Chapter 12
Taiwan Mandarin Quantifiers

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In this chapter, we provide an overview of the inventory of Taiwan Mandarin[1] quantifiers (Section 12.1) and the basic phenomena involving them (Section 12.2).[2]

[1] We would like to thank Edward Keenan, Denis Paperno, and an anonymous reviewer for their suggestions and three consultants who provided judgments for some of the examples. All consultants and the first author are native speakers of Mandarin of around 30 years in age; they were born and raised in Taiwan and also speak some Taiwanese. Thus, we restrict the scope of our description to Taiwan Mandarin to recognize that significant dialectal variation may be present in Mandarin quantification.

[2] We follow the convention in the syntactic/semantic literature of not marking lexical tone and guiding the segmentation of Mandarin words by the morphemic segmentation in the English gloss rather than segmenting syllable by syllable. In some cases, we do provide a finer segmentation when we want to draw attention to morphological composition, such as in the first mention of a quantifier or in the discussion of numerals in Section 12.1.1.1. A list of abbreviations used in the chapter for glossing, with rough descriptions of meanings, follows:

- ASP aspect marker, gloss for *guo* (experiential), *le* (perfective), and *zhe* (durative)
- BA Mandarin object marker
- BEI Mandarin passive marker
- COMP comparative
- CL classifier (Section 12.1.6)
- DOU Mandarin quantifier (very roughly, 'all', but see Section 12.1.3)
- GE Mandarin distributive quantifier (Section 12.1.4)
- DE Mandarin possessive marker or nominalizer
- LOC locative
- NEG negation, gloss for *bu* and *mei(you)* (Section 12.1.1.3)
- Q question particle
- YOU Mandarin existential verb (roughly 'have', but see Section 12.1.1.3)

Throughout the chapter, we use the traditional term NP to descriptively refer to nominal expressions; some theoretical frameworks would refer to some of these expressions as DPs.

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E.L. Keenan, D. Paperno (eds.), *Handbook of Quantifiers in Natural Language*,
Studies in Linguistics and Philosophy 90, DOI 10.1007/978-94-007-2681-9_12,

12.1 Inventory of Quantifiers

In this section, we give an overview of the basic inventory of quantifiers in Mandarin, with the goal of illustrating the diversity of quantifiers in the language. We inventory generalized existential (intersective) quantifiers in Section 12.1.1 and generalized universal (co-intersective) quantifiers in Section 12.1.2. We then discuss in particular two Mandarin quantifiers, *dou* (Section 12.1.3) and the distributive quantifier *ge* (Section 12.1.4), and discuss proportional quantifiers in Section 12.1.5. Lastly, we give an overview of the interaction of quantifiers and numeral classifiers in Section 12.1.6.

12.1.1 Generalized Existential (Intersective) Quantifiers

12.1.1.1 D-Quantifiers

Generalized existential quantifiers are productive in Mandarin, and as in English, the most productive subclass of generalized existential D-quantifiers is that of the cardinal quantifiers.

Cardinal Quantifiers

We illustrate cardinal quantifiers in Mandarin below in (1).

(1) Cardinal quantifiers in Mandarin
   a. **Basic** ∅, *yixie* 'some' (cf. footnote 8), *yi-CL* 'a/an/one', *mei(you)* 'no', *ji-CL* 'a few/several', *liang-CL* 'two', . . ., *shi-CL* 'ten', . . ., *liang-bai-CL* 'two hundred',. . .
   b. **Value judgment** *hen-duo* 'many (lit. very-many)', *hen-shao* 'few (lit. very-few)', *tai-duo* 'too many', *tai-shao* 'too few', *bu gouduo* 'not enough (NEG enough)'
   c. **Modified** *chaoguo ba-CL* 'more than eight', *zhishao ba-CL* 'at least eight', {*ganghao*/*bu-dao*/*zuiduo*/*zhiyou*} *liu-CL* '{exactly/fewer than (lit. NEG-reach)/at most/only} six', *jieyu liu-CL han shi-CL* 'between six and ten', *jiangjin*/*dayue ershi-CL* 'nearly/approximately twenty', *bu chaoguo shi-CL* 'not more than ten', *zhishao liang-CL danshi bu chaoguo wu-CL* 'at least two but not more than five', *wuxian duo-CL* 'infinitely many', *ji-CL* 'how many'

Here are some examples of basic cardinal quantifiers in sentences.

(2) Basic cardinal quantifiers
   a. wo kanjian bilu shang you yi-zhang qiujier de huaxiang
      1sg see fireplace LOC YOU one-CL Churchill DE picture
      'I saw a/one picture of Churchill above the fireplace.'

b. you yixie shuishou zai jie shang changge
YOU some sailor at street LOC sing
'Some sailors are singing in the street.'

c. you ji-ge nuren shenqing-le zhe-fen gongzuo
YOU several-CL woman apply-ASP this-CL work
'Several women applied for the job.'

Value Judgment Cardinals

As in English, Mandarin has a subset of cardinal quantifiers which make a value judgment based on the expected value, e.g. *henduo* 'many'. We give some examples with value judgment quantifiers below. Perhaps more productively than in English, e.g. 'many, many…', reduplication can be used to intensify a value judgment as in (3-c), resulting in a value judgment similar to the English 'surprisingly many/few.'

(3) a. laoban miantan-le {henduo / henshao} yingzhengzhe
boss interview-ASP {many / few} applicant
'The boss interviewed many / few applicants.'

b. lai canjia juhui de xuesheng {tai-duo / bu gouduo}
come attend meeting DE student {too-many / NEG enough}
'Too many / Not enough students attended the meeting.'

c. you {tai-duo tai-duo / tai-shao tai-shao} xuesheng lai canjia
YOU {too-many too-many / too-few too-few} student come attend
juhui le
meeting ASP
'Surprisingly many / Surprisingly few students came to the meeting.'

Numerals and Modified Numerals

Mandarin has systematic ways of naming numerals. For the cardinals, each power of ten has a unique morpheme up to ten thousand: 1 = *yi*, 10 = *shi*, 100 = *bai*, 1,000 = *qian*, 10,000 = *wan*. Thereafter, the numerals are compound: 100,000 = *shi-wan*, 1,000,000 = *bai-wan*, 10,000,000 = *qian-wan*, until 100,000,000 = *yi* (this is Tone 4, compared to Tone 1 for 'one'), with monomorphemic forms for each power of 10^{4n}, where $n = 1, 2, 3 \ldots$. Traditionally, numerals were marked off by fours, e.g. 1234×10^8 rather than threes 123×10^9, as shown below (Chao, 1968, p. 573):

(4) yi-qian-er-bai-san-shi-si yi
one-thousand-two-hundred-three-ten-four hundred-million
'one hundred twenty-three billion and four hundred million'

We give an example of numerals modified by quantification in sentences below in (5):

(5) {chaoguo ba-ge / ganghao ba-ge / zhiyou ba-ge / bu dao ba-ge} xuesheng tongguo kaoshi
{over eight-CL / just eight-CL / only eight-CL / NEG reach eight-CL} student pass exam
'More than/Just/Only/Less than eight students passed the exam.'

Some other examples of numerals and modified numerals include:

(6) {chaoguo / zhishao / shaoyu} wu-ge
{over / at-least / less-than} five-CL
'over/at least/less than five'

(7) {zhenghao / ganghao / zhiyou} wu-ge
{exactly / just / only} five-CL
'exactly/just/only five'

(8) {dayue / jiangjin} wu-ge
{nearly / approximately} five-CL
'nearly/approximately five'

(9) jihu yi-bai-ge
almost one-hundred-CL
'almost one hundred'

(10) jieyu wu-ge han shi-ge
between five-CL and ten-CL
'between five and ten'

(11) {you-xian / wu-xian / wu-shu} -ge
{YOU-limit / without-limit / without-number} -CL
'finitely many/infinitely many/infinitely many'

(12) {jihu mei(you) renhe / jihu mei(you)}
{almost NEG any / almost NEG}
'hardly any / almost no'

Here are a couple more examples of complex generalized existential D-quantifiers in the form of modified numerals, built using Boolean connectives.

(13) a. (you) bu chaoguo shi-ge xuesheng lai tiaowu
(YOU) NEG over ten-CL student come dance
'Not more than ten students came to the dance.'

b. (you) zhishao liang-ge danshi bu chaoguo wu-ge xuesheng
(YOU) at-least two-CL but NEG over five-CL student
lai tiaowu
come dance
'At least two but not more than five students came to the dance.'

12.1.1.2 A-Quantifiers

In addition to having generalized existential quantifiers that are D-Quantifiers, Mandarin also has ones that are A-Quantifiers, e.g. *you-shihou* 'sometimes', *liang ci* 'twice/two times',[3] *ba ci* 'eight times', *henduo ci* 'many times', *mei(you) henduo ci* 'not very many times', {*chang*/*shi*/*tong*}-*chang* 'often', *jihu bu* '(almost NEG) almost never', *cong-bu* 'never (lit. from-NEG)'. Below, we give examples of a few of these A-Quantifiers.

(14) a. wo {changchang / congbu} zoulu shang-xue
1sg {often / never} walk attend-school
'I often / never walk to school.'

b. wo baifang-guo ta {liang-ci / henduo-ci}
1sg visit-ASP 3sg {two-time / many-time}
'I have visited him twice / many times.'

12.1.1.3 Existential Constructions

Generalized existential (intersective) quantification is typically used in existential constructions. The closest counterpart to the English *there*-construction in Mandarin uses the existential verb *you*. Mandarin is different from English in the restricted distribution of indefinite subjects: generally, the existential verb *you* must be present to introduce one (cf. Footnote 1 in Aoun and Li (1989) and references therein).

We first describe existential constructions with *you* and then those without. According to Huang (1987), *you*-constructions have the general form

(15) . . . (NP) . . . V . . . NP . . . (XP) . . .
1 2 3 4

Note that positions 1 and 4 are optional. In the examples below from Huang (1987), in (16-a), positions 2 and 3 are filled; in (16-b), positions 2 through 4 are filled (4 is filled with a clause of predication); in (16-c), positions 1 through 3 are filled (position 1 is filled with a locative NP), and in (16-d), all positions are

[3] Because *ci* is a unit of time, it can be considered a classifier; thus we could also choose the gloss *liang-ci* 'two-CL'. But to emphasize the use of *n-ci* as an A-Quantifier, for some natural number *n*, we choose to gloss *ci* as 'time', e.g. 'two-time' here.

filled (position 1 is filled with a locative NP and position 4 with a clause of predication).

(16) Existential constructions (Huang, 1987)

a. you gui
YOU ghost
'There are ghosts (here).'

b. you yi-ge ren hen xihuan ni
YOU one-CL man very like 2sg
'There is a man who likes you very much.'

c. zhuo shang you yi-ben shu
table LOC YOU one-CL book
'On the table there is a book.'

d. zhuo shang you yi-ben shu hen youqu
table LOC YOU one-CL book very interesting
'On the table there is a book that is very interesting.'

The form of *you*-constructions in Mandarin does not vary with tense or aspect. For example, we show that the form does not vary with tense in the affirmative existentials (17-a) and (17-b) below.

(17) a. xianzai ban shang you wu-ge nusheng, qu-nian you shi-ge
now class LOC YOU five-CL girl last-year YOU ten-CL
'There are five women in the class now; last year there were ten (women in the class.)'

b. xianzai ban shang mei(you) nusheng, danshi qu-nian you henduo-ge
now class LOC NEG girl but last-year YOU many-CL
'There are no women in the class now, but last year there were many (women in the class.)'

Other forms of existential constructions in Mandarin do not use *you* and do interact with aspect. Huang (1987) describes three such types: the first involves verbs related to coming into or going out of existence, e.g. *lai*/*qu* 'come/go' (18). The aspectual marker *le* (perfective) or *guo* (experiential) is required since these verbs refer to bounded events that have been completed or experienced. Aspectual markers other than these cannot be used.

(18) shang-ge yue fasheng-*(le/guo) yi-jian chehuo
last-CL month happen-ASP/ASP one-CL accident
'An accident happened last month.'

The second type involves locational verbs, e.g. intransitive verbs *tang* 'lie', *zhan* 'stand' (19-a) and transitive verbs *gua* 'hang', and *fang* 'put' (19-b). If the locational verb is intransitive, then the only aspectual marker that can be used is *zhe*, which marks durative aspect; if the verb is transitive, then both aspectual markers *le* and *zhe* may be used, resulting in different meanings.

(19) a. chuang shang tang-{zhe/*le} yi-ge bingren
bed LOC lie-{ASP/*ASP} one-CL patient
'On the bed lies a patient.'

b. fangjian li fang{-zhe/-le} liang-zhang chuang
room LOC put-{ASP/ASP} two-CL bed
'Two beds are in the room/Two beds were put in the room.'

The third type of existential construction not using *you* can involve any transitive verb, so long as the aspectual markers *guo* or *le* are used (20).

(20) wo jiao-{guo/le} yi-ge xuesheng
1sg teach-{ASP/ASP} one-CL student
'I had the experience of teaching a student/I taught a student.'

