Covert (Universal) Quantification:
A Generalised Quantifier Theory Analysis of *-men*∗

Sherry Yong Chen
University of Oxford

Introduction

This paper explores the hypothesis of covert quantification – the idea that some nominals can be treated as having a (universal) quantifier covertly – by examining the interaction between the suffix *-men* and the particle *dou* within the Generalised Quantifier Theory framework (Barwise & Cooper, 1981; henceforth GQT). I begin by introducing the puzzle posed by *-men* in Mandarin Chinese (henceforth Chinese), a suffix that has been widely analysed as a collective marker but demonstrates various features of a plural marker. I argue that neither analysis is satisfactory given the interaction of *-men* and *dou*, the latter of which can be analysed as the lexical representation of the Matching Function (Rothstein, 1995; henceforth the M-Function). Crucially, the collective analysis of *-men* fails to explain why it can co-occur with *dou*, which requires access to individual atoms, while the plural analysis of *-men* fails to predict many of its distributions and interpretations.

In light of these puzzles, I observe that when there is no overt universal quantifier in the sentence, nominals with *-men* turn out to be ambiguous between a strong and a weak reading, but they must receive a definite interpretation and have a "significant subpart" requirement, analogous to the semantic denotation of *most of the X*. This motivates the GQT treatment of *-men* which assumes covert quantification in its semantic representation. Moreover, the two readings of *-men* disambiguate in the presence of *dou*, with only the strong reading left, which further suggests the existence of a covert universal quantifier in *-men*, given that *dou* as the M-Function seeks a universal quantifier in the semantic composition (Pan, 2005; Zhang, 2007). To this end, I offer an alternative analysis in GQT terms that compares nominals with *-men* to *most of the X*, and further argue against the view that *dou* itself is a universal quantifier by addressing several persisting problems from previous accounts.

It is profitable to explore the covert (universal) quantification hypothesis in several ways: it provides a solution to the compositionality problem when *dou* co-occurs with a universal quantifier such as *mei*, and also explains the presence of *dou* in sentences with no overt quantifiers, accounting for the asymmetric pattern where a universal quantifier requires *dou* but not vice versa. All of these can be accomplished in the current analysis without having to independently stipulate any type-shifting rule for either *mei* or *dou*.

This paper is organised as follows: Section 1 shows that *-men* is neither a simple collective marker nor an ordinary plural marker, motivating a third approach that resorts to a covert quantifier; Section 2 zooms in onto the interaction between *-men* and *dou*, briefly introducing Rothstein's proposal of the M-Function and analysing *dou* as the lexical realisation thereof; Section 3 offers a GQT analysis of *-men* in analogy to *most of the X*, outlining the covert (universal) quantification hypothesis in greater details; Section 4 reviews

an alternative account of *dou* as a universal quantifier, and ultimately defends the proposal of covert (universal) quantification developed here. Section 5 concludes.

1. The Puzzle of *-men*

Classifier languages such as Chinese are said to lack number morphology, which has led many to argue that there is no plural marking on Chinese nouns (Cheng & Sybesma, 1999; Doetjes, 1996; a.o.). Of particular interest here is the debate on the suffix *-men*: as shown in (1), although *-men* clearly contributes to the plural meaning in a way that is reminiscent of plural markings in Indo-European languages, it has been widely analysed as a collective marker rather than a true plural marker:

(1) xuesheng-men   biye   le

      student-MEN[1]   graduate   PERF

      'The students have graduated.'

The collective account of *-men* is indeed motivated on empirical grounds; many have argued that *-men* is "not an ordinary plural marker" given its distribution and interpretation (Cowper & Hall, 2012, p. 39). To begin with, the distribution of *-men* is highly restricted: unlike the English plural suffix *-s*, *-men* can only occur for animate beings (usually humans) but not inanimate beings (Li & Thompson, 1989):

(2) a. haizi-men   zai   wanshua

         child-MEN   PROG   play

         'The children are/were playing.'

    b. *shuben-men   shi   wo-de

         book-MEN   BE   1SG-POSS

         (Intended: 'The books are/were mine.')

