a), the quantifier algunas conveys an *unspecified number* with no precise numerical boundaries, making the use of the cardinal number 'dos' (two) as a response in (75-b) appropriate and natural. In other words, since the response is a negation, reversing the truth-condition of (75-a), the acceptability of 'dos' indicates that 'algunas' does not convey a specific numerical value and is not functioning as a true plural.

(75) a. Hay algunas moscasen la sopa
there.are ALGUNAS flies in the soup
'There are several flies in my soup'

b. No, sólo hay dos/# cinco
No only there.are two/# five
'No, there are only two/# five Martí (2015)

Therefore, paucal denotes a subregion of a predicate, and the subregion is join-incomplete. Harbour (2014) generalises this distinction through the feature [± addition]. In simple terms, the feature [+addition] represents the plural condition (which is addable), where the subregion is closed-no matter how many elements are added, they remain within this subregion. In contrast, [-addition] stands for the paucel condition (non-addable), where the boundary is unclear, and adding an element might extend beyond the region. For instance, as shown above in (75-b), 'algunas' implies a range from one to four, since replacing 'algunas' with 'cinco' (five) creates an unnatural statement.

(76) [± additive]=$\lambda P \lambda x(\neg)\forall y(Q(y) \rightarrow Q(x \cup y)$ (Q(x), Q⊂P)

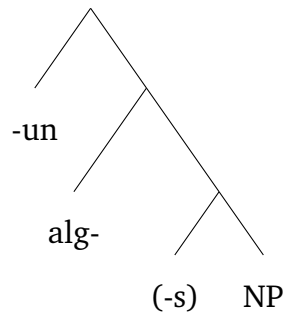
Building on this semantic analysis, Martí (2015) clarifies the paucal meaning of the Spanish determiners 'algún' and 'algunos'. Although both 'algún' and 'algunos' express paucal meanings, there is a subtle difference in the degree of paucity they convey. As shown in (77-a), the numeral range indicated by alguna starts at one, with *alguna mosca* meaning one or very few flies. In contrast, as seen in (77-b), *algunas moscas* refers to several flies, with a larger numeral range compared to alguna.

(77) a. Hay **alguna** mosca en la sopa
there.is ALGUN.FEM fly in the soup
There is **one or a very few** flies in my soup.

b. Hay **algunas** moscas en la sopa
there.are ALGUN.FEM flies in the soup
'There are **several** flies in my soup' Martí (2015)

In her analysis, Martí (2015) decomposes algun into two morohemes, 'alg' and 'un'. The prefix alg is a paucal marker, while the suffix 'un' functions as an existential quantifier, having the same function with the Spanish indefinite article 'un'. Consequently, the structural distribution of these morphemes are drawn, as shown in (78).

(78)



Following the semantic roles discussed earlier from Harbour (2014), each of the components in (78) serves a semantic role: NP is number natural, its denotation include both atoms and joint atoms. *-s* contributes the [+additive] feature in the sense of Harbour (2014), denoting a subregion with clear closure. *Alg-* contributes the [-additive] feature,

denoting a subregion without a closure, a paucal meaning. Finally, the morpheme *-un* is an existential quantifier.

After this process, the subtle difference between 'alguna mosca' and 'algunas moscas' becomes clear. The key distinction lies in the application of the plural marker *s*. In the case of *alguna mosca*, the paucal prefix *alg-* applies directly to the nominal predicate, resulting in a set that includes both individual elements (atoms) and combined elements (joint atoms). The existential morpheme -un then selects a single atom from this set, leading to the interpretation of *one or very few flies*.

In contrast, for 'algunas moscas', the plural marker -s first combines with the NP, creating a subregion that primarily contains joint atoms (i.e., groups of flies). When alg- and -un are subsequently applied, the interpretation shifts to 'a small number of flies, but more than two'.

Referring back to the case in MC, where the semantic role of xie and ji is hard to define, as they exhibit both characteristics of classifier and quantifiers. By considering the meaning of paucity, and the variation of paucity addressed above, I assume Ji is paucal operator within numeral domain, whereas Xie is a paucal operator to CLP. Semantically, ji denotes a set of unspecified value, and it has an upper boundary of its numeral value.

Cheekily borrowing the test from Martí (2015), we can analyse how paucal ji functions and its general numeral range. Imagine a quarrel where, in (79-a), someone complains that missing a few books is not a big deal. In this context, as shown in (79-b), using specific cardinal numbers like 'one', 'two', or even 'thirteen' causes unnatural responses.

(79) a. Jiu **ji ben shu**, zhi-yu ma?
Only **ji CL book**, as-for what?
'Only **a few** books, big deal?'

b. Wu/#Yi/#Liang/#Shi-san ben hai bu zhi-yu?
Five/#Yi/#Two/#Thirteen CL also neg as-for?
'Five/#One/#Two/#Thirteen isn't big enough?'

To be more specific, using numeral 'Yi' (one) and 'Liang' (two) to replace Ji yields a strong infelicity. As exemplified in (80-a), when people want to refer to a very low numerical range, such as one, two, or three, they typically use the numeral 'Liang' (two), not 'Ji'. In other words, the phrase 'Liang ge ren' in (80-a) can convey its actural numeral value, 'two people', However, in certain contexts, 'Liang ge ren' can also imply an unspecified, yet small quantity, indicating that the numerical value is low.

(80) a. Ni qu zhao **Liang ge** ren
You go find **Two CL**$_{ge}$ people
'You go and find a few people (**one to three**)'

b. Ni qu zhao **Shi-ji ge** ren
You go find **Ten-ji ge** people
'You go and find a few people (**more than ten**)'

Moreover, replacing 'Ji' with an additive complex numeral (e.g., 'Shi-san' as shown in (79-b)) is also infelicitous. When a speaker wants to express a numeral range greater than ten, they should use the combination [Shi-Ji] (as demonstrated in (80-b)) instead of just Ji. Therefore, it can be argued that 'Ji' functions as a *paucal operator*, indicating a limited numeral range-specifically, numbers greater than very low values like one or two but still within the range of ten. This paucity range in 'Ji' can be roughly drawn, as illustrated in Figure 3.10.

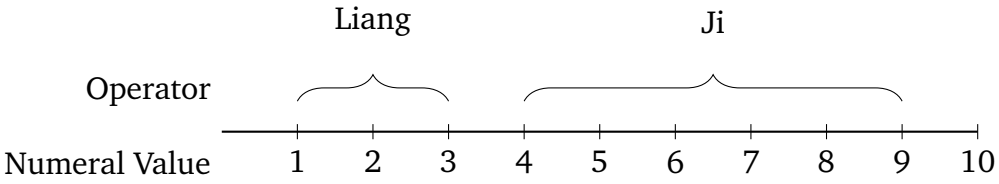
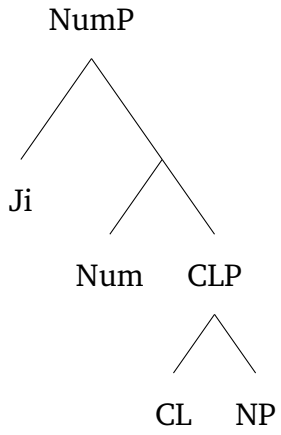


Figure 3.10: Numeral range in Liang and Ji

Comparing to the Spanish determiners 'algun' and 'algunos', the scope of Ji is narrower, it solely functions on numerals, with its structural distribution schematised in (81). In other words, I argue that Ji is a *paucal modifier*, its presence is built on an established numeral context.

(81)



Under this view, the paucal operator as a modifier to a cardinal number. A question immediately arises, as introduced previously, Ji can be used as an alternative to simplex numerals and precede the [CL-N] sequence, as shown below (82-a). In this case, ji is the numeral item in the phrase, rather than modifying a numeral item.

(82) a. Wo mai-le **ji ben shu**
'I buy-Par **ji CL book**
'I bought **a few books**'

However, there is a crucial difference in Ji and simplex numeral expressions, apart from enumerating a classifier phrase, a simplex numeral can be used independently (83-a) and denote a specific numeral value of type $\langle n \rangle$. This semantic function is assumed as the basic meaning in numerals assumed in Rothstein (2012).

(83) a. Da-an shi **san**
answer be **three**
'The answer is **three**'

b. Da-an shi **ji**
answer be **ji**
'The answer is **how many**?'

When considering ji in the same context as shown in (83-b), it seems that ji does not

function as a simple numeral. Instead, using ji transforms a declarative sentence into a question. This observation is also discussed by Huang and Crain (2014), who identified a hidden range of numeral values associated with ji and linked it to the *how many* interpretation. In their analysis, Ji serves as an existential quantifier. Therefore, ji and pure numerals are distinct grammatical elements. In this section, considering the close relation between ji and numeral elements, I suggest that ji syntactically modifies the Num(number) head, which hosts simple numerals. Semantically, ji acts as a paucal operator, limiting the range of simple numerals to values greater than two or three but less than ten.

A similar suggestion regarding the role of quantity-denoting modifiers is made by Kayne (2005). He analyses modifiers such as few, little, and many as modifying a silent element, either NUMBER or QUANTITY. More specifically, Kayne (2005) proposes that there is a lexical pair in English, <number, NUMBER >. In this pair, number is a countable nominal element that appears overtly in the surface structure, while NUMBER is its silent counterpart, a non-plural, singular-optional element. According to this analysis, phrases like *few books* contain a hidden structure, as shown in (84), with the silent noun NUMBER implied in brackets.

(84) a. She has few books.
b. she has few [NUMBER] books.

This approach elegantly explains the ungrammaticality of the form 'a many'. The singular property of the silent NUMBER favours modifiers that convey a small quantity, which makes a few a well-formed phrase, while a many becomes problematic.

Continuing on the assumption that Ji modifies the Number head, the complete structure for the sequence [Ji-CL-N] should be [Ji-Simplex Number-CL-N], where Ji modifies a silent simplex number. In other words, in the phrase [Ji-ben-shu] (85), each component plays a distinct semantic role. At the lowest level, the NP is number-neutral, meaning that the nominal domain of *shu* (book) includes both atoms and joint atoms. A classifier serves as a partitioning tool, [ben-shu] denotes a set of atomic *ben-kind* books. Next, the number

head assigns a specific numeral value. This number head can have two forms: either an explicit numeral value, as in '*san ben shu*' (three books), or a paucal numeral value that serves as an enumeration tool. In the latter case, before enumerating the classifier phrase, Ji adjoins with the number head, indicating an unspecified numeral range.

