The syntax of classifiers in Mandarin Chinese

Li Julie Jiang
University of Hawai'i at Manoa

Peter Jenks
University of California, Berkeley

Jing Jin
The Education University of Hong Kong

To appear in Cambridge Handbook on Chinese Linguistics

1. Introduction

1.1 Overview of the chapter

Mandarin Chinese is well known for its rich system of numeral classifiers, a system which has been the topic of intense study over several decades. Because numeral classifier constructions do not occur in every language, developing an empirically and theoretically grounded understanding of their syntax is important not only for our understanding of Chinese but also for our understanding of the syntax of natural languages more generally, particularly the syntax of nominal expressions across languages.

The main aim of this chapter is to provide a careful examination of Mandarin Chinese classifiers from the perspective of generative syntax. A comprehensive overview of the distribution of classifiers is provided along with the existing syntactic analyses of classifiers. A central conclusion of this chapter, following much recent work, is that there are two distinct structural configurations that numeral classifiers participate in, and that these structures can distinguish both the type of classifier participating in the structure as well as its semantic interpretation. We also contextualize the syntactic analyses of classifiers in the context of formal semantic analyses of numeral classifiers.

This chapter is organized as follows. The remainder of this section provides an overview of the basic types of classifiers that occur with nouns (Section 1.2). Section 2 discusses different phrases that contain classifiers, with an exclusive focus on nominal classifiers. These include phrases with numerals (Section 2.1), phrases without numerals (Section 2.2), phrases without a head noun (Section 2.3), phrases in which the modification marker *de* appears between the classifier and the noun (Section 2.4), phrases where adjectives intervene between the numeral and the classifier (Section 2.5), and phrases where the classifier is reduplicated (Section 2.6). Section 3 presents, informally, two different perspectives on the semantic function of classifiers, one in which numeral classifiers are "for nouns" (Section 3.1) and another in which classifiers are "for numerals" (Section 3.2). These two proposals are then compared (Section 3.3), and the data are shown to favor the view that classifiers are for nouns. Finally, Section 4 provides an overview and critical discussion of the syntactic analyses of classifiers, including the perspective that numeral classifiers are functional projections above the noun (Section 4.1), the idea that they uniformly form a constituent with the numeral to the exclusion of the noun (Section 4.2), and the perspective, which finds clear support in the data, that both types of structures are needed (Section 4.3).

1.2 Types of classifiers

Chinese classifiers can be divided into two main categories, nominal classifiers and verbal classifiers. Nominal classifiers count or measure the quantity of entities while verbal

classifiers count the frequency or measure the duration of events. This section will be devoted to an overview of nominal classifiers, followed by a brief discussion of verbal classifiers.

In Mandarin, nominal classifiers can be distributionally defined as a word which must occur between a numeral and a common noun. In the existing literature, nominal classifiers are commonly assumed to consist of several subtypes, which we discuss in turn (Chao 1968: 584-620; Croft 1994: 151-152; Krifka 1995; Yang 2001; Zhu 1982; Guo 2004, Zhang 2017).

(i) *Individual classifiers*

Individual classifiers, also called sortal classifiers or just numeral classifiers, name a unit that represents the inherent individualhood of entities, as illustrated below. One important property of individual classifiers is that they are restricted to count nouns, where they are obligatory (1a-b). However, individual classifiers cannot occur with mass nouns (1c) (Cheng and Sybesma 1998, 1999, X. Li 2013, Zhang 2013).

(1) a. *liang* **(ben)* *shu*
two Cl book
'two books'
b. *yi* **(ge)* *xuesheng*
one Cl student
'a student'
c. **liang* *ge* *qiyou*
two Cl gasoline
'two gasolines

As examples (1a-b), show, individual classifiers are obligatory when they occur with count nouns in Mandarin. Individual classifiers generally name the atomic units associated with the associated noun, so *ben* in (1a) means something like 'volume.' Such semantic content is not necessary, however, as the general individual classifier *ge* in (1b) contributes no content and occurs with human nouns as well as a wide variety of other nouns, including inanimate ones. While individual classifiers are obligatory when counting the inherent atoms of count nouns, other kinds of classifiers can be used in the same syntactic position, with different semantic effects.

(ii) *Measure classifiers*

The measure classifier describes a standard unit of measurement. Measure classifiers can combine with both mass and count nouns:

(2) a. *san* *mi* *bu*
three Cl_{meter} cloth
'three meters of cloth'
b. *shi* *gongjin* *pingguo*
ten Cl_{kilo} apple
'ten kilos of apples'

(iii) *Container classifiers*

The container classifier serves to package entities/substances denoted by the associated noun into a counting unit, as illustrated below. Container classifiers are nouns used as measures, and can always take *de* before a following noun (c.f. Chao 1968: 601). Some scholars make a

distinction between the classifiers in (3a,b) and those in (3c,d) (e.g. Zhu 1982; Guo 2004): in (3a,b), the classifiers *xiang* 'box' and *bei* 'cup' cannot be used as a noun independently in Mandarin Chinese unless the suffix *-zi* is added, i.e. *san ge xiangzi* 'three Cl boxes' and *liang ge beizi* 'two Cl cup'; whereas the classifiers in (3c,d) can be used as nouns and take a classifier directly, e.g. *san ge bao* 'three Cl bag' and *si liang kache* 'four Cl truck'. These authors refer to the classifiers in (3c, d) as temporary classifiers, which are nouns in ordinary cases and are used temporarily as counting unit. It is important to note that the 'temporary classifier' in Zhu (1982) and Guo (2004) differs from that in Chao (1968), which we will introduce below in (7).

(3) a. *yi* *xiang* *shu*
one Cl_{box} book
'one box of books'
b. *liang* *bei* *guozhi*
two Cl_{glass} juice
'two glasses of juice'
c. *san* *bao* *mi*
three Cl_{bag} rice
'three bags of rice'
d. *si* *kache* *mei*
four Cl_{truck} coal
'four trucks of coal'

(iv) *Group classifiers*
The group classifier serves to collect individuals into aggregates, as illustrated below:

(4) a. *liang* *shu* *hua*
two Cl_{bunch} flower
'two bunches of flowers'
b. *yi* *qun* *xuesheng*
one Cl_{crowd} student
'a crowd of students'

(v) *Partitive classifiers*
The partitive classifier denotes a unit for dividing the associated noun denotation into individual parts/sections. For example:

(5) a. *liang* *jie* *ganzhe*
two $Cl_{section}$ sugarcane
'two sections of sugarcane'
b. *yi* *duan* *lu*
one $Cl_{section}$ road
'a section of road'

(vi) *Kind classifiers*
The kind classifier is one classifying the associated noun denotation into individual kinds/types, as shown below:

(6) a. *san* *zhong* *shiwu*
three Cl_{kind} food
'three kinds of food'
b. *liang* *lei* *ren*
two Cl_{type} person
'two types of people'

(vii) *Temporary classifiers*
Temporary classifiers are like container classifiers in being primarily nouns and used directly after numerals to measure the amount of things, but differ from container classifiers in measuring the outside extent and only rarely the inside capacity (c.f. Chao 1968: 603, see also Li and Thompson 1981: 111; Zhang 2013: 101). They do not allow numerals more than *yi* 'one'; when *yi* is used, it expresses a meaning of 'all over' (Chao 1968: 603; Zhang 2013: 101):

(7) a. *peng-le* *yi* *bizi* *hui*
bump-ASP one nose dust
'has bumped against dust all over the nose, —got buffed.' (Chao 1968: 603)
b. *Ta-men* {*yi*/**san*} *lian* *you*.
3-PL one/three face oil
'They, their whole faces are covered by oil.' (Zhang 2013: 101)

(viii) *Verbal classifiers*
In addition to nominal classifiers, Mandarin has a system of verbal classifiers. Verbal classifiers denote a unit for event quantification (Chao 1968; Zhu 1982; Yang 2001; Guo 2004; del Gobbo 2014; Zhang 2017). In the literature, they are generally split into two subtypes: (i) the frequency classifier, which denotes a unit for counting occurrences of a particular event (e.g., *tang* 'time', *ci* 'time'), and (ii) the duration classifier, which denotes a standard unit for measuring the duration of events (e.g., *tian* 'day', *nian* 'year'), as given in (8) and (9), respectively:

(8) a. *qu* *liang* *tang*
go two Cl_{time}
'to go twice'
b. *Zhangsan* *kan* *le* *san* *ci* *dianying*.
Zhangsan watch PFV three Cl_{time} movie
'Zhangsan watched movies three times.'

(9) a. *wan* *yi* *tian*
play one Cl_{day}
'to play for one day'
b. *Zhangsan* *xue* *le* *liang* *nian* *gangqin*.
Zhangsan learn PFV two Cl_{year} piano
'Zhangsan has learn playing the piano for two years.'

Given that the focus of this chapter is placed on classifiers relevant to entity quantification rather than event quantification, verbal classifiers will be excluded from the following discussion, and the classifiers to be dealt with in this chapter will only be nominal classifiers.

2. The syntactic distribution of numeral classifiers

This section provides a description of the syntactic distribution of phrases containing nominal classifiers. We begin with bare numeral classifiers phrases, i.e., phrases that contain a bare numeral, a classifier and a noun, in the order of [Num Cl N].

2.1 Numeral classifier phrases

Numeral classifier phrases can appear in both subject and object positions in Mandarin. They typically receive an indefinite interpretation, for example in episodic sentences (10a), and are freely allowed in postverbal object positions (e.g. Chao 1968: 67; Li and Thompson 1981: 91; Y.-H. A. Li 1997, 1998; Cheng and Sybesma 2005, among many others):

(10) a. *jin lai le yi ge ren.*
enter come PFV one Cl person
'A person came in.' (Li and Thompson 1981: 91)
b. *wo xiang mai yi ben shu.*
I want buy one Cl book
'I would like to buy a book.' (Cheng and Sybesma 2005: 263)

In general, indefinite nominal expressions are somewhat marginal in subject position in Mandarin (e.g. Chao 1968: 67; Y.-H. A. Li 1997, 1998). As noted in Chao (1968: 76). It is, however, sometimes possible for indefinite numeral classifier phrases to appear in subject position, as shown in (11a), but the preferred (i.e. more frequent) form would be the one in (11b), where the indefinite expression appears postverbally.

(11) a. *yi ge mai shuazi de zai menkou-er ne.*
one Cl sell brush De at door SFP
'A brush peddler is at the door.'
b. *menkou-er you (yi) ge mai shuazi de.*
door have one Cl sell brush De
'The doorway has a rush peddler.' (Chao 1968: 76)

In some literature, sentences in which indefinite numeral classifier phrases appear in subject position are marked unnatural or unacceptable (e.g. Li and Thompson 1981: 91; Y.-H. A. Li 1997, 1988; Cheng and Sybesma 2005):

(12) a. ??*san ge xuesheng chi le dangao.*
three Cl student ate PFV cake
Intended reading: 'Three students ate the cake.' (Y.-H. A. Li 1997: 2)
b. **yi zhi gou yao guo malu.*
one Cl dog want cross road
Intended: 'A dog wants to cross the road.' (Cheng and Sybesma 2005: 263)

If the existential marker *you* 'exist/have' occurs in the sentence initial position in (12), the resultant sentences are improved/grammatical (e.g. Li and Thompson 1981; Y.-H. A. Li 1998; Tsai 2001):

(13) a. *you san ge xuesheng chi le dangao.*
exist three Cl student ate PFV cake
'Three students ate the cake.'
b. *you yi zhi gou yao guo malu.*
exist one Cl dog want cross road
'A dog wants to cross the road.'

In addition, there are a variety of contexts that allow an indefinite numeral classifier phrase to appear in subject position: (i) when it is used referentially by modifying the NP with a vivid description (Lee 1986), (ii) when it is used with an intransitive verb that takes a complex form (Fan 1985), (iii) when it is used in very short sentences, expressing unexpected new discoveries and depending on the current scene or a known knowledge background (X. Zhu 1988), and (iv) when it is used with stage-level predicates instead of individual-level predicates (Shyu 1995) (c.f. Huang, Li and Li 2009: 318-320).

Y.-H. A. Li (1998: 694) notes that authors mark sentences like those in (12) as unacceptable or unnatural because these examples are cited out of context. In fact, such sentences are acceptable in contexts which favor a pure quantity reading. In other words, as long as an appropriate context is provided, indefinite numeral classifier phrases are possible in subject positions (see also Jiang 2012: 117, forthcoming).

Numeral classifier phrases in Mandarin can appear in both generic and episodic sentences (e.g. Li and Thompson 1981: 167; Y.-H. A. Li 1998; Tsai 2001; Huang, Li and Li 2009; Liao 2011; Jiang 2012, forthcoming):

(14) *wu ge xiaohai chi bu wan shi wan fan.*
five Cl child eat not finish ten bowl rice
'Five children cannot finish ten bowls of rice.' (Y.-H. A. Li 1998: 659)

While Y.-H. A. Li (1998) refers to the numeral classifier phrase in (14) as 'the number-denoting interpretation', these cases should be treated as generic: the sentence is a general statement about the number of children that is not sufficient to finish ten bowls of rice across situations (see Liao 2011; Jiang 2012, forthcoming).

Like indefinites in English, indefinite numeral classifier phrases in Mandarin can receive either a wide scope or a narrow scope interpretation (C.-T. J. Huang 1982; Aoun and Li 1989, 2003; F. Liu 1997; X. Li 2011, 2013; Jiang 2012, forthcoming). Consider the following sentence, as first observed in C.-T. J. Huang (1982: 214-220):

(15) *wo mai-le* [NP [*san ge ren xie*] *de mei ben shu*]
I buy- PFV three Cl man write MOD every book
(i) Wide Scope: 'There are three men x such that every book x wrote I bought.'
(ii) Narrow Scope: 'I bought every book that three men wrote.' (C.-T. J. Huang 1982: 214)

In (15), when the numeral-classifier phrase *san ge ren* 'three Cl men' has wide scope out of the complex noun phrase, it receives a specific indefinite reading and refers to "three specific men" as in (15i). In contrast, when *san ge ren* 'three Cl men' receives a narrow scope interpretation within the complex noun phrases, it refers to "any three men" and this interpretation is nonspecific indefinite as in (15ii). The scope properties of numeral indefinites in Mandarin differ from those of their bare nouns (and indeed kind-denoting bare

nouns generally), which only exhibit the narrowest scope ability (Yang 2001, Dayal 2004; X. Li 2011, 2013; Jiang 2012).