Thus far we have discussed affirmative existentials in Mandarin. Wh-question interrogatives (21-b) are built from affirmative existentials as in (21-a) by replacing the existential construction *you-ren* 'someone (lit. YOU-man)' with the wh-word *shei* 'who'. Yes/No interrogatives are built from affirmative existentials like (21-a) by adding a question particle *ma* at the end of the sentence, as in (21-c).

(21) a. youren zai wuzi li
someone at house LOC
'There is someone in the house.'

b. shei zai wuzi li
who at house LOC
'Who is in the house?'

c. youren zai wuzi li ma?
someone at house LOC Q
'Is there anyone in the house?'

d. mei(you) ren zai wuzi li
NEG man at house LOC
'There isn't anyone in the house.'

Negative existentials are built from affirmative existentials by adding *mei* 'NEG' before the existential predicate *you*, which may be optionally deleted (Li and Thompson, 1981, p. 416), as in (21-d). Negative existentials use the same negation construction as in simple declarative sentences, as shown in (22) and (23).

(22) mei(you) (renhe) laoshu zai wuzi li
NEG (any) mouse at house LOC
'There aren't (any) mice in the house.'

(23) wo mei(you) kandao (renhe) laoshu zai wuzi li
1sg NEG see (any) mouse at house LOC
'I didn't see (any) mice in the house.'

Note then, that in a sense, Mandarin has a monomorphemic 'no' that can be used to quantify NPs, *mei*: it co-occurs with *you* as *mei(you)* 'NEG', but since *you* may be optionally deleted, *mei* can occur alone in negative existentials:

(24) mei(you) xuesheng lai shang-ke
NEG student come attend-class
'No students came to class.'

You can also be used to express possession, as shown in (25-b).

(25) a. you san-ge nusheng zai wuzi li
YOU three-CL girl at house LOC
'There are three girls in the house.'

b. wo you san-ge nuer
1sg YOU three-CL daughter
'I have three daughters.'

Like in English, certain determiners are blocked in Mandarin from the nominal phrase in existential sentences that are built with *you*. In these sentences, all types of generalized existential quantifiers (basic, value judgment, and modified) are allowed, as well as proportional quantifiers of type D + *DE* + N – those expressed as percentages and fractions (Section 12.1.5), as shown in (26-a); for *yixie* 'some' and unmodified numerals, the presence of *you* is required. As shown in (26-b), generalized universal quantifiers and proportional quantifiers expressed as part-to-whole ratios are blocked from the nominal phrase.

(26) a. you {yixie / qi-ge / henduo / chaoguo ba-ge / shaoshu /
YOU {some / seven-CL / many / over eight-CL / few /
sanfenzhier de} xuesheng zai jiaoshi li
two-thirds DE} student at classroom LOC
'{Some / seven / many / over eight / few / two-thirds of the} students are in the classroom.'

b. {*you quanbu de xuesheng dou / *you shi-ge xuesheng ganghao
{YOU all DE student DOU / YOU ten-CL student just
qi-ge} zai jiaoshi li
seven-CL} at classroom LOC
'{All students / exactly seven out of ten students} are in the classroom.'

12.1.1.4 Interrogatives

Interrogatives can be built from generalized existential quantifiers in Mandarin as in English, e.g. the cardinal quantifiers *duo-shao* 'how {many/much} (lit. many-few)' (27-a), and *duo-chang* 'how often (lit. many-frequent)' (27-b), as well as the non-cardinal quantifier *na-CL* 'which (sg)' or *na-xie* 'which (pl)' (27-c). Note that *duo* here has a degree interpretation, cf. English 'how' in 'how many', rather than acting as a generalized existential quantifier with the meaning 'many'.

(27) a. (you) duoshao xuesheng lai ting yanjiang
(YOU) how-many student come listen talk
'How many students came to listen to the talk?'

b. ni (you) duochang qiao-ke
2sg (YOU) how-often skip-class
'How often do you play hooky?'

c. (you) naxie xuesheng tongguo-le kaoshi
(YOU) which student pass-ASP exam
'Which students passed the exam?'

12.1.2 Generalized Universal (Co-Intersective) Quantifiers

Like English, Mandarin has generalized universal (co-intersective) quantifiers, both D-Quantifiers and A-Quantifiers.

12.1.2.1 D-Quantifiers

Examples of generalized universal D-Quantifiers in Mandarin include *quanbu, suoyou, zheng-CL* 'all', *mei-CL* 'every/each', *ge-CL* 'GE' (further described in Section 12.1.4), *quanbu chule wu-CL* 'all but five', {*jiangjin*/*jihu*} *quanbu* 'nearly/almost all', *bingfei* {*quanbu*/*suoyou*/*zheng-CL*} 'not all', *bingfei mei-CL* 'not every', *mei-CL* ... {*han*/*gen*/*huo*} ... 'every ... and/and/or ...'. Mandarin *dou* has also often been considered a universal D-Quantifier and is discussed further in Section 12.1.3. In the examples below, we see that *dou* is obligatory in all instances of basic, unmodified universal quantification, but is optional in generalized universal quantification, e.g. 'all but ...'.[4]

Below we give some example sentences with generalized universal D-Quantifiers in (28). Note in (28-a) that the universal quantifiers *quanbu* and

[4] In the cases of generalized universal quantification, e.g. 'all but ...', the addition of *dou* seems to either pick out a specific set for quantification (28-d) or act as an intensifier (28-e). See also discussion of *dou* as a quantifier at the end of Section 12.1.3.

suoyou refer to the set of individual poets, while *zheng-qun* 'zheng-CL' refers to the set of poets as a single indivisible unit, as a group.

(28) a. suoyou shiren *(dou) zuobairimeng
all poet DOU daydream
'All poets daydream.'

b. ban shang mei-ge xuesheng *(dou) xie-le yi-shou shi
class LOC every-CL student DOU write-ASP one-CL poem
'Every student in the class wrote a poem.'

c. mei-ge nanren, nuren han xiaohai *(dou) likai-le zhe-ge
every-CL man woman and child DOU leave-ASP this-CL
chengshi
city
'Every man, woman and child left the city.'

d. bingfei suoyou de mao dou shi huise de
NEG all DE cat DOU is grey DE
'Not all the cats are grey.'

e. ban shang suoyou de xuesheng chule liang-ge dou tongguo-le
class LOC all DE student except two-CL dou pass-ASP
kaoshi
exam
'All but two students in the class passed the exam.'

12.1.2.2 A-Quantifiers

Examples of generalized universal A-Quantifiers in Mandarin include *zongshi* 'always', *jihu zongshi* 'almost always', {*wulun*/*buguan*} *heshi* 'whenever', *(jihu) mei ci* '(almost) every time'.

Below are some example sentences in Mandarin with generalized universal A-Quantifiers.

(29) a. wo jihu zongshi da gongche shang-xue
I almost always ride bus attend-school
'I almost always ride the bus to school.'

b. Zhangsan mei-ci guahuzi *(dou) hui ge-shang ziji
Zhangsan every-time shave DOU will cut-hurt self
'Zhangsan cuts himself every time he shaves.'

c. Zhangsan {wulun heshi / buguan heshi} guahuzi *(dou) hui
Zhangsan {regardless when / regardless when} shave DOU will
ge-shang ziji
cut-hurt self
'Zhangsan cuts himself whenever he shaves.'

12.1.2.3 Interrogatives and Indefinite Pronouns

Like English, Mandarin can form universal quantifiers from interrogative or indefinite pronouns, e.g. {*wulun*/*buguan*} *shei* 'whoever', {*wulun*/*buguan*} *shenme* 'whatever', {*wulun*/*buguan*} *heshi* 'whenever', {*wulun*/*buguan*} *nali* 'wherever', {*wulun*/*buguan*} *ruhe* 'however', but *{*wulun*/*buguan*} *weishenme* *'whyever'. Additionally, unlike in English, such universal quantifiers must also be followed by *dou*, as shown below.

(30) wo {wulun / buguan} shenme *(dou) xihuan chi
1sg {regardless / regardless} what DOU like eat
'I like to eat whatever.'

Any discussion of generalized universal quantification in Mandarin is incomplete without attention to *dou* and *ge*; we discuss these in the next Sections 12.1.3 and 12.1.4.

12.1.3 Dou

Theoretical viewpoints on Mandarin *dou* have always been diverse and controversial. A great amount of work has been done on the analysis of *dou*, e.g. Chen (2008); Cheng (1991, 1995); Chiu (1990, 1993); Huang (1996); Lee (1986); Li (1995); Liu (1990); Lin (1998); Que (2006); Wu (1999); Zhang (1997). What follows are some basic facts concerning the syntax and semantics of *dou*.

Syntactically, *dou* has the following characteristics.

First, *dou* occurs preverbally:

(31) a. tamen DOU lai-le
3pl DOU come-ASP
'They all came.'

b. *tamen lai-le DOU
3pl come-ASP DOU
'Lit. They all came.'

Dou in (31-a) can quantify the NP *tamen* 'they' when it is preverbal. However, *dou* is generally not able to quantify the NP when the NP is postverbal (31-b). An exception is that *dou* can quantify the *wh*-phrase *shenme* 'what' in object position[5]:

(32) ni dou mai-le shenme ne
2sg DOU buy-ASP what Q
'What all did you buy?'

[5] We thank an anonymous reviewer for noting this.

Second, *dou* can only quantify an NP to its left:

(33) a. zhexie xuesheng dou xihuan wo
these student DOU like me
'All of these students like me.'

b. *dou zhexie xuesheng xihuan wo
DOU these student like me
'Lit. All of these students like me.'

In (33-a), *dou* quantifies the NP to the left, *zhexie xuesheng* 'these students'. But in (33-b), there is no NP to the left for *dou* to quantify, thus, it is ungrammatical.

Third, *dou* does not have to be adjacent to the NP it quantifies, but there are some locality restrictions.

(34) a. zhexie xuesheng wo dou xihuan
these student 1sg DOU like
'All of these students I like.'

b. *zhexie xuesheng zhidao wo dou xihuan Zhangsan
these student know 1sg DOU like Zhangsan
'Lit. All of these students know that I like Zhangsan.'

Dou in (34-a) can quantify the object *zhexie xuesheng* 'these students' even though the subject *wo* 'I' intervenes between them. However, *dou* in (34-b) is in the embedded clause which makes it unable to quantify the subject of the main clause *zhexie xuesheng* 'these students'. In this sense, *dou*-quantification is clause-bounded.

However, in (35), the *dou* in the embedded clause can quantify the subject 'these students' in the main clause:

(35) zhexie xuesheng wo zhidao Zhangsan dou xihuan
these student 1sg know Zhangsan DOU like
'All of these students, I know that Zhangsan likes (them).'

Notice that the subject 'these students' is moved from the object position of the embedded clause. In other words, *dou* and the NP it quantifies, 'these students', originate from the same clause. Therefore, it is plausible to say that cross-clausal *dou*-quantification is only possible when *dou* and the NP it quantifies are base-generated in the same clause (Wu, 1999). This account explains why (36) is ungrammatical. In (36), *dou* is base-generated in the main clause, whereas the NP it quantifies 'these students' is base-generated in the embedded clause.

(36) *zhexie xuesheng wo dou zhidao Zhangsan xihuan
these student 1sg DOU know Zhangsan like
'Lit. All of these students, I know that Zhangsan likes (them).'

Semantically, *dou* has the following characteristics.

First, Cheng (1995) states that the NP that *dou* quantifies must have a plural interpretation, as shown in (37-a) and (37-b).

(37) a. tamen dou hen taoyan Lisi
3pl DOU very hate Lisi
'They all hate Lisi.'

b. *ta dou hen taoyan Lisi
3sg DOU very hate Lisi
'Lit. He all hates Lisi.'

However, this is not necessarily true. The plurality requirement seems vulnerable in the following two examples. In (38-a), the NP *zhe-ben shu* 'this book' that *dou* quantifies is semantically singular, but the sentence is acceptable. In addition, in (38-b), the NP *yi-qun xuesheng* 'a group of students' that *dou* quantifies is semantically plural, but the sentence is not acceptable.

(38) a. zhe-ben shu wo dou du-le
this-CL book 1sg DOU read-ASP
'I have read all of the book. (I have read every part of the book.)'

b. *yi-qun xuesheng dou chuxi-le huiyi
one-CL student DOU attend-ASP conference
'Lit. A group of students has all attended the conference.'

Notice that the NP *dou* quantifies in (38-b) is an indefinite NP *yi-qun xuesheng* 'a group of students'. Zhang (1997) proposed that an NP that *dou* quantifies must be semantically measurable by the eventuality expressed by the predicate. The NP *yi-qun xuesheng* 'a group of students' is an indefinite NP so that it is not measurable. Wu (1999) has provided a further discussion characterizing NPs with respect to their *dou*-quantifiability.

Second, the NP modified by *dou* can only yield a definite interpretation. In (39), the NP *san-ge ren* must refer to three specific people, i.e. it is interpreted as a partitive, which means that this sentence lacks the reading 'There are three people who left.'

(39) san-ge ren dou likai-le
three-CL man DOU leave-ASP
'The three people left.'

Third, apart from the meaning of 'all', *dou* conveys other meanings: 'already' or 'even' in some sentences or structures, such as *lian* . . . *dou* 'even'.