However, the restriction on the distribution of *-men* merely shows its differences from English *-s* but offers no strong argument against a plural analysis. More critical is the fact that, unlike an ordinary plural marker, *-men* is incompatible with numerals (Li, 1999):

(3) a. Three students

    b. *san-wei   xuesheng-men

        three-CL   student-MEN

As (3b) shows, a noun with the *-men* suffix can no longer be modified by numerals.

In terms of the semantic interpretation, it has been observed that *-men* contributes more than just plurality. Li (1999) insightfully points out that nominals with *-men* always receive a definite interpretation[2], as shown above in the translation of (1) and (2a). One consequence of the definiteness of *-men* is that it cannot occur in existential constructions:

---

[1] A list of glosses used in this paper: CL = classifier, BE = copular, 1SG = first person singular, 3SG = third person singular, CONJ = conjunctive, PERF = perfective, POSS = possessive, PROG = progressive.

[2] Based on this, Li (1999) argues that *-men* surfaces on D, and nominals with *-men* undergo the N-to-D movement, which is blocked by an intervening classifier, hence the ungrammaticality of (3b). The analysis of the syntactic position of *-men* plays a crucial role in understanding its semantics, although I will not go into the details of Li's proposal here as it falls outside the scope of this paper.

(4) a. na-li   you ren

          there   have person

          'There is someone/There are some people.'

    b. *na-li   you ren-men

          there   have person-MEN

          (Intended: 'There are some people.')

Nor can nominals with *-men* receive a generic reading: *ren-men* is taken to mean 'a situationally anchored or defined group of individuals', not 'people (in general)' or 'the mankind' (Rygaloff, 1973; Yorifuji, 1976; Iljic, 1994; Cheng & Sybesma, 1999). These observations are inconsistent with the analysis of *-men* as a plural marker.

In addition, as M. Xiang (2008, p. 238) correctly notes, the interpretation of *haizi-men* 'children' in (5) does not require strict maximality:

(5) haizi-men qu-le   gongyuan

    child-MEN go- PERF   park

    'The children went to the park.'

That is to say, (5) could be true if most of the children that are contextually relevant went to the park, but perhaps one or two did not go. Note that the lack of maximality in (5) holds for pronominal *-men* as well:

(6) ta-men   zuijin   hen mang

    3SG-MEN   recently   very busy

    'They have been very busy recently.'

In (6), it is possible that among a group of people, most of them are very busy, but one or two are not[3]. This further argues against analysing *-men* as a straightforward plural marker.

However, several puzzling facts remain unaccounted for in the collective analysis. Notably, when attaching to an animate nominal, *-men* is obligatory for pronouns in order to achieve a contrastive reading (*wo* 'I' vs. *wo-men* 'we'), but optional for common nouns (*haizi* 'child/children' vs. *haizi-men* 'children'). To capture the above-mentioned discrepancies, many have argued that *-men* should be analysed as a collective suffix after nouns (henceforth N-*men*), but the pronominal *-men* (henceforth PRO-*men*) continues to be considered a plural marker (Chao, 1968; Norman, 1988). More recently, Iljic (1994, 2001) offers a unified account for N-*men* and PRO-*men* as both collective nominals, arguing that PRO-*men* typically functions as "subjective grouping"; unlike English *we*, Chinese *wo-men* is ambiguous between a strong and a weak collective reading, the latter of which does not entail *all of us*. As Scha (1984) puts it, a collective reading requires that "some significant subpart" of the individuals participate in the event in question, as suggested in (5) and (6). This in part settles the debate on two different (and somewhat incompatible) treatments of *-men* after nouns and pronouns.