In addition to appearing in subject and object positions, with an indefinite or a generic reading, numeral classifier phrases in Mandarin can appear with demonstratives to yield a deictic or anaphoric definite interpretation, as in (16) (Jiang 2012; Jenks 2018); they can further be used with quantifiers such as *mei* 'every', as in (17) (Jiang 2012).

(16) *Zhangsan guyong le na/zhe liang ge nanhai*. [Dem Num Cl N]
Zhangsan hire PFV that/this two Cl boy
'Zhang hired those/these two boys' (Jiang 2012: 119)

(17) *mei san ge xuesheng jiao yi fen baogao* [Q Num Cl N]
every three Cl students hand-in one Cl report
'Every group of three students hands in a report.' (Jiang 2012: 118)

The numeral is optional in these constructions, as demonstrative and quantifiers themselves are capable of licensing the numeral classifier, as we will see in the following section.

Before we end the discussion in this section, there is another type of numeral classifier phrase that is worth noting. In Mandarin, bare numerals and individual classifiers are not compatible with nouns marked with *-men*, a morpheme which expresses plurality (Lü, 1947, 1999; Chao, 1968; Norman, 1988; Iljic, 1994; Y.-H. A. Li, 1999, among others):

(18) **san ge xuesheng-men*
three Cl student-MEN
'three student+*men*' (Y.-H. A. Li 1999: 77)

Example (18) would be acceptable without *-men*. However, when the individual classifier is replaced with a group classifier, such as *qun* 'group', *zu* 'team', and *dui* 'pile, crowd', the [Num Cl N-*men*] phrase becomes acceptable (Hsieh 2008; Jiang 2012, 2017; F. Li 2015), as shown in (19i). Similarly, when the bare numeral is replaced by [Num + group classifier], functioning as a numeral approximation phrase, the phrase also becomes acceptable (Hsieh 2008; Y.-H. A. Li 2015; Jiang 2017), as illustrated in (19ii).

(19) i. [bare numeral + group classifier + N-*men*]
a. *Ta zai gen yi qun haizi-men wan.*
he in with one Cl child-MEN play
'He is playing with a group of children.' (Hsieh 2008: 142)
b. *shao da yixie de shihou, wo bian he yi qun huoban-men qu*
a-little old a-bit De time I then with one Cl_{group} partner-Men go
lincun gan xi le.
neighbor-village hurry-on opera Asp
'When I was a little older, I started to go to the nearby villages one after another with a group of partners to perform operas.'
(Peking University Corpus, Jiang 2017: 199)

ii. [numeral approximation + individual classifier +N-*men*]
a. *sanbai duo wei laoshi ji juanshu-men posuoqiwu...*
three:hundred more Cl teacher and family:dependant-MEN beautifully:dance
'…more than three hundred teachers and their family dependants danced beautifully…' (Academia Sinica Corpus, Hsieh 2008: 8)

b. *jijian-jiaolian Liu Yuling zhengzai zhidao*
fencing-instructor Liu Yuling PROG guide
qishi duo ge xuesheng-men lianxi.
seventy many/which Cl student-MEN practice
'The fencing instructor Liu Yuling is giving seventy-some students directions to practice fencing'
(Beijing Language and Culture University Corpus, Jiang 2017: 202)

In addition to classifier phrases, Mandarin allows phrases which consist only of a classifier and a noun but no numeral [Cl N]. We discuss phrases of this sort in the next section.

2.2 Numeral-less classifier phrases

Numeral-less classifier phrases, which are also referred to as bare classifier phrases (i.e. bare ClPs) in the literature, receive an interpretation similar to [*one* Cl N] in Mandarin and can only appear in restricted positions (Lü 1944; Chao 1968; Paris 1981; Y.-H. A. Li 1997; Cheng and Sybesma 1999; Borer 2005; C.-T. J. Huang 2014; Cheng et al. 2012; X. Li and Bisang 2012; Zhang 2013; Jiang 2012, 2014, 2015; Li and Feng 2015, among others). Bare ClPs are allowed in the post-verbal position but cannot occur in coordination structures after the first conjunct in a listing situation as in (20a); they are banned in the topic position and the preverbal positions as in (20b, c).

(20) a. *Yuehan mai le (yi) ben shu he *(yi) zhi bi.*
John buy PFV one Cl book and one Cl pen
'John bought a book and a pen.' (R. Yang 2001: 69)
b. **ge pingguo ah, wo yijin chi le.*
Cl apple TOP I already eat SFP
c. A: Where is the book?
B. **na ben shu, ge xuesheng mai zou le.*
that Cl book Cl student buy away SFP
Intended: 'That book, a student bought it.' (Li and Bisang 2012: 338)

Numeral-less classifier phrases in Mandarin are widely associated with nonspecific indefinite interpretations (e.g. see Lü 1944; Chao 1968; Y.-H. A. Li 1997; Cheng and Sybesma 1999; Chen 2004; C.-T. J. Huang 2014, X. Li and Bisang 2012, among many others), exemplified below.

(21) a. *men-qian you ge ren.*
door-front have Cl people
'There is someone outside the door.' (Cheng and Sybesma 1999: 525)
b. *gankuan qu zhao (yi) ge ren lai, shenme ren dou xing.*
Hurriedly go find one Cl person come any person all fine
'Hurry up and get somebody; anybody will be just fine.' (Chen 2004: 1160)

However, bare classifier phrases can also receive a specific indefinite interpretation (Lü 1944; Chen 2004; C.-T. J. Huang 2014; Jiang 2012, 2015). We illustrate this point with two tests for specificity in Mandarin.

The first test for specificity comes from Lü (1944), Sybesma (1992, 1999), and Chen (2004), who illustrate that Mandarin *ba*-construction requires the nominals which follow *ba* to be interpreted as either definite or specific. Concerning Mandarin numeral-less classifier phrases, they can appear in *ba*-construction and can be interpreted as specific, as first observed in Lü (1944: 161) and further discussed in Chen (2004), Jiang (2012, 2015) and Huang (2014):

(22) a. *(ta) re-de shangsi bu xihuan, ba ge guan nong-diao le.*
3sg annoy boss not like Ba Cl job (of an official) make-lose SFP
'He annoyed his boss and lost a job. (Lü 1944: 161)
b. *ta ba ge (hao) pengyou gei dezui le.*
3sg Ba Cl good friend give offend SFP
'He got a (good) friend offended.' (Huang 2014:35)

Another test for specificity comes from Huang (1987), who showed that Mandarin bare nouns cannot appear in the secondary predication sentences as in (23a), but the numeral classifier phrases [*one* Cl N] can, as in (23b). This test shows that bare nouns behave differently from numeral indefinites in that they do not allow a specific interpretation.

(23) a. **wo jiao-guo xuesheng hen congming.*
I teach-EXP student very intelligent
b. *wo jiao-guo yi-ge xuesheng hen congming.*
I teach-EXP one-Cl student very intelligent
'I once taught a student who was very intelligent.' (Huang 1987: 248)

The numeral-less classifier phrase can appear in the secondary predication sentence and behaves like [*one* Cl N] rather than bare nouns (Jiang 2012, 2015):

(24) a. *wo kan le (yi) ben shu te you-yisi*
I read PFV one Cl book rather interesting
'I read a book which is very interesting.'
b. *ta jiao le (yi) ge nüpengyou hen piaoliang.*
he make PFV one Cl girlfriend very pretty
'He got a girlfriend who is very pretty.' (Jiang 2015: 336)

Although the numeral-less classifier phrase [Cl N] and the numeral classifier phrase [*one* Cl N] share the nonspecific and specific indefinite interpretations, they do differ in one respect: the former cannot be used in contexts where the numeric content of *yi* 'one' is emphasized, as first observed in Lü (1944: 166-167) and further discussed in Li and Bisang (2012) and Jiang (2012). Some of their examples are given below.

(25) a. *wo hua le *(yi) ge xiaoshi chifan.*
I spend PFV one Cl hour eat-meal
'I spent one hour eating meal.'
b. *wo zai xianggang dai le *(yi) ge yue.*
I at Hong Kong stay PFV one Cl month
'I stayed for one month in Hong Kong.' (Li and Bisang 2012: 345)

In addition to appearing in certain post-verbal positions, with an indefinite reading, numeral-less classifier phrases in Mandarin can appear with demonstratives or with quantifiers such as *mei* 'every':

(26) a. *zhe/na* *(yi) ge ren*
this/that one Cl man
'this man/that man'
b. *mei* *(yi) ge ren*
every one Cl man
'every man'

These constructions are interesting in their own right. Jenks (2018) shows that demonstrative phrases like those in (26a) serve to mark anaphoric definiteness, while Mandarin bare nouns are typically unique definites. Regarding the determiner *mei* 'every' in (26b), there is some debate as to whether it is a maximality operator (Lin 1998, Cheng 2009) or a universal quantifier (Liu 2017). We refer to the reader to these works for further discussion of Mandarin determiners. In the following section, we discuss classifier phrases without nouns.

The ability of numeral classifiers to occur with determiners, as well as to be used anaphorically in cases of N'-ellipsis (see following section), are properties of noun classifiers rather than numeral classifies in the typology of Aikhenvald (2000). However, it is nevertheless true that Mandarin classifiers are obligatory with numerals, so they serve functions of both noun classifiers and numeral classifiers. Formal semantic and syntactic analyses of Mandarin classifiers which take classifiers to be functional projections of the noun have made sense of this exact pattern of use, however, as we will see in Sections 3 and 4 below.

2.3 N'-ellipsis with classifier phrases [Num Cl], [Dem Cl], [Q Cl]

In contexts where the lexical content of the noun is recoverable from content, the noun can be omitted from a numeral classifier phrase, leaving behind the classifier and any noun-phrase internal material that precedes the classifier (Saito et al. 2008: 262, Her 2012: 1234; Zhang 2013: 177). We indicate the position of the missing noun with *<e>*, as we take these cases to be instances of ellipsis or deletion.

(27) *Suiran Zhangsan mai le [san ben shu], dan Lisi mai le [wu ben <e>]*
though Zhangsan buy ASP three Cl book but Lisi buy ASP five Cl
'Zhangsan bought three books, but Lisi bought five.' (Saito et al. 2008: 261)

The constituent that can be deleted in these contexts can be larger than just the noun. For example, in the sentence below, the clear implication is that Lisi bought five interesting books.

(28) *Zhangsan mai le [san ben youqu-de shu], Lisi mai le [wu ben <e>].*
Zhangsan buy PFV three Cl interesting-DE book Lisi buy PFV five Cl
'Zhangsan bought three interesting books; Lisi bought five.'

We will refer to this phenomenon as N'-ellipsis, following Saito et al. (2008).

Classifiers in any context can license N'-ellipsis. For example, we have seen that demonstratives and quantifiers license classifiers (Li and Thompson 1981: 105-106), and these elements also license N'-ellipsis with the classifier:

(29) N'-Ellipsis with Dem-Cl
Zhangsan mai le [na ben shu], Lisi mai le [zhe ben <e>].
Zhangsan buy PFV that Cl book Lisi buy PFV this Cl
'Zhangsan bought that book; Lisi bought this one.'

(30) N'-Ellipsis with Q-Cl
suiran Zhangsan du le [yi ben shu], Lisi que du le [mei ben e].
although Zhangsan read PFV one Cl book Lisi however read PFV every Cl
'Though Zhangsan only read one book, but Lisi read all of them.'

Furthermore, N'-ellipsis is not restricted to individual classifiers. For example, container classifiers are also capable of licensing N'-ellipsis

(31) N'-ellipsis licensed by container classifier
ta you san ben shu, wo you san xiang
he have three Cl book I have three M.box
'He has three books, I have three boxes (of books).' (Her 2015:1222)

Her (2015) takes the ability of different types of classifiers to license ellipsis as evidence of shared structure among the different constructions.

The discourse conditions on N'-ellipsis resemble those conditions on ellipsis more generally. For the most part, N'-ellipsis must be licensed by prior mention in discourse. The only exceptions are cases where the content of the noun is recoverable from immediate context. For example, a speaker could point at an unidentified object and ask a question about it, such as: *[nei ge <e>] shi shenme?* 'What's that?' These cases are restricted to contexts where there is a referent which both speakers can easily identify, however. Otherwise, prior mention in discourse is required to license N'-ellipsis with numeral classifiers.

Not all languages with numeral classifiers allow N'-ellipsis in argument positions, however. Saito et al. observe that the typical prenominal position of numeral classifiers in Japanese does not license deletion of the noun (Saito et al. 2008: 261, ex. 49). This observation indicates that the availability of N'-ellipsis with Mandarin classifiers must derive from some syntactic property which is absent in Japanese. Relatedly, Japanese systematically allows [Num Cl] sequences to appear discontinuously from the noun, a phenomenon that is typically identified as a form of quantifier float (e.g. Nakanishi 2008). In addition, Japanese allows [Num Cl] sequences to be topicalized independently from a case-marked noun:

(32) a. *Taroo-wa san-satu no hon-o katta.*
Taroo-TOP three-Cl no book-ACC bought
'Taroo bought three books.'
b. *San-satu, Taroo-wa hon-o katta.*
three-Cl Taroo- TOP book-ACC bought (Saito et al. 2008: 260)

Significantly, both of the processes which are possible in Japanese—quantifier float and topicalization of [Num Cl] sequences—are impossible in Mandarin. This is illustrated below for topicalization:

(33) a. *Zhangsan mai-le san-ben shu.*
Zhangsan bought three-Cl book
Zhangsan bought three books.'
b. **San ben, Zhangsan mai-le shu.*
three-CL Zhangsan bought book (Saito et al. 2008: 260)

On the basis of these differences between Mandarin and Japanese, Saito et al. (2008) conclude that [Num Cl] sequences form a constituent which excludes the noun in Japanese but not in Mandarin, where they assume the classifier is a head. This distinction could potentially account for other differences between classifiers in Japanese and Mandarin, such as the inability of demonstratives to license classifiers in Japanese.[1] However, there are some confounds for the argument from ellipsis for the functional head analysis of classifiers in Mandarin, an issue we return to in Section 4.1 below.