(85) Ji (Simplex Number) ben shu
Ji (SIMPLEX NUMBER) CL book
'A few [NUMBER] books'

Accordingly, for the phrase [Ji ben shu], the CLP [ben-shu] is enumerated through 'Ji(Num)', wherein Num presents the Num head, hosting simplex numerals. This proposal can be further supported by considering the following comparison in (86).

(86) a. Ni you **san ge shou-ji**
Ni have **three CL$_{ge}$ hand-machine**
'You have three smartphones'

b. Ni you **ji ge shou-ji**
You have **Ji CL$_{ge}$ hand-machine**
'You have how many smartphones?'

c. Ni you **hao-ji ge shou-ji**
You have **good-ji CL$_{ge}$ hand-machine**
'You have quite a few smartphones'

When a simplex numeral is used before a classifier phrase, as shown in (86-a), it is interpreted as meaning 'three smartphones'. According to the discussions of weak and strong quantifiers in Milwark (1977); Barwise and Cooper (1981), cardinal numbers, along with definite and indefinite articles, are categorised as weak quantifiers. The presence of a weak quantifier introduces existential closure, which asserts the existence of something. Syntactically, an NP quantified by a weak quantifier is compatible with existential clauses (e.g., 'There are three students'). On the other hand, strong quantifiers, such as the universal

quantifier, are incompatible with existential contexts (e.g., '*There is every student') [10].

In contrast, when Ji is placed before a classifier phrase, the phrase '*Ji-ge-shou-ji*' does not assert the existence of a few smartphones. Instead, similar to the case in (83-b), the phrase turns into a question. To convey an existential meaning, 'Ji-CLP' must follow a degree adjective, as demonstrated in (86-c). In this case, '*Ji-ge-shou-ji*' implies the existence of a few smartphones. In other words, the phrase Ji-CLP introduces an open domain, in order to restrict this open domain, another phrase projection is required, as reflected in '*Hao-Ji-ge-shou-ji*' (86-c), where Ji-phrase follows a degree phrase [11].

Based on the analyses, the data set presented in (86) suggests that Ji alone is insufficient to function as a quantifier or introduce existential closure in an NP domain. This corroborates the idea that Ji is a paucal modifier rather than a simplex numeral.

This suggestion naturally raises the question of the status of simplex numerals and complex numerals: Are they derived from the same position, and do they share the same semantic roles? Before exploring this further, I will analyse another paucal operator, *Xie*.

Comparing to Ji, more syntactic restrictions are posited from xie, as repeated below (87), only the numeral one can combine with xie to quantifier an NP (87-a), other cardinal numbers (including Ji) are not allowed to combine with xie (87-b), and more crucially, xie can precede the general classifier (87-c).

(87) a. Yi **xie** shu
One **xie** book
'Some books'

b. ***Liang/Shi/Ji** xie shu
***Two/Ten/A dew** xie book

[10] However, the distinction between strong and weak quantifiers is more complex than this. For instance, the syntactic context can affect the interpretation of a quantified noun phrase, as discussed in Van Geenhoven (2003); De Swart (2001). Since this topic is beyond the scope of the current discussion, which focuses on comparing the differences between the paucal modifier Ji and simplex numerals, I will not delve further into how weak quantifiers function in Mandarin Chinese.

[11] I will specify the degree meaning and degree structures in the proceeding section, here, the general assumption is that 'hao' is a degree modifier headed by an overt degree head, as discussed in Kennedy and McNally (2005); Kennedy (2007))

c. Yi **xie ge** shu
One **xie ge** book
'Some books'

Similar to Ji, Xie also conveys an approximate quantity. However, its numeral range is not as restricted as Ji. Referring to the example in (87-a), Xie means 'some books' without specifying a particular numeral range. For instance, imagine a context where there are two hundred books that need to be moved. In this scenario, the statement in (88) would be true if I took an amount of books that is less than two hundred. In other words, the numeral range indicated by Xie is determined by the nominal domain it refers to. If, assuming the total number of books is fifty, then the numeral value of the statement (88) would be less than fifty.

(88) Wo zhi na-le **yi xie shu**
I only take-Par **one xie book**
'I only took a few books' (**a few of two hundred books**)

Due to this key variation in the hidden numeral value between Ji and Xie, I propose that Xie functions as a paucal operator to a classifier phrase. As discussed in the previous section, a classifier phrase denotes a set of atoms or a set of joint atoms. The operator Xie defines a subregion within the domain of the CLP, such that [Xie-CLP] represents a part of the lattice domain of the CLP. This subregion does not have specific boundaries concerning its numeral range. However, if a contextual numeral value is introduced by the NP, the scope of [Yi-xie] cannot exceed this contextual numeral value, as schematised in fig 3.11.

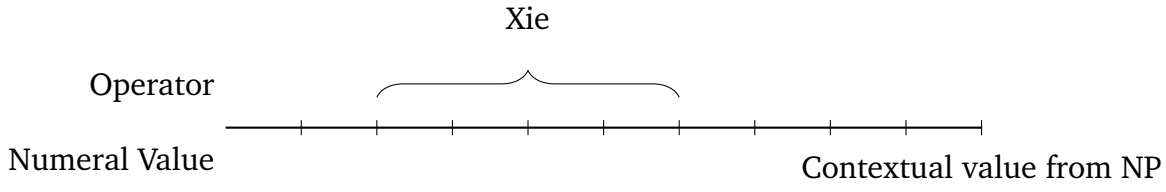
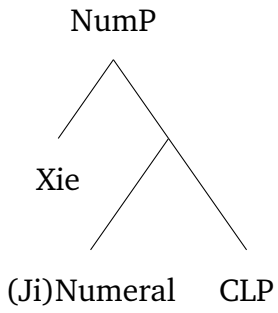


Figure 3.11: Numeral range in Xie

In terms of its syntactic position, Xie should be generated above the CLP, repeated below

in (89). This positioning explains the co-occurrence of Xie-ge, as shown in (87-c), where the general classifier ge is merged as the CL head. The emergence of a Number layer provides a specification of numeral value and introduces existential closure. To convey paucity, there are two mechanisms available in the grammar: first, Ji combined with an unpronounced numeral head, which limits the paucal range to within ten; second, Xie, where Xie and cardinal numbers are in complementary distribution. In this mechanism, the paucal range expressed by Xie is determined by both Xie and the contextual value (if applicable) from the NP.

(89)



This analysis is further supported by the previously discussed distinction between strong and weak quantifiers. According to the classic test established by Milwark (1977), which posits that strong quantifiers and weak quantifiers are hierarchically generated (e.g., 'Every three students'), Xie proves to be stronger than both Ji and simplex numerals. As illustrated in (90), the universal quantifier 'Mei' (every) can precede a simplex numeral (90-a) or the paucal modifier Ji (90-b). However, ungrammaticality occurs when Mei is placed before Xie (90-c).

(90) a. Mei san ge xue-sheng zuo yi ge ti
Every three $CL_{general}$ student complete one $CL_{general}$ task
'**Every three students** do one task'

b. Mei ji ge xue-sheng zuo yi ge ti
Every few $CL_{general}$ student complete one $CL_{general}$ task
'**Every few students** (less than ten) do one task'

c. *Mei yi xie xue-sheng zuo yi ge ti
*Every one xie student complete one $CL_{general}$ task

The distributional variation illustrated in (90) suggests a scopal variation among quantifiers in Mandarin Chinese. Roughly, from strong to weak, they should be arranged as $Mei \succ Xie \succ Number$. Despite this, Xie should still be generated within the numeral domain. This is supported by the fact that the numeral 'Yi' (one) can combine with Xie. In other words, I adopt the view that 'Yi' in 'Yi-Xie' serves merely as an identifier (Wu, 2019), restricting Xie to operate within the syntactic domain of NumP.

To summarise, in the section, the role of two classifier-like items are addressed, Ji and Xie. In light of the analysis of paucity from Harbour (2014), as well as the related empirical data, I assume that Ji and Xie are paucal operators. Precisely, Ji is a paucal modifier, it modifies the Num head. While Xie is a stronger operator, it can substitute a Num head and functions directly on the CLP.

The analysis of Ji and Xie highlights potential discrepancies in numeral expressions. As discussed, Ji modifies the numeral head (Num), restricting the numeral range to values greater than a low number but less than ten. Following this reasoning, numeral expressions-especially those involving general number bases should differ from simplex numerals.

(91) a. Shi-Ji ge ren
Ten-Ji CL_{ge} people
'More than ten (less than twenty) people'

b. Ji-Shi ge ren
Ji-Ten CL_{ge} people
'A few tens of people'

c. *Wo mai-le bai ben shu
*I buy-Par hundred CL book

d. Wo mai-le wu bai ben shu
I buy-Par five hundred CL book
'I bought five hundred books'

Recalling the formation of complex numerals with Ji, Ji + (simplex number) can function either as an addend (91-a) or a multiplicand (91-b). If both simplex numbers and general

number bases are derived from the Num head, it becomes challenging to explain why the simplex numeral must be omitted when a paucal modifier appears. Additionally, as evidenced in (91-c), placing a numeral base before a classifier phrase fails to generate a numeral expression with a specific value. In other words, general number bases do not introduce existential closure, whereas simplex numerals do, as shown in (91-d).

In the following section, I explore the discrepancies between simplex numerals and complex numerals, as well as the syntactic positions for general number bases.

3.4 Simplex and Complex Numerals in Mandarin-Chinese

12

In this section, I analyse the syntactic distributions and semantic denotations of numerals in Mandarin Chinese, distinguishing between simplex numerals (ranging from one to nine), which I argue function as heads of Numeral Phrases. General number bases function as partitioning tools akin to nominal items. This section organises as follows: first, I present empirical evidence concerning the positioning of the adjective '*da*' (big). Then, I propose syntactic structures for both types of numerals, focusing on the structural differences between numeral expressions that denote '*counting*' and those that denote '*partitioning*'. This analysis includes a detailed examination of multiplicative and additive numerals.

Recalling the previous section, the analysis of the paucal modifier Ji highlights the variation between *simplex numerals* and *general number bases*. Empirical data further demonstrates that general number bases cannot function as enumerating tools to express numeral values in the same way that simplex numerals do (as exemplified in (92)). In this section, I introduce another critical piece of evidence: the positioning of the adjective da 'big' within numeral classifier phrases to further demonstrate the difference between simplex numerals and general bases.