Following Iljic (1994), Cheng and Sybesma (1999) further point out that collective markers are not unique to Chinese, but have been reported for several languages including Ewe, Icelandic, and Afrikaans. A common characteristic of the collective markers in these

---

[3] This intuition is shared by all ten informants that I have consulted, many of whom promptly commented on the two possible readings of *wo-men* by noting that (5) and (6) are true as long as most – but not necessarily all – of the people participated in the described event.

languages is that they can attach to conjoined nominal phrases. I would like to add that this generalisation also holds for Chinese -*men*:

(7) laoshi   he   xuesheng -men

     teacher   CONJ   student   -MEN

     'Teachers and students'

This again contrasts with plural markings in Indo-European languages. In sum, the standard analysis of -*men* as a collective marker is very well received in the literature and seems to have offered strong arguments based on ample empirical evidence.

Nevertheless, a few more pieces of the -*men* puzzle remain missing as some of its critical behaviours are still largely unaccounted for by the collective analysis (Li, 1999; Bale & Barner, 2012). In a plural account of -*men*, Li (1999) notes that N-*men* can occur with the Chinese particle *dou* to achieve a maximal interpretation of the nominal, as shown in (8):

(8) xuesheng-men   dou   zou   le

     student-MEN   DOU   leave   PERF

     'The students have all left.'

This is in direct contradiction with the collective account since (i) "a collective group is not concerned with or not compatible with individuals", so far as the standard notion of "collectivity" is concerned, and (ii) the use of *dou* must involve individuals in order to achieve a distributive or universal meaning in this context (Li, 1999, p. 80). The co-occurrence of -*men* and *dou* casts serious doubt on the well-received collective account of -*men*, yet no explanation was ever offered to address this issue.

Given the seemingly chaotic pattern of -*men* that has been observed, both the collective account and the plural account of -*men* stand as unsatisfactory. Taking Li's puzzle as an initial point, I will argue that, if we examine the interaction between -*men* and *dou* in the above-mentioned context more closely, there is a third approach to -*men* such that the tension between the two previous analyses can be resolved without suffering from any of the problems that arise in either the collective or the plural account, and that the discrepancy between N-*men* and PRO-*men* can also be nicely reconciled. To approach the puzzle, let us first look at the role of *dou*, before I propose the alternative account of -*men*.

2. *Dou* as the M-Function

The somewhat puzzling co-occurrence of -*men* and *dou* can provide new insight into the semantics of the -*men* suffix if we analyse *dou* as the M-Function proposed by Rothstein (1995).

According to Rothstein (1995), English sentences like "I regretted it every time I had dinner with him" are said to have what is called the "matching effect", which is truth-conditional: it is true iff every event of "I have dinner with him" matches up with every event of "I regret it". Following Parsons (1990) in a Neo-Davidsonian framework, Rothstein (1995) offers a simple compositional analysis in which the matching effect is derived from a functional relation between the adverbial (e.g. every time) and the event argument of the main verb (e.g. regret). As Rothstein (1995) puts it, the ultimate goal of representing the matching effect is that "two sets of events are related in such a way that every event from the first set can be mapped onto a different one from the second set". To this end, she proposes a representation that uses the M-Function:

(9) $\forall e$ [[HAVE DINNER(e) & Th(e)=I & Exp(e)=HE] $\rightarrow$ $\exists e'$ [REGRET (e') & Exp(e')=I & M(e')=e]]

where M is a (partial) function from the set of events *e'* to the set of events *e*, and it maps every single regretting event onto no more than one having-dinner event, such that there are at least as many having-dinner events as regretting events (i.e. there can be more regretting events that are not related to having-dinner events), and each having-dinner event is the value of the M-Function applied to each regretting event. Crucially, I would like to point out that according to Rothstein's proposal, M is a partial function where each having-dinner event is in the range of M, but not all regretting events in the domain of M are paired with a having-dinner event. This can be illustrated in the following paradigm:

regretting events		having-dinner events
e'_1	------------------------------------>	e_1
e'_2	------------------------------------>	e_2
e'_3	------------------------------------>	e_3
e'_4	------------------------------------>	e_4
e'_5		
e'_6		

Therefore, the M-Function implicitly requires a universal quantifier that has scope over its range, which means that all having-dinner events that are relevant in the context in (9) are being maximally matched up with a different regretting event, but not vice versa.