2.4 Numeral classifier phrases with *de* [Num Cl *de* NP]

In addition to [Num-Cl-N], classifiers in Chinese may also participate in forming numeral classifier constructions of the form [Num Cl *de* N], where *de* is the polyfunctional marker of nominal modification (e.g. Zhu 1956, 1961; Chao 1968; Lu 1987; Cheng and Sybesma 1998, 1999; Tang 1990, 2005; X. Li 2007, 2011, 2013; Hsieh 2008; Jiang 2009; Li 2011; Liao and Wang 2011; Tsai 2011; Li and Rothstein 2012; Huang and Jenks 2014; Jin 2016b, 2018; among many others). Noun phrases of the shape [Num Cl *de* N] can be used to express two different readings, an attributive reading and a quantifying reading, as illustrated below:

(34) Attributive [Num Cl *de* N]:
a. *qi bang de ying'er hen changjian.*
seven Cl_{pound} DE infant very common
'Seven pound infants are very common.'
b. *100 du de shui tai tang le.*
100 Cl_{degree} DE water too hot SFP
'100 degree water is too hot.'

(35) Quantifying [Num Cl *de* N]
a. *Zhangsan yigong mai le qi bang de pingguo.*
Zhangsan in.total buy PFV seven Cl_{pound} DE apple
'Zhangsan bought seven pounds of apples in total.'
b. *Zhangsan yigong he le yi sheng de niunai.*
Zhangsan in.total drink PFV one Cl_{liter} DE milk
'Zhangsan drank a liter of milk in total.'

The attributive and the quantifying [Num Cl *de* N] can be clearly distinguished at the syntactic level (e.g. Tang 2005; Hsieh, 2008; Jiang 2009; X. Li 2011, 2013; Tsai 2011; Zhang 2013; Jin 2016b, 2018; a.o.). To illustrate, first, the attributive [Num Cl *de* N] allows for ellipsis of N whereas the quantifying [Num Cl *de* N] does not, as shown below:

[1] Y.-H. A. Li (2007), examining much of the same data, offers an even more radical view—that while Mandarin projects to DP in argument positions, Japanese only ever projects to NP.

(36) a. *qi* *bang* *de* *ying'er* *hen* *changjian*,
seven Cl_{pound} DE infant very common
shiwu *bang* *de* *(ying'er)* *bu* *name* *changjian*.
fifteen Cl_{pound} DE infant not so common
'Seven pound infants are very common, while fifteen pound ones are not so common.'

b. *Zhangsan* *yigong* *mai* *le* *qi* *bang* *de* *pingguo*,
Zhangsan in.total buy PFV seven Cl_{pound} DE apple
Lisi *yigong* *mai* *le* *ba* *bang* *de* **(pingguo)*.
Lisi total buy PFV eight Cl_{pound} DE apple
'Zhangsan bought seven pounds of apples in total, while Lisi bought eight pounds.'

Second, while the N in the attributive [Num Cl *de* N] can be topicalized, the N in the quantifying [Num Cl *de* N] cannot, as illustrated below:

(37) a. *ying'er,* *qi* *bang* *de* *hen* *changjian*.
infant seven Cl_{pound} DE very common
'As for infants, the seven pound ones are very common.'

b. **pingguo, Zhangsan* *yigong* *mai* *le* *qi* *bang* *de.*
apple Zhangsan in.total buy PFV seven Cl_{pound} DE
Intended: 'As for apples, Zhangsan bought seven pounds in total.'

Third, while the attributive [Num Cl *de* N] can be further quantified by a [Num Cl] expression, this is not allowed for the quantifying [Num Cl *de* N]. Consider the following contrast between (38i) and (38ii):

(38) *Zhangsan* *yigong* *mai* *le* *liang* *bao* *qi* *bang* *de* *pingguo*.
Zhangsan in.total buy PFV two Cl_{bag} seven Cl_{pound} DE apple
i. 'Zhangsan bought two bags of seven-pound-packed apples in total.'
ii. Not: 'Zhangsan bought two bags of apples which are seven pounds in total.'

Fourth, while the *de* occurring in the attributive [Num Cl *de* N] is obligatory, that occurring in the quantifying [Num Cl *de* N] is optional, as given below:

(39) a. *qi* *bang* **(de)* *ying'er* *hen* *changjian*.
seven Cl_{pound} DE infant very common
'Seven pound infants are very common.'

b. *100* *du* **(de)* *shui* *tai* *tang* *le*.
100 Cl_{degree} DE water too hot SFP
'100 degree water is too hot.'

(40) a. *Zhangsan* *yigong* *mai* *le* *qi* *bang* *(de)* *pingguo*.
Zhangsan in.total buy PFV seven Cl_{pound} DE apple
'Zhangsan bought seven pounds of apples in total.'

b. *Zhangsan* *yigong* *he* *le* *yi* *sheng* *(de)* *niunai*.
Zhangsan in.total drink PFV one Cl_{liter} DE milk
'Zhangsan drank a liter of milk in total.'

Focusing on the quantifying [Num Cl *de* N], various attempts have been made in previous studies to uncover the condition on the (non-)licensing of different subtypes of classifier to participate in forming [Num Cl *de* N]. As illustrated below, not all subtypes of nominal classifiers can be used to form the quantifying [Num Cl *de* N]:

(41) a. *yi sheng de niunai*
one Cl_{liter} DE milk
'one liters of milk'
b. *liang xiang de pingguo*
two Cl_{box} DE apple
'two boxes of apples'
c. **liang ge de xuesheng*
two Cl DE student
Intended: 'two students'
d. **yi qun de niao*
one Cl_{flock} DE bird
Intended: 'a flock of birds'
e. **liang duan de lu*
two $Cl_{section}$ DE road
Intended: 'two sections of road'

To deal with this issue, an influential dichotomy between count-classifier vs. mass-classifier (henceforth "massifier") dichotomy, was proposed by Cheng and Sybesma (1998): count classifiers express counting units corresponding to natural individualhood of the associated noun denotation, whereas massifiers create counting unit irrelevant to built-in individualhood of the associated noun denotation. In accordance with Cheng and Sybesma, massifiers can, whereas count classifiers cannot, be used to form the quantifying [Num Cl *de* N].

X. Li (2011, 2013) proposes a different classifier dichotomy to address this issue, namely, the [+Count] classifier vs. [+Measure] classifier distinction. This dichotomy is based on two features which pick two general semantic functions of classifiers, i.e. counting and measure. The [+Count] classifier maps kinds denoted by the associated noun onto sets of atomic instantiations, while the [+Measure] classifier serves to map kinds onto sets of instantiations with a certain quantity. X. Li claims that only [+Measure] classifiers can participate in forming the quantifying [Num Cl *de* N].

However, both the analyses by Cheng and Sybesma (1998) and X. Li (2011, 2013) are unable to explain why certain types of classifiers cannot form the quantifying [Num Cl *de* N], in particular group classifiers and partitive classifiers, as shown in (41d, e). Jin (2013, 2018) accounts for these facts by proposing that the key condition regulating whether a classifier is able to enter the quantifying [Num Cl *de* N] construction is about whether the classifier in question semantically encodes a standardized amount-related meaning. Such an amount-related meaning can be either (i) conventionally standardized, as in the case of the measure classifier, which represents a fixed gauge in length, thickness, volume, etc., or (ii) contextually standardized, as most commonly observed in the case of the container classifier, which is often used as a volume measure. Along this line, the above shown inability of group and partitive classifiers to form the quantifying [Num Cl *de* N] is explained in that the amount-related meaning conveyed by these two types of classifiers is normally vague and non-standardized. For example, there are no well-determined criteria for defining the precise amount expressed by the group classifier *qun* 'crowd' in *yi qun ren* 'a crowd of people' and

the partitive classifier *duan* 'section' in *liang duan lu* 'two sections of road', hence the failure of the two classifiers to satisfy the semantic condition on the licensing of [Num Cl *de* N] in (40d, e). In the same vein, the fact that normally the individual classifier cannot form the quantifying [Num Cl *de* N] is explained in that the individual classifier usually denotes a minimal, atomic unit for cardinal counting, which by itself does not encode any standardized amount-related meaning. Furthermore, Jin points out that as long as the context in which the classifier occurs involves some syntactic means to coerce a standardized amount-related meaning for the classifier, the classifier – even if it is a group/partitive/individual one – would also be permitted to enter the quantifying [Num Cl *de* N] (Jin 2018, sec. 2.3.2).

In view of the syntactic asymmetries exhibited by the attributive [Num Cl *de* N] and the quantifying [Num Cl *de* N], consensus has been reached among linguists that the two should be fundamentally distinguished at the syntactic level. However, the structure of quantifying [Num Cl *de* N] nominals is an issue of some debate. There are two main approaches in the literature. The first approach analyzes the *de* in the quantifying [Num Cl *de* N] as a modification marker which serves to mark the modification relationship between [Num-Cl] and the N (Tang 1993, Cheng and Sybesma 1998, Hsieh 2008, X. Li 2011). A main problem facing this line of analysis is that this would leave the observed asymmetries between the attributive and the quantifying [Num Cl *de* N] described above unexplained.

A different perspective is that the quantifying [Num Cl *de* N] is distinct from the modification construction (Jiang 2009, Tsai 2011, Y.-H. A. Li 2013, Jin 2013, 2016b, 2018). For example, Jiang (2009) proposes a relativization analysis for the attributive [Num Cl *de* N] and a phrasal movement analysis for the quantifying [Num Cl *de* N]. It is hypothesized that the attributive [Num Cl *de* N] is derived based on the small clause [N [Num Cl]] via relativizing the N, with the *de* here as the complementizer under C. Differently, the quantifying [Num Cl *de* N] results from predicate inversion in the sense of den Dikken (2006), with *de* being the LINKER head. See the illustration below:

(42) a. *100* *du* *de* *shui*
100 Cl_{degree} DE water
'100 degree water'
b. [$_{NP}$ [$_{CP}$ [$_{IP}$ t_i *100 du*] C(=*de*)][N' *shui*$_i$]] (Jiang 2009)

(43) a. *san* *bang* *de* *rou*
three Cl_{pound} DE meat
'three pounds of meat'
b. [$_{FP}$ *san bang*$_i$ [$_{F'}$ F [$_{FP}$ t_i [$_{F'}$ LINKER(=*de*) [$_{IP}$ *rou* t_i]]]]] (Jiang 2009)

Another perspective is Tsai (2011), who argues that the attributive [Num Cl *de* N] is a Modifier Phrase, with *de* as the head, [Num Cl] as the specifier, and the N as the complement; while the quantifying [Num Cl *de* N] underlyingly correlates with a NP projection, with [Num Cl] occupying [Spec, NP] and the *de* being a clitic optionally attached to [Num Cl], as visualized below, respectively:

(44) a. *100* *du* *de* *shui*
100 Cl_{degree} DE water
'100 degree water'
b. [$_{ModP}$ *100 du* [$_{Mod'}$ Mod(=*de*)[$_{NP}$ *shui*]]] (Tsai 2011)

(45) a. *san bang* *de* *rou*
three Cl_{pound} DE meat

'three pounds of meat'
b. [$_{NP}$ [*san bang*]-*de* [$_{N'}$ *rou*]] (Tsai 2011)

Jin (2013, 2016b, 2018) treats the attributive [Num Cl *de* N] as a modification construction, analyzing *de* here as a modifier marker. Different from previous studies, Jin assumes the quantifying [Num Cl *de* N] to correlate with a DP-internal Focus Phrase (FocP) in the sense of Aboh (2004), Corver and van Koppen (2009), Giusti (1996), and Ntelitheos (2004), based on the observation that the occurrence of *de* is always associated with a (contrastive) focus on [Num Cl], as also observed by Y.-H. A. Li (2013, 2014). As a premise, it is assumed that the classifier that encodes a standardized amount-related meaning does not syntactically take a complement, for which the corresponding [Num Cl N] underlyingly correlates with a MonP (semantically corresponding to the monotonic measurement) and the [Num Cl] contained form a constituent (i.e., ClP) occupying [Spec, MonP]; whereas the classifier which does not encode a standardized amount-related meaning underlyingly takes an NP complement, as illustrated below (Jin 2013, 2018):

(46) a. [$_{MonP}$[$_{ClP}$ *san* [$_{Cl'}$ *bang*]] [$_{Mon'}$ Mon [$_{NP}$ *rou*]]]
three Cl_{pound} meat
'three pounds of meat'
b. [$_{ClP}$ *san* [$_{Cl'}$ *ge* [$_{NP}$ *ren*]]]
three Cl person
'three persons' (Jin 2013, 2018)

Then, to capture the contrastive focus reading of [Num Cl] in the quantifying [Num Cl *de* N], it is hypothesized that in this case the [Num Cl] originated in [Spec, MonP] moves [Spec, FocP] to check the [+Foc] feature, a process that could be (optionally) accompanied by the P(rosodically motivated)-insertion of *de* between the focalized [Num Cl] and the N, a line of analysis inspired by Y.-H. A. Li's (2013) treatment for *e* in the Taiwanese quantifying [Num Cl *de* N]. The use of *de* here is for the purpose of linearly separating the focused [Num Cl] and the N, whereby a case of word-order vacuous movement of [Num Cl] can be prevented and a more efficient mode of communication can be obtained.