(92) a. *Wo yong-le **bai zhang** zhi
*I use-Par **hundred CL** paper

b. Wo yong-le **Yi bai zhang** zhi
I use-Par **One hundred CL** paper
'I used one hundred papers'

[12]Credit for half of the ideas presented in this analysis, particularly regarding the syntactic analysis of complex numerals, is attributed to ShiYang Fu, a PhD candidate at the University of York. This collaborative work has been jointly developed and previously disseminated at multiple international conferences.

3.4.1 The dual roles in da

The insertions of adjectives within numeral classifiers phrases has been mentioned in this dissertation repetitively, however, a clear derivation of the positional restriction remains untouched. To begin with, adjectives are allowed in a numeral classifier phrase, but the class of adjectives determines their distributions within the phrase.

As shown in (93), the adjective 'da' and 'xiao' [13] can be positioned before a classifier (93-a) or before the noun (93-b). In the former case, the adjective serves an attributive modifier, with its modifiee the head noun. In the latter case, da/xiao functions as a degree modifier, projection a degree phrase.

(93) a. Wu ke **da/xiao** zhen-zhu
Five CL **big/small** pearl
'Five big/small pearls'

b. Wu **da/xiao** ke zhen-zhu
Five **big/xiao** CL pearls
'Five big/small pearls'

The distinction between the two meanings of da becomes clearer when these phrases are used in sentential contexts. In (94-a), the sentence is true if I took away five pearls, and the pearls are large in size. However, when da precedes the classifier ke, as in (94-b), the sentence becomes ambiguous, conveying both an attributive and a degree meaning, with the degree meaning often overriding the attributive one. In this context, if I took away five pearls, three large and two small, (94-b) would still be considered true. Here, the focus shifts to the total quantity of five pearls being taken away, rather than the size of each individual pearl.

(94) a. Wo na-zou wu ke da zhen-zhu
I take-away five CL big pearl
'I took away five big pearls' (**attributive**)

[13] Da and xiao are antonyms, with their literal meanings being 'big' and 'small,' respectively. For simplicity, I will use da to illustrate the degree meaning, which also applies to xiao

b. Wo na-zou wu da ke zhen-zhu
I take-away five big CL pearl
a. Five pearls is a lot to take away (**degree**)
b. I took away five big pearls (**attributive**)

In comparison, apart from da/xiao, other adjective classes such as colour, shape, evaluative adjectives are restricted to placed before an nominal item, and they have a unified semantic function, as the attributive modifier of the head noun (95).

(95) a. Wo you wu (*fang) zhang **fang** zhuo
I have five (*square) CL **square** table
'I have five squre-shaped tables'

b. Wo you san (*lv) jian **lv** yi
I have three (*green) CL **green** cloth
'I have three green clothing'

c. Wo you yi (*hao) jian **hao** shi xuan-bu
I have one (*good) CL **good** thing announce
'I have a good news to announce'

Meanwhile, as evidenced in the grammatical sequence shown in (96-a) and the ungrammatical combinations (96-b) (96-c), a sequential ordering of attributive adjectives is revealed, which is $size \succ colour \succ length$ (see more data about multiple adjectives in MC in Paul (2005)).

(96) a. Wu ge **da hong chang** yi
Five CL **big red long** chair
Five big red long chairs.

b. *Wu ge da chang hong yi
*Five CL big long red chair

c. *Wu ge hong da chang yi
*Five CL red big long chair

The sequential ordering of attributive adjectives is a cross-linguistic phenomenon, for

instance, as shown in (97) Finnish and English adjectives also exhibit a hierarchy regarding their position before a head noun, in which the following ordering is exhibited: $size \succ age \succ shape \succ colour$.

(97) a. suuri vanha musta englantilaninen koira
big old black English dog

b. pitka kuuma kesa
long hot summer

c. *kuuma pitka kesa
*hot long summer

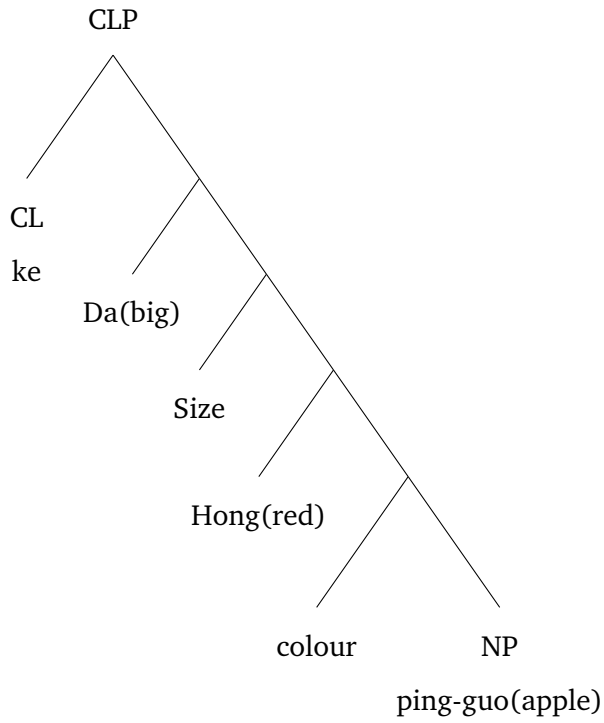
Finnish data described in Scott (2002)

Building on Cinque (1999) that adverbs occupy the specifier position of a functional projection, Scott (2002) hypothesised that adjective modifiers function similarly to adverbial modifiers. According to this view, adjectives are associated with the projection of functional layers around the head noun. Therefore, in the phrase '*That really cool long dress*', 'cool' and 'long' function as specifiers of CommentP and LengthP. Both CommentP and LengthP are extended projections of the head noun 'dress'.

Referring back to the distribution of adjectives within numeral classifier phrases in MC, as mentioned, the universal sequential ordering of $size \succ colour$ observed by Scott (2002) is also evident, as repeated in (98). In this example, both adjectives modify the head noun 'ping-guo' (apple), aligning with Scotts proposal. Schematically, the syntactic distribution of 'da' and 'hong' should be as shown in (99). Based on this analysis, the status of the attributive da seems clear, it likely occupies the specifier position of a SizeP.

(98) Wu ke da hong ping-guo
Five CL big red apple
'Five big red apples'

(99)



Turning to the degree da, typically, its position is before the classifier but after a numeral. The pre-classifier *da* has been identified as a tool to reflect the feature encoded in classifiers. Generally, mensural classifiers are modifiable but not sortal classifiers (Cheng and Sybesma, 1999), classifiers with [+counting] feature are modifiable but not those with the feature [+measuring] (Li, 2011b), and in Zhang (2013) classifiers encoded [+delimitable] feature can be modified by da. These studies capture the attributive side of da, however, the degree-based meaning remains untouched.

Specifically in examples (100), the phrase 'wu da ben shu' (five big CL book) conveys a degree-based meaning. To clarify, a degree interpretation, as described by Kennedy and McNally (2005); Kennedy (2007), involves mapping individuals onto a contextualised scale, accompanied by a measuring function. In relation to examples (100), the insertion of 'da' before the classifier phrase introduces a degree meaning, where the numeral 'wu' (five) is evaluated against a scale, indicating that 'five' represents a relatively large quantity.

(100) a. Wo du-le wu da ben shu
I read-Par five big CL book
'I read five books, which is a lot'

b. Wo he-le wu da bei shui
I drink-Par five big CL water
'I drink five glasses of water, which is a lot'

Typically, gradable adjectives function as degree predicates. For example, the adjective tall conveys two essential pieces of information: a dimension (in this case, height) and a scale structure.[14] The ordering function determines how arguments are positioned along this scale. For instance, although the antonyms *tall* and *short* share the same dimension and scale structure, the sentences 'Lu is short' and 'Lu is tall' entail opposite truth conditions. This contrast arises from how the argument Lu is ordered on the scale. Therefore, the semantic denotation of 'tall' is formalised as (101).

(101) $\|tall\| = \lambda d \lambda x$: d is the scale for height. μ tall(x) $\geq$ d

Referring back to the pre-classifier da, the sentence (100-a) means 'reading five books is a lot/too much'. If, da is an attribute modifier to the classifier, ben, it should be the specifier of the classifier (indicated in the diagram (99)), and conveying a size-relating meaning, wherein the (100-a) would indicate the following: 'I read five books, which are large in size', but this interpretation is not obvious. Thus, by combining the idiosyncratic reading in pre-classifier da as well as the degree interpretation encoded by gradable adjectives, I suggest that the reading shown in (100-a) is due to the projection of a *degree phrase*.

According to Kennedy and McNally (2005), a Degree Phrase consists of a degree morpheme applied to a gradable adjective. Semantically, degree morphemes map the meaning of a gradable adjective onto properties of individuals, typically with the type d,et,et. Lexical items such as very and much are typical degree morphemes; for example, very tall

[14]According to Kennedy and McNally (2005), this information is encoded in the lexical entry of a gradable predicate. Open-scale predicates (e.g., long, short, tall) do not specify minimum or maximum boundaries, whereas closed-scale predicates (e.g., invisible, closed, full) do.

forms a Degree Phrase in which very modifies the adjective tall. Importantly, degree morphemes can also be covert. In a sentence like Lu is tall, the interpretation involves an implicit degree morpheme, often analysed as *pos*, which precedes the adjective and maps the gradable predicate onto a contextually appropriate standard. A related distinction is proposed by Neeleman et al. (2004), who identifies two classes of degree modifiers: Class-One modifiers (e.g., much, very), which project a Degree Phrase, and Class-Two modifiers, which function solely as attributive modifiers and do not project a Degree Phrase.

To account for the degree interpretation observed in (100-a), where the pre-classifier adjective da introduces evaluative force, it is crucial to establish an interpretive link between the numeral and the classifier phrase (CLP). Specifically, the entity denoted by the CLP must be associated with a degreecontributed by the numeraland further evaluated against a scale introduced by the degree adjective through its internal measuring function. This compositional process requires two inputs: a degree-denoting expression and a predicate of individuals. I propose that the simplex numeral acts as the degree argument, which saturates the degree operator denoted by da, yielding a derived predicate that reflects both quantity and evaluative force.

First, there is an important restriction must be noted: only **simplex numerals** are allowed in the Num-Da-CL-Noun sequence. As shown in (102), a construction like 'three-big-CLP' is grammatical (102-a), while 'thirty-big-CLP' (102-b) and 'thirteen-big-CLP' are ungrammatical. This contrast suggests that simplex numerals and complex numerals belong to different semantic classes, such that the presence of a numeral base disrupts or alters the relation established between da and the classifier phrase.