(40) a. ta dou bashi sui le
3sg already eighty year ASP
'He is already eighty years old.'

b. Lisi dou tongguo kaoshi le ni que meiyou
Lisi even pass exam ASP, 2sg but NEG
'Even Lisi passed the exam, but you didn't.'

c. Lisi qiong dao lian mianbao dou mai buqi
Lisi poor reach even bread even buy NEG
'Lisi is so poor that she can't even afford the bread.'

Fourth, *dou* does not allow collective readings. In (41-a), there is no *dou*, and both collective and distributive readings are available. But in (41-b), the presence of *dou* makes the collective reading unavailable.

(41) a. tamen chi-le yi-ge pingguo pai
3pl eat-ASP one-CL apple pie
'They each ate an apple pie.' or 'They ate an apple pie together.'

b. tamen dou chi-le yi-ge pingguo pai
3pl DOU eat-ASP one-CL apple pie
'They each ate an apple pie.'

Some linguists consider Mandarin *dou* to be equivalent to the English universal quantifier 'all'. However, this is not true because the distribution of *dou* and the syntactic and semantic restrictions on *dou* make it different from 'all' in English. In recent studies, it has been treated as a distributivity operator (Lee, 1986), generalized distributor (Lin, 1998), or a sum operator (Huang, 1996).

The examples in Section 12.1.2 show that *dou* is obligatory in basic universal quantification, but not for generalized universal quantification, e.g. universal quantification with exceptions like 'all but . . .': for basic universal quantification, *dou* is obligatory even in the presence of another universal quantifying determiner, as in (28-a). In Section 12.1.5, we also see that *dou* is optional in proportional quantification.

Note also, that in terms of the set-theoretic definition of generalized universal quantifiers being defined as co-intersective, *dou* could be considered a generalized universal quantifier in its own right. It is possible for *dou* to appear alone and act as a co-intersective determiner, as shown below.

(42) mao dou shi bai de
cat DOU is white DE
'All the cats are white.'

In this sentence, *dou* satisfies the definition of co-intersectivity (Keenan and Moss, 2008):

(43) A Det D is *co-intersective* iff

$$DAB = DXY \quad \text{whenever} \quad A - B = X - Y.$$

Here, we have $DOU(A)(B) = T$ iff $A - B = \varnothing$, where $A = CAT$ and $B = IS\ WHITE$. (42) without *dou*, with just the bare NP *mao* 'cat' is a generic, e.g. 'Cats are white.' With the addition of *dou*, the quantification is done over a specific set of cats, for instance, the cats in that alley.

12.1.4 The Distributive Quantifier ge

Mandarin *ge* is a distributive quantifier: a sentence with *ge* is restricted to a distributive reading. For instance, (44-a) is a sentence without *ge*, and it has both distributive and collective readings. However, in (44-b), the presence of *ge* makes the collective reading unavailable (as with *dou* in (41-b)).

(44) a. tamen chi-le yi-ge pingguo pai
3pl eat-ASP one-CL apple pie
'They each ate an apple pie.' or 'They ate an apple pie together.'

b. tamen ge chi-le yi-ge pingguo pai
3pl GE eat-ASP one-CL apple pie
'They each ate an apple pie.'

In addition, *ge* can occur only preverbally. It is not grammatical to have *ge* in a postverbal or sentence-final position, as shown in (45-b) and (45-c), cf. (45-a).

(45) a. tamen ge mai-le liang-dong fangzi
3pl GE buy-ASP two-CL house
'They each bought two houses.'

b. *ge tamen mai-le liang-dong fangzi
GE 3pl buy-ASP two-CL house
'Lit. They each bought two houses.'

c. *tamen mai-le liang-dong fangzi ge
3pl buy-ASP two-CL house GE
'Lit. They each bought two houses.'

In addition, according to Lin (1998), *ge* must quantify a distributable argument which is semantically plural: if the quantified NP is not distributable or is not semantically plural, then the sentence is unacceptable, as shown in (46-b).

(46) a. zhexie fanren ge chi-le san-wan fan
these criminal GE eat-ASP three-CL rice
'These criminals each ate three bowls of rice.'

b. *zhe-ming fanren ge chi-le san-wan fan
this-CL criminal GE eat-ASP three-CL rice
'Lit. This criminal each ate three bowls of rice.'

Moreover, *ge* must bind an indefinite expression within the VP adjoined by *ge*.

(47) a. ta han Lisi ge mai-le yixie wanju
3sg and Lisi GE buy-ASP some toy
'He and Lisi each bought some toys.'

b. *ta han Lisi ge mai-le zhexie wanju
3sg and Lisi GE buy-ASP these toy
'Lit. He and Lisi each bought these toys.'

c. *ta han Lisi ge likai-le
3sg and Lisi GE leave-ASP
'Lit. He and Lisi each left.'

The examples (47-b) and (47-c) show that if there is no indefinite expression for *ge* to bind, then the sentence is unacceptable. However, if there is an indefinite expression for *ge* to bind, such as *yixie wanju* 'some toys' in (47-a), the sentence is acceptable.

Note that the indefinite expression that *ge* binds is not necessarily a NP. For instance, in (48), the indefinite expression is the number of times, i.e. *san-bian* 'three-time'.

(48) zhe-liang-ben shu wo ge du-le san-bian
these-two-CL book 1sg GE read-ASP three-time
'These two books, I read three times each.'

In addition, the NP that *ge* quantifies can refer to events. The distributable argument that *ge* binds refers to two events, *wo zai taipei* 'I am in Taipei' and *(wo zai) tainan* 'I am in Tainan'. Furthermore, as in (48), the indefinite expression that *ge* binds in (49) is 'the number of times that I borrowed the book', rather than the topicalized 'book'.[6]

(49) zhe-ben shu wo zai taipei han tainan ge jie-le san-ci
the-CL book 1sg at Taipei and Tainan GE borrow-ASP three-time
'This book, I borrowed three times each when I was in Taipei and when I was in Tainan.'

To summarize, *ge* in Mandarin is a distributive quantifier which occurs only preverbally, must quantify a distributable argument, and binds an indefinite expression within the VP.

12.1.5 Proportional Quantifiers

Mandarin has proportional quantifiers like English including D-Quantifiers and A-Quantifiers.

[6] In both (48) and (49), it is also possible to not topicalize the object.

12.1.5.1 D-Quantifiers

The structure of proportional D-quantification in Mandarin differs from that in English. The type D + N in English is realized as two different types in Mandarin: D + (*DE*) + N and D_{whole} + N + D_{part}, and the type D + of + N in English is realized as D + *DE* + N in Mandarin.

D + (*DE*) + N

Proportional D + (*DE*) + N quantifiers include *duo-shu (de)* 'most (lit. many-count)' and *shao-shu (de)* 'few (lit. few-count)'; *de*, which acts here as a partitive marker, is optional. For example,

(50) duoshu/shaoshu (de) shiren hui zuobairimeng
most/few (DE) poet will daydream
'Most/few poets daydream.'

D_{whole} + N + D_{part}

Proportional quantification expressed as ratios of part-to-whole have the structure D_{whole} + N + D_{part} quantifiers, e.g. *shi-CL* ... ({*ganghao*/*zhiyou*/*zhishao*/*chaoguo*}) *qi-CL* '({exactly/only/at least/more than}) seven out of ten ...', *shi-CL ... zhiyou yi-CL* 'only one ... in ten ...', *shi-CL ... mei(you) yi-CL* 'not one ... in ten'; we give some example sentences below:

(51) a. shi-ge shiren (ganghao) qi-ge hui zuomeng
ten-CL poet (exactly) seven-CL will dream
'(Exactly) seven out of ten poets will dream.'

b. shi-ge xuesheng chaoguo yi-ge hui de-jiang
ten-CL student over one-CL will win-prize
'More than one student in ten will win the prize.'

c. shi-ge laoshi mei(you) yi-ge zhidao wenti de daan
ten-CL teacher NEG one-CL know question DE answer
'Not one teacher in ten knows the answer to the question.'

D + *DE* + N

Proportional quantification expressed as percentages or fractions have the structure D + *DE* + N, e.g. *bai-fenzhi-bashi de* ... 'eighty percent of ... (lit. hundred-divide-eighty of ...)', *san-fenzhi-er de* ... 'two-thirds of ... (lit. three-divide-two of ...)', {*da duoshu* / *da bufen*} *de* ... 'a (large) majority of ...', {*shao bufen* / *xiao bufen*} *de* ... 'a (small) minority of ...', *chaoguo baifenzhi-ershi de*

. . . 'over twenty percent of . . . (lit. over percent-twenty of)', {*shaoyu*/*xiaoyu*/*diyu*} *sifenzhiyi de* . . .'less than one-quarter of . . .', *jieyu baifenzhi-ershi han baifenzhi-sanshi de* . . . 'between twenty and thirty percent of . . .', *quanbu chule shifenzhiyi de* . . . 'all but a tenth of . . .', *(zhiyou) xiao bili de* . . . '(only) a small percentage of . . .', *duoshao bili de* . . . 'what percentage of . . .?', *ji-fenzhi-ji de* . . . 'what fraction of . . .?', *ban-shu de* . . . 'half (of) . . . (lit. half-count (of) . . .)', *chaoguo banshu de* . . .'more than half (of) . . .', *shaoyu*/*diyu ganghao banshu de* . . . 'less than exactly half (of) . . .' *quanbu*/*suoyou de* 'all (of)'. We give two examples below:

(52) a. baifenzhi-sanshi de meiguo qingshaonian chaozhong
percenty-thirty DE America teenager overweight
'Thirty percent of American teenagers are overweight.'

b. shaoyu wufenzhiyi de meiguoren shi wailaiyimin
under one-fifth DE American is immigrant
'Less than one-fifth of Americans are immigrants.'

12.1.5.2 A-Quantifiers

A-Quantifiers expressing proportional quantification include adverbs such as *(bu) pinfan* '(in)frequently', *yiban* 'mostly/generally', *tongchang* 'usually', *buchang* 'seldom', *henshao*/*nande* 'rarely', *shichang*/*changchang* 'often', *ouer dan buchang* 'occasionally but not often'.

Below we give some example sentences with these:

(53) a. nusheng yiban tou gei oubama
woman mostly/generally vote for Obama
'Women mostly vote for Obama.'

b. tongchang taofan zai duobi jingcha de shihou bu hui
Usually outlaw at elude police DE occasion NEG will
tingxialai he kafei
stop drink coffee
'Usually when outlaws flee the police, they don't stop for coffee.'

c. Zhangsan shichang da gongche qu shang-xue
John often ride bus go attend-school
'John often rides the bus to school.'

d. Zhangsan nande zai xingqitian canguan bowuguan
John rarely at Sunday visit museum
'John rarely visits the museum on Sundays.'

As a final note, we observe that *dou* may optionally appear in proportional quantification, as shown below:

(54) {baifenzhi-bashi / sifenzhiyi} de xinshenger (dou) shi nusheng
{percent-eighty / one-fourth} DE newborn DOU be girl
'Eighty percent / One fourth of the newborns are (all) girls.'

The addition of *dou* seems to create emphasis, but doesn't change the truth conditions of the sentence significantly.

With our basic overview of Mandarin quantifiers complete, we turn to the interaction of Mandarin quantifiers and numeral classifiers.

12.1.6 Numeral Classifiers

Languages of Southeast and East Asia are well-known to be languages where classifiers are obligatory in expressions with numerical determiners: expressions with a numeral quantifying a noun, (and in fact, other classes of expressions as well), must include a classifier (Gil, 2008). As a well-known case of a numeral classifier language, Mandarin is no exception and has a rich inventory of numeral classifiers (Chao, 1968; Li and Thompson, 1981). Mandarin classifiers must occur in expressions with numerals (55-a), demonstratives (55-b), and some quantifiers (55-c) (Li and Thompson, 1981, p. 104).[7]

Each noun has its own proper classifier; some may have more than one. The classifier most frequently paired with different nouns is *ge*, (this is different from the distributive *ge* which is pronounced with Tone 4; the classifier *ge* has neutral tone) which has replaced some of the rarer classifiers (Li and Thompson, 1981, p. 112).

(55) Distribution of Mandarin classifiers

a. With numerals
liu-*(zhi) gou
six-CL dog
'six dogs'

b. With demonstratives
zhe-/na-*(ben) shu
this/that-CL book
'this/that book'

c. With universal quantifier
mei-*(liang) che
every-CL car
'every car'

Do Mandarin classifiers occur obligatorily in all quantificational expressions?[8] No. Quantification with A-Quantifiers does not require classifiers, unless the expression is a rate phrase, such as *yi-tian liang-ci* 'one-CL two-CL' (literally 'one-day two-times') meaning 'twice a day', cf. also Section 12.1.6.4 on

[7] The word *ren* 'person' is an exception and may occur in determiner expressions without classifiers, e.g. *liu ren* 'six people', *mei ren* 'every person'.

[8] Li and Thompson (1981) suggest that numeral classifiers are obligatory only for some quantifiers, e.g. *zheng* 'whole, entire', *ji* 'how many, a few', *mei* 'every', and *mou-yi* 'a certain'.

rate phrases. Among D-Quantifiers, existential, universal, and proportional quantifiers behave differently in interacting with classifiers: generalized existential and universal quantification typically require classifiers, while some cases of proportional quantification do and others do not.