(47) a. Focus-driven movement of [Num Cl]
[$_{FocP}$ [$_{ClP}$ *san*[$_{Cl'}$ *bang*]]$_i$ [$_{Foc'}$ Foc [$_{MonP}$ t_i [$_{Mon'}$ Mon [$_{NP}$ *rou*]]]]]
b. P-insertion of *de*
san bang rou → *san bang de rou*

In all, a shared conclusion of the above work is that different structures are needed to account for the different uses of *de* with classifiers. This conclusion anticipates the more general idea that [Num Cl] can either form a constituent to the exclusion of the noun or take the noun as its complement, which we will argue is correct in section 4.3 below.

2.5 Adjective modification of classifier phrases: [Num Adj Cl NP]

In Mandarin Chinese, the classifier can be modified by an adjective, yielding the [Num Adj Cl] construction (Chao 1968; Paris 1981; Lu 1987; Cheng and Sybesma 1998, 1999; Tang 1990, 2005; Hsieh 2008; X. Li 2011, 2013; Liao 2015; Jin 2016a; Luo et al. 2017):

(48) a. *yi xiao xiang pingguo*
one small Cl_{box} apple
'a small box of apples'
b. *yi da shu hua*
one big Cl_{bunch} flower
'a big bunch of flowers'
c. *yi bao pian jirou*
one thin Cl_{jian} chicken
'a thin piece of chicken'
d. *yi zheng ping jiu*
one whole Cl_{bottle} wine
'a whole bottle of wine'

The ability of different classifiers to be modified by adjectives has been taken as a test for distinguishing the so-called count classifiers and massifiers (Cheng and Sybesma 1998). It had been considered that massifiers, but not count classifiers, can be modified by adjectives:

(49) a. **yi da ge pingguo*
one big Cl apple
b.* *yi da wei laoshi*
one big Cl teacher (Cheng and Sybesma 1998: 390)

However, many later studies have pointed out that compatibility with preceding adjectives is not a reliable test for distinguishing count classifiers and massifiers (Tang 2005; Hsieh 2008; X. Li 2011, 2013; Y.-H. A. Li 2015; Liao 2015; Jin 2016a; Luo et al. 2017), as it is possible for count classifiers to be modified by an adjective:

(50) a. *liang da tiao yu*
two big Cl fish
'two big fishes'
b. *yi da gen cong*
one big Cl scallion
'a big scallion'
c. *yi xiao zhang dipian*
one small Cl negative
'a small negative'
d. *yi zheng ge pingguo*
one whole Cl apple
'a whole apple'

An important property of the [Num-Adj-Cl-N] construction is the inability of the Adj to be modified by degree modifiers such as *hen* 'very.'

(51) No degree modification of Adj before classifiers
a. * *san hen da zhi langgou*
three very big Cl hound
b. **san hen da tiao yu*
three very big Cl fish (Luo et al. 2017: 8)

This fact is somewhat surprising from the perspective of pre-nominal adjectives more generally of Mandarin, which typically allow degree modifiers, and indicates that such constructions are not normal instances of adjectival modification.

Recent research on [Num Adj Cl N] has also focused on the pragmatic characteristics of this construction, with several authors observing that pre-classifier adjectives reflect a speaker-oriented, subjective evaluation concerning the unit of entities/substances in a particular context (X. Li 2011, 2013; Jin 2013, 2016a, 2018; Luo et al. 2017). Consider the following examples:

(52) *The stewardess in the airplane handed each passenger a bowl of rice:*

a. *na ge san sui de xiaohai gangcai chi le yi da wan fan.*
that Cl three year DE kid just.now eat PFV one big Cl_{bowl} rice
'That three-year old kid ate a big bowl of rice.'

b. *na ge lanqiu yundongyuan zhi chi le yi xiao wan fan.*
that Cl basketball player only eat PFV one small Cl_{bowl} rice
'That basketball player only ate a small bowl of rice.'

(X. Li 2011: 161)

As shown above, although the bowls of rice served on the airplane should be of the same size, it is completely felicitous to modify the classifier *wan* 'bowl' by *xiao* 'small' in (52b) and by *da* 'big' in (52a). This is because the pre-classifier *xiao* and *da*, rather than being intended as describing objective properties of the bowls of rice taken by the kid and the basketball player respectively, function to provide an evaluation made relative to the consumption ability of the kid and the basketball player in the given context.

That the evaluation expressed by [Num Adj Cl N] is speaker-oriented is clearly illustrated by the following example:

(53) *wo mingming chi le yi da tiao huanggua,*
I clearly eat PFV one big Cl cucumber
ta que shuo wo chi de bu gou da.
s/he but say I eat DE not enough big
'I did eat a big cucumber; however, s/he said that what I ate was not big enough.'

(Luo et al. 2017: 9)

The above example shows that the cucumber under discussion is not necessarily viewed as big by all the interlocutors in the given context. This indicates that the evaluation associated with the pre-classifier adjective *da* 'big' is made relative to the standard contextually held by the speaker.

While general agreement has been reached among scholars with respect to the interpretive characteristics of [Num Adj Cl N], there have been several different syntactic proposals about the structure of such structures without much agreement. For example, Tang (1990) assumes that the pre-classifier adjective and the classifier form a compound classifier, forming a complex head along with the numeral. On the other hand, Hsieh (2008) treats the adjective in such structures as a phrasal adjunct to the projection of the classifier, while X. Li (2011) places the adjective in the specifier of ClP.

A couple of recent analyses propose that the speaker-oriented properties of [Num Adj Cl N] constructions can be accounted for in the syntax. For example, Jin (2013, 2018)

hypothesizes a DP-internal EvalP (Doetjes and Rooryck 2003) for [Num Adj Cl N]. She assumes with Tang (1990) that the adjective forms a compound with the classifier, accounting for its inability to be modified by degree modifiers, and further places the numeral in the specifier of this complex head. Jin then places this ClP in specifier of EvalP, with the NP as the complement.

(54) [$_{EvalP}$ [$_{ClP}$ *yi* [$_{Cl'}$ *da-tiao*]][$_{Eval'}$ Eval [$_{NP}$ *yu*]]] (Jin 2013, 2018)
one big-Cl fish

On the other hand, Luo et al. (2016) propose that the pre-classifier adjective heads a DegP, with [Num Adj Cl N] being taken as correlating with either a DP or a QP, as illustrated below:

(55) [$_{DP/QP}$ *yi* [$_{DegP}$ [$_{Deg}$ *da*] [$_{ClP}$ *tiao yu*]]] (Luo et al. 2017: 5)
one big Cl fish

Luo et al. associate the adjective with a Deg head so that it can introduce a measure function which "maps individuals to degree values along a certain dimension, which is subject to the evaluation of a speaker or any other judge in a particular context" (Luo et al. 2016: 5), capturing the speaker-oriented properties of this construction. They also suggest that this analysis captures the restriction on degree modification in (51) as the adjective itself is serving as a degree head.

To end this section, while there has been much discussion in the literature concerning the semantic properties of pre-classifier adjectives and the semantic relationship between pre-classifier adjectives and classifiers, formal investigations into the syntax of [Num Adj Cl N] are still comparatively few, with little consensus having been reached among linguists regarding the syntactic nature of the pre-classifier adjective, be it a head, adjunct, or specifier.

2.6 Phrases containing reduplicated classifiers [Cl Cl] and [Cl Cl NP]

To end the overview of syntactic phenomena involving classifier phrases, we discuss reduplicated classifiers. Classifiers in Mandarin can be reduplicated to refer to every member of a class (e.g. Chao 1968: 77; Li and Thompson 1981: 34; Song 1981; Guo 1999); the phrases containing reduplicated classifiers need to appear in a 'fronted position' (*qianzhi wei zhi*), i.e. pre-verbal position (c.f. Chao 1968: 77):

(56) a. *shuang shuang xie dou chuan-po le*
Cl$_{pair}$ Cl$_{pair}$ shoe dou wear-broken SFP
'Every pair of shoes has been worn through'
b. **ta dong jian jian shiqing*.
he understand Cl Cl thing
Intended: 'He understands everything.' (Chao 1968: 77-78)

In addition to expressing universal quantification, reduplication of classifiers can express plurality and usually occur with *yi* 'one' (e.g. Song 1981; Guo 1999; H. Yang 2005: 63; Hsieh 2008: 66; Zhang 2013: 116):

(57) a. *jintian zaoshang wo kandao ta ba yi zhang zhang zhi fangdao*
today morning I see s/he BA one Cl Cl paper put
shubao li.
school-bag in
'This morning I saw him/her put the (individual) pieces of paper into his/her school bag.' (H. Yang 2005: 63)

b. *yi ge ge haizi tizhi shubao shangxue qu.*
one Cl Cl child carry school-bag go-to-school go
'The children carry school bags to school.' (H. Yang 2005: 82)

c. *he-li piao-zhe (yi) duo-duo lianhua.*
river-in float-DUR one Cl-Cl lotus
'There are many lotuses floating on the river.' (Zhang 2013: 116)

The [*yi* Cl Cl N] phrase can appear in both subject and object positions, as seen in (57). Without reduplication of classifiers, [*yi* Cl N] only express singularity.

Crucially, reduplication of classifiers only allows the numeral *yi* 'one' and rejects any other numerals (H. Yang 2005: 81; Hsieh 2008: 56; Zhang 2013: 285):

(58) **san zhang zhang zhi*
three Cl Cl paper (H. Yang 2005: 81)

This restriction to *yi* modification for indefinites holds more generally in Mandarin (e.g. Zhang 2019), such as for the 'temporary classifiers' introduced earlier in section 1.2, as well as for minimizers or NPIs (Chen 2015). The most relevant parallel is the plural marker *xie*, arguably a plural classifier, which can only be modified by *yi* as well. Jiang (2012: sec. 4.2) and Wu (2019) proposes that *xie* is a kind of classifier, a partitive classifier for Jiang and a plural classifier for Wu. Both proposals account for the inability of *xie* to occur with numerals other than *yi* 'one' based on the plural semantics of *xie*. A natural line of explanation for the restriction in (58) would follow similar lines, though details remain to be worked out.

To summarize, in this section we discussed the syntactic distribution of nominal classifiers in the noun phrase, and a number of syntactically notable constructions that they occur in, including bare classifier phrases, classifier phrases with N'-ellipsis, numeral classifier phrases with *de*, adjective modified classifier phrases, and phrases containing reduplicated classifiers.

Stepping back, we can see that the characterization of numeral classifiers as elements whose distribution is fundamentally linked to the distribution of numerals is a bit simplistic: classifiers need not occur with numerals, and often do not, such as when they occur with demonstratives, quantifiers, or are reduplicated. At the same time, no clear picture of their syntactic status emerges from these observations. While some evidence indicates they form a constituent with numerals to the exclusion of the noun, such as the ability of *de* to intervene between the classifier and the noun, other evidence indicates they are functional projections of the noun, such as their ability to license N'-ellipsis. In the following section, we provide some semantic context for this discussion, focusing on different functions which have been proposed for classifiers which might explain why they occur in the first place. We then return to the question of the syntactic constituency of classifier phrases in section 4 and lay out the evidence for a split analysis of numeral classifiers.

3. The semantic function of classifiers

Parallel to the question about the syntactic status of classifiers is the question of their semantic function. Incorporating a clear understanding of the different proposals for classifier semantics is important to understanding the viability of the different syntactic proposals discussed in the following section. In either case, the analysis of classifiers, particularly individual or sortal classifiers, has taken it as given that there is some difference between languages like Mandarin that requires classifiers with numerals and languages like English which do not. The debate centers around where this difference is located.

There are two camps. The first camp holds that classifiers occur with numerals in Mandarin because of the semantic requirements of nouns: Mandarin classifiers convert the numer-neutral denotations of nouns to a denotation which is suitable for counting. The second camp holds that clasifiers supply Mandarin numerals with measure functions, enabling the numeral to serve as a counter of some kind. This section provides a non-technical overview of the two views, with a few formalisms, and describes some of the data which seems to favor one side or the other, coming down in favor of the first camp. This conclusion will dovetail with the syntactic considerations in the following section.

3.1 Theory 1: Classifiers as number marking for nouns

Mandarin lacks obligatory number marking, that is, obligatory singular-plural inflection on nouns, and this is seen as crucially connected to the presence of numeral calssifiers in the first view. The conneciton between optional plural marking on one hand and classiifers on the other has been dubbed the Sanchez-Greenberg-Slobin Generalization by Doetjes (2012), summarized below (Greenberg 1972, Sanchez and Sobin 1973):

(59) *The Sanchez-Greenberg-Slobin Generalization*
"If a language includes in its basic mode of forming quantitative expressions numeral classifiers, then […] it will not have obligatory marking of the plural on nouns." (Greenberg 1972: 286)

We will discuss potential counterexamples to this generalization in section 4.1. However, this generalization applies to Mandarin: nouns in Mandarin are morphologically unspecified for singular and plural. The one plural affix in the language, the suffix *-men,* discussed in Section 2.1, is restricted to human nouns and often contributes a definite interpretation in isolation (e.g. Iljic 1994, Y.-H. A. Li 1999, Jiang 2017).

The counterpart of optional number marking is that bare nouns themselves are unspecified for number; they have what Corbett (2000) calls 'general number.' This is conclusively illustrated in Rullman and You 2006, who show that an antecedent bare noun an elided noun anaphoric to the antecedent in Mandarin do not need to have the same number interpretation: one can be singular and the other plural, or vice versa.