(102) a. Wo du-le san da ben shu
I read-Par three big CL book
'I read three books, which is a lot'

b. *Wo du-le **san-shi da ben shu**
I read-Par **thirty big CL book**

c. *Wo du-le **Shi-San da ben shu**
I read-Par **thirteen big CL books**

I will set aside the role of numeral bases and the formation of complex numerals for now, and begin by defining simplex numerals. Drawing on previous discussions about the semantic types of numerals, there are three options to choose: numbers as terms for numbers of type $\langle n \rangle$ (Rothstein, 2012), numerals as modifiers of type $\langle et, et \rangle$ (Krifka, 1998), and numerals as determiners of type $\langle et, et, t \rangle$ (Keenan and Stavi, 1986).

None of these options are suitable for the degree projection. The denotation of type $\langle n \rangle$ applies when a numeral is used as an argument (e.g., 'Three is three), not for pre-classifier numerals. If numerals are quantifiers, denoting the semantic type $\langle et, et, t \rangle$, then the phrase 'san da ben shu' (three big CL books) should express a counting interpretation, meaning there are three individual books. In this case, da would function as an attributive modifier of the noun, since no clear degree head can form a degree phrase. However, as shown earlier, this interpretation does not hold. A similar issue arises with the modifier usage of numerals. Following Ionin and Matushansky (2006), numerals denote a sum of individuals (of type $\langle et, et, \rangle$), if this were the case, then 'san da ben shu' should denote a sum of three books, but this is not the case.

To capture the degree-based meaning conveyed by the [Num-Da-CLP], I follow the discussions of Nouwen (2010); Kennedy (2013) on numerals. First, numerals are considered as second-order properties. This means that numerals belong to a fixed scale or interval. This 'part of a scale' denotation is also found in other second-order properties, such as height, weight, and volume, positioning numerals as a type of degree.

Furthermore, the part-of-scale is also reflected through the two-sided meaning from bare numerals. For example, the numeral 'ten' refers to a specific point on this scale, which includes values both above and below ten, thus a bare numeral can indicate scalar implicatures. As reviewed previously, scalar implicatures in numerals is a much-debated topic, see the quotation from below Horn (1972).

> "numerals assert lower-boundedness-'at least n'- and given tokens of utterances containing cardinal numbers may, depending on the context, implicate upper boundedness-'at most n'-so that the number may be interpreted as denoting an

exact quantity" Horn (1972)

With regard to the dual interpretation of numerals, Hackl (2000) and Nouwen (2010) employ a degree-based semantics to define the denotation of both bare and modified numerals. Bare numerals are treated as singular terms of degrees, specifically denoting type $\langle d \rangle$. The upper and lower-bounded interpretations are attributed to the quantifier MANY, which has two versions, as formalised in (103). The existential, lower-bounded interpretation is captured by the version in (103-a).

(103) a. MANY1= $\lambda n \lambda P \lambda Q . \exists x [\# x = n \& P(x) \& Q(x)]$

b. MANY2= $\lambda n \lambda P \lambda Q . \exists! x [\# x = n \& P(x) \& Q(x)]$ Nouwen (2010)

For example, in the sentence '*John read five books*', the bare numeral 'five' represents the degree of a numeral interval, and $|\text{MANY2}(Five)|$ denotes the set $\{1, 2, 3, 4, 5\}$, where all lower-bounded numeral values are included. However, when the quantifier MANY2 is involved, $[\exists! x]$ highlights the exclusivity of a specific numeral value. In other words, $|\text{MANY2}(Five)|$ denotes the singleton set $\{5\}$, yielding a strong interpretation of 'five', namely, the reading of 'exact five' [15]

In contrast, Kennedy (2013) proposes a slightly different approach, where bare numerals are treated as quantifiers over degrees by default, denoted by the semantic type $<< d, t > t >$. Although bare numerals can function as singular terms ($\langle d \rangle$), this is achieved through type-shifting operators. Under this interpretation, numerals are shifted to numbers via the BE and IOTA operators (as described in Partee (1988)). Therefore, for the sentence '*John read five books*', the corresponding logical formula is shown in (104). Under this view, the statement is true if John read exactly five books, and five is the maximum number, excluding any higher numeral. The lower-bounded interpretation is also available, captured by the trace of d.

[15] Modified numerals, such as more than five or fewer than five, involve the Max and Min operators. Since this section focuses on the degree interpretation of bare numerals, modified numerals will not be addressed here.

(104) $MAX\{\lambda d.\exists x[read(x)(John) \wedge books(x) \wedge \#(x) = d] = 5\}$ [16]

This type of analysis sheds light on the puzzle of the sequence [Num-Da-CLP]. I adopt the view that numeral expressions are polysemous and can denote singular terms of type $\langle d \rangle$. However, I do not reject the idea that numerals can also function as quantifiers, as discussed earlier. The shift in semantic denotation requires specific operators, but determining exactly how a numeral shifts from a quantifier meaning to type $\langle d \rangle$ is not the primary focus here. Therefore, I assume that in the sequence [Num-Da-CLP]', the Num is interpreted as a number (type $\langle d \rangle$), rather than as a numeral in the quantificational sense.

Building on this, why a degree adjective 'da' can intertwine between a cardinal number and a CLP can be explained. First, directly combining a degree of type $\langle d \rangle$ with a property of individuals of type $\langle e, t \rangle$ (the denotation of the CLP) is not feasible. This is where *da* comes into play, functioning as a degree operator with the denotation $\langle d, \langle e, t \rangle \rangle$. In this role, da links a degree (type $\langle d \rangle$) to a property of individuals (type $\langle e, t \rangle$), as formalised in (105).

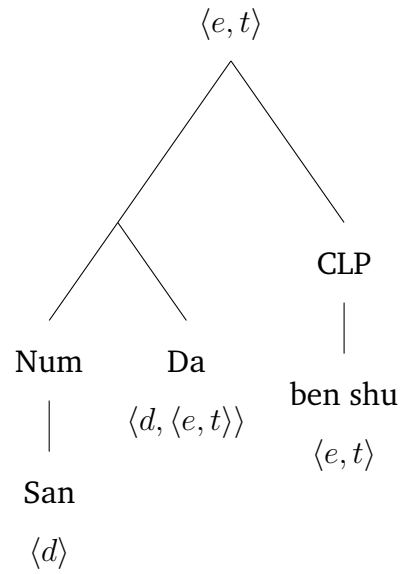
(105) the function da in Numeral classifier phrase:
$\|da\| = \lambda d \lambda x.\#(x) = d$

Under this analysis, the degree interpretation observed in (106-a) can be fully accounted for. As illustrated in (106-b), the numeral san (three) is treated as a degree-denoting expression, corresponding to the numerical value three (type d). The degree adjective-functioning as a degree operator of type d, e, tintroduces a scale structure by applying an internal measuring function to the classifier phrase. When the degree-denoting numeral san combines with the degree operator, it saturates the degree argument, yielding a property of individuals (type e, t). This interaction allows the quantity denoted by san to be evaluated as relatively large along a contextually relevant scale. Consequently, the inter-

[16] As indicated in this formulae, the denotation of 'maximum numeral is five' has the widest scope, this is due to Quantifier Raising.

pretation of (106-a) is not merely that there are three books, but rather that three books constitutes a considerable amount to read. The corresponding syntactic configuration is given in (106-b).

(106) a. Wo du-le san da ben shu
I read-Par three big CL book
'I read three books, which is a lot'

b. 

A key question arises regarding this proposal: what criteria allow da to function as a degree operator in the pre-classifier position, while limiting it to an attributive modifier when positioned post-classifier?

The semantic relation between CLP and NP is key to answer this question. As addressed in the previous section, NP is predicate ($\langle e, t\rangle$) of sums. CLP defines a partitioned domain, a classifier phrase denotes a set of atomic instances derived from NP. With this understanding, the unique role of da in the pre-classifier position can be explained, it involves the concept of *Monotonicity Constraints*.

Schwarzschild (2002, 2006) observed that strong infelicity arises when measuring the temperature of water or the purity of gold, as in *three degrees of water and *twenty carats of gold. In contrast, measuring other dimensions, such as weight, volume, do not

result in similarly infelicitous phrases, as demonstrated in (107).

(107) a. Three liters of water
b. Five ounces of gold
c. Seven pounds of meat
d. *Three degrees of water
e. *Twenty carats of gold Schwarzschild (2006)

Schwarzschild (2006) specifies the connection between a dimension and a measured NP. First, quantifying a substance NP requires a measuring function 'μ', different dimensions can be applied to μ to quantify a substance domain, as shown in (107), 'liter of water' is a part of the water domain. However, not all dimensions can express a part-whole relationship with the measured NP.

For example, if the NP is water and it is measured by weight, then the phrase *three liters of water* represents a subpart of the domain of water. In contrast, the dimension of temperature does not imply a part-whole relationship in the same way, the temperature of a subpart of 'thirty-degree water' is not necessarily lower than thirty degrees.

More crucially, 'three liters of water' can be further divided into subpart, where the weight is less than three liters. This relation between a measuring dimension and a measured NP is termed as 'monotonicity constrains', formalised as (108).

(108) μ is monotone with respect to P : $\forall x, y \in P\,[x \leq_{\text{Par}} y \rightarrow \mu(x) \leq \mu(y)]$
Adopted from Schwarzschild (2006)

Reflecting on the surface structure, for the non-monotonic dimensions, they are infelicitous with pseudo-partitive constructions, thus, they have to convert into attributive modifiers to modify an NP, such as 'thirty-degree water'.

Nakanishi (2004) also investigates the cross-linguistic phenomenon of monotonic relations

in measure functions. For example, in Japanese, as shown in (109-b), when the dimension is interpreted as diameter, which is non-monotonic, the measuring component [san-senti-no] serves as an attributive modifier to the noun 'keeburu' (cable).

(109) a. [San-rittoru-no mizu]-ga tukue-nouede kobore-ta
[three-liter-GEN water]-NOM table-on spill-PAST
'Three liters of water spilled on the table'

b. John-ga kinoo [san-senti-no keeburu]-o kat-ta
John-NOM yesterday [three-centimeter-GEN cable]-on buy-PAST
'John bought a three centimeter cable yesterday

Monotonicity constraints offer a way to capture the dual roles of da. When da appears before NP, as in (110), the NP denotes a complete domain, including both atomic and joint atoms. In this context, no partitioning operator is applied to the NP, so the pre-nominal adjective (including da) functions solely as an attributive modifier to the NP. In this usage, da and color adjectives, as shown in (110-b), serve the same role.