We now turn to the matching effect in Chinese. Chinese *mei* can be regarded as equivalent to English *every*, a distributive-key universal quantifier that provides universal quantificational force and imposes a relationship of distributivity between the NP and the predicate (Gil, 1995; Luo, 2011). In (10), the Chinese equivalent of "I regret it every time I have dinner with him" also gives rise to the matching effect: *mei-ci* 'every time' universally quantifies over the having dinner events, and the sentence is true iff every event of having dinner is mapped on a different event of regretting:

(10) mei-ci   he   ta   chi fan, wo   *(dou)   hen   houhui

      every-CL   with   3SG   eat meal 1SG DOU   very   regretful

      'Every time when having dinner with him, I always feel very regretful.'

Interestingly, (10) requires the presence of *dou*, which obligatorily co-occurs with a universal quantifier in the Topic-Comment construction (Lin & Landman, 1998; Jiang, 1998; Pan, 2000, 2005; a.o.); the absence of *dou* leads to infelicity. This is known as the co-occurrence constraint between *mei* and *dou* in Chinese, whereas no such constraint applies to English *every*.

It is obvious that the obligatoriness of *dou* in this context is related to universal quantification. A straightforward way to capture the semantic contribution of *dou* in this context is to analyse it an overt realisation of the M-Function. According to Rothstein (1995), M is an extensional function whose content is supplied in the context (i.e. pragmatically construed as a causative relation or temporal simultaneity), although sometimes it can be "contentless" and thus difficult to identify. Critically, she further suggests that the M-function "be understood as an empty preposition", as it does not have a lexical representation (Rothstein, 1995, p. 25). This seems to be the case in English, where such a functional relation is purely abstract. However, Chinese *dou* seems to be a promising candidate for the

lexical representation of the M-Function, and by pursuing this hypothesis[4], we may probe into some interesting interactions between *-men* and *dou*.

Although independently developed in this paper, the idea that *dou* is the M-Function is not completely new; the following example can be first identified in Pan (2005), which is further spelt out in Zhang (2007):

(11) mei-ge   er-ci   fangcheng dou you liang-ge   butong   jie

every-CL   quadratic   equation   DOU have two-CL   different solutions

'Every quadratic equation has two different solutions.'

In their analysis, *mei* acts as a universal quantificational determiner and *dou* realises the M-Function:

(12) $\forall x$ [$x \in$ [|quadratic equation|] $\rightarrow \exists e$ [e = have two different solutions & M(e) = x]]

This representation says that "for every *x*, if *x* is member of quadratic equations and *x* is a quadratic equation, there is an event *e* 'have two different solutions', and the set of *e* and the set of *x* forms the function M" (Zhang, 2007, p. 19). Recall that the original M-Function developed by Rothstein (1995) maps every event from the first set of events onto a different one from the second set of events. In Pan (2005) and Zhang (2007), however, the M-Function has been extended to mapping every event from a set of events onto a different individual from a set of individuals. This provides the first instance of applying the M-Function to the nominal domain.

The M-Function analysis of *dou* suggests that the key property of *dou* is quantifier licensing[5]. Having established this stance, we now come back to the interaction between PRO/N-*men* and *dou*. Let us take a look at (13), two variants of Rothstein's sentences where there is no overt universal quantifier in the sentence, in which case *dou* is optional (as in 13a), but its presence imposes a strong reading of PRO-*men* (as in 13b):

(13) a.   he   ta   chifan   shi, wo-men   hen   houhui

with   3SG   eat-meal time 1SG-MEN   very   regretful

'When having dinner with him, *all of us* felt very regretful.'

'*...... at least a significant subgroup of us* felt very regretful.'

b.   he   ta   chifan   shi, wo-men   dou   hen   houhui

with   3SG   eat-meal time 1SG-MEN   DOU   very   regretful

'When having dinner with him, *all of us* felt very regretful.'