(60) *wo you tie fanwan. Yuehan ye you <e>.*
I have iron bowl. John also have
'I have one or more iron bowls. So does John.' or
'I have one or more steady jobs. So does John.' (Rullman and You 2006, ex. 18a)

The ability of antecedent and ellided noun to differ in their number interpretation rules out an analysis where Mandarin nouns are ambiguous between a singular and plural interpretation in Mandarin, for example, via a null affix, and shows instead that nouns include both individuals and pluralities in their denotation. This argument is strengthened by the observation that idiomatic interpretations of the same noun, a genuine case of lexical ambiguity, cannot differ between antecedent and ellipsis site.

The number-neutrality of nouns in Mandarin is fundamental to the proposals of Chierchia (1998, 2010) and Doetjes (1996, 2012), who focus on the complementarity of number morphology and numeral classifiers across languages. Chierchia identifies the number-neutral denotation of nouns in Mandarin with Carlsonian kinds (Carlson 1977), a denotation that he notes is ill-suited for counting. Numerals, under this view, are assumed to be universal across languages in requiring that the element they are they are counting are of a uniform type, typically individual instances of the noun but also groups or measures of a specified size or unit. Chierchia proposes that the numeral classifiers are functions from kinds to atomic predicates, of type <e,<e,t>, an idea that has been fleshed on in much later work (Ionin and Matushansky 2006, Dayal 2012: 211, X. Li 2013: 169). A slight variant of this analysis has classifiers taking an additional semantic argument, a numeral (Jenks 2011:81, Jiang 2012: 140). In general, an analysis which does not require classifiers to take a numeral on all occurrences has the benefit of not requiring a morphologically null 'one' every time a numeral is not overt, as in the contexts discussed in Section 2.2.

One piece of support for this approach to classifiers is the observation by Cheng and Sybesma (1999) that individual classifiers are restricted to count nouns, and hence numeral classifiers themselves provide evidence for the count-mass distinction in Mandarin Chinese. This observation sharpens the parallel between numeral classifiers and plural marking, which is often restricted to count nouns in languages with obligatory plural marking (Doetjes 2012).

Following this line of reasoning, Borer (2005) and Nomoto (2013) argue that numeral classifiers occupy the same functional projection above is often expressed by plural classifiers, a fucntion that was illustrated earlier for classifier reduplication, as well as, under some analyses, as an analysis of plural classifier *xie* (Wu 2019). Under this view, sortal numeral classifiers are markers, and Mandarin is a language like Turkish which requires singular in the presence of numerals (see also Cheng et al. 2012 for discussion). For Nomoto, numeral classifier languages make a three-way distinction between general number, plural, and singular, though plural and singular sometimes require a higher licensing head. While Nomoto takes bare nouns to be predicates rather than kinds, classifiers are interpreted as semantic functions from number neutral nouns to either singular or plural denotations, and, so, under his view, classifiers are nevertheless "for nouns."

3.2 Theory 2: Classifiers as measure functions for numerals

A different view of numeral classifiers is that they are "for numerals," supplying them with measure functions for counting nouns. The idea is that in languages like English, which do not require numeral classifiers, numerals have their measure functions built into their semantics, but numerals are split from their associated measure functions in numeral classifier languages, where numeral classifiers serve the role of measure functions. This view was first articulated by Krifka (1995), and fleshed out in more detail by Yang (2001). While Krifka and Yang do assume kind-level denotations for bare nouns in Mandarin, they do not see classifiers as simple functions on this denotation but rather as two-place functions from kinds and numerals to a predicate of quantity. Under this view, numerals in English and

similar languages have a built-in measure function which allows them to combine directly with nouns. In contrast, numerals in Mandarin have an additional argument which specifies the unit-type by which the numeral will count the noun. The choice of classifier, then, whether a measure word like `pound' or a group classifier like 'herd', will pick out the type of units that the numeral will measure. The composed numeral-classifier unit then combines with the noun.

While it has generally been the minority view, Krifka's analysis of numeral classifiers finds support from Bale and Coon (2014), who observe that there are putative numeral classifier languages where classifiers are only required with certain numerals but not others, providing examples are Chol (Mayan) and Mi'gmaq (Algonquian). A natural explanation of this observation is available in the classifiers-for-numerals analysis: whichever numerals require numeral lack their measure function while those that occur without numeral classifiers have their measure function built-in. Bale and Coon suggest that numeral-sensitivity of classifiers in these languages provide evidence that Krifka's analysis is on the right track, although they do not adopt the kind-based view of nouns advocated by Krifka and Chierchia, showing that such an assumption is not necessary when the classifiers-for-numerals view is adopted. However, we have already seen that bare nouns in classifier langauges can be analyzed as predicates even in the classifiers-for-nouns view, as in the analysis of Nomoto (2013).

Another recent proposal which advocates an analysis reminiscent of Krifka's is Sudo (2016), which focuses on Japanese. The set-up for Sudo's argument is the claim that the semantic function of classifiers is to convert numerals, which for Sudo are not measure functions but rather entities of a restricted semantic type, and convert them into predicates which can combine with nouns like other modifiers. It is worth noting that this proposal is admittedly appealing for Japanese, where [Num Cl] sequences are marked like modifiers, but less so for Mandarin, where we have already seen that *de*-modification marking on [Num Cl] sequences is quite restricted (Section 2.5). Additionally, classifiers much more freely occur without numerals in Mandarin than in Japanese, where, for example, they are not licensed by demonstratives. Sudo's argument for his approach to Japanese classifiers comes from the observation that numerals in predicate positions in Japanese require a classifier. This observation follows from the proposal that classifiers convert numerals into predicates which can combine with nouns. It remains to be seen whether similar arguments can be constructed on the basis on Mandarin examples, or if Mandarin and Japanese numeral classifiers are fundamentally different in this regard.

3.3 Discussion

The classifiers-for-nouns versus the classifiers-for-numerals view of numeral classifiers entails different assumptions about the syntactic constituency of numeral classifiers: the classifiers-for-nouns view requires that numeral classifiers always be composed with nouns before numerals, while the classifiers-for-numerals requires the opposite. So it is relevant that most syntactic work on Mandarin numeral classifiers since the influential papers by Cheng & Sybesma (1999) and Y.-H. A. Li (1999) has adopted the idea that individual numeral classifiers take nouns as their complement, including the comprehensive studies of Jiang (2012), X. Li (2013), and Zhang (2015). Most of this literature adopts the view, as we will see in the following section, that measure-type constructions can involve structures where the numerals can form constituents with the noun. But individual numeral classifiers, the focus of the semantic literature above, are almost always assumed to form a constituent with the noun.

So the classifiers-for-numerals analysis remains the minority view. Considering the two proposals side by side for Mandarin, and restricting our focus to individual classifiers, there is strong evidence for the classifiers-for-nouns view.

The first and simplest observation in suppis that Mandarin Chinese does not have the kind of numeral sensitivity that Bale and Coon observe for Chol and Mi'gmaq; individual classifiers are required with all numerals in Mandarin. The closest parallel to numeral sensitivity is the observation that some numerals use for sequential counting, are distinct from the numerals used for classifiers, so while children learn to count *yi-er-san* 'one-two-three', 'two dogs' is rendered *liang zhi gou*, where *liang* is a version of 'two' that appears in noun phrases. However, any number of analysis of this fact are consistent with the clasisifers-for-nouns view, including simple contextual allomorphy: *liang* is the morphological variant of 'two' which is used in a syntactic context adjacent to a classifier. Support for the idea that the choice of 'two' is relatively superficial is provided by Zhang (2013:24, fn. 12), who observes that *er* is used with individual classifiers in many dialects, and that *er* is possible with some 'standard measures.' Such random variation supports the idea that what is conditioning the choice of numeral may simply a list of morphological or syntatic contexts.

Second, while numeral classifiers in Mandarin do not show numeral sensitivity, they do show noun sensitivity, a point which is not acknowledged by Bale and Coon. In particular, the fact that individual classifiers cannot occur with mass nouns shows that classifiers are sensitive to the atomic structure of the noun they compose with. Such sensitivity is unsurprising if classifiers are functions on noun denotations, such as in any analysis assuming that classifiers are the typological counterpart of number marking in isolating languages. However, it is unclear how to account for this dependence if numeral classifiers are obligatory arguments of numerals.

Third, the fact that numeral classifiers in Mandarin do not need to occur with numerals might supplies general support of the classifiers-for-nouns view, as the classifiers-for-numerals view predicts that classifiers exist solely to supply numerals with a measure function. As we saw in Section 2.2, classifiers occur without numerals in a number of environments in. For example, demonstratives and quantifiers can combine with numeral classifiers in the absence of a numeral (as in (29) and (30)). These observations follow without further stipulation if classifiers are for nouns: classifier-noun sequences are regular singular count predicates which can combine with numerals or other determiners, as in the analysis of X. Li (2013), for example.

The final observation based solely on Mandarin is that numeral classifiers serve an anaphoric function similar to English *one* in the ellipsis contexts described in Section 2.3. While there are some Mandarin-internal confounds for ellipsis as a diagnostic for the status of classifiers as heads, reviewed in the following section, the ability of classifiers to serve an essentially anaphoric function is unsurprising if they are part of the extended projection of the noun, with their complement elided, but is somewhat more surprising if the function of classifiers is simply to supply numerals with a measure function.

These are just the arguments against the classifiers-for-numerals analysis for Mandarin. When we look beyond Mandarin, it is even clearer that classifiers in many languages are far more integrated into a system marking definiteness and number than they are Mandarin, as we discuss further in the following section, and certain types of classifiers, for example, plural classifiers in Weining Ahmao (Gerner and Bisang 2010), never occur with numerals at all, although they are in a paradigmatic altnernation with singular classifiers which do. There is no clear sense in which the plural classifier in Weining Ahmao could be said to be providing a measure function for numerals; however, the plural classifier could

easily be analyzed a function on the noun producting a plural predicate, again, as in the analysis of *xie* by Wu (2019) or the analysis of Bangla plural classifiers in Dayal (2014).

Even in plural-marking languages like English, nouns such as *furniture* and *jewelry*, dubbed fake mass nouns by Chierchia 2010, pattern like Mandarin nouns in requiring a numeral classifier *piece* in the context of numerals (*three pieces of furniture*) and demonstratives (*this piece of furniture*). Fake mass nouns have general number as they can be used to refer to a single piece of furniture or multiple pieces of furniture, and they do not require an article in argument positions to achieve generic interpretations. In other words, fake mass nouns in English behave semantically just like common nouns in classifier languages like Mandarin, where the classifier (*piece*) seems to occur for the sole purpose of hosting number morphology. The existence of fake mass nouns in English cannot be explained by the classifiers-for-numerals view: English numerals always must come supplied with their measure function intact, so the choice of noun should be irrelevant for whether classifiers are necessary with numerals. On the other hand, the existence of such nouns in English follows naturally from the classifiers-for-nouns perspective, where it is precisely the semantic deficiency of fake mass nouns which results in their requiring a classifier. Note that the problem for the classifier-for-numerals view is not so much the observation that there are fake mass nouns in English, it is rather the observation that something like a numeral classifier would ever occur with English numerals, since English numerals are supposed to have their measure function built in.

Bale and Coon (2014) anticipate this argument and suggest that words like *piece* in English are not true classifiers, observing that *piece* "shares the same distribution with regular nouns and take nominal morphology such as plural marking." They furthermore point to the presence of pseudopartitive *of* as a potential problem. However, if *of* is semantically vacuous (Matthewson 2001), hence present for purely syntactic reasons such as Case, its presence is semantically irrelevant. Furthermore, English lacks the category Clf (or this is simply Num, which cannot be realized independent of a noun), so an auxiliary N must be used to express number for nouns which lack built in plural structure (Chierchia 2010). The fact that English classifiers like *piece* mark plurality is expected, particularly if classifiers and number marking occupy the same functional projection, as proposed by Borer (2005). Finally, these syntactic observations, while interesting, do not entail any particular conclusion about the semantics of English classifiers; the fact remains that fake mass nouns like *furniture* contain natural atoms in their extension that cannot be accessed without a nominal auxiliary like *piece*, which enables reference to and quantification over individual atoms, but otherwise lacks any lexical content of its own. This is precisely the function of individual classifiers in Mandarin. So the argument stands.

The conclusion from this discussion is that, while the the full range of variation in numeral classifiers structures across languages is still poorly understood, it is likely that there are a range of distinct syntactic elements which have been labeled "numeral classifiers" in different languages. While classifiers may be 'for numerals' in Mi'gmaq and Chol, they are clearly 'for nouns' in Mandarin.

4. Syntactic Constituency of classifier phrases

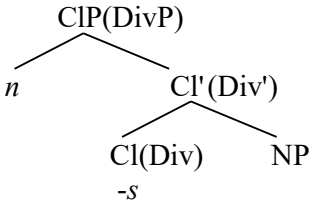
This section addresses the structure of numeral classifier phrases [Num Cl NP], with a focus on their syntactic constituency, one of the most contentious issues in the study of the syntax of classifier phrases. Syntactically, classifiers have been treated as heads of their own projection (e.g. Tang 1990a, b, 2005; Cheng and Sybesma 1998, 1999; Li 1999; Borer 2005).

However, whether classifiers should form a constituent with nouns or with numerals has been the topic of extensive debate. Three analyses have been proposed. The first analysis treats classifiers and nouns as a constituent, i.e. [Num [Cl N]] (e.g. Tang 1990b; Doetjes 1996; Chierchia 1998; Cheng and Sybesma 1998, 1999; Li 1999; Borer 2005, among others). The second analysis treats classifiers and numerals as a constituent, i.e. [[Num Cl] N] (e.g. Li and Thompson 1981: 105; Tang 1990a; Krifka 1995; Yang 2001: 64; Hsieh 2008; Her 2012). Different from the above authors, a number of authors propose a non-uniform analysis, in which both [Num [Cl N]] and [[Num Cl] N] are possible structures (X. Li 2011, 2013; Jiang 2012, 2017; Jin 2013, 2018; Zhang 2013). We will discuss these three analyses in turn, and show that the evidence clearly favors the final view, adopted in most recent work.