Generalized existential quantifiers require classifiers except for *yixie* 'some' and *mei(you)* 'NEG':

(56) Generalized existential quantifiers

a. yi-*(pi) ma (Basic: numeral)
one-CL horse
'a horse'

b. henduo-*(tiao) kuzi (Value Judgment)
many-CL pants
'many pairs of pants'

c. bu dao liu-*(ba) dao (Modified)
NEG reach six-CL knife
'fewer than six knives'

d. yixie-*pi ma (Basic, 'some')
some-CL horse
'some horses'

e. mei(you)-*bei cha (Basic, 'NEG')
NEG-CL tea
'no tea'

Note that in the expression *yi-xie* which is bimorphemic since *yi* is 'one', we do not consider *xie* a classifier since it is ungrammatical to say *{*liang* / *henduo* / *chaoguo ba*} *-xie* '{two / very-many / over} eight -xie', cf. {*liang* / *henduo* / *chaoguo ba*} *-zhi*, where *zhi* is a classifier that can be used for counting some animals, i.e. *xie* does not show the same productivity of combination with different quantifiers that other classifiers do.

Most generalized universal quantifiers require classifiers but some do not. The universal quantifiers *quanbu* and *suoyou* cannot co-occur with classifiers. The generalized universal quantifiers that require classifiers include *zheng-CL* 'entire-CL' and *quan-CL* 'whole-CL', *mei-CL* 'every-CL', *ge-CL* 'GE-CL', and some modified quantifiers such as *quanbu chule wu-ge* 'all except five-CL'. Note that in the last case, a classifier is required even though the basic form this modified quantifier is built from, *quanbu*, cannot co-occur with a classifier. However, the modified quantifier ends in a numeral, and so may behave like a basic generalized existential quantifier, i.e. whether the quantifier co-occurs with a classifier or not may also be dependent on only a portion of the quantificational expression that is most local to the classifier in some sense. Below, the first two examples show generalized universal quantifiers which may

not co-occur with classifiers and the rest of the examples show quantifiers that require classifiers.

(57) Generalized universal quantifiers

a. quanbu-*ge (de) laoshi dou lai-le
all-CL (DE) teacher DOU arrive-ASP
'All the teachers have arrived.'

b. suoyou-*ge (de) xuesheng dou chi-dao-le
all-CL (DE) student DOU late-arrive-ASP
'All the students were late.'

c. zheng-*(zhang) (de) zhi
whole-CL (DE) paper
'whole piece of paper'

d. quan-*(ban) (de) xuesheng tongguo-le kaoshi
whole-CL (DE) student pass-ASP exam
'All the class's students passed the exam.'

e. mei-*(zhi) *de mao chule zhe-*(zhi)
every-CL DE cat except this-CL
'every cat except this one'

f. ge-*(zhi) *de gou dou you ziji de zhuren
GE-CL DE dog DOU YOU self DE owner
'Each dog has its own owner.'

g. quanbu chule wu-*(ge) *de pingguo dou landiao-le
all except five-CL DE apple DOU rotten-ASP
'All but five apples were rotten.'

Classifiers cannot appear in proportional quantification of the structure D + (*DE*) + N:

(58) duoshu/shaoshu-*ge (de) xiaohai xihuan tangguo
most/few-CL (de) child like candy
'Most children like candy.'

However, proportions expressed as part-to-whole ratios, of type $D_{whole} + N + D_{part}$, must co-occur with classifiers, as in (59).

(59) shi-*(ke) shu dangzhong chaoguo san-*(ke) sidiao-le
ten-CL tree among over three-CL die-ASP
'More than three out of ten trees died.'

Proportional quantification with structure D + *DE* + N, for percentages and ordinal fractions, behaves differently, as in (60): the classifier is optional and must occur as the word preceding *de*, which is obligatory.

If the classifier is excluded, then the percentage or fraction can refer to a single individual or members of a set, as in (60-a) and (60-b); if the classifier is included, then whether the percentage or fraction refers to a single individual or members of a set is unambiguous, as in (60-c) and (60-d), where the percentage/fraction can only refer to a single individual.

(60) Proportional quantifiers: percentages and fractions

a. sifenzhiyi *(de) zhi
one-fourth DE paper
'one fourth of the paper/one fourth of the papers'

b. baifenzhi-ershi-wu *(de) zhi
percenty-twenty-five DE paper
'twenty-five percent of the paper/twenty-five percent of the papers'

c. sifenzhiyi-zhang *(de) zhi
one-fourth-CL DE paper
'one fourth of the paper'

d. baifenzhi-ershi-wu-zhang *(de) zhi
percent-twenty-five-CL DE paper
'twenty-five percent of the paper'

12.1.6.1 The Count-Mass Distinction in Mandarin

In English, the count/mass noun distinction can be drawn from the fact that mass nouns, unlike count nouns, require a classifier or other measure word to be counted, e.g. **two corns*, but *two ears of corn* (mass noun); *two dogs* (count noun). Thus, in Mandarin, by this distinction, all nouns are mass nouns, since classifiers are obligatory to make nouns countable (Cheng and Sybesma, 1998).

In fact, though, there does exist a cognitive count/mass noun distinction in Mandarin, but it is encoded in the classifier rather than the noun (Cheng and Sybesma, 1998; Chien et al., 2003; Zhang, 2007). Mandarin numeral classifiers have been divided into two sets by many linguists, e.g. count-noun classifier and mass-noun classifiers (Zhang, 2007) or classifiers and massifiers (Cheng and Sybesma, 1998). We use the terminology of classifiers/massifiers below.

Croft (1994); Tai and Wang (1990), i.e., as referenced in Cheng and Sybesma (1998), have proposed that while massifiers create a unit of measure, e.g. *san-wan tang* 'three-CL soup', literally, 'three bowls of soup', classifiers do not, e.g. *san-zhi gou* 'three-CL dogs', where *zhi* does not create a unit of measure. That is, massifiers create units of measure that can allow the quantification of nouns that don't occur in individual, discrete units (they include measures that are like container expressions in English); while classifiers pick out individual,

discrete units for nouns that naturally occur in such units (these do not have analogs in English).

Evidence that the mass/count distinction in Mandarin is encoded in the classifier comes from examples where QNPs formed from the same noun but different classifiers behave differently (Cheng and Sybesma, 1998, pp. 4–5) and from an acquisition study by Chien et al. (2003).

Below is an example where the noun of interest is *mi* 'rice', and the massifier is *dai* 'bag' and the classifier is *li* 'grain' (61).

(61) a. wo na-le liang-dai (de) mi
1sg take-ASP two-CL DE rice (Massifier)
'I took two bags of rice.'

b. wo na-le liang-li *de mi (Classifier)
1sg take-ASP two-CL DE rice
'I took two grains of rice.'

Depending on whether rice is quantified with *dai* or *li*, the QNP behaves differently. Chao (1968, pp. 509, 555) and Cheng and Sybesma (1998) (and references therein) propose that massifiers can optionally take *de* between them and the noun being quantified, while classifiers cannot, cf. (61). Moreover, Cheng and Sybesma (1998), citing Tang (1990), state that adjectives can marginally appear between the numeral and the massifier, but not between the numeral and the classifier. Accordingly, there is a distinction below in (62). For *dai*, the adjective *da* 'big' can be added after the numeral. For *li*, adding *da* after the numeral is questionable in acceptability.

(62) a. wo na-le liang da dai mi
1sg take-ASP two big CL rice (Massifier)
'I took two big bags of rice.'

b. wo na-le liang ?da li mi (Classifier)
1sg take-ASP two big CL rice
'I took two big grains of rice.'

Based on examples like (61) and (62), the count/mass distinction is not encoded in the noun, but in the measure word: the classifier/massifier. Even in quantifying the same noun, the massifier allows an adjective before it and *de* after it, while the classifier may not.

The cross-sectional acquisition study by Chien et al. (2003) consisted of two guessing game tasks with 80 children from 3 to 8 years old as well as adult controls, in Taipei, Taiwan. A context was set up to see if children comprehended the count-/mass-classifier distinction:

(63) Mi-laoshu shuo ta yao yi-tiao [something]
Mickey-Mouse say 3sg want one-CL something
'Mickey Mouse says he wants something.'

Children were asked to guess what Mickey Mouse wanted, given the context of the classifier, e.g. *tiao*, a count-classifier for long thin objects, above, and were presented with three objects, a combination of objects and substances to choose from. Results showed that even from a young age, children could reliably use contexts with a count-classifier to select objects with naturally discrete countable units and contexts with a mass-classifier to select objects without such naturally discrete countable units.

Put together with syntactic data in (61) and (62), the experimental data from the acquisitional study support the cognitive reality of the count/mass distinction in Mandarin being encoded in the numeral classifier.

12.1.6.2 Containers

Container expressions are massifiers in Mandarin. They create units of measure and they can always take *de* before the following noun (Chao, 1968, p. 603), as in (64). They can convert mass to count terms, as in (64-a), (64-b), and (64-c) and they retain their literal meaning: if one has drunk *qi bei jiu* 'seven cups of wine', then one has held actual cups of wine in one's hand. Container expressions can take count nouns as well as mass nouns; examples with count nouns are given in (64-d) and (64-e).

(64) Container expressions

a. qi bei (de) jiu
seven cup (DE) wine
'seven cups of wine'

b. yi ping (de) niunai
one bottle (DE) milk
'one bottle of milk'

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

d. henduo he (de) tangguo
many box (DE) candy
'many boxes of candies'

e. mei dai (de) shu
every bag (DE) book
'every bag of books'

Some container expressions can refer to atypical containers that are not convex geometric forms like boxes, bowls, bottles, etc, cf. (65). In this sense, they refer to abstract containers, as in measure phrases, discussed below. However, for these expressions, the containers do retain their literal meanings, as for the examples in (64). For instance, in (65-a), if you tell the restaurant that you are

reserving a banquet dinner for *san zhuo keren* 'three tables of guests', the restaurant will prepare three tables for you. In (65-b), if fifth grade is composed of *jiu ban xuesheng* 'nine classes of students' and the teachers complain there are too many classes, the students can be redistributed into seven classes, with more students in each class. (65-c) is a little trickier: we include (65-c) as a container expression because it is grammatical to have more than a single *dui* 'pile' of garbage, so this example behaves differently from those discussed for measure phrases in Section 12.1.6.3. But it is also possible to specify a single *dui* 'pile' of garbage, in which case the expression behaves like the measure phrases and loses its literal meaning.

(65) Container expressions with atypical containers
   a. san zhuo (de) keren
      three table (DE) guest
      'three tables of guests'
   b. jiu ban (de) xuesheng
      nine class (DE) student
      'nine classes of students'
   c. ji dui (de) lese
      several pile (DE) garbage
      'several piles of garbage'

12.1.6.3 Measure Phrases

Measure phrases in Mandarin are similar to container expressions but refer to abstract containers and create units of measurement; they are massifiers as well and are characterized by referring purely to quantity. They can use measurement units like units of weight and length, as in (66), so that the abstract container refers directly to quantity. The use of *de* is also optional, as for container phrases.

(66) Measure phrases with units of weight/length
   a. yi-qianke (de) yan
      one-kilogram (DE) salt
      'one kilogram of salt'
   b. liang-bang (de) doufu
      two-pound (DE) tofu
      'two pounds of tofu'
   c. san-chi (de) bu
      two-foot (DE) cloth
      'two feet of cloth'

Measure phrases can also refer directly to abstract containers as in (65). Chao (1968. p. 603) classifies these as *temporary measures*, which do not allow numerals greater than one as determiners, see (67). These expressions also tend to be opaque and the abstract containers do not retain their literal meaning. For instance, for (67-a) below, *yi di de shui* does not literally mean 'one floorful of water' but that there is water all over the floor, and one can not use any numeral in this expression other than 'one'. Similarly, in (67-b), *yi shen de han* does not literally mean 'one bodyful of sweat', but a lot of sweat.

(67) Measure phrases with abstract containers
a. {yi / *liang / man} di (de) shui
{one / *two / entire} floor (DE) water
'a/entire floorful of water, lots of water on the floor'

b. {yi / quan} shen (de) han
{one / whole} body (DE) sweat
'a bodyful of sweat, lots of sweat'

The abstractness and temporary nature of the massifiers described in this section underscore another distinction between classifiers/massifiers that has been discussed in the literature: a semantic difference, cf. Tai (1992, 1994), Tai and Wang (1990) as referenced in Chien et al. (2003). Classifiers denote inherent or permanent properties of an object, while massifiers simply indicate temporary properties of an object. For instance, *tiao* can be described as a classifier that is typically used for flexible objects that are cylindrical in shape and long and thin, e.g. rope, snake, fish – the classifier is associated with inherent geometric and structural properties of the objects and thus selects a set of objects with these properties. On the other hand, massifiers are not associated with inherent properties of objects and do not select a well-defined set of objects – they simply denote measures as shown below for the massifier *wan* 'bowl':

(68) a. yi-wan fan/huasheng
one-CL rice/peanut
'a bowl of rice/peanuts'

b. yi-wan lamian
one-CL ramen
'a bowl of ramen'

12.1.6.4 Units of Time and Distance

We have described measure phrases of weight and length; here are some examples of measure phrases in Mandarin using time and distance. Note that we gloss the measure phrases as units of time and distance rather than as classifiers (unlike in the discussion of rate phrases in A-quantification earlier in Section 12.1.6 on p. 665) to be clear about their meanings.