(110) a. Wu ke da shu
Five CL big tree
'Five big trees'

b. Wu ke lv shu
Five CL green tree
'Five green trees'

When da appears before a classifier phrase, the monotonic constraints required by the measuring function are satisfied. Recalling the previous analysis of degree adjectives, they inherently encode a measure function. For example, in 'tall', the measuring function compares the adjective 'tall' to a contextually determined degree. Thus, when someone says 'someone is tall', it means that person is taller than the contextual standard.

Similarly, with da, the part-whole relationship between the classifier phrase and the noun phrase allows da to appear before the classifier. In the sequence 'da-ke-shu' (big-CL-tree),

the classifier ke specifies a kind term, establishing the first layer of the part-whole relationship with the NP 'shu' (tree), where ke-shu represents a subdivision of 'shu' (tree). In other words, the inherent measuring function of da requires it to combine with a phrase that reflects a part-whole relationship within a larger domain. Otherwise, da functions solely as an attributive modifier.

Notably, using monotonic restriction to explain the role of pre-classifier adjectives is not new, particularly in Luo et al. (2017). In this study, the main assumption is that only 'size adjectives' can be used as pre-classifier adjectives, drawing on the evidence shown in (111). In these examples, both the adjective 'da'(big) and 'chang' (long) are placed before classifiers. Their analyse this parallelism based on the built-in measuring function of these adjectives, measuring a contextual degree and comparing it to a standardised degree, formalised as (112).

(111) a. Yi chang tiao yu
One long CL fish
'A long fish'

b. Yi da ben shu
One big CL book
'A big book'

(112) $\|da\| = \lambda f_{<e,t>}\, \lambda x.\text{f(x)} \wedge \exists D(D \in dimension(f) \wedge \mu(D)(x) \geq Standard(big))$

However, the built-in measuring function alone does not explain why da, but not other adjectives, can function as a pre-classifier adjective. Since measuring is encoded in all gradable adjectives (Kennedy and McNally, 2005, 2010), one might expect that a color adjective could also appear before a CLP. Empirical data, however, shows that this is not the case. Therefore, building upon the monotonic constraints, I propose that the key to an adjective's placement before a CLP lies in it being 'dimensionally vacuous'.

To elaborate, there is a key distinction between da and other size/shape adjectives like 'chang' (long), 'kuan' (wide), which lies in how they restrict their dimensional information.

Adjectives such as 'chang' (long), 'yuan' (round), and kuan' (wide) are tied to specific dimensions. Reflecting on their semantics, for example, the sentence in (113-a) would be true if I bought three fish, all of which are long in shape. Thus, their semantic meaning aligns with a head element that provides dimensional information, highlighting their role as attributive adjectives.

(113) a. Wo mai-le san chang tiao yu
I buy-par one long CL fish
'I bought a long fish'

b. Wo du-le san da ben shu
I read-Par three big CL book
'I read three books, which is a lot'

Da, on the other hand, is not confined to a specific dimension [17]'. As evidenced in (114-a), (114-b), da is not tied to the dimension of 'size', it can also indicate a general degree meaning. This flexibility makes it an ideal candidate to mediate between the number head and another predicate. Consequently, da/xiao (big/small) can be positioned before a classifier phrase and following a simplex number.

(114) a. Da-ren
big-people
'adults (mature people)'

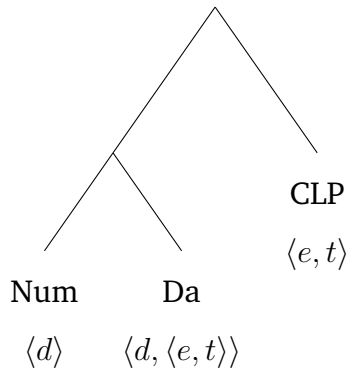
b. Da-wen-ti
big-question
'a huge question'

Now, we can complete the degree structure with proper reasoning. The degree reading that arises from the Num-Da-CLP structure, as shown again in (115), occurs because the simplex number functions as the degree head. However, composing a degree with a CLP

[17]This is further evident when we consider another pre-classifier adjective, 'zheng' (whole), which is one of the few adjectives that can precede a CLP. Previous studies (Jiang et al., 2022) have specified the semantic denotation for individual classifiers but have not discussed the shared characteristics of these adjectives. The notion of 'vacuity to dimension' offers insight here: along with da (big) and xiao (small), zheng (whole) is also vacuous to dimensions, making it possible to precede the CLP.

requires a mediator, which is da. This mediator serves two crucial functions: first, it establishes the monotonic relationship between the numeral and the CLP, similar to expressions like 'three liters of water'. Second, it combines the degree head with the CLP. Meanwhile, da is the suitable than other adjectives due to its *vacuity of dimensionality*.

(115)



To summarise the discussion so far, I propose that adjectives within numeral classifier phrases serve different functions. (Most) Pre-nominal adjectives are attributive adjectives[18], while pre-classifier adjectives are degree adjectives. Degree adjectives are vacuous with respect to other dimensions and act as degree operators. A degree operator combines a degree (denoted by a simplex number) with a property of individuals (denoted by the classifier phrase). Ultimately, for the phrase 'san da ben shu', a degree meaning arises.

This analysis of adjective modifiers further highlights the distinction between simplex and complex numerals in Mandarin Chinese. As mentioned earlier, a degree phrase can only be formed with a simplex number (116-a). In contrast, additive complex numerals (116-b) and multiplicative numerals (116-c) do not allow the insertion of da after them.

(116) a. Wo zhong-le **san da ke shu**
I plant-Par **three big CL tree**
'I planted three trees, which is a lot' da after a simplex numeral

[18]Certain size adjectives can also appear before classifiers, such as in 'san chang tiao deng' (three long CL stool), but they still function as attributive adjectives. For the sake of avoiding contradictions, I will address this in more detail at the end of this chapter.

b. *Wo zhong-le **shi-san da ke shu**
*I plant-Par **thirteen big CL tree**
da after an additive complex numeral

c. *Wo zhong-le **san-shi da ke shu**
*I plant-Par **thirty big CL tree**
da after a multiplicative numeral

Interestingly, when the numeral is **multiplicative**, formed as a 'simplex number-numeral base', the degree operator da can be placed before the numeral expression, as shown in (117-a). Notably, this pattern occurs exclusively with multiplicative numerals. In contrast, this combination is not possible with simplex numbers (117-b) or additive complex numerals (117-c). In the following section, the focus shifts to the formation of complex numerals, and the nature of numeral bases.

(117) a. Wo zhong-le **Da San-Shi ke shu**
I plant-par **big thirty CL tree**
'I planted big thirty trees'

b. *Wo zhong-le **Da Shi-San ke shu**
I plant-par **big thirteen CL tree**

c. *Wo zhong-le **Da San ke shu**
*I plant-par **big three CL tree**

3.4.2 Number bases and complex numerals

As introduced earlier, the formation of complex numerals involves attaching a general numeral base. The [*Simplex-Base*] structure represents multiplicative values like 'twenty', 'thirty'. Whereas the [*Base-Simplex*] structure corresponds to additive values, such as 'thirteen', 'fourteen'. This section begins by presenting how the degree operator, da, is inserted in complex numeral constructions.

To generalise, three pieces of empirical evidence distinguish between simplex and complex numerals. First, the previous section has addressed that the degree operator da can be inserted between a simplex numeral and the classifier phrase, resulting in the word order 'Num-Da-CL-Noun'. However, this structure cannot be generated when the numeral is complex (see comparison in (117)).

Second, general number bases alone are insufficient to function as cardinal numbers and enumerate a classifier phrase. As shown in (118-a), the [base-CLP] structure fails to generate a numeral classifier phrase with a clear numeral value. This requires cooperation with a simplex numeral, as demonstrated in (118-b), or a paucal modifier-Ji, as shown in (118-c).

(118) a. *Wo you bai zhang zhi
*I have hundred CL paper

b. Wo you **san bai** zhang zhi
I have **three hundred** CL paper
'I have three hundreds of paper'

c. Wo you **Ji bai** zhang zhi
I have **few hundred** CL paper
'I have a few hundreds of paper'

Third, the degree operator 'da' can be placed before a general number base. Under this usage, there are two occasions. First, when da solely precedes a general number base, the resulting sequence typically indicates the value or price of something (see (119-a)). Second, da can precede a multiplicative numeral classifier phrase. For instance, in the

sequence 'da-san-shi-ke-shu' (big-thirty-CL-tree), da modifies the entire numeral classifier phrase, and the statement (119-b) is true only if I planted thirty trees, and the entirety of the thirty trees is massive'.

(119) a. Wo hua-le **da-bai** mai de shu
I spend-Par **big-hundred** buy de book
'I spent **quite a few hundreds** to buy the books'

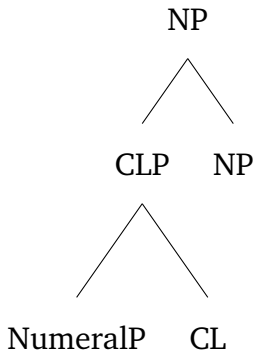
b. Wo zhong-le **da san-shi ke shu**
I plant-Par **big three-ten CL tree**
'I planted a **big thirty trees**'

'The entirety of the thirty trees is massive'

In addressing this variation, the key is to determine the syntactic positions and semantic denotations of general numeral bases. In the preceding, two questions will be addressed. First, do simplex numerals differ from general numeral bases? Second, why can the degree operator da only precede multiplicative numerals? These questions shed light on the syntactic status of numeral items in Mandarin Chinese. However, before exploring them, it is necessary to first review the findings of He (2015), which detail the formation of complex numerals in Mandarin Chinese.

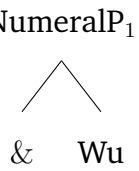
The formation of numerals in MC has been systematically studied in He (2015). There are two central assumptions in this study. First, numerals are driven by syntax, and both simplex numerals and complex numerals are Numeral Phrases. Second, the semantic denotation of a numeral is polysemous, either denoting a noun-like semantics, or denoting the semantics of modifiers. Crucially, under this view, a general numeral base functions in the same way as a simplex numeral, and both can serve as an numeral head to project an numeral phrase, and an numeral phrase is independent from CLP, as depicted in (120).