4.1 Analysis 1: classifiers and nouns form a constituent [Num [Cl N]]

As we saw in the previous section, a clear connection exists between numeral classifiers and countability, as individual classifiers are restricted to count nouns (Greenberg 1972; Sanches and Slobin 1973; T'sou 1976; Doetjes 1996, 2012; Chierchia 1998, 2010; Cheng and Sybesma 1999; Borer 2005, among others). Not only are the use of number morphology and that of classifiers largely in complementary distribution ((59), Sanches and Slobin 1973: 4; T'sou 1976: 1216), but their semantic roles can be analyzed in parallel, i.e. classifiers and the number morphology both signal the presence of minimal parts and that 'numerals need the presence of a syntactic marker of countability which can be either individual classifiers or number morphology' (Doetjes 1996: 35). Based on either their complementary distribution or their parallel role, a number of authors identify classifiers with number morphology and propose that they should appear in same position in the structure, which is taken to be the head of NumP, DivP, or ClP by different authors. While nouns in number-marking languages morphologically combine with the higher Num/Div/Cl head, for example by head movement (e.g. Ritter 1991 for Hebrew and English), an isolating language like Mandarin spells out these two functional projections as two separate heads (Doetjes 1996; Chierchia 1998; Cheng and Sybesma 1999; Borer 2005, among others). Although the details of their analyses of the internal structure of numeral classifier phrases may differ, these authors seem to agree on a structure roughly like the one below.

(61)



In (61), the number morphology and the classifier appear in the same position, i.e. the head of the Classifier Phrase Cl or the head of the Division Phrase Div; the Cl head merges with an NP, forming a larger phrase (i.e. Cl' or Div') and further merging with a numeral *n*. As was mentioned above, a similar structure has been adopted for individual classifiers specifically by the majority of work on this topic (Tang 1990b, 2005, Cheng and Sybesma 1999, Li 1999, Jiang 2012, X. Li 2013, Zhang 2013).

Nevertheless, it is important to note such complementary distribution is not perfect; counterexamples in which classifiers and number morphology co-occur have been observed in a number of languages, such as Armenian (Gebhardt 2009: 258); Ejagham (Aikhenvald

2000), Halkomelem (Wiltschko 2008); Mayan (Allan 1977; Zaavala 2000), Vietnamese (Goral 1979), Dutch and German (De Belder 2008, 2011; Ott 2011), and even with English classifiers like *piece* as we saw in the previous section. Additionally, the fact that the plural element *-men* can co-occur with group classifiers (19i) as well as with individual classifiers (19ii) (c.f. Section 2.1) adds Mandarin to the list of the languages above. In addition to the co-occurrence of classifiers and number morphology, some languages have one more type of plurals in the addition to the regular plural morphology, and allow the occurrence of double plurals, such as Breton (Acquaviva 2008: 260) and Amharic (Kramer 2009, 2010, 2016). To account for the co-occurrence of classifiers and number morphology or the co-occurrence of double plurals in these cases, two main approaches have been proposed. One approach rejects the connection between classifiers and number morphology and assumes one projection dedicated to number morphology and another one dedicated to classifiers (e.g. Gebhardt 2009; Zhang 2013). Alternatively, many authors still maintain such a connection between classifiers and number morphology and propose either a split analysis of plurality (e.g. Wiltschko 2008; Dékány 2011; Butler 2012; Mathieu 2012, 2013, 2014; Mathieu and Zareikar 2015; Kramer 2009, 2010, 2016; Jiang 2017) or a split analysis of classifiers (e.g. Svenonius 2008; Ott 2008).

Although the supporters of the two approaches disagree on whether classifiers and plural morphology are in complementary distribution, they agree on the analysis that the classifier and the noun form a constituent, which further merges with the numeral *n*:

(62) $[_{\text{ClP}}\ n\ [_{\text{Cl}'}\ \text{Cl NP}]]$

Additionally, the discussion in the previous section regarding Chol and Mi'gmaq raises the possibility that some cases of numeral classifiers are 'for numerals', and hence are not related to number marking at all. Indeed, both Chol and Mi'gmaq allow plural marking on nouns to co-occur with numeral classifiers; in the case of Mi'gmaq, plural marking is obligatory.

Turning back to Mandarin, The analysis in (62) also receives support from other varieties of Chinese besides Mandarin. As we saw in section 2.2, numeral-less classifier phrases [Cl N] cannot freely occur in argument positions in Mandarin (c.f. (20)); however, they can freely appear in argument positions in other dialects of Chinese, such as Cantonese and Wu, where they are typically associated with definite interpretations, while bare nouns are typically indefinite (Cheng and Sybesma 1999, 2005, Wu and Bodomo 2009, X. Li 2013), as shown in (63). Such a fact also indicates that classifiers and nouns form a constituent.

(63) a. *<u>bzek gau</u> zungji sek juk.* (Cantonese)
Cl dog like eat meat
'The dog likes to eat meat.'
b. *Ngo zungji tong <u>zek gau</u> waan.*
I like with Cl dog play
'I like to play with the dog.' (Cheng and Sybesma 1999: 511)

The fact that classifiers are directly integrated into definiteness marking in many Chinese dialects can be accounted for either by directly associating classifiers with determiners (Cheng and Sybesma 1999, 2012) or by placing ClfP directly below a potentially null D head, which licenses the occurrence of a null Clf, possibly via head movement (Simpson 2005, Wu and Bodomo 2009).

Another argument for the structure in (62) in Mandarin are the differences in ellipsis licensing and topicalization between Mandarin and Japanese described in Section 2.3. These differences follow straightforwardly from the hypothesis that classifiers in Mandarin take NP complements, while in Japanese they form a constituent with the numeral. If heads license ellipsis of their complement, N'-ellipsis is correctly predicted to be possible in Mandarin but not in Japanese. Similarly, if topicalization targets syntactic constituents, topicalization of [Num Cl] is correctly predicted to be possible in Japanese but not in Mandarin.

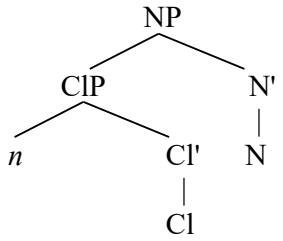
However, there is a confound for the argument based on ellipsis observed by several authors (Her 2012:1236-7, Zhang 2013: 177), namely the observation that phrasal modifiers can license ellipsis more generally in Mandarin, but not in Japanese. As such, even if [Num Cl] formed a constituent to the exclusion of a noun in Mandarin, this constituent would be expected to license ellipsis by virtue of its status as a phrasal modifier. The analysis of Saito et al. (2008) follows Simpson (2003), Cheng and Sybesma (2009), and others in assuming that *de* and classifiers are both functional heads of N in Mandarin, and hence both modifiers headed by *de* and classifiers can license ellipsis. Yet Saito et al. and Simpson's analysis of *de* is controversial, as many analyses of *de* treat is as a constituent with preceding modifiers (Aoun and Li 2003, Zhang 2013, S.-Z. Huang and Jenks 2014), and even modifiers without *de* are independently capable of licensing ellipsis (Her 2012:1237).

Another issue is that for Saito et al. (2008) it is something of a coincidence that both Cl and *de* are functional projections of N in Mandarin but not in Japanese, as the status of *de* and Cl as heads is logically independent (though see Cheng & Sybesma 2009). If there were a language in which classifiers were able to license ellipsis while phrasal modifiers could not, it would indicate that ellipsis licensing by classifiers is independent from ellipsis licensing by phrasal modifiers. In fact, Thai is such a language: Jenks (2011:90-92) demonstrates that numeral classifiers license N'-ellipsis in Thai while other phrasal modifiers of nouns do not (S.-Z. Huang and Jenks 2014), and Thai generally seems to behave like a language where numeral classifiers are heads, as in (62). This suggests that the ability of classifiers to license N'-ellipsis in a given language cannot be derived from the ability of modifiers to license ellipsis, and hence the ability of classifiers to license N'-ellipsis in a given language is due to the status of the classifier as a head. So even though phrasal modifiers in Mandarin independently license N'-ellipsis, the ability of classifiers to license ellipsis does lend circumstantial support that the structure in (62) is correct for Mandarin.

4.2 Analysis 2: classifiers and numerals form a constituent [[Num Cl] N]

While there is good evidence for (62), the earliest analyses of numeral classifiers in Mandarin analyze them as a constituent with the preceding numeral, and in fact the close link between numerals and classifiers is what gives numeral classifiers their name. For example, Li and Thompson 1981:105) refer to [Num Cl] sequences as 'classifier phrases,' Huang (1982) analyzes such sequences as QPs which occurs as an N'- adjunct or NP specifier, Greenberg (1990) observes that numerals and classifiers are "in direct construction" (p. 227). Other, more recent works assuming the constituency of numerals and classifiers include Tang (2000a), Yang (2001), Hsieh (2008), Her (2012), and He (2015, 2016). An example of this structure is provided below:

(64)



The structure above dovetails with the view advocated by Krifka (1995), discussed in Section 3.2, that numeral classifiers are "for numerals", the idea that they provide a measure function which enables numerals to combine with nouns. This perspective is based on the assumption that different types of classifiers in section 1.2 all occur in the same structure. As we will see, a central challenge facing this approach is explaining the distinct behaviors of different classifiers, as discussed most extensively in Zhang (2013: 157-172).

The simplest argument for [Num Cl] constituency in (64) is word order. In Mandarin and many other numeral classifier languages, [Num Cl] are almost always adjacent. Not only do numerals and classifiers tend to be adjacent across languages, but there is a strong tendency for numerals to precede classifiers, even in head-initial languages like Japanese (Jones 1970, Rijkhoff 1990).

One way of capturing the tight syntactic connection between numerals and classifiers is to analyze numerals and classifiers as a single head, with the classifier as a numeral suffix (e.g. Yang 2001). One issue for this analysis is the ability of adjectives to intervene between the numeral and classifier (Section 2.5), which indicates that more structure is present than a single head. Although scholars such as Tang (1990) have proposed that the Num-Adj-Cl sequence forms a single complex head in such cases, the fact that the numeral can be a complex phrasal category makes a complex head analysis implausible. More generally, Zhang (2013:172-174) demonstrates that surface adjacency between numerals and classifiers can correspond to a number of different syntactic structures and by itself does not constitute an argument for constituency.

The tendency for numerals to precede classifiers can also be explained without assuming they necessarily form a constituent. For example, if numerals are analyzed as the specifier of ClP as in (64) rather than as heads taking classifiers as complements, the typological tendency for numerals to precede classifiers follow from the near universality of specifier-head order rather than constituency (Jenks 2011: 170). Supporting evidence for this idea comes from He (2015), who presents detailed arguments that complex numerals are syntactic constituents in Mandarin Chinese, a point that would follow from the idea that they occupy a specifier position. Additionally, there are exceptions to the strong tendency for numerals to precede classifiers across languages, notably Jingpho, which has the order Noun-Classifier-Numeral (Bisang 1999: 145). As such, the cross-linguistic order of numerals and classifiers do not really constitute an argument for the idea that [Num Cl] form a constituent.

A novel argument for the uniform constituency of [Num Cl] in all classifier constructions is presented by Her (2012), who observes that individual classifiers and measure and container classifiers pattern alike with respect to a number of syntactic patterns. The similarities are as follows: the two types of classifiers cannot co-occur, both license NP ellipsis, both can be elided along with an NP when preceded by a high round number (a multiplicand), both allow *de* in some contexts (though see Section 2.4), both allow optional *yi* 'one', both are transparent to semantic selection by verbs, and both can be followed by *ban* 'half' and *duo* 'more.' In light of these similarities, Her argues that a unified analysis is

favored, particularly one where [Num Cl] form a constituent, and that mixed analyses cannot account for the many similarities between measure and classifier constructions.

However, Her's criticism only applies to split analyses which assume that there are structural difference among classifiers depending on classifier type. As such, split analyses such as those of X. Li (2011, 2013) and Jiang (2009, 2017), which allow both measures and classifiers to occur in both structures, modulo semantic details, can accommodate the structural parallels that Her observes. On the other hand, there is important positive evidence that structural splits are real. For example, data like (41) illustrate that not all types of classifiers can occur with *de*, challenging Her's claim that the structure of measure classifiers and individual classifiers are parallel. Additional detailed responses to Her (2012)'s arguments are contained in Zhang (2013:172-186), including discussions of the distribution of *ban* and *duo*, whose distribution is complex with nuanced differences in interpretation.

Another recent argument for the constituency of [Num Cl] in all numeral classifier constructions is made by He (2016). Like Her (2012), some of He's positive arguments focus on the observation that approximate measure constructions and related constructions favor the constituency of [Num Cl]. While these do constitute convincing arguments for the constituency of [Num Cl], they can be accommodated by a split analysis where [Num Cl] is one of two structures that numerals classifiers occur in, such as those described in the following section.

4.3 Analysis 3: both [Num [Cl N]] and [[Num Cl] N] are needed

To account for all of the facts described, there is growing consensus that a non-unified analysis of numeral classifiers is needed. In such analyses, both left and right branching structures are possible (e.g. X. Li 2011, 2013; Jiang 2009, 2017; Jin 2013, 2018; Zhang 2013):

(65)

While many agree that both structures are needed, there are different proposals pertaining to the details of these structures and their distribution.

X. Li (2011, 2013) proposes that classifiers have two basic functions, counting and measuring, and claim that the counting function and the measure function of classifiers are distinguishable at the level of syntax in Chinese. According to X. Li, the structure in (65a) corresponds to the counting reading of numeral classifier phrases, and the structure in (65b) corresponds to the measuring reading of numeral classifier phrases. For example, in (66a), the numeral classifier phrase *liang ping jiu* 'two Cl_{bottle} wine' has a counting reading, which involves two concrete bottles, and corresponds to the structure in (65a). In contrast, *liang ping jiu* in (66b) is interpreted with a measure reading, which means that the maximal amount of red wine that he can drink is two bottles, and the real bottles are not required to be present; such a reading, according to X. Li (2013: 135-136), corresponds to the structure in (66b).