These observations raise several questions: Where does the ambiguity arise in (13a)? More curiously, given that *dou* in (13b) seems to have the same meaning as it does in (10), if *dou* is the M-Function that always requires a universal quantifier in this context, then what licenses the presence of *dou* in where there is no overt universal quantifier in the sentence? The answer to these questions lies in how we analyse *-men*.

---

[4] Many have noted the multi-functionality of *dou* in various context, and I should point out that the goal of this paper is not to come up with a unified semantics of *dou*; readers who are interested in such an endeavour may refer to Lin (1996), Huang (1996), Giannakidou & Cheng (2006), M. Xiang (2008), and Y. Xiang (2016), among many others.

[5] The quantifier licensing property of *dou* has been discussed by many authors; see, for example, Lee (1986), Liu (1990) , Gao (1994), Hsieh (1994), among many others.

<u>3. Some Structural Analogies between PRO/N-*men* and *Most of the X*</u>

These questions raised in Section 2 conceptually motivate what I will call the Covert (Universal) Quantification Hypothesis. In this section, I will outline the details of my proposal by showing some structural analogies between PRO/N-*men* and *most of the X*. I first offer an explanation for the ambiguity of *wo-men* in (13a), an observation that is not predicted by the plural account of -*men*. By re-examining the co-occurrence between PRO/N-*men* and *dou*, which poses a problem for the collective account, I further argue that the presence of *dou* can be licensed by assuming a covert (universal) quantifier in PRO/N-*men*. In terms of the theoretical framework, I will begin with a Neo-Davidsonian event semantics approach in the spirits of Rothstein (1995), but eventually offer a more sophisticated analysis of PRO/N–*men* and *dou* in GQT terms.

First of all, the ambiguity between the strong and weak readings in (13a) stems from the semantics of *wo-men*: it is acceptable as long as some significant subpart – typically understood as at least half, but not necessarily all – of the individuals who were situationally anchored participated in the regretting event. For example, suppose there are five people – A, B, C, D, and E – who participated in the regretting event. The strong reading of *wo-men* is "all of us", so *wo-men* denotes the set {A, B, C, D, E}. In the weak reading, if the "significant subpart" requirement is taken to mean "at least half but not all", then the actual denotation of *wo-men* can be any proper subset of {A, B, C, D, E} whose cardinality outnumbers half of its own cardinality, namely: {A, B, C, D}, {A, B, C, E}, {A, B, D, E}, {A, C, D, E}, {B, C, D, E}, {A, B, C}, {A, B, D}, {A, B, E}, {A, C, D}, {A, C, E}, {A, D, E}, {B, C, D}, {B, C, E}, {B, D, E}, {C, D, E}. Note that crucially, a direct consequence of this requirement is a plural presupposition on the nominal that -*men* attaches to. To account for these intuitions, we tentatively propose the following representation of *wo-men* for (13a):

(14) $\exists$e. regret (e) & Th(e) = X

   $\exists$x. x $\in$ X & X $\subseteq$ '*wo-men*' & $|X| \geq$ ½|'*wo-men*'|

This representation says that there exists an individual *x*, which is a member of the set of *X*, and *X* is a subset of *wo-men* such that the cardinality of *X* is at least half of the cardinality of *wo-men*.

This captures the ambiguous readings we observed in (13a): when the cardinality of *X* is at least half of the cardinality of *wo-men* but still smaller than that, a significant subpart of the set *X* participated in the regretting event, giving rise to the weak reading; in the case where the cardinality of *X* equals the cardinality of *wo-men*, we get the strong reading. Thus the ambiguity lies inherently in the denotation of PRO/N-*men*. The two readings can be further spelt out (tentatively) in predicate logic terms as follows:

(15) a. $\exists$x. x $\in$ X & X $\subseteq$ 'wo-men' & ½ |'wo-men'| $\leq$ |X| < |'wo-men'| (weak)

   b. $\exists$x. x $\in$ X & X $\subseteq$ 'wo-men' & |X| = |'wo-men'| (strong - tentative)