(120)



Specifically, taking the numeral expression '*Wu-bai wu-shi wu*' (five hundred fifty five) to illustrate. First, multiple Numeral Phrases (NumeralP) are projected to generate the target numeral string. Beginning with the most embedded numeral value-the simplex numeral 'wu'(five). Additionally, a hidden coordinator '&' is projected alongside 'wu', as seen in (121).

(121)



Notably, the coordinator '&' links two NumeralP, and it is silent when a numeral value at most involves two calculations, such as 'Wu-shi wu' (fifty five), 'San-bai wu' (three hundred fifty), where only multiplication and addition are involved. For a more complicated condition when there is a '*numeral gap*' between two NumeralP, the numeral 'ling' (zero) functions as a coordinator. By 'numeral gap', I refer to the absence of a numeral value in the numeral expression. To better understand this scenario, it is necessary to recall the structure of the Chinese numeral system, which, as previously introduced, operates on two hierarchical levels when forming complex numerals.

(122) a. Multiplicative $\succ$ Addition

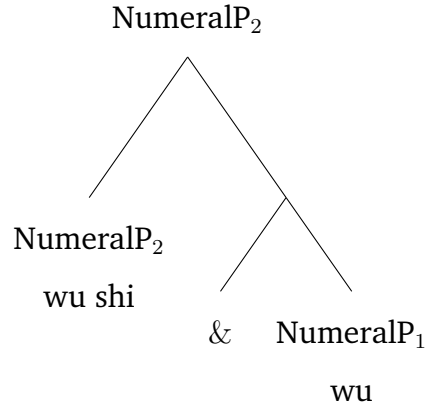
b. Wan-Qian-Bai-Shi-Ge[19]
'Ten thousand-Ten hundred-Hundred-Ten-Simplex'

First, multiplication always precedes addition (122-a). For example, in 'wu-bai wu-shi wu' (five hundred and fifty five), the implicit calculation is 'five $\times$ hundred $+$ five $\times$ ten $+$ five'.

The second hierarchy involves the arrangement of each layer of numeral values. As shown in (122-b), if a numeral value reaches the thousand (qian) level, the order 'qian-bai-ten-ge' must be followed. For this condition, if the numeral value for 'bai' (hundred) is missing, this creates a *numeral gap*. In such cases, the numeral 'ling' (zero) must fill the gap, as seen in 'san-qian **ling** wu-shi'(three thousand **zero** fifty), denoting the value of *three thousand and fifty*. Therefore, the '&' shown in (121) also hosts the numeral 'ling' (zero) when needed.

Continuing on the formation of a complex numeral, the structure (121) projects recursively till the targeted sting is formed. So the second projection for 'Wu-bai wu-shi wu' is the numeral value of 'wu-shi' (fifty), which corresponds to the NumeralP$_2$ in (123).

(123)

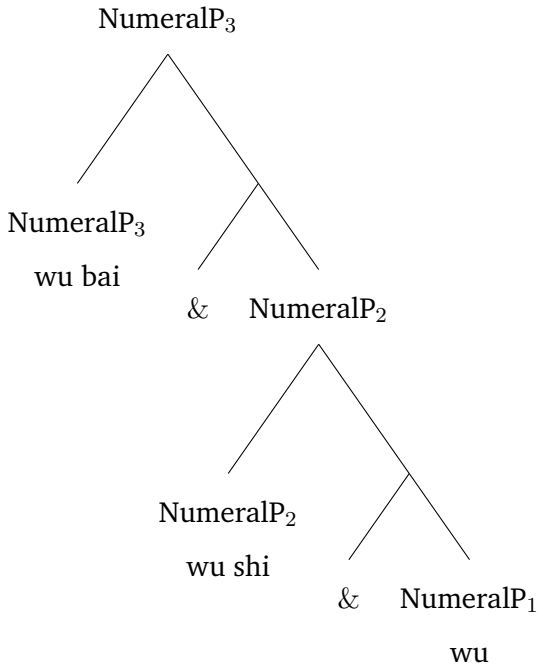


Finally, another NumberalP is projected above NumeralP$_2$, for the numeral value 'wu-bai'

[19]Here, ge does not refer to the classifier ge, rather, it means the numeral values less than ten, namely, simplex numeral values, ranging from one to nine.

(five-hundred), as seen in (124). Notably, a newly formed NumberP is positioned at the specifier position, using the similar syntactic analysis with Ritter (1992); Scontras (2013).

(124)



As shown in the illustration, He (2015) provides a thorough syntactic derivation of numeral expressions in Mandarin Chinese. I agree with the view that numeral constructions are syntax-driven and semantically polysemous, and the general syntactic template. However, building on his analysis, I seek to further clarify the syntactic status of *simplex numerals* and *general numeral bases*. Contrary to the assumption that both can project NumberP, I propose that only *simplex numerals* function as heads of the NumP (Number Phrase), while general number bases are complements of simplex numbers, utilising the evidence of the puzzling condition with respect to *da* and *duo* modification.

Simplex numerals can function as a degree head has been addressed in the previous section, shortly recalling, the Num head denotes $< d >$, yielding the degree interpretation of the sequence 'Num-Da-CLP'. Notably, under this usage, Num denotes 'number' but not a 'numeral', it represents a specific numeral value but not a quantifier. Continuing on this analysis and considering the condition of the 'numeral' side of simplex numbers.

Under this condition, the phrase 'Num-CLP' functions as a counting structure, consistent with the well-documented phenomenon in bare numerals, where two possible interpretations are available (as discussed in Kennedy (2015); Bylinina and Nouwen (2020) previously). For instance, when answering question (125-a), both a positive answer (125-b) and a negative answer (125-c) are acceptable. In the positive response, using 'four books' to a question asking for 'three' reflects the first interpretation of a bare numeral-'*at least n*'. Similarly, in the negative response, the acceptability of negation signals the '*exact n*' interpretation of 'san' (three). Therefore, I follow that simplex numerals also function as a quantifier, denoting $<< d, t >, t >$.

(125) a. Ni you du **san ben shu** ma?
You have read **three CL book** Question?
'Have you read **three books**'

b. You, wo du-le **si ben**
Have I read-Par **four CL**
'Yes, I've read **four books**'

c. Mei, wo du-le **si ben**
No, I read-Par **four CL**
'No, I've read **four books**'

Turning to the numeral values involving general number bases. Briefly recalling the data, [Simplex-Base] forms multiplicative numerals, while [Base-simplex] forms additive numerals. The former can be modified by 'da', as in '*da san-bai ke shu*' (big three-hundred CL tree), but the additive numerals cannot. Besides this key difference, there is another difference between [simplex-Base] and [Base-simplex], the form of a comparative numeral.

In MC, the comparative morpheme, duo (more) can be attached by the end of a numeral item to form a modified numeral. Compared to the paucal modifier 'Ji', which indicates a small numeral range within a numeral context, 'duo' indicates a numeral range beyond an established numeral context, namely '*more than n*'. Notably, only multiplicative numerals allow the insertion of 'duo', as illustrated in (126).

(126) a. [Wu bai]-**duo** ben shu
[Five hundred]-**more** CL book
'More than five hundred books' duo after multiplicative numeral

b. *[Wu]-**duo** ben shu
*[Five]-**more** CL book
duo after simplex numeral

c. *[Shi Wu]-**duo** ben shu
*[Ten Five]-**more** CL book
duo after additive numeral

This comparison further supports my earlier assumption that general number bases are distinct from simplex numerals. Interestingly, I have found that the numeral 'shi' (ten) is a special case, as it is ambiguous between being a simplex numeral and a general number base. Specifically, as shown in (127-a), 'shi' (ten) behaves like other simplex numerals. However, unlike numerals from one to nine, 'shi' (ten) permits the insertion of 'duo' to form a modified numeral. In (127-b), 'shi-duo' means 'more than ten', aligning its behavior with that of other general number bases.

(127) a. Wo yao **shi** zhi bi
I want **ten** CL pen
'I want **ten** pens' Shi as a simplex numeral

b. Wo yao **shi-duo** zhi bi
I want **ten-more** CL pen
'I want **more than ten** pens' Shi as a general number base

If we simply draw a numeral scale, the distribution of simplex numeral and the general number bases should be as shown in Figure 3.12, wherein shi (ten) stands out as a borderline case, displaying the characteristics of simplex numerals and number bases.

Based on figure 3.12 and the previous data, I propose that simplex numerals function as Num head, while general number bases act as their complements. However, shi (ten) is somewhat unique, as it can serve both as a simplex head and as a general number base.

The analysis of He (2015) emphasises that 'shi' (ten) is one of the general bases. However,

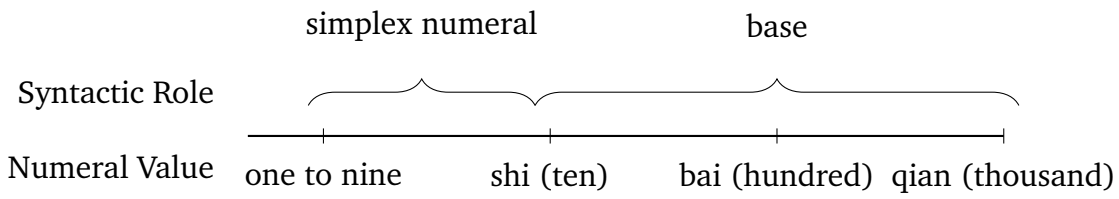


Figure 3.12: Simplex numeral and number bases

the issue arises because, unlike pure bases such as 'bai' (hundred) and 'qian' (thousand), 'shi' (ten) can also function as a simplex numeral. As shown in (128), when subjected to the same test used for simplex numerals, 'shi' (ten) yields a two-sided interpretation. In contrast, the base 'bai' (hundred) cannot even form a counting phrase (e.g., *wo du-le bai ben shu is ungrammatical).