(66) a. *wo ling le liang ping jiu, zuo shou yi ping, you shou yi ping.*
I lift PFV two Cl_{bottle} wine left hand one Cl_{bottle} right hand one Cl_{bottle}
'I carried two bottles of wine, one in the left hand and the other in the right hand.'

b. *ta-de jiuliang shi liang ping hong jiu.*
his drinking-capacity be two Cl_{bottle} red wine
'His drinking-capacity is two bottles of red wine.' (X. Li 2013: 135)

X. Li (2011, 2013) further proposes to take [±Counting] and [±Measuring] as features constraining the way classifiers can be interpreted and syntactically realized. The [±Counting, ±Measuring] features divide the classifiers in Mandarin into four types and capture different classifiers' behaviors in different structures.

Jiang (2009, 2017) sides with X. Li (2011, 2013) and argues that the [Num Cl] unit has a measuring interpretation in contrast with the [Num [Cl N]] unit in which the classifier and the noun form a constituent. Jiang further proposes that different classifiers have different semantics and these differences predict their behavior in the [Num Cl N-*men*] structure and the [Num Cl *de* N] structure. For instance, in (67a) the individual classifier is an atomizing function shifting a count kind to a set of atomic instantiations of the kind, providing the correct semantics for the numeral *san* 'three' to combine with; the numeral classifier phrase *san ge xuesheng* has the structure in (66a). In contrast, in (67b), the individual classifier is treated as an estimation function, which takes a numeral *n* and returns a set of atomic entities whose estimated value is *n*; the phrase '*qishi-ji ge xuesheng-men*' then denotes a salient group of students whose estimated value is seventy-some ($70 < n < 80$) and is associated with the structure in (66b).

(67) a. *san ge xuesheng*
three Cl student
'three students'
b. *jijian-jiaolian Liu Yuling zhengzai zhidao*
fencing-instructor Liu Yuling PROG guide
qishi duo ge xuesheng-men lianxi.
seventy many/which Cl student-MEN practice
'The fencing instructor Liu Yuling is giving seventy-some students directions to practice fencing' (Beijing Language and Culture University Corpus)
(Jiang 2017: 202)

Jin (2013, 2018) also argues that the [Num Cl N] sequence may correlate with two syntactic structures, and that there is no one-to-one correspondence between the type of the classifier and the syntactic configuration it projects into. From a syntax-semantics interface perspective, it is argued that when a classifier is used as a unit which encodes a standardized amount-related meaning, the classifier exhibits an "auto-semantic" character with regard to entity domains; correspondingly, it does not take an NP complement syntactically. In contrast, when a classifier is not used to denote a standardized amount-related meaning, it always needs to be interpreted as performing a discretizing function to an entity domain, and, at the syntactic level, it requires the existence of an NP complement (see (46) above for a depiction).

Zhang (2013) also argues for a non-unified analysis of the structure of numeral classifier phrases. But unlike X. Li (2011, 2013), Jiang (2009, 2017), and Jin (2013, 2019), Zhang (2013: 157-172) proposes that the left- and right-branching structures correlate with different types of classifiers. Specifically, Zhang proposes that individual classifiers (*ge* 'general CL'), individuating classifiers (*di* 'drop') and kind classifiers (*zhong* 'kind') have a right-branch structure in (66a), whereas four other types of classifiers, i.e., container classifiers, standard measure classifiers, collective classifiers and partitive classifiers, have a

left-branching structure in (66b). Zhang further proposes that the different syntactic and semantic behaviors of different types of classifiers, such as their selection of nouns and their modifier association, are related to the constituency contrasts. Take the contrast between (68) and (69) as an example, in (68), a delimitive adjective can appear in the position either preceding or following the individual classifier, and the two expressions basically mean the same; however, if we replace the individual classifier with other types of classifiers, such as the container classifier, the readings of the two examples become different, as shown in (69a) and (69b).

(68) a. *yi chang tiao xianglian*
one long Cl necklace
b. *yi tiao chang xianglian*
one Cl long necklace
Both: 'one long necklace' (Zhang 2013: 160)

(69) a. *yi xiao he kouzi*
one small box button
'one small box of buttons'
b. *yi he xiao kouzi*
one box small button
'one box of small buttons' (Zhang 2013: 161)

Zhang (2013: 160-162) uses such a contrast to distinguish individual classifiers from collective, partitive, container, and standard measure classifiers. According to her, the possible displacement of the modifier in (69) indicates that the individual classifier c-commands the noun so that the modifier of the former can be semantically related to the modifier of the latter; Zhang further suggests that the c-commanding relation is represented by the right-branching structure in (66a). In contrast, the examples in (69) have a different structure in (66b) in which the container classifier does not c-command the noun so that the modifier of the former does not interact with the modifier of the latter.

To summarize, in this section we discussed the non-uniform analysis of numeral classifier phrases in which both [Cl NP] and [Num Cl] are needed. Although the authors above disagree on whether different structures correlate with different types of classifiers or all types of classifiers may participate in different structures, it should be clear that the complex facts regarding classifier phrases in Mandarin (i.e., different types of classifiers have different syntactic and semantic behaviors, and the same type of classifiers may participate in different constructions) are unlikely to be understood and accounted for if one assumes a uniform syntactic structure.

5. Conclusion

Numeral classifiers have long been seen as among the most distinctive properties of Mandarin noun phrases. The preceding sections have demonstrated that the distribution of numeral classifiers is complex, and that several categories which could be labelled numeral classifiers show differences in their syntactic distribution which call for distinct analyses. Thus far, there are still a number of issues subject to ongoing debates regarding numeral classifiers, not only for Mandarin Chinese but also for other languages. Undoubtedly, further exploration is called for in this area in order to arrive a better understanding of the syntax and semantics of the Mandarin Chinese classifier system.

References

Aboh, Enoch O. 2004. Topic and focus within D. *Linguistics in the Netherlands*, 21(1), 1–12.

Acquaviva, Paolo. 2008. *Lexical plurals: A morphosemantic approach*. Oxford: Oxford University Press.

Aikhenvald, Alexandra Y. 2000. *Classifiers: a typology of noun categorization devices*. Oxford University Press, New York.

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

Aoun, Joseph, and Yen-hui Audrey Li. 1989. Scope and Constituency. *Linguistic Inquiry* 20: 141–172.

Aoun, Joseph and Yen-hui Audrey Li. 2003. *Essays on the representational and derivational nature of grammar.* MIT Press.

Bale, Alan and Jessica Coon. 2014. Classifiers are for numerals, not for nouns: consequences for the mass/count distinction. *Linguistic Inquiry* 45(4), 695–707.

Bisang, Walter. 1999. Classifiers in East and Southeast Asian languages: counting and beyond. *Numeral Types and Changes Worldwide*, ed. by Jadranka Gvozdanović, 113–185. Berlin & New York: Mouton de Gruyter

Borer, Hagit. 2005. *In name only*. New York: Oxford University Press.

Butler, Lindsay Kay. 2012. Crosslinguistic and experimental evidence for non-number plurals. *Linguistic Variation*, 12, 27–56.

Chao, Yuen-Ren. 1968. *A grammar of spoken Chinese*. Berkeley: University of California Press.

Chen, I-Hsuan. 2015. *The Diachronic Development and Synchronic Distribution of Minimizers in Mandarin Chinese*. Doctoral dissertation, UC Berkeley.

Cheng, Lisa Lai-Shen. 2009. On every type of quantificational expression in Chinese. In Quantification, Definiteness, and Nominalization, ed. M. Rather and A. Giannakidou, 53–75. Oxford: Oxford University Press.

Cheng, Lisa Lai-Shen and Rint Sybesma. 1998. *Yi-wan tang, yi-ge tang*: Classifiers and massifiers. *Tsing-Hua Journal of Chinese Studies* 28(3): 385–412.

Cheng, Lisa Lai-Shen and Rint Sybesma. 1999. Bare and not so bare nouns and the structure of NP. *Linguistic Inquiry* 30(4): 509–542.

Cheng, Lisa Lai-Shen, and Rint Sybesma. 2009. De 的 as an underspecified classifier: first explorations. *Yuyanxue Luncong* [Essays on Linguistics] 39: 123–156. Beijing: Commercial Press.

Cheng, Lisa Lai-Shen and Rint Sybesma. 2012. Classifiers and DP. *Linguistic Inquiry* 43(4): 634–650.

Cheng, Lisa Lai-Shen, Jenny Doetjes, and Rint Sybesma. 2008. How universal is the universal grinder? In M. van Koppen and B. Botma (eds.), *Linguistics in the Netherlands* 2008: 50–62. Amsterdam & Philadelphia: John Benjamins.

Chierchia, Gennaro. 1998. Plurality of mass nouns and the notion of semantic parameter. In Susan Rothstein (ed.), *Events and grammar*, 53–103. Dordrecht: Kluwer.

Chierchia, Gennaro. 2010. Mass nouns, vagueness and semantic variation, *Synthese* 174: 99–149.

Corver, Norbert and van Koppen, Marjo. 2009. Let's focus on noun phrase ellipsis. *Groninger Arbeiten zur Germanistischen Linguistik*, 48: 3–26.

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

Dayal, Veneeta. 2004. Number marking and (in)definiteness in kind terms. *Lingustics and*

Philosophy 27, 393-450.
Dayal, Veneeta. 2012. Bangla classifiers: mediating between kinds and object. *Rivisita di Linguistica* 24(2), 195-226.
Dayal, Veneeta. 2014. Bangla plural classifiers. *Language and Linguistics* 15(1), 47-87
De Belder, Marijke. 2008. Size matters: Towards a syntactic decomposition of countability. In *Proceedings of the 27th West Coast Conference on Formal Linguistics*, edited by Natasha Abner and Jason Bishop, pp. 116–122. Cascadilla Press, Somerville, MA.
De Belder, Marijke. 2011. A morphosyntactic decomposition of countability in Germanic. *Journal of Comparative Germanic Linguistics*, 14(3), 203–240.
Dékány, Éva Katalin. (2011). A profile of the Hungarian DP - The interaction of lexicalization, agreement and linearization with the functional sequence. Doctoral dissertation: University of Tromsø.
del Gobbo, Francesca. 2014. Classifiers. In *The handbook of Chinese linguistics*, ed. C.-T. J. Huang, Y.-H.A. Li, and A. Simpson, 26–48. Chichester: Wiley Blackwell.
Doetjes, Jenny. 1997. Quantifiers and selection: On the distribution of quantifying expressions in French, Dutch and English. Doctoral dissertation, Leiden University.
Doetjes, Jenny. 2012. Count/mass distinctions across languages. In C. Maienborn, K. von Heusinger, & P. Portner (Eds.), *Semantics: an international handbook of natural language meaning*, 3, 2559-2580. De Gruyter.
Doetjes, Jenny and Johan Rooryck. 2003. Generalizing over quantitative and qualitative constructions. In Martine Coene and Yves D'hulst (eds.), *From NP to DP, Volume 1: The Syntax and Semantics of Noun Phrases*, 277–296. Amsterdam: John Benjamins.
Fan, Jiyan. 1985. Wuding NP zhuyuju [Sentences with indefinite NP subjects]. *Zhongguo Yuwen* 5: 321–328.
Gebhardt, Lewis. 2009. Numeral classifiers and the structure of DP. Ph.D. thesis, Northwestern University, Evanston, Illinois.
Giusti, Giuliana. 1996. Is there a FocusP and a TopicP in the noun phrase structure? *Working Papers in Linguistics*, 6(2), 105–128.
Goral, Donald R. 1979. Numeral classifier systems: A Southeast Asian cross-linguistic analysis. *Linguistics of the Tibeto-Burman Area* 4 1: 1–72.
Greenberg, Joseph H. 1972. Numeral classifiers and substantival number: Problems in the genesis of a linguistic type. *Working Papers on Language Universals* 9: 1–39.
Greenberg, Joseph H. 1990. Dynamic aspects of word order in the numeral classifier. In *On Language: Selected Writings of Joseph H. Greenberg*, ed. by Keith M. Denning and Suzanne Kemmer, 227–240. Stanford: Stanford University Press.
Guo, Jimao. 1999. Zai tan liangci chongdie xingshi de yufa yiyi [Revisit the grammatical meaning of classifier reduplication], *Hanyu Xuexi* 8(4): 6–9.
Guo, Rui. 2004. *Xiandai Hanyu Cilei Yanjiu* [A study on lexical categorization in Modern Chinese]. Beijing: Commercial Press.
He, Chuansheng. 2015. Complex numerals in Mandarin Chinese are constituents. *Lingua* 164: 189–214.
He, Chuansheng. 2016. Lun hanyu shuliang zuhe de chengfen wanzhengxing [On the constituenthood of numeral-classifier combinations in Chinese]. *Dangdai Yuyanxue* [Contemporary linguistics] 18(1): 1–18.
Her, One-Soon. 2012. Structure of classifiers and measure words: a lexical functional account. *Language and Linguistics* 13: 1211–1251.
Huang C.-T. James. 1982. Logical relations in Chinese and the theory of grammar. Doctoral dissertation, MIT.

Huang C.-T. James. 2014. On syntactic analyticity and parametric theory. In *Chinese Syntax in a Cross-Linguistic Perspective*, ed. Audrey Li, Andrew Simpson, and Wei-Tien Dylan Tsai, 1–48. New York: OUP USA.

Huang, Shi-Zhe. 2006. *Property theory, adjectives, and modification in Chinese*. Journal of East Asian Linguistics 15: 343–369.

Huang, Shi-Zhe and Yen-hui Audrey Li. 2009. Henda Guwu—More on the Type Matching Constraint on Modification, In *Essays on Linguistics*, Vol. 39. The Commerce Press, Beijing, China. 157-203.