(69) a. wo shui-le shi-xiaoshi
1sg sleep-ASP ten-hour
'I slept for ten hours.'

b. yi-xingqi you qi-tian
one-week YOU seven-day
'There are seven days in a week.'

c. wo gei-le yi-ge sanshi-fenzhong de yanjiang
1sg give-ASP one-CL thirty-minute DE talk
'I gave a thirty-minute talk.'

d. fengdanbailu li bali wushi gongli
Fontainebleau away Paris fifty kilometer
'Fontainebleau is fifty kilometers from Paris.'

e. wo bi ni gao san gongfen
1sg COMP 2sg tall three centimeter
'I am three centimeters taller than you.'

f. wo yijing zou-le jiqian-li de lu
1sg already walk-ASP thousands-mile DE road
'I have already walked for thousands of miles.'

As for rate phrases, Mandarin word order is inverted from English word order: the denominator in the rate comes before the numerator. For instance, rather than say 'go 400 kilometers per hour' in (70-a) as in English, Mandarin speakers say *yi-xiaoshi zou sibai gongli* 'lit. one hour go 400 kilometers'.

(70) a. na-liang huoche yi-xiaoshi zou si-bai gongli
that-CL train one-hour go four-hundred kilometers
'That train goes 400 kilometers per hour.'

b. wo yi-tian pao ershi gongli
1sg one-day run twenty kilometer
'I run twenty kilometers a day.'

c. Zhangsan {yi / mei}-tian xi lian {liang / san}-ci
John {one / every}-day wash face {two / three}-time
'John washes his face twice a day/three times a day/every day.'

12.1.6.5 Mass vs. Count Qs Without Classifiers

In Mandarin, D-quantifiers can combine freely with count nouns or mass nouns. Typically, D-quantifiers must appear with classifiers, containers, or measure phrases to combine with count and/or mass nouns, and these co-occurring elements can even convert a mass to a count noun, e.g. in container expressions.

As for D-quantifiers that do not co-occur with classifiers, e.g. *suoyou* 'all', *quanbu* 'all', *mei(you)* 'NEG', *yixie* 'some' – they can combine with count and mass nouns:

(71) a. suoyou de zhurou / zhu
all DE pork / pig
'all the pork/pigs'

b. mei(you) qiyou / jiayou-zhan
NEG gasoline / gas-station
'no gasoline/gas stations'

c. yi-xie tang / tang-wan
some soup / soup-bowl
'some soup/soup bowls'

Thus, Mandarin does not have D-quantifiers that can combine with mass but not count nouns, or that combine with count but not mass nouns.

12.2 Phenomena Involving Mandarin Quantifiers

With the basic inventory of Mandarin quantifiers at hand, we turn to phenomena involving quantifiers in Mandarin.

12.2.1 Some NP Background

12.2.1.1 Definite NPs

Definite NPs in Mandarin are formed by using *zhe*/*na* 'this/that' + CL + NP, e.g. *zhe-ge nuren* 'this-CL woman', *na-zhi mao* 'that-CL cat', or in possessive constructions, NP_1 *de* NP_2 'NP_1's NP_2', e.g. *Zhangsan de haizi* 'John DE child' (John's child). Proper nouns in Mandarin are typically multimorphemic, e.g. *Zhang-xiansheng* 'Mr. Chang', where *xiansheng* is a suffix which is used in addressing a male. Mandarin has adnominal demonstratives (e.g. *zhe*/*na* + CL), which can be used as pronominal demonstratives. For example, *zhe-ben shu* 'this-CL book', an adnominal demonstrative, can also be expressed as *zhe-ben*, a pronominal demonstrative, in which *ben* is the classifier appropriate for books. In Mandarin, *zhe-CL* 'this', *na-CL* 'that' cover the functions of both definite articles and demonstratives.

12.2.1.2 Generic NPs

In Mandarin, generic NPs are formed using bare nouns, as shown below[9]:

(72) a. gou yao-ren
dog bite-man
'Dogs bite.'

b. tuzi fanzhi-de hen kuai
rabbit reproduce-DE very fast
'Rabbits reproduce rapidly.'

c. konglong juezhong-le
dinosaur extinct-ASP
'Dinosaurs are extinct.'

12.2.2 Monomorphemic Quantifiers

The typical quantifier in Mandarin is multimorphemic; the counterparts of monomorphemic quantifiers in English such as numerals must be followed by a classifier in Mandarin and thus are not monomorphemic in Mandarin. However, 'no' can be expressed with the monomorphemic quantifier *mei*, as shown above in (24), which results from a multimorphemic quantifier *mei(you)*, since *you* is optional, as in (74-a).

As in English, Mandarin has multiple universal quantifiers: *mei-CL* 'each/every', *quanbu*/*suoyou*/*zheng-CL* 'all', as discussed in Section 12.1.2.1. While these are multimorphemic, Mandarin does have a monomorphemic 'all', i.e. *dou* used as in Section 12.1.3. However, Mandarin does not have a monomorphemic form of 'one', since *yi* 'one' must be followed by a classifier in a quantificational expression, e.g. *yi-zhi gou* 'one-CL dog'. As in English, *yi*, 'one' in Mandarin, also functions as an indefinite article, e.g. 'one dog' and 'a dog' are both *yi-zhi gou* 'one-CL dog'. Mandarin does not have a monomorphemic proportional determiner, cf. Section 12.1.5. One exception to this is the A-Quantifier *chang* 'often', as shown below.

(73) ta chang(chang) lai ting yinyuehui
3sg often come listen concert
'He often comes to concerts.'

Mandarin does not have a monomorphemic value judgment quantifier translating 'many' but has instead the bimorphemic *hen-duo* (lit. very-many).

[9] The postverbal *de* in (72-b) is a different morpheme than the *de* used with nominals.

In Mandarin, A-quantifiers are not necessarily morphosyntactically more complex than D-quantifiers since both are typically multimorphemic. For instance the D-quantifier 'a majority of/most' is *da duo-shu de* while the A--quantifier 'often' is *shi-chang*. In addition, Mandarin does not have cases of semantic back-formation of A-quantifiers as in English, e.g. *a frequent visitor*, *a quick lunch*.

12.2.3 Decreasing NPs

Mandarin has determiners which build decreasing NPs. Below we show decreasing NPs built from intersective quantifiers (74), co-intersective quantifiers (75), and proportional NPs (76).

(74) Decreasing NPs built from intersective quantifiers
   a. mei(you) xuesheng lai shang-ke.
      NEG student come attend-class
      'No students came to class.'

   b. bu dao ba-ge xuesheng lai-le.
      NEG reach eight-CL student come-ASP
      'Fewer than eight students came.'

(75) Decreasing NPs built from co-intersective quantifiers
   mei(you) xuesheng lai shang-ke.
   NEG student come attend-class
   'No students came to class.'

(76) Decreasing NPs built from proportional quantifiers
   a. bu dao sifenzhiyi de xuesheng tongguo-le kaoshi.
      NEG reach one-fourth DE student pass-ASP exam
      'Less than a quarter of the students passed the exam.'

   b. shi-ge shuishou bu chaoguo qi-ge hui chouyan.
      ten-CL sailor NEG over seven-CL will smoke
      'Not more than seven out of ten sailors will smoke.'

Decreasing NPs can license negative polarity items, as shown in (77).

(77) Decreasing NPs license negative polarity
   a. shu-jia de shihou bu dao ba-ge xuesheng
      summer-vacation DE time NEG reach eight-CL student
      du-le renhe shu
      read-ASP any book
      'During summer vacation fewer than eight students read any books.'

b. *shu-jia de shihou chaoguo ba-ge xuesheng du-le
*summer-vacation DE time over eight-CL student read-ASP
renhe shu
any book
'Lit. During summer vacation more than eight students read any books.'

c. *shu-jia de shihou wu dao ba-ge xuesheng
*summer-vacation DE time five reach eight-CL student
du-le renhe shu
read-ASP any book
'Lit. During summer vacation five to eight students studied any books.'

In (77-a), the negative polarity item *renhe* 'any' occurs within the argument of the decreasing expression *bu dao ba-ge xuesheng* 'not more than eight students' and is licensed. However, in (77-b) and (77-c), the negative polarity item *renhe* occurs within the argument of the increasing expression *chaoguo ba-ge xuesheng* 'more than eight students' in the former and within the argument of the nonmonotonic expression *wu dao ba-ge xuesheng* 'five to eight students' in the latter and is not licensed in either case. This is evidence that the Ladusaw-Fauconnier Generalization holds in Mandarin. We note, though, that although *renhe* behaves like English *any* in this respect, the usage of *renhe* is pragmatically conditioned in a way that *any* isn't: it seems to require particular focus conditions.

Like *renhe*, existential *wh*-phrases in Mandarin can be licensed by negative environments (Lin, 2004) (and references therein).

(78) Negation licenses existential *wh*-phrases
a. shu-jia de shihou mei(you) xuesheng nian-le shenme
summer-vacation DE time NEG student study-ASP what
'During summer vacation no students studied anything.'

b. *shu-jia de shihou xuesheng nian-le shenme
summer-vacation DE time student study-ASP what
'During summer vacation students studied something.'

12.2.4 Boolean Compounds

Mandarin can form Boolean compounds of determiners for both D-Quantifiers and A-Quantifiers as shown below.

(79) Boolean compounds of D-Quantifiers
a. ming-nian zhishao liang-ge dan bu chaoguo shi-ge xuesheng hui
next-year at-least two-CL but NEG over ten-CL student will
dedao jiangxuejin.
win scholarship
'At least two but not more than ten students will get scholarships next year.'

b. dabufen dan bu shi suoyou de shiren dou zai xiawu shuijiao.
most but NEG be all DE poet DOU at afternoon sleep
'Most but not all poets sleep in the afternoon.'

c. meiyou mei-ge xuesheng huo mei-ge laoshi dou lai
NEG every-CL student or every-CL teacher DOU come
canjia wuhui
attend party
'Neither every student nor every teacher came to the party.'

(80) Boolean compounds of A-Quantifiers

a. Zhangsan chi-dao-le liang-ci danshi bu chaoguo wu ci
John late-arrive-ASP two-time but NEG over five times
'John was late at least twice but not more than five times.'

b. ?Lisi changchang dan bu mei-ci toupiao gei minzhudang
?Lisi often but NEG every-time vote for democrats
'Lisi frequently but not always votes for the democratic party.'

c. suiran Lisi changchang toupiao gei minzhudang dan bu shi
although Lisi often vote for democrats but NEG be
mei-ci.
every-time
'Lisi frequently but not always votes for the democratic party.'

12.2.5 Exception Phrases

Exceptions to generalizations in quantificational expressions can be expressed in Mandarin using *chule . . . (yiwai)* 'except' as in the examples below:

(81) a. chule Zhangsan (yiwai) mei-ge xuesheng dou
except John (except) every-CL student DOU
zao-dao-le
early-arrive-ASP
'Every student but John arrived early.'

b. chule Zhangsan (yiwai) mei(you) xuesheng zao-dao
except John (except) NEG student early-arrive
'No student except John arrived early.'

In Mandarin, adverbial clauses typically have to precede the main clause (Lin, 2006), so that the sentence structure with the exception phrase *chule . . . (yiwai)* preceding the quantified NP is preferable in Mandarin. In English, though, the order with the adverbial clause preceding the main clause e.g. *Except John, every/no student arrived early*, seems to put focus on *John*.

In Mandarin, the order with the adverbial clause following the quantified NP is still possible, though:

(82) a. mei-ge xuesheng chule Zhangsan (yiwai) dou
every-CL student except John (except) DOU
zao-dao-le
early-arrive-ASP
'Every student but John arrived early.'

b. meiyou xuesheng chule Zhangsan (yiwai) zao-dao-le
NEG student except John (except) early-arrive-ASP
'Nobody except John arrived early.'

12.2.6 Only

'Only' + NP in Mandarin can be expressed as *zhiyou*, as shown below.

(83) a. zhiyou Zhangsan choudao da jiang
only Zhangsan draw big prize
'Only Zhangsan drew the big prize.'

b. zhiyou xuesheng canjia dianli
only student attend ceremony
'Only students attended the ceremony.'

Like English 'only', Mandarin *zhiyou* could be taken as a counterexample to the generalization that all determiners are conservative (Keenan and Moss, 2008; Keenan, 2011), as shown by the different truth conditions of the two statements below:

(84) a. zhiyou nusheng shi landuo de
only girl be lazy DE
'Only girls are lazy.'

b. zhiyou nusheng shi landuo de nusheng
only girl be lazy DE girl
'Only girls are lazy girls.'