The strong reading in (15b) is thus a special case of (14) where the cardinality of *X* equals the cardinality of *wo-men*, and this reading is essentially equivalent to having a universal quantifier that scopes over the individual *x*. In this sense, (15b) can be re-formulated as follows:

(15) c. $\forall$x. x $\in$ 'wo-men' $\rightarrow$ x $\in$ X   (strong - revised)

Therefore, the strong reading involves a universal quantifier, which states that all individuals denoted by *wo-men* is an element of *X*, the set of the participants of the event of being

regretful. The weak reading, which has an existential quantifier over *x*, asserts that the cardinality of the set *X* is greater than at least half of the cardinality of the set denoted by *wo-men*. This captures the "significant subpart" requirement for interpreting PRO/N-*men*, as well as the interaction between *dou* and *wo-men*: in the absence of *dou* in (13a), both weak and strong readings are available; with *dou* in (13b), only the strong reading is available as *dou* imposes maximality by acquiring a universal quantifier from the semantic of -*men*.

Thus, the current analysis suggests that it is profitable to think of PRO/N-*men* as analogous to *most of the X* in the following three ways: (i) both must receive a definite interpretation, (ii) the semantic denotation of both constructions are inherently ambiguous between a strong and a weak reading, and (iii) there is a "significant subpart" requirement in their quantificational meaning, which consequently puts a plural presupposition on the nominal that is being quantified over. Motivated by these striking parallelisms, I note that the meaning of PRO/N-*men* is reminiscent of the GQT analysis of *most*:

(16) a.   Most people are regretful.

$\{\, y \mid y \text{ is regretful} \,\} \in \{\, X \mid |X \cap \{\, z \mid z \text{ is a person} \,\}| \geq \tfrac{1}{2} \mid \{\, z \mid z \text{ is a person} \,\}| \}$

b.   Every person is regretful.

$\{\, y \mid y \text{ is regretful} \,\} \in \{\, X \mid \{\, z \mid z \text{ is a person} \,\} \subseteq X \,\}$

The denotation of *most* requires that at least half of the members in the set of *X* are regretful, in which case *every person is regretful* is simply a special case where the cardinality of *X* equals the cardinality of $\{\, z \mid z \text{ is a person} \,\}$. These correspond to the weak and strong readings of PRO-*men* that we have just discussed and represented in event semantics terms. We are now in a position to spell out the basic denotation and the two possible readings of *wo-men* in GQT terms:

(17) a. $\{\, y \mid y \text{ is regretful} \,\} \in \{\, X \mid |X \cap \{\, z \mid z \text{ is one of 'wo-men'} \,\}| \geq \tfrac{1}{2} \mid \{\, z \mid z \text{ is one of 'wo-men'} \,\}| \}$ (ambiguous)

b. $\{\, y \mid y \text{ is regretful}\} \in \{\, X \mid \tfrac{1}{2} \mid \{\, z \mid z \text{ is one of 'wo-men'}\}| \leq |X \cap \{\, z \mid z \text{ is one of 'wo-men'}\}| < |\{\, z \mid z \text{ is one of 'wo-men'}\}| \}$ (weak)

c. $\{\, y \mid y \text{ is regretful}\} \in \{\, X \mid \{\, z \mid z \text{ is one of 'wo-men'}\} \subseteq X\}$ (strong)

We assume that *wo-men* is a quantifier of the type <<e→t>→t>, which then gets saturated by the predicate *hen houhui* 'be very regretful' to derive a proposition. Since *dou* as the M-Function simply seeks a universal quantifier, it does not change the type of *wo-men* but is a complex modifier that requires to be saturated by a universal quantifier in order to derive a quantifier; it belongs to type <<e→t>→t> → <<e→t>→t>. To capture this property of *dou*, we adopt the following key properties of universal quantifiers in GQT terms (Partee, ter Meulen, & Wall, 2012):