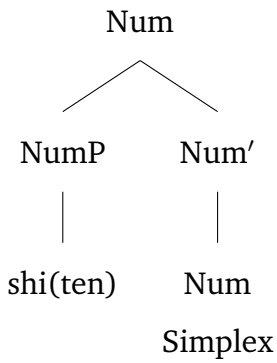
(128) a. Ni du-le shi ben shu ma?
You read-Par ten CL book Question?
'Have you read ten books?'

b. Dui, wo du-le shi-yi ben
Yeah, I read-Par ten-one CL
'Yes, I have read eleven books' at least n meaning

c. Mei, wo du-le shi-yi ben
No, I read-Par eleven CL
'No, I have read eleven books' at most n meaning

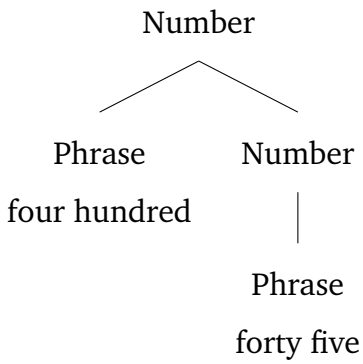
Therefore, applying the same syntactic template that places 'shi' (ten) in the specifier position next to a simplex head, as shown in (129), is not ideal. If (129) were accurate, we would expect 'bai' (hundred) to behave similarly, but this is not the case. For instance, the sequence 'bai ling san' (hundred and three) is not an acceptable numeral combination; an overt simplex numeral must precede bai, as in 'yi-bai ling san' (one hundred and three). This further reinforces my assumption that a general number base is a complement of a simplex number.

(129)

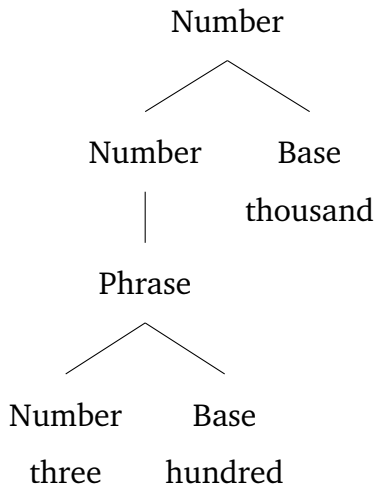


The *Packing Strategy* (Hurford, 2007) was treated as the general constraints to build up the structure for Chinese numerals in He (2015), in which a key generalisation about universal constraints on numeral systems is suggested. Specifically, it states that the '*sister of a number must be the highest value*'. In this context, 'number' refers to both additive and multiplicative complex numeral values. For example, in the numeral '*four hundred forty-five*', the highest value is found in the phrase *four hundred*, which is positioned next to *forty five*, as illustrated in (130-a). Similarly, in a multiplicative numeral, the highest value is represented by the numeral base, which is also placed next to the numeral, schematised in (130-b).

(130) a.



b.

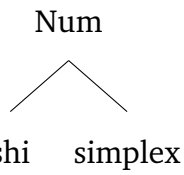


As discussed, the additive numeral [shi-simplex] poses challenges to the Spec-Head position observed in other numeral combinations. To address the issue presented by shi (ten), it is necessary to further specify how *packing strategy* influence the syntactic formation of numerals.

Typically, when shi (ten) functions as a general base numeral, it is insufficient on its own to enumerate a classifier phrase. However, when the numeral value exceeds nine, no simplex numeral is available to directly represent the value. In such cases, shi (ten) serves as a simplex numeral to fill this gap. Under these circumstances, shi (ten) operates as the Num head, specifically as shi-simplex, as illustrated in (131). In other words, I propose that shi-simplex forms a complex head [20]. As a result, to meet the universal constraints posited by packing strategy, shi (ten) becomes a borderline case, functioning both as a simplex numeral and a general base numeral.

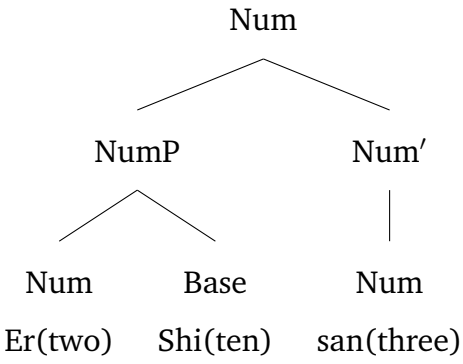
[20]I acknowledge that this is a general solution and that the underlying reasoning remains complex. Syntactically, as suggested by the complex head structure in Harizanov and Gribanova (2019), two functional projections are typically required. However, this approach is difficult to apply solely to numerals. An alternative root-based analysis, such as that proposed by Klockmann and taalkunde (2017), may be more applicable but requires identifying specific features in the Num head-a challenge given the lack of sufficient evidence. Hence, I present the dual function of shi (ten) to support my analysis, distinguishing between simplex numerals and general number bases within the grammar.

(131)



When a targeted numeral value is higher than nineteen (shi-jiu), a separate numeral phrase is generated, and under this condition, 'shi' (ten) serves as an number base, see the diagram (132). For instance for the numeral 'Er shi san' (twenty three), the expression 'er shi' (twenty) is treated as a separate multiplicative numeral, which is combined with the simplex numeral san (three) to form the complete numeral.

(132)



In this structure, because the head is the simplex numeral san (three), the entire phrase functions as a quantifier, denoting $\langle d, \langle d, t\rangle\rangle$. As a result, the degree operator da cannot follow Er-shi-san (twenty-three), since it requires the numeral to have a denotation of $\langle d\rangle$.

Except for shi (ten), all other general numeral bases are monosemous, consistently denoting a predicate-type semantics, as illustrated in the comparison in (133). They cannot function as quantifiers that precede a classifier phrase. The reasoning is straightforward: these numeral bases serve as complements to the Num head.

(133) a. *Wo you bai zhang zhi
*I have hundred CL paper

b. Wo you san bai zhang zhi
I have three hunudred CL paper
'I have three hundreds of paper'

Finally, there is one remaining variation to explain: the derivation of the sequence '**Da-Multiplicative-CLP**'. Briefly recalling the data, Da can be positioned before a multiplicative numeral, as shown in (134), and the resulting expression is true if only I have planted three hundred trees, and the totality of which is massive.

(134) Wo zhong-le **Da san-bai ke shu**
I plant-Par **Big three-hundred CL tree**
'I planted **a big three hundred of trees**'

The semantic and syntactic analysis presented thus far offers a solution. Recall the constraints imposed by da, it can serve as an attributive modifier or a degree operator. For the latter usage, it only combines with a domain that is part of a larger one, such as the relationship between a CLP and an NP, and it requires a degree head to project a degree phrase.

The semantics of (134), however, is not a degree-based meaning. If it is a degree-based meaning, the numeral 'san-bai' should be denoting the number term of type $\langle d \rangle$, and da should be positioned after san-bai. Thus, I assume da in Da-Multiplicative-CLP serves as an attributive modifier, with its modifiee as the multiplicative numeral.

As previously mentioned, the [Simplex-Base] structure forms an NumeralP that functions as the specifier of a simplex head. Due to its phrasal nature, [Simplex-Base] is ambiguous, as it can convey both a *counting meaning* and a *partitioning meaning*. Specifically, in statement (135), the multiplicative numeral can act as a quantifier, triggering interpretation (a). However, there is another possibility where the phrase [san-bai] functions as an nominal item, turning the phrase [san-bai ke shu] into a pseudo-partitive phrase, typically with the form of N1 of N2, and corresponding to interpretation (b).

(135) Wo zhong-le san-bai ke shu
I plant-Par three-hundred CL tree
'a.I planted three hundred trees' (**Counting meaning**)
'b.I planted a totality of three hundred trees out of unspecified amount of trees' (**Partitioning meaning**)

To elaborate on interpretation (b), as discussed earlier, Chinese NPs are number-neutral; without contextual information, the quantity indicated by a bare noun remains unspecified. Now, assuming a scenario where the task is to plant five thousand trees. In response to question (136-a), the statement in (136-b) would indicate that the three hundred planted trees are part of the total five thousand, which constitutes a significant portion. In this case, the phrase can be modified by da because it is not functioning as a quantifier but rather as a nominal item.

(136) (Common ground: there are total five thousand trees to plant)

a. **Q**: Zhong-le duo-shao shu le?
Q: Planted-Par more-less tree par?
'How many trees have been planted?'

b. **A**: Zhong-le da san bai le
A: Plant-Par big three hundred par
'Already planted a big three hundred trees (out of five thousand trees)

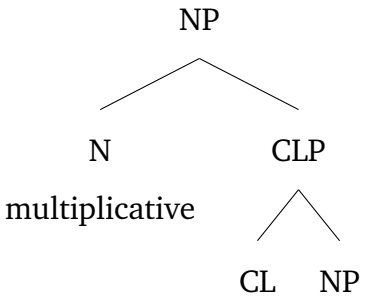
To better understand the interpretation in (136-b), it is reasonable to assume that the multiplicative numeral functions as a partitioning unit. This blend of quantifier and nominal properties is a cross-linguistic phenomenon. For example, Q-nouns, as explored by Klockmann (2017), show that certain English quantifying elements can also be modified by adjectives, as demonstrated in (137). In her analysis, these preceding adjectives merge through agreement with the Q-noun. Q-nouns are viewed as semi-lexical items, possessing both lexical content and grammatical features. Consequently, their preceding adjectives must align with this quantifying function. This explains why only intensifying adjectives, such as large or high, are permitted, while other types are excluded.

(137) a. Large number of students were sleeping..
b. Vast numbers of Maine lobster..
c. High number of contractors.. Klockmann (2017)

The semantics and syntactic projection of Q-nouns have been further developed by Tsoulas and De Vries (2023), where Q-nouns project a functional structure called the portion phrase. For example, in *heaps of sand*, the portion operator is *heap*, which semantically partitions the total mass of sand (the semantics of the NP) into discrete sand-heaps, further pluralised by the plural marker, 's'. Given the parallel semantics between [san-bai] (three hundred) and heaps, the idea that a multiplicative numeral can serve as a nominal partitioning tool becomes even more compelling.

With this understanding, the general structural position of a partitive multiplicative can be drawn, schematised as (138). The remaining task is specifying the semantic role of a partitive multiplicative numeral.

(138)



However, a controversy arises when using the numeral to partition a classifier phrase, as the CLP itself already functions as a partitioning domain. As discussed in an earlier section, the role of the classifier projection is to create a subdivision within the NP, therefore, attempting to partition an already partitioned structure presents a conceptual problem.

This is where the paucal operator xie comes into play. In my earlier analysis, xie is a strong paucal operator applied to the CLP, stronger than cardinal numbers, though still restricted within the numeral projection. Semantically, xie denotes an approximate amount out

of the classifier phrase, to illustrate with the phrase 'Yi xie ping-guo', its compositional analysis is as shown in (139). In other words, Xie groups certain amount of individual apples, this is ideal to tackle the current semantic controversy.