12.2.7 Partitives: D + of + $NP_{def.pl}$

As in English, definite plural NPs provide a conservativity domain, presupposed non-empty. The determiner may be cardinal as in (85-a), interrogative as in (85-b), universal as in (85-c), or proportional as in (85-d) and (85-e). For more details on partitive constructions with proportional quantifiers, see Section 12.1.5.

(85) a. zhenghao liang-ge {wo / Zhangsan}-de xuesheng tongguo-le kaoshi
just two-CL {1sg / John}-DE student pass-ASP exam
'Just two of {my/John's} students passed the exam.'

b. zhexie xuesheng na-ge tongguo-le kaoshi?
these student which-CL pass-ASP exam
'Which of these students passed the exam?'

c. (bingfei) quanbu (de) xuesheng dou tongguo-le kaoshi
(NEG) all (DE) student DOU pass-ASP exam
'(Not) All of the students passed the exam.'

d. chaoguo {baifenzhi-bashi / liufenzhiwu} *(de) xuesheng
more-than {percent-eighty / five-sixths} DE student
tongguo-le kaoshi
pass-ASP exam
'More than eighty percent/five-sixths of the students passed the exam.'

e. dabufen (de) xuesheng dou tongguo-le kaoshi
most (DE) student DOU pass-ASP exam
'Most of the students passed the exam.'

The closest Mandarin counterpart to the English 'of' in partitive constructions as shown above is *de*. However, it is optional in most cases, except for some proportional quantifiers as in (85-d), cf. Section 12.1.5; in fact, in some cases, it cannot appear where English 'of' does, as in (85-a) and (85-b).

As can be seen in the examples above, Mandarin has syntactically complex NP partitives; in fact there are no monomorphemic determiners that can be used to express partitives such as English 'most' (cf. *da bu-fen*).

12.2.8 Quantificational Negative Polarity Items

Like English 'any', *renhe* in Mandarin does not occur in affirmative contexts; its presence requires a decreasing function, and it can have an existential reading when under the scope of a decreasing function. For instance, suppose the context is that you are looking for long skirts for costumes for a school play and you ask a friend who you believe to own many skirts:

(86) ni you (yixie) chang-qun, dui ma
2sg YOU (some) long-skirt, right Q
'You have some long skirts, right?'

She can then reply:

(87) wo mei(you) (renhe) chang-qun.
1sg NEG (any) long-skirt.
'I don't have any long skirts./It is not the case that I have some long skirts.'

12.2.9 Predicates

Predicate quantifiers in Mandarin include value judgment cardinals (88-a), cardinal numerals (88-b), and some modified cardinal numerals (88-c) but not others (88-d) as predicate quantifiers.

(88) Predicate quantifiers

a. Value judgment cardinals
lai-de xuesheng (you) {henduo / henshao}
come-DE student (YOU) {many / few}
'The students who came are many/few.'

b. Basic cardinal numerals
lai-de xuesheng *(you) shi-ge
come-DE student YOU ten-CL
'The students that came were ten.'

c. Modified cardinal numerals
lai-de xuesheng {zhishao / ganghao / jiangjin} (you)
come-DE student {at-least / just / approximately} YOU
shi-ge
ten-CL
'The students that came were at least/just/approximately ten.'

d. Other modified cardinal numerals
lai-de xuesheng (you) {*quanbu / *yixie / *mei(you) /
come-DE student (YOU) {all / some / NEG /
*daduoshu / *mei-ge chule yi-ge / *shi-ge you qi-ge}.
most / all-CL but one / ten-CL YOU seven-CL}
'Lit. The students that came were all/some/none/most/all but one/
seven out of ten.'

12.2.10 NPs

Most quantifiers in Mandarin can function as NPs, unlike in English, where the distribution of quantifiers that can do so is more restricted. Some generalized existential quantifiers as in (89) must co-occur with the classifier appropriate for the antecedent. For generalized existential quantifiers with plurality, *xie* is used in (89-b), as discussed in Section 12.1.6. For generalized universal quantifiers,

dou must be used and the word order is restricted such that the quantifier appears before *dou*, which appears before the verb, *mai* 'buy' in (90); additionally classifiers are used only in some cases, e.g. if the quantifier is *mei* 'every', as in (90-b). Proportional classifiers can also function as NPs, as shown in (91).

(89) Generalized existential quantifiers as NPs

a. naxie lingdai hen pianyi suoyi wo mai-le {yi / san / ji / henduo} –tiao
those tie very cheap so 1sg buy-ASP {one / three / several / many} –CL
'Those ties were very cheap so I bought one/three/several/many.'

b. naxie lingdai hen pianyi suoyi wo mai-le yixie -*tiao
those tie very cheap so 1sg buy-ASP some -CL
'Those ties were very cheap so I bought some.'

(90) Generalized universal quantifiers as NPs

a. naxie lingdai hen pianyi suoyi wo quanbu-*tiao dou mai le.
those tie very cheap so 1sg all-CL DOU buy ASP
'Those ties were very cheap so I bought them all.'

b. naxie lingdai hen pianyi suoyi wo mei-*(tiao) dou mai le.
those tie very cheap so 1sg every-CL DOU buy ASP
'Those ties were very cheap so I bought every one.'

(91) Proportional quantifiers as NPs

a. naxie lingdai hen pianyi suoyi wo dabufen dou mai le.
those-CL tie very cheap so 1sg most DOU buy ASP
'Those ties were very cheap so I bought most of them.'

b. naxie lingdai hen pianyi suoyi wo mai-le baifenzhi-ershi.
those tie very cheap so 1sg buy-ASP percent-twenty-CL
'Those ties were very cheap so I bought twenty percent of them.'

12.2.11 Distribution

12.2.11.1 Mandarin QNPs Occur in all Major Grammatical Functions

Mandarin QNPs occur in all major grammatical functions, as illustrated below.

(92) a. you san-ge xuesheng chi-bao le (Subject)
YOU three-CL student eat-full ASP
'Three students are full.'

b. Zhangsan zhi huida-le san-dao wenti (Direct object)
John only answer-ASP three-CL question
'John only answered three questions.'

c. wo huida-le quanbu chule yi ti (Direct object)
1sg answer-ASP all but one question
'I answered all but one question / all but one of the questions.'

d. Lisi huida-le {dabufen / sifenzhisan} de wen-ti
Lisi answer-ASP {most / three-fourths} DE question
(Direct object)
'Lisi answered most / three fourths of the questions.'

e. tushuguan ji-le yi-fen tongzhi gei {ji-ge xuesheng /
library send-ASP one-CL notice to {several-CL student /
suoyou de xuesheng / jiangjin yi-ban de xuesheng}
all DE student / about half DE student}
(Indirect object)
'The library sent a notice to several students / all the students / about half the students.'

f. liang-ge xuesheng de yisheng bei daibu-le (Possessor)
two-CL student DE doctor BEI arrest-ASP
'Two students' doctors were arrested.'

g. {mei-ge / ge-ge} xuesheng de yisheng dou fuhe zige
{every-CL / GE-CL} student DE doctor DOU match qualification
(Possessor)
'Every / Each student's doctor is well qualified.'

h. Zhangsan miantan-le dabufen xuesheng de yisheng
John interview-ASP most student de doctor
(Direct object's possessor)
'John interviewed most of the students' doctors.'

12.2.11.2 Mandarin QNPs in Special Positions

QNPs in Mandarin do not occupy special positions not allowed or unusual for definite NPs.

As in English, overtly negated NPs are better in subject than object position:

(93) a. mei(you) mei-ge xuesheng huida-le mei-ge wenti
NEG every-CL student answer-ASP every-CL question
'Not every student answered every question.'

b. *mei-ge xuesheng huida-le mei(you) mei-ge wenti
every-CL student answer-ASP NEG every-CL question
'Lit. Every student answered not every question.'

12.2.11.3 Scope Ambiguities

In Mandarin, two or more arguments of a given predicate can be bound simultaneously by QNPs, leading to scope ambiguities.

In Aoun and Li (1989, p. 7) and Aoun and Li (1993), it is stated that, unlike in English, in Mandarin, the interpretation of doubly quantified structures, e.g. (94), is unambiguous, with only the subject wide scope (SWS) every > one reading available. However, scope interpretation interacts with *wh*-operators like in English: if there is a subject *wh*-phrase then only a SWS and not an object wide scope (OWS) reading with who > every allowed, but if there is an object *wh*-phrase then either SWS or OWS readings are possible.

(94) a. Every man loves a woman. (ambiguous)

b. mei-ge ren dou xihuan yi-ge nuren
every-CL man DOU like one-CL woman
'Everyone loves a woman.' (unambiguous SWS)
SWS: for every person *x*, x loves a woman
*OWS: one woman is such that every man loves her

(95) a. Who bought everything for Max? (unambiguous SWS)

b. shei gei Zhangsan mai-le mei-ge dongxi
who for John buy-ASP every-CL thing
'Who bought everything for John?' (unambig. SWS)

(96) a. What did everyone buy for Max? (ambiguous)

b. mei-ge ren dou gei Zhangsan mai-le shenme?
every-CL man DOU for John buy-ASP what
'What did everyone buy for John?' (ambiguous)

However, other work suggests that even doubly quantified sentences without *wh*-operators, such as (94), are ambiguous in Mandarin (Kuno et al., 1999; Zhou and Gao, 2009). Kuno et al. (1999, p. 96) states that there are speakers who in fact find (94) ambiguous, citing also Wu (1992). Zhou and Gao (2009) presents both off-line judgment task and on-line eyetracking data showing that doubly quantified sentences with interaction with *wh*-phrases like (94) can be ambiguous, with both SWS and OWS readings.

In general, the particular instantiation of a doubly quantified construction given the two quantifiers can affect the scope interpretation. For instance, (94) contains the quantifiers *mei-ge* 'every-CL' in subject position and 'yi-CL' in object position, and while the OWS reading is possible for some speakers, it is less marginal in the example below, which uses the same quantifiers:

(97) mei-ge yinhangjia dou xiang-zhe yi-jian shi
every-CL banker DOU think-ASP one-CL issue
'Every banker is thinking of an issue.'
SWS: For every banker *x*, *x* is thinking of an issue
OWS: There is one issue, such that every banker is thinking of it.

In (98) with an existential and a universal quantifier in the subject and object position respectively, Mandarin only has a SWS reading: there is one editor x such that x read all the manuscripts, unlike English, which also has the OWS reading: each manuscript is such that at least one editor read it.

(98) you (yi)-ge bianji du-le mei-pian (de) shougao
YOU one-CL editor read-ASP every-CL DE manuscript
'Some editor read every manuscript.'[10]

In (99-a) below with basic numeral quantifiers, Mandarin has both an OWS reading and group reading, but not a SWS reading, and the group reading is most prominent.

SWS: There are three instructors each one of which graded one hundred exams.
OWS: There are one hundred exams such that each instructor graded them.
Group: There is a group of three instructors and a group of one hundred exams and the group of instructors graded the group of exams.

Adding the distributive quantifier *ge* as in (99-b) forces the SWS reading. Adding *zonggong* 'in total' preverbally as in (99-c) yields both group and OWS readings, with the OWS reading more prominent; in either position, *zonggong* modifies the QNP *yi-bai-fen kaojuan* 'one hundred exams'.

(99) a. san-ge laoshi gai-le yi-bai-fen kaojuan
three-CL teacher grade-ASP one-hundred-CL exam
'Three instructors graded one hundred exams.' (group, OWS)

b. san-ge laoshi ge gai-le yi-bai-fen kaojuan
three-CL teacher GE grade-ASP one-hundred-CL exam
'Three instructors each graded one hundred exams.' (SWS)

c. san-ge laoshi zonggong gai-le yi-bai-fen kaojuan
three-CL teacher total grade-ASP one-hundred-CL exam
'Three instructors graded one hundred exams in total.' (OWS, group)

As in English, modified numerals in object position tend to force narrow scope in Mandarin. In (100-a) below, as in English, the interpretation is ambiguous between SWS and OWS readings:

SWS: For every student x, x read three Zhang Ailing novels
OWS: Three Zhang Ailing novels were such that every student read them

However, in (100-b), the addition of *zhishao* 'at least' forces a SWS reading.

[10] English 'some' as in (98) does not have a direct correspondent in Mandarin; the closest expression is *you yi-ge* 'YOU one-CL' or *mo-ge* 'certain-CL'.

(100) a. mei-ge xuesheng zai shu-jia dou du-le san-ben
every-CL student at summer-vacation DOU read-ASP three-CL
zhang ailing de xiaoshuo
Zhang Ailing DE novel
'Every student read three Zhang Ailing novels over the summer vacation.' (ambiguous)

b. mei-ge xuesheng zai shu-jia dou zhishao du-le
every-CL student at summer-vacation DOU at-least read-ASP
san-ben zhang ailing de xiaoshuo
three-CL Zhang Ailing DE novel
'Every student read at least three Zhang Ailing novels over the summer vacation.' (SWS)

In Mandarin, a decreasing NP in subject position forces a SWS reading (101-a), and a decreasing NP in object position forces a SWS reading still: as in English, decreasing NPs are just interpreted in situ. In Mandarin, *mei(you)* 'NEG' negation of NPs is not felicitous in object position, but other decreasing NPs can be in object position (101-b).