Huang, Shi-zhe and Peter Jenks. 2014. Nominal modification in Chinese and Thai. *Proceedings of the 31st West Coast Conference on Formal Linguistics*, ed. Robert E. Santana-LaBarge, 227–237. Somerville, MA: Cascadilla Proceedings Project.

Ionin, Tanya, and Ora Matushansky. 2006. The composition of complex cardinals. *Journal of Semantics* 23: 315-260.

Jenks, Peter. 2011. The hidden structure of Thai noun phrases. Doctoral dissertation, Harvard University.

Jenks, Peter. 2018. Articulated definiteness without articles. *Linguistic Inquiry* 49: 3, 501-536.

Jiang, L. Julie. 2009. Monotonicity and measure phrases in Chinese. In *Proceedings from the Annual Meeting of the Chicago Linguistics Society* 45: 1, 303–317.

Jiang, L. Julie. 2012. Nominal arguments and language variation. Doctoral dissertation, Harvard University.

Jiang, L. Julie. 2015. Marking (in)definiteness in classifier languages. *Bulletin of Chinese Linguistics*. 8, 417-449.

Jiang, L. Julie. 2017. Mandarin associative plural *-men* and NPs with *-men*. *International Journal of Chinese Linguistics* 4: 2, 191-256.

Jiang, L. Julie. Forthcoming. *Nominal arguments and language variation.* New York: Oxford University Press.

Jin, Jing. 2013. Functions of Chinese classifiers: A syntax-semantics interface account. Doctoral dissertation. The Hong Kong Polytechnic University.

Jin, Jing. 2016a. Cong yuyi-yuyong jiemian kan hanyu[shu-xing-ming] geshi [A Semantics-pragmatics Interface Study on [Num-A-Cl-N] in Chinese] .*Yuyan yanjiu* [Studies in Language and Linguistics] (36(1), 92–96.

Jin, Jing. 2016b. Hanyu "duliang duanyu+de+mingci" de zai fenlei [A subcategorization of "measure phrase+de+noun" in mandarin Chinese]. *Dangdai Yuyanxue* [Contemporary Linguistics], 18(2), 216–232.

Jin, Jing. 2017. The syntax of the abstract-type measurement construction in Mandarin Chinese. *Studies in Chinese Linguistics*, 38(1), 35–61.

Jin, Jing. 2018. *Partition and Quantity: Numeral Classifiers, Measurement, and Partitive Constructions in Mandarin Chinese*. London/New York: Routledge.

Jones, Robert B. 1970. Classifier constructions in southeast Asia. *Journal of the American Oriental Society* 90: 1–12.

Kramer, Ruth. (2009). Definite markers, phi-features, and agreement: A morphosyntactic investigation of the Amharic DP. Doctoral dissertation, UC Santa Cruz.

Kramer, Ruth. (2010). The Amharic definite marker and the syntax-morphology interface. *Syntax*, 13,196–240.

Kramer, Ruth. (2016). A split analysis of plurality. *Linguistic Inquiry*, 47(3), 527–559.

Krifka, Manfred. 1995. Common nouns: A contrastive analysis of Chinese and English. In The Generic Book, ed. G. N. Carlson and F. J. Pelletier. Chicago, IL: The University of Chicago Press, Chicago.

Lee, H.-T. Thomas. 1986. *Studies on Quantification in Chinese.* Doctoral dissertation, UCLA.
Li, Charles, N. and Sandra, A. Thompson. 1976. Subject and Topic: A New Typology of Language. In *Subject and Topic*, eds. C. N. Li, 458–489. New York: Academic Press.
Li, Charles N. and Sandra, A. Thompson. 1981. *Mandarin Chinese: A Functional Reference Grammar*. Berkeley, California: University of California Press.
Li, XuPing. 2007. The *big/small* issue of mass/count classifiers. Paper presented at the fifth annual conference of EACL (European Association of Chinese Linguistics). Leipzig, 2007.
Li, XuPing. 2011. On the semantics of classifiers in Chinese. Doctoral dissertation, Bar Ilan University & University of Mainz.
Li, XuPing. 2013. *Numeral classifiers in Chinese: the syntx-semantic interface*. Berlin: De Gruyter Mouton.
Li, XuPing and Walter Bisang. 2012. Classifiers in Sinitic languages: from individuation to definiteness-marking. *Lingua* 22: 335–355.
Li, Yen-Hui Audrey. 1997. Structures and Interpretations of Nominal Expressions, ms. University of Southern California, LA, California.
Li, Yen-Hui Audrey. 1998. Argument Determiner Phrases and Number Phrases. *Linguistic Inquiry*, Vol. 29, No. 4: 693–702.
Li, Yen-hui Audrey. 1999. Plurality in a classifier language. *Journal of East Asian Linguistics* 8: 75–99.
Li, Yen-Hui Audrey. 2013. P-insertion and ellipsis. *Studies in Chinese Linguistics*, 34(2), 99–128.
Li, Y.-H. Audrey. 2014. Quantification and scope. In *The handbook of Chinese linguistics*, eds. C.-T. James Huang, Y.-H. Audrey Li, and Andrew Simpson, 208-247. Wiley Blackwell.
Li, Yen-hui Audrey, and Shengli Feng. 2015. 'yi' zi shenglüe de yunlü tiaojian [The prosodic conditions on "yi"-deletion]. *Yuyan Kexue* [Linguistic Sciences], 14(1): 1–12.
Liao, Wei-wen Roger. 2011. The symmetry of syntactic relations. Doctoral dissertation, University of Southern California.
Liao, Roger. 2015. On modification with whole/zheng in English and Chinese and the uniformity of syntax. Journal of East Asian Linguistics 24: 53–74.
Lin, Jo-Wang. 1998. Distributivity in Chinese and its implications. *Natural Language Semantics* 6:201–243.
Liu, Feng-Hsi. 1997. *Scope and specificity*. Amsterdam & Philadelphia: John Benjamins.
Lu, Jianming. 1987. Shuliangci zhongjian charu xingrongci qingkuang kaocha [A survey of the insertion of adjectives between numerals and classifiers]. *Yuyan jiaoxue yu yanjiu* [Language Teaching and Linguistic Studies] 4: 53–72.
Luo, Qiongpeng, Miao-Ling Hsieh and Dingxu Shi. 2017. Pre-classifier adjectival modification in Mandarin Chinese: a measurement-based analysis. *Journal of East Asian Linguistics* 26 (1), 1-36.
Lü, Shuxiang. 1944. 'Ge' zi de yingyong fanwei, fulun danweici qian 'yi' zi de tuoluo. [On the usages of GE and the dropping of the numeral yi before classifiers]. *Xihua Daxue zhongguo wenhua huikan*, Jinlin, Qilu.
Matthewson, Lisa. 2001. Quantification and the nature of crosslinguitic variation. *Natural Language Semantics* 9: 145-189.
Mathieu, Eric. 2012. Flavors of division. *Linguistic Inquiry*, 43(4), 650–679.
Mathieu, Eric. 2013. On the plural of the singulative. In I. Kučerova (ed.), *McGill working papers in Linguistics*.

Mathieu, Eric. 2014. Many a plural. In A. Aguilar-Guevara, B. Le Bruyn & J. Zwarts (Eds), *Weak referentiality*, 157–181. Amsterdam: John Benjamins.

Mathieu, Eric and Zareikar, Gita. 2015. Measure words, plurality, and cross-linguistic variation. *Linguistic Variation*, 15(2), 169–200.

Nakanishi, Kimiko. 2008. The Syntax and Semantics of Floating Numeral Quantifiers. In *The Handbook of Japanese Linguistics*. S. Miyagawa and M. Saito (eds.) Oxford: Oxford University Press

Ntelitheos, Dimitris. 2004. *Syntax of Elliptical and Discontinuous Nominals*. MA thesis, UCLA.

Ott, Dennis. 2011. Diminutive-formation in German: Spelling out the classifier analysis. *Journal of Comparative Germanic Linguistics* 14 1: 1–46.

Pan, Haihua and An Fengcun. 2012. Yinghan mingci duanyu hexin jufa cengji jiegou bijiao yanjiu [A comparative study on the core syntactic hierarchies of English and Chinese noun phrases]. *Waiyu Jiaoxue yu Yanjiu* [Foreign language teaching and reasearch] 5: 658–670.

Paris, Marie-Claude. 1981. *Problèmes de syntaxe et de sémantique en linguistique chinose*. Paris: Collège de France.

Paul, Waltraud. 2007. The insubordinate subordinator *de* in Mandarin Chinese. Ms., CRLAO, EHESS, Paris. Available at: <http://ling.auf.net/lingbuzz/001010/current.pdf> [accessed 16 August 2017].

Paul, Waltraud. 2010. Adjectives in Mandarin Chinese: the rehabilitation of a much ostracized category. In Patricia Cabredo-Hofherr and Ora Matushansky (eds.), *Adjectives: Formal Analysis in Syntax and* Semantics, 115–154. Amsterdam: Benjamins.

Rijkhoff, Jan. 1990. Explaining word order in the noun phrase. *Linguistics* 28: 5–42.

Ritter, Elizabeth. 1991. Two functional categories in noun phrases: Evidence from Modern Hebrew. In *Perspectives on phrase structure: Heads and licensing* (pp. 37-62). Brill.

Rullman, Hotze, and Aili You. 2006. General number and the semantics and pragmatics of indefinite bare nouns in Mandarin Chinese. In *Where semantics meets pragmatics*, ed. Klaus von Heusinger and Ken P. Turner, 175–196. Amsterdam: Elsevier.

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

Sanches, Mary and Linda Slobin. 1973. Numeral classifiers and plural marking: An implicational universal. *Working Papers on Language Universals* 11: 1–22.

Sanches, Mary and Linda Slobin. 1973. Numeral classifiers and plural marking: An implicational universal. *Working Papers on Language Universals* 11: 1–22.

Shyu Shu-ying. 1995. The Syntax of focus and topic in Mandarin Chinese. Doctoral dissertation University of Southern California.

Song, Yuzhu. 1981. *Xiandai hanyu yufa lunji* [essays of modern Chinese grammar]. Tianjin: Tianjin People's Publishing House.

Schwarzschild, R. 2006. The role of dimensions in the syntax of noun phrases. *Syntax*, 9(1), 67–110.

Svenonius, Peter. 2008. The position of adjectives and other phrasal modifiers in the decomposition of DP. In *Adjectives and adverbs: Syntax, semantics and discourse*, edited by Louise McNally and Christopher Kennedy, Oxford studies in theoretical linguistics 19, pp. 16–42. Oxford University Press, Oxford.

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

Tang, Chih-chen Jane. 1990b. *Chinese phrase structure and extended X'-theory*. Cornell University dissertation.
Tang, C.-C. Jane. 2005. Nouns or classifiers: A non-movement analysis of classifiers in Chinese. *Language and Linguistics* 6.3: 431–472.
Tang, Chih-Chen Jane. 2007. Modifier licensing and Chinese DP: a feature analysis. *Language and Linguistics* 8.4: 967–1024.
Tsai, Wei-Tien Dylan. 2011. Rethinking formal licensing. Paper presented at the 5th International Conference on Formal Linguistics. Guangdong University of Foreign Studies, 10-12 December.
T'sou, Benjamin K. 1976. The structure of nominal classifier systems. In *Austroasiatic studies II* , edited by Philip N. Jenner, Laurence C. Thompson, and Stanley Starosta, Oceanic Linguistics Special Publication No. 13, pp. 1215–1247. The University Press of Hawaii, Honolulu.
Wiltschko, Martina. 2008. The syntax of non-inflectional plural marking. *Natural Language and Linguistic Theory* 26: 639–694.
Wu, Yi-Chi. Plural Classifier xie and Grammatical Number in Mandarin Chinese. *Berkeley Papers in Formal Linguistics*, 2(1): 1-26.
Wu, Yicheng and Adams Bodomo. 2009. Classifiers ≠ determiners. *Linguistic Inquiry*, *40:* 487-503.
Yang, Rong. 2001. *Common nouns, classifiers, and quantification in Chinese*. Doctoral dissertation, Rutgers University.
Yang, S.-F. Henrietta. 2005. Plurality and Modification in Mandarin Noun Phrases. Doctoral Dissertation: The University of Texas at Austin.
Zavala, Roberto. 2000. Multiple classifier systems in Akatek Mayan. In *Systems of nominal classification*, edited by Gunter Senft. 114–146. Cambridge University Press, Cambridge.
Zhang, Niina Ning. 2013. *Classifier structures in Mandarin Chinese*. Berlin & New York: Mouton de Gruyter.
Zhang, Niina Ning. 2019. Complex indefinites and the projection of DP in Mandarin Chinese. *Journal of East Asian Linguistics* 28, 179-210.
Zhang, Niina Ning. 2017. The syntax of event-internal and event-external verbal classifiers. *Studia Linguistica*, 1–35.
Zhu, Dexi. 1956. Xiandai Hanyu Xingrongci Yanjiu [Studies of adjectives in modern Chinese]. *Yuyan yanjiu* 1. Also published in Zhu Dexi (1980) *Xiandai Hanyu Yufa Yanjiu* [Grammatical studies of modern Chinese]. Commercial Press, Beijing, 3–41.
Zhu, Dexi. 1961. Shuo DE [On DE]. *Zhongguo Yuwen*. China: Beijing. Also published in Zhu Dexi (1980) *Xiandai Hanyu Yufa Yanjiu* [Grammatical studies of modern Chinese]. Commercial Press, Beijing, 67–103.
Zhu, Dexi. 1982. *Yufa Jiangyi* [Lecture notes on grammar]. Beijing: Commercial Press.
Zhu, Xiaonong. 1988. Hypothesis-induction in grammatical studies. *Journal of East China Normal University (Philosophy and Social Sciences)* 4: 59–66.