(139) yi xie (ge) ping-guo

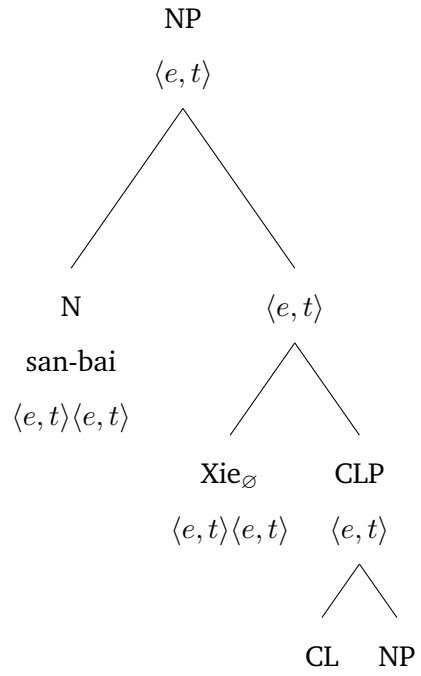
a. Ping-guo: a set of individual apples and sums of apples (X).

b. Ge (ping-guo): a set of individual apples (Y), Y is a subdivision of X.

c. Xie (ge(ping-guo)): a set of sum of individual apples (Z), such that Z $\in$ Y.

Accordingly, I propose that the full structure of the pseudo-partitive phrase [san-bai ke shu] should be as illustrated in (140). In other words, when a [simplex-base] functions as a nominal partitioning tool, it is separated from the Numeral projection and occupies a position higher than NumP. Partitioning a CLP requires the step of 'summation', which is performed either by numerals or operators within the Numeral projection (following the analysis in Ionin and Matushansky (2006)).

(140)



Here, I draw on my previous analysis of the paucal operator 'xie', and considering 'Xie' the covert operator that groups individual atoms from the CLP. This connection allows the [simplex-base] to function as a partitioning tool, and what it actually applies to is the sequence 'xie$_{\varnothing}$-CLP'. Under this perspective, the semantic role of the partitioning multiplicative numeral is specified in (141).

(141) ||multiplicative numeral||(X) = {y $\in X$ |y is a contextually individuated sum with a quantity property C}

Referring back to the example 'da-san-bai ke shu' (big-three-hundred CL tree), since the multiplicative numeral 'san-bai' functions merely as a nominal predicate, and considering the unique nature of *da* as a dimension-vacuous modifier, da can modify a wide range of nouns (such as da-ren, meaning 'adults'). This allows for the grammatical sequence [da-multiplicative].

In contrast, when a numeral unit ends with a simplex numeral, such as 'san-shi er' (thirty-two), 'san-shi' and 'er' are in a spec-head relationship within the Num projection. Since the entire numeral unit functions as a quantifier, inserting da before it is not permitted.

3.5 Summary

This chapter investigates the dual roles of cardinal numerals in Mandarin Chinese: their syntactic distribution and their nuanced semantic interpretations. A core division is made between simplex numerals (monomorphemic and denoting specific cardinal values) and complex numerals (polymorphemic, formed via additive or multiplicative operations). Simplex numerals directly denote numerical values, whereas complex numerals rely on number bases (e.g., *shi* ten, *bai* hundred) and often require a simplex numeral or a paucal modifier (*ji*) to fully saturate their value.

A key empirical observation is the limited distribution of the degree operator *da*, which may intervene between a simplex numeral and the classifier phrase (Num*da*CLN) but cannot appear in complex numeral contexts. The chapter formalises *da* as a degree operator with type $\langle d, \langle e, t\rangle\rangle$, linking a degree to a property, enabling scalar evaluations (e.g., interpreting three books as a relatively large amount). This reflects the necessity of saturation: simplex numerals are expressions of type $\langle d\rangle$ and can saturate the degree operators input, whereas complex numerals-especially additive onescannot unless mediated by additional elements.

The chapter also examines two paucal operators, *ji* and *xie*, which express vague or approximate quantities. *Ji* functions syntactically as a modifier of the Num head, encoding a defined upper boundary (typically less than ten), and can either replace or modify simplex numerals. *Xie*, by contrast, operates over the classifier phrase and denotes a partitive subregion of a contextually defined domain. These two operators occupy distinct syntactic positions, following the hierarchy: *xie* $\succ$ *ji* $\succ$ Numeral, with *xie* having stronger quantificational force than *ji* or simplex numerals, as evidenced by their compatibility with universal quantifiers.

Lastly, the chapter argues that complex numeral expressions in Mandarin are syntactically derived through hierarchical NumeralP projections, often coordinated (silently) or mediated by *ling* in the case of numeral gaps. These structural and semantic distinctions support

a model where numerals are not semantically uniform and where their integration with classifier phrases reflects deeper syntactic and interpretive asymmetries.

General Conclusion

This dissertation investigates the internal structure and semantic interpretation of nominal classifier phrases (CLP) in Mandarin Chinese, with particular focus on how nouns, classifiers, and numerals interact within the syntax. Framed within the Distributed Morphology and syntactic approaches to lexical meanings, the study examines how lexical content emerges from structural configurations and how lexical and functional elements are differentiated and integrated.

Across three chapters, the dissertation addresses three interrelated questions:

- How are noun-classifier constructions (N-CL pairs) structurally formed, and what accounts for their semantic variation?
- What is the initial status of classifiers, and why are certain classifiers structurally and semantically integrated with the nominal domain they modify?
- How do numerals function as degree or quantificational expressions, and how do they interact with classifier phrases and scalar modifiers?

Chapter 1 introduces the empirical puzzle of N-CL pairs in Mandarin, which behave as atomic nominal expressions yet display internal variation in how semantic content is distributed. To account for this variation, the chapter proposes a typology of four structural patterns:

- $\mathbf{N_{full}CL_{null}}$: Noun-driven interpretation in which the noun contributes the full semantic content, and the classifier is semantically vacuous.

- **$N_{half}CL_{half}$**: Shared lexical load, where both noun and classifier contribute to the interpretation in a mutually dependent manner.

- **$N_{less}CL_{more}$**: Classifier-driven interpretation, with the classifier contributing the core content and the noun playing a subordinate role.

- **$N_{full}CL_{full}$**: Redundant lexical richness, where both the noun and classifier are ontologically independent and semantically rich, yet form a unified expression.

These patterns challenge purely lexicalist accounts and indicate that the semantic contribution of classifiers cannot be determined solely by their lexical properties. Instead, N-CL structures are argued to emerge from a dedicated syntactic domainspecifically, the nP-where roots are first categorised and interpreted. The resulting structure is shaped by locality constraints (i.e., the semantic association between classifiers and CLP) and PF competition during spell-out. Crucially, despite internal variation in the distribution of content meaning, N-CL pairs consistently exhibit atomic semantic content, supporting a view of conceptual atomism encoded within syntactic derivation.

Chapter 2 advances the central theoretical claim that classifiers are not uniformly functional elements. Instead, many classifiers originate as roots and enter into categorisation structures within the *n*P domain, where semantic content is first fixed. Drawing from root-based syntax, the chapter argues that variation in classifier behaviour can be accounted for by differences in initial merge position, dependency on nominal roots, and internal projections within *n*P.

Four structural configurations are proposed to account for the interpretive variation among N-CL pairs, each corresponding to a distinct arrangement of roots, categorisers, and inner morphemes within the *n*P domain.

$N_{full}CL_{null}$ involve a noun root merged with an *n* categoriser, while the classifier is realised as a structurally dependent element introduced via an inner morpheme (labelled as *x*). The classifier in this configuration is semantically inert and inserted post-syntactically as a default spell-out.

Second, $N_{half}CL_{half}$ contain two roots-one for the noun and one for the classifier-each merged under the same *n*P projection. Their interpretation arises from mutual dependency, which is attributed to the inner morpheme 'de'.

For $N_{less}CL_{more}$ and $N_{full}CL_{full}$ pairs, the structure involves the integration of two fully categorised *n*Ps, each headed by an independent root. To syntactically integrate these two conceptual units while preserving their atomic interpretations, the derivation assumes a step of downgrading, in which one of the *n*Ps is reanalysed as a sub-derivation. This restructuring ensures that the resulting configuration contains only a single active *n* categoriser within the main *n*P domain.

Furthermore, the competition between classifiers and the general classifier *ge* is analysed as a result of elsewhere-condition competition at PF, with *ge* filling the CLP slot only when more specific classifiers are not present or not licensed by structural conditions. The insight that content meaning is stabilised at *n*P provides a coherent explanation for why N-CL pairs maintain their meaning regardless of movement or structural position.

Chapter 3 extends the inquiry into the semantics of numerals, exploring their dual role as degree-denoting and quantificational expressions. A primary distinction is drawn between Simplex numerals (e.g., *san* three), which denote degrees of type $\langle d \rangle$ and Complex numerals (e.g., *san-bai* three hundred), which are built from number bases and function as quantificational expressions over pluralities.

The chapter argues that only simplex numerals can combine with the degree operator *da* to form scalar evaluative expressions like *san da ben shu* (three big books), because they can saturate the degree argument of *da*, which is formally defined as: $\|da\| = \lambda d \lambda x.\#(x) = d$. This composition yields a property of individuals whose cardinality equals d, allowing the sequence to be evaluated along a contextual scale (e.g., what counts as a lot to read).

In contrast, complex numerals lack degree-denoting status and cannot enter into this configuration. They are shown to involve hierarchical NumeralP projections, often coordinated or mediated by silent conjunction or overt markers like *ling* (zero), especially in

additive constructions with numeral gaps.

Finally, the chapter provides a detailed analysis of the paucal operators *ji* and *xie*, which contribute scalar and quantificational effects in numeral classifier phrases. *Ji* occupies a position within NumP, modifying or substituting a numeral, and introduces an upper-bounded vague quantity (typically <10). *Xie*, on the other hand, modifies the classifier phrase directly, denoting a partitive plurality within a larger contextually defined set. The structural hierarchy of these elements is proposed as: xie $\succ$ ji $\succ$ Numeral. These distinctions contribute to a richer understanding of how Mandarin quantification interacts with degrees, vagueness, and classifier structure.

By synthesising structural syntax with fine-grained semantic distinctions, this dissertation advances our understanding of how complex content meaning is assembled in classifier languages. It also opens paths for future research in cross-linguistic classifier typology, syntax-semantics mapping, and the cognitive grounding of morphosyntactic structure.

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