(101) a. {mei(you) (yi-ge) / budao san-ge} zhengke zai yimaihui
{NEG one-CL / fewer-than three-CL} politician at fair
bajie mei-ge laoban
fawn every-CL boss
'No/fewer than three politicians fawned over every boss at the fair.'

b. mei-ge zhengke zai yimaihui bajie {*mei(you) / budao
every-CL politician at fair fawn {NEG / fewer-than
san-ge} lao-ban
three-CL} boss
'Every politician fawned over fewer than three bosses at the fair.'

Here is one more pair of examples illustrating NPs interpreted in situ. In (102-a), the decreasing object NP *shi-ge bu chaoguo qi-ge de wenti* 'not more than seven out of ten questions' is interpreted in situ (SWS reading), and in (102-b), the subject NP *quanbu chule yi-ge xuesheng* 'all but one-CL student' is also interpreted with an in situ (SWS) reading.

(102) a. zhiyou yi-ge xuesheng huida-le shi-ge bu chaoguo
only-YOU one-CL student answer-ASP ten-CL NEG over
qi-ge de wenti
seven-CL DE question
'Just one student answered not more than seven out of ten questions.'

b. quanbu chule yi-ge xuesheng huida-le zhishao yi-ge
all except one-CL student answer-ASP at-least one-CL
wenti
question
'All but one student answered at least one question'

D-quantifiers that are near synonyms can result in different scope interpretation. For example, in the sentences with universal quantifiers below in (103-a) and (103-b), the sentences with the quantifiers *mei-pian* 'every-CL' and *ge-pian* 'GE-CL' in (103-a) have scope ambiguity between SWS and OWS readings. However, the sentences with the quantifiers *suoyou*/*quanbu* 'all' are unambiguous with only a SWS reading. Thus, Mandarin behaves like English, where 'Some editor read all the manuscripts' has just a SWS reading but 'Some editor read every/each manuscript' has scope ambiguity.

(103) a. you liang-ge bianji du-le {mei-pian / ge-pian} (de)
YOU two-CL editor read-ASP {every-CL / GE-CL} (DE)
baodao
news-report
'Two editors read every/each manuscript.' (ambiguous)

b. you liang-ge bianji du-le {suoyou / quanbu} de baodao
YOU two-CL editor read-ASP {all / all} DE news-report
'Two editors read all of the news-reports.' (SWS)

In Mandarin, *suoyou (de)* + N 'all the + N' and *mei-ge* + N 'every-CL + N' occur naturally with symmetric predicates, allowing collective interpretations, but the distributive *ge-ge* + N 'GE-CL + N' does not. This is in contrast to English, where 'all the + N' occurs naturally with symmetric predicates, but 'every/each + N' does not.

(104) a. {suoyou (de) / mei-ge} xuesheng zuotian wanshang dou
{all DE / every-CL} student yesterday night DOU
ju zai yuanzi li
gather at courtyard LOC
'All the students / Every student gathered in the courtyard last night.'

b. *ge-ge xuesheng zuotian wanshang dou ju zai yuanzi
GE-CL student yesterday night DOU gather at courtyard
li
LOC
'Lit. Each student gathered in the courtyard last night.'

In addition, Mandarin scope interpretations with universal quantifiers can be influenced by the presence of *dou*. In the example (105) below with *suoyou*/

quanbu 'all', the presence of *dou* results in a distributive reading, as discussed in Section 12.1.3.

(105) {suoyou / quanbu} xuesheng de zhaopian dou zai zhuozi shang
{all / all} student DE picture DOU at table LOC
'For each student, a picture of that student was on the table.'
(as many pictures as students)

However, if there's no *dou*, then in addition to the meaning 'as many pictures as students', there is another possible collective meaning available where there is one picture with many students on the table. If *mei-ge*/*ge-ge* 'every-CL/GE-CL' are used for universal quantification instead, cf. (106), then *dou* is required and the distributive but not the collective reading is possible.

(106) {mei / ge} -ge xuesheng *(de) zhaopian *(dou) zai zhuozi shang
{every / GE} -CL student DE picture DOU at table LOC
'For each student, a picture of that student was on the table.'
(as many pictures as students)

As discussed above in (95) and (96), the interaction of QNPs and *wh*-phrases in Mandarin is the same as in English: if the subject in a sentence is a *wh*-phrase, *na-ge xuesheng* 'which student' (107), then the scope interpretation of the sentence is unambiguously a SWS reading, but if the object is a *wh*-phrase, *na-ge wen-ti* 'which question' (108), then the scope interpretation is ambiguous between SWS and OWS readings.

(107) na-ge xuesheng huida-le {zuiduo / suoyou} de wen-ti
which-CL student answer-ASP {the-most / all} DE question
'Which student answered the most/all the questions?' (SWS)

(108) mei-ge xuesheng huida-le na-ge wenti
every-CL student answer-ASP which-CL question
'Which question did each student answer?' (ambiguous)

However, if the subject is a QNP with the universal quantifier *suoyou* 'all', then only the OWS reading is available, as in English.

(109) suoyou de xuesheng huida-le na-ge wenti
all DE student answer-ASP which-CL question
'Which question did all the students answer?' (OWS)

In self-embedding of QNPs in Mandarin, the choices of determiners on the whole NP and on the embedded NP are fairly independent, e.g. {*mei-ge yiyuan de yi-ge*/*liang-ge*/*mei-ge*} *pengyou* '{one-CL/two-CL/every-CL} friend(s) of every senator' and the expressions built from the embedding are ambiguous, as shown below with the expression *mei-ge yiyuan de liang-ge pengyou* 'two friends of every senator':

(110) women bangjia-le mei-ge yiyuan de liang-ge pengyou
1pl abduct-ASP every-CL senator DE two-CL friend
'We abducted two friends of every senator.'

The two possible meanings are: (i) for every senator *y*, two friends of *y* have been abducted by us, and (ii) two people, each of whom is a friend of every senator, have been abducted by us.

Note however, that pragmatic considerations can restrict the possible readings, as shown below, where *pengyou* 'friend' has been replaced by *jiaren* 'family member.' In this case, it is implausible that two people could be family members of every senator. Thus, the only reading available is the one where, for every senator *y*, two family members of *y* have been abducted by us.

(111) women bangjia-le mei-ge yiyuan de liang-ge jiaren
1pl abduct-ASP every-CL senator DE two-CL family-member
'We abducted two family members of every senator.'

As in English, Mandarin exhibits scope ambiguity between nominal and verbal quantifiers, as shown below:

(112) liang-ge nan-sheng chang-le san-ci
two-CL boy sing-ASP three-time
'Two boys sang three times.'

Here, the two possible interpretations are the following:

SWS: There are two boys who sang three times each.
OWS: On three occasions, there were two boys who sang.

12.2.12 Distributivity

Mandarin has a distributive operator *ge*, discussed in Section 12.1.4. It usually occurs in preverbal position, as in (113-a), (113-b) and (113-c). In (113-a), without *ge* in the sentence, the sentence means that there are two spears in total being carried. When *ge* is added, it means that each person is carrying two spears. In (113-b), the sentence without *ge* means that the person put a flag in one place, then moved it to a second place, and then a third. With *ge*, three flags are involved, and there was one put at each of three places. Similarly, in (113-c), six books at a time are involved, and each man carried three at once.

In addition to expressing distributivity with *ge*, Mandarin can also use reduplication, as shown below in (113-d), in which students file two-by-two into two separate lines; (in Mandarin these two separate lines are considered one unit, *yi-pai*). Examples (113-e) and (113-f) compare distributivity expressed by *ge* and reduplication of the numeral + classifier. In (113-e) using *ge*, there were six suitcases in total, and John took three, and Lisi took the other three. In (113-f) using reduplication, there were many suitcases, at least three, and John

and Lisi carried three suitcases each time together (three in total each time) when they went into the hotel.

(113) a. tamen ge na liang-zhi mao
3pl GE take two-CL spear
'They carry two spears each.'

b. ta zai san-ge difang ge cha yi-zhi qizi
3sg at three-CL place GE stab one-CL flag
'He put one flag at each of the three places.'

c. liang-ge ren ge na san-ben shu
two-CL men GE take three-CL book
'Two men carried three books each/*three books are such that each of two men carried them.'

d. zhexie xuesheng liang-ge liang-ge paicheng yi-pai
those student two-CL two-CL form one-line
'Those students lined up two by two.'

e. Zhangsan han Lisi ge ti san-ge xinglixiang jin luguan
John and Lisi GE carry three-CL suitcase into hotel
'John and Lisi moved three suitcases each into the hotel.'

f. Zhangsan han Lisi ba xinglixiang san-ge san-ge ti jin
John and Lisi BA suitcase three-CL three-CL carry into
luguan
hotel
'John and Lisi moved suitcases three by three into the hotel.'

12.2.13 Indexing Function of Universal Quantifier

In Mandarin, the domain of the universal quantifier can be used as an index set for another set being enumerated. For example, in (114-a), as in the English translation, the interpretation is as follows: Write #(Toyota, *n*) for the number of Toyotas bought by people in year *n*. Then (114-a) means: for all years *n*, #(Toyota, $n + 1$) > #(Toyota, *n*). In Mandarin, 'more' can be expressed as *yue-lai-yue-duo*, which specifies a monotonically increasing function. Note also that unlike in English, the domain of the universal quantifier *mei* 'every' but not the distributive *ge* (similar to English 'each') can be used as an index set. Like English, generalized existential quantifiers like *yixie* 'some', *xu* 'five' also cannot be used to index another set. Similarly, in (114-b), the domain of *mei-li* 'every-CL' is used to index the set of trees.

(114) a. {mei / *ge / *yixie / *wu}-nian yuelaiyueduo (de) ren mai
every / GE / some / five}-year more-and-more (DE) man buy
Toyota
Toyota
'Every year more people buy Toyotas.'

b. mei-li zhongzi zhang yi-ke shu
every-CL seed grow one-CL tree
'For every seed, a tree grows.'

Additionally, there is a well-known Chinese saying:

(115) yi-li mi yang bai yang ren
one-CL rice raise hundred kind man
'From a grain of rice, a hundred kinds of people are raised.'

More figuratively translated, this means that even under identical nurturing conditions, people can become totally different. In the saying, rather than having a one-to-one mapping as in the cases where the domain of universal quantifiers are used to index another set, there is a one-to-many mapping.

12.2.14 Type (2) Quantifiers

Mandarin has type (2) quantifiers: functions that express a property of binary relations. For instance, (116-a) refers to a binary relation on the set of pairs (s, q) for s a student and q a question that s has answered. We give examples of type (2) quantifiers below.

(116) a. naxie xuesheng huida-le naxie wenti
which-CL student answer-ASP which-CL question
'Which students answered which question?'

b. suoyou (de) xuesheng huida-le xiangtong de wenti
all (DE) student answer-ASP same DE question
'All the students answered the same questions.'

c. {mei / ge} -ge xuesheng huida-le bu tong de wenti
{every / GE} -CL student answer-ASP NEG same DE question
'Each student answered a different question.'

d. bu tong (de) xuesheng huida-le bu tong de wenti
NEG same (DE) student answer-ASP NEG same DE question
'Different students answered different questions.'

e. Zhangsan han Lisi zhu zai linjin de cunzhuang
John and Lisi live at neighboring DE village
'John and Lisi live in neighboring villages.'

f. Zhangsan han Lisi zhichi didui de zheng-dang
John and Lisi support opposing DE political-party
'John and Lisi support opposing political parties.'

g. tamen zhu zai tong yi-dong dalou de bu tong gongyu
3pl live at same one-CL building DE NEG same apartment
'They live in different apartments in the same building.'

h. suoyou de fangke da-le tongyang yanse de lingdai
all DE visitor wear-ASP same color DE neck-tie
'All the visitors wore the same color necktie.'

i. Zhangsan gen Mali tiaowu danshi mei(you) bie ren gen qita ren tiaowu
John with Mary dance but NEG other man with other man dance
'John danced with Mary but no one else danced with anyone else.'

j. zhexie hua yinggai gua zai bu tong de fangjian huoshi tong yi-ge fangjian de bu tong de qiang shang
this-CL painting should hang at NEG same DE room or same one-CL room DE NEG same DE wall LOC
'These paintings should be hung in separate rooms or on opposite walls of the same room.'

k. bu tong de peishenyuan cong xiangtong de zhengju tuilun chu bu tong de jielun
NEG same DE juror from same DE evidence infer out NEG same DE conclusion
'Different jurors drew different conclusions from the same evidence.'

12.2.15 Type ((1,1),1) Quantifiers

12.2.15.1 Comparative D-Quantifiers

Like in English, Mandarin comparative D-quantifiers are built from two place adnominal determiners. However, they are not always constituents; thus, unlike in English, comparative D-quantifiers don't have the basic distribution of other NPs. Mandarin can build them in three ways: (i) NP_1 *bi* NP_2 $D_{adnominal}$ (117-a), or (ii) NP_1 $D_{adnominal}$-*yu* NP_2 (117-b), or (iii) NP_1 *gen* NP_2 *yiyang* $D_{adnominal}$ (117-c). In the first and third case, the position where the $D_{adnominal}$ is can also be filled by adjectives, e.g. *nianqing* 'young'; in the second case, the $D_{adnominal}$ position can be filled only by *duo* 'many' or *shao* 'few'. The first and second ways are used to build unequal comparisons, cf. 'more/less than' while the third way is used to build equal comparisons, cf. 'as many as', 'as few as'.

(117) a. lai canjia wuhui de xuesheng bi laoshi {duo / shao}
come attend party DE student COMP teacher {many / few}
'More/fewer students than teachers came to the party.'

b. lai canjia wuhui de xuesheng {duoyu / shaoyu} laoshi
come attend party DE student {more / fewer} teacher
'More/fewer students than teachers came to the party.'

c. lai canjia wuhui de xuesheng gen laoshi yiyang duo
come attend party DE student with teacher same many
'As many students as teachers came to the party.'

The sentences below with comparative quantification in direct objects can be ambiguous with respect to which sets are being compared: for instance, in both (118-a) and (118-b), the sets compared may be either 'the students I know' and 'the teachers I know' or 'the students I know' and 'the students the teacher knows.'

(118) a. wo renshi de xuesheng bi laoshi duo
1sg know DE student COMP teacher many
'I know more students than teachers./I know more students than the teacher does.'

b. wo renshi de xuesheng duoyu laoshi
1sg know DE student more teacher
'I know more students than teachers./I know more students than the teacher does.'

In raising to object (119), passivizing to subject (120), or possessor constructions (121), the structure of comparative quantification in an object, subject, or possessor, respectively, must be altered from when it is the subject as in (117). These alterations have the result that, while comparative quantificational subjects and direct objects are not constituents – unlike in English – they *are* QNPs (and constituents), like in English, in the examples below:

(119) a. wo xiangxin bi nansheng duo de nushen qian-le
1sg believe COMP man many DE woman sign-ASP
tongyishu
consent
'I believe more women than men to have signed the consent form.'

b. wo xiangxin duoyu nansheng de nusheng qian-le tongyishu
1sg believe more man DE woman sign-ASP consent
'I believe more women than men to have signed the consent form.'

(120) a. bi laoshi duo de xuesheng bei yiwei qian le tongyishu
COMP teacher many DE student BEI believe sign ASP consent
'More students than teachers were believed to have signed the consent form.'

b. duoyu laoshi de xuesheng bei yiwei qian-le tongyishu
more teacher DE student BEI believe sign-ASP consent
'More students than teachers were believed to have signed the consent form.'

(121) ganghao gen laoshi yiyang duo de xuesheng de jiaotache bei tou-le
exactly with teacher same many DE student DE bicycle BEI steal-ASP
'Just as many students' as teachers' bicycles were stolen.'

(i) NP_1 *bi* NP_2 $D_{adnominal}$ (117-a) becomes *bi* NP_2 $D_{adnominal}$ *de* NP_1 in (119-a) and (120-a).
(ii) NP_1 $D_{adnominal}$ *yu* NP_2 (117-b) becomes $D_{adnominal}$ *yu* NP_2 *de* NP_1 in (119-b) and (120-b).
(iii) NP_1 *gen* NP_2 *yi-yang* $D_{adnominal}$ (117-c) becomes *gen* NP_2 *yi-yang* in $D_{adnominal}$ *de* NP_1 (121).

12.2.15.2 Combinations with Conjunctions

As in English, type ((1,1),1) quantifiers can occur in combination with conjunctions, as shown below:

(122) a. mei-ge nanren nuren {gen / huo} xiaohai dou tiao xia shui
every-CL man women {and / or} child DOU jump LOC water
'Every man, woman and child jumped overboard.'

b. {YOU yixie / mei(you)} nanren nuren gen/huo xiaohai zai xingqitian gongzuo
{YOU some / NEG} man woman and/or child at Sunday work
'{Some/no} man, woman or child works on Sunday.'

In (122-a) and (122-b), the universal quantifier *mei-CL* and the existential quantifiers *yixie* 'some' and *mei(you)* 'NEG', respectively can be combined with both *gen* 'with/and' and *huo* 'or'.

12.2.15.3 Type ((1,1),1)

Mandarin also has quantifiers of type (1,(1,1)), where there is a single conservativity domain but two predicate properties, as exemplified below:

(123) a. lai canjia wuhui de xuesheng bi zhunbei kaoshi de duo
come attend party DE student COMP prepare exam DE many
'More students came to the party than studied for their exams.'

b. tongyang de xuesheng chi dao zao tui
same DE student late arrive early leave
'The same students came late as left early.'

12.2.16 Floating Quantifiers

As in English, the universal quantifier in Mandarin can float, as shown below for *quanbu* 'all':

(124) a. quanbu xuesheng dou lai canjia wuhui
all student DOU come attend party
'All students came to the party.'

b. xuesheng quanbu dou lai canjia wuhui
student all DOU come attend party
'All students came to the party.'

Note that Mandarin has no direct counterpart to English 'both', though, so that there is no quantifier float for 'both', as shown below:

(125) Zhangsan han Lisi liang-ge dou die xia shanpo
John and Lisi two-CL DOU fall down hill
'Both Zhangsan and Lisi fell down the hill.'

As in Hebrew and Japanese, numerals in Mandarin may float as well, as shown below for *liang-ge* 'two-CL':

(126) a. (you) liang-ge xuesheng xiao de hen dasheng
YOU two-CL student laugh DE very loud
'Two students laughed loudly.'

b. xuesheng liang-ge xiao de hen dasheng
student two-CL laugh DE very loud
'Two students laughed loudly.'

Like in Pima (Munro, 1984), subjects (126), direct objects (127), indirect objects/PPs (128), and possessors (129) can antecede floating quantifiers.[11]

[11] While all the floating quantifier examples given here were accepted by our consultants, the reviewer notes to us, possibly referring to a different dialect of Mandarin, that (126-b) is grammatical only under a pragmatic context of contrast indicated in a following sentence (other students did not laugh loudly), (129-b) is grammatical only with a prosodic break after the object *laoshi* and (128-b) and (131-b) are ungrammatical.

(127) a. wo kanjian liang-ge xuesheng
1sg see two-CL student
'I saw two students.'

b. wo xuesheng kanjian liang-ge
1sg student see two-CL
'I saw two students.'

(128) a. wo gei liang-ge xuesheng yixie hua
1sg give two-CL student some flower
'I gave two students some flowers.'

b. wo gei xuesheng liang-ge yixie hua
1sg give student two-CL some flower
'I gave two students some flowers.'

(129) a. wo kanjian wo-de haizi de liang-ge laoshi
1sg see my child DE two-CL teacher
'I saw the two teachers of my child.'

b. wo kanjian wo-de haizi de laoshi liang-ge
1sg see my child DE teacher two-CL
'I saw the two teachers of my child.'

Similar to Pima, in cases where a subject and a non-subject are both possible antecedents for a floated quantifier, the non-subject takes precedence:

(130) a. wo-de yixie pengyou juan yixie shu gei tushuguan
1sg-DE some friend donate some book to library
'Some of my friends donated some books to the library.'

b. wo-de pengyou juan shu yixie gei tushuguan
my friend donate book some to library
'My friends donated some books to the library.'
*'Some of my friends donated books to the library.'

Unlike in Pima, in Mandarin, if a sentence has two quantifiers and both quantifiers are floated simultaneously, each floated quantifier follows its antecedent so no crossing dependencies can occur in the determination of antecedence. This is exemplified below: in the example of double quantifier float in (131-b), *liang-ge* 'two-CL' follows its antecedent *xuesheng* 'student' and *yixie* 'some' follows its antecedent *liwu* 'gift'.

(131) a. xiaozhang song liang-ge xuesheng yixie liwu
principal give two-CL student some gift
'The principal gave the two students some gifts.'

b. xiaozhang song xuesheng liang-ge liwu yixie
principal give student two-CL gift some
'The principal gave the two students some gifts./*The principal gave some students two gifts.'

References

Aoun, Joseph, and Yen-hui Audrey Li. 1989. Scope and constituency. *Linguistic Inquiry* 20 (2):141–172.

Aoun, Joseph, and Yen-hui Audrey Li. 1993. *Syntax of scope*. Cambridge, MA: The MIT Press.

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

Chen, Lipeng. 2008. *Dou: distributivity and beyond*. PhD dissertation, Rutgers University, New Brunswick, NJ.

Cheng, Lisa L. S. 1991. *On the typology of wh-questions*. PhD dissertation, Massachusetts Institute of Technology, Cambridge, MA.

Cheng, Lisa L.S. 1995. On dou-quantification. *Journal of East Asian Linguistics* 4(3):197–234.

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

Chien, Yu-Chin, Barbara Lust, and Chi-Pang Chiang. 2003. Chinese children's comprehension of count-classifiers and mass-classifiers. *Journal of East Asian Linguistics* 12 (2):91–120.

Chiu, Bonnie. 1990. *A case of quantifier floating in Mandarin Chinese*. Paper presented at Northeast Conference on Chinese Linguistics, Cornell University, Ithaca, NY.

Chiu, Bonnie. 1993. *The inflectional structure of Mandarin*. PhD dissertation, University of California, Los Angeles, CA.

Croft, William. 1994. Semantic universals in classifier systems. *Word* 45(2):145–171.

Gil, David. 2008. Numeral classifiers. In *The world atlas of language structures online*, eds. Martin Haspelmath, Mathew S. Dryer, David Gil, and Bernard Comrie. Volume Available online at http://wals.info/feature/55. Munich: Max Planck Digital Library, Chapter 55.

Huang, C.T. James. 1987. Existential sentences in Chinese and (in)definiteness. In *The representation of (in)definite-ness*, 226–253. Cambridge, MA: MIT Press.

Huang, Shi-Zhe. 1996. *Quantification and predication in Mandarin Chinese: A case study of dou*. PhD dissertation, University of Pennsylvania, Philadelphia, PA.

Keenan, Edward L. 2011. Quantifiers. In *Semantics: an international handbook of natural language meaning*. Volume 2, eds. K. Von Heusinger, C. Maienborn, and P. Portner. Berlin: Mouton de Gruyter.

Keenan, Edward L., and Lawrence S. Moss. 2008. *Mathematical structures in language*. APS Notes, UCLA, Los Angeles, CA.

Kuno, Susumu, Ken-ichi Takami, and Yuru Wu. 1999. Quantifier scope in English, Chinese, and Japanese. *Language* 75(1):63–111.

Lee, Thomas H. 1986. *Studies on quantification in Chinese*. PhD dissertation, University of California, Los Angeles, CA.

Li, Jie. 1995. dou and wh-questions in Mandarin Chinese. *Journal of East Asian Linguistics* 4 (4):313–323.

Li, Charles N., and Sandra A. Thompson. 1981. *Mandarin Chinese: A functional reference grammar*. Berkeley, CA: University of California Press.

Lin, Jo-Wang. 1998. Distributivity in Chinese and its implications. *Natural Language Semantics* 6(2):201–243.
Lin, Jo-Wang. 2004. Choice functions and scope of existential polarity wh-phrases in Mandarin Chinese. *Linguistics and Philosophy* 27(4):451–491.
Lin, T.H. Jonah. 2006. Syntactic structures of complex sentences in Mandarin Chinese. *Nanzan Linguistics* 3:63–97.
Liu, Feng-Hsi. 1990. *Scope dependency in English and Chinese*. PhD dissertation, University of California, Los Angeles, CA.
Munro, Pamela. 1984. Floating quantifiers in Pima. In *The syntax of Native American languages*, Vol. 16, 269–287. Orlando, Florida: Academic Press.
Que, Min. 2006. *Quantification puzzles of 'dou'*. Master's thesis, Universiteit Utrecht, Utrecht.
Tai, James H.Y. 1992. Variation in classifier systems across Chinese dialects: Toward a cognition based semantic approach. *Zhongguo Jingnei Yuyan Ji Yuyan Xuie: Hanyu Fangyan* 1:587–608.
Tai, James H.Y. 1994. Chinese classifier systems and human categorization. In *In honor of William S.-Y. Wang: Interdisciplinary studies on language and language change*, eds. M.Y. Chen and O. Tzeng, 479–494. Tapei, Taiwan: Pyramid Press.
Tai, James, and Linqing Wang. 1990. A semantic study of the classifier tiao. *Journal of the Chinese Language Teachers Association* 25(1):35–56.
Tang, Chih-Chen Jane. 1990. *Chinese phrase structure and the extended X'-theory*. PhD dissertation, Cornell University, Ithaca, NY.
Wu, Yuru. 1992. *Anaphora and quantifier scope in Mandarin Chinese*. PhD dissertation, Harvard University, Cambridge, MA.
Wu, Jianxin. 1999. *A minimal analysis of Dou-quantification*. Ms. University of Maryland College Park, MD.
Zhang, Ning. 1997. *Syntactic dependencies in Mandarin Chinese*. PhD dissertation, University of Toronto, Toronto.
Zhang, Hong. 2007. Numeral classifiers in Mandarin Chinese. *Journal of East Asian Linguistics* 16(1):43–59.
Zhou, Peng, and Liqun Gao. 2009. Scope processing in Chinese. *Journal of Psycholinguistic Research* 38(1):11–24.