(18) Let *D* be a binary relation in a model M = <*E*, ⟦ ⟧> on the sets *A*, *B*, *C* ⊆ *E*; the following properties of relations are expressed as:

Reflexivity: $D_E AA$

Anti-symmetry: $D_E AB \, \& \, D_E BA \rightarrow A = B$

Transitivity: $(D_E AB \, \& \, D_E BC) \rightarrow D_E AC$

This is used to provide a compositional analysis of *dou*:

(19) $[\![DOU]\!] = \lambda \mathscr{P}. \lambda P. \lambda Q. \ \mathscr{P}(x, P(x), Q(x)) \wedge M(x) = x$

$\wedge \ \mathscr{P}(X, P(x), P(x)) = T$

$\wedge \ \forall R. \ \mathscr{P}(x, P(x), R(x)) \wedge \mathscr{P}(x, R(x), P(x)) \rightarrow P = R$

$\wedge \ \forall S. \ \forall T. \ \mathscr{P}(x, P(x), S(x)) \wedge \mathscr{P}(x, S(x), T(x)) \rightarrow \mathscr{P}(x, P(x), T(x))$

In this sense, the M-Function as expressed by *dou* is still "contentless" (although no longer abstract) as it is only there to require a universal quantifier in the compositional process. Moreover, the intuition that *wo-men* does not necessarily entail *all of us* is now neatly captured in the formal representation in (17a), which assumes a covert quantifier that is similar to *most of the X*; a covert universal quantifier is selected when *dou* is present, forcing a strong reading as in (17c). In a nutshell, by scrutinising the interaction between PRO/N-*men* and *dou*, I show that PRO/N-*men* are analogous to *most of the X* in terms of their semantic denotations[6], and effectively nominals with -*men* can contribute a covert universal quantifier when *dou* is present.

The compatibility between PRO/N-*men* and *dou* goes hand in hand with the incompatibility between *dou* and mass nouns. I adopt the view from Cheng and Sybesma (1999) that Chinese nouns are lexically categorised as mass or count, and that Chinese mass nouns (e.g. water, wood) cannot be individuated without a preceding "massifier"[7]. Chinese mass nouns that appear bare in the preverbal position can receive either a definite or a generic/kind interpretation, but the latter is blocked in the presence of *dou*:

(20) *shui   dou   hen   ganjing

      water   DOU   very   clean

      (Intended: 'All kinds of water are very clean.')

Note that (20) is only felicitous in a situation where *water* has a definite reference and can be clearly individuated and counted, e.g. there are many bottles of water and all of them are very clean. The interpretation of *water* in such a situation would be bottles of water rather than water as a kind, which would otherwise render (20) infelicitous since it cannot be individuated or counted, and thus cannot be universally quantified. Therefore, the current analysis correctly predicts that *dou* is incompatible with bare mass nouns when they receive a generic/kind reading, essentially because they fail to provide a universal quantifier that *dou* requires.

In addition, since *dou* requires a universal quantifier in the logical form, the current analysis predicts that it will be prohibited in sentences where there is no more than one event and/or one participant of the event. In the following cases, *dou* cannot apply since there is truly no domain applicable for universal quantification, be it overt or covert:

---

[6] There are, of course, differences between the semantics of *most of the X* and PRO/N-*men* in terms of their quantificational force: since PRO/N-*men* do not need to have *dou*, these nominals fall into the category of weak quantifiers (Cheng, 2009), whereas *most* is a strong quantifier that resists existential constructions. There are also pragmatic differences between the two constructions: based on the Maxim of Quantity, *most of the X* triggers a scalar implicature such that *most of the X* ↛ *all of the X*. However, in terms of logical entailment, *all of the X* → *most of the X*, and this is indeed achieved in the GQT framework. But I will set aside these differences for the time being as they are not the focus of this paper.

[7] All nouns in Chinese behave like mass nouns in the sense that they need a classifier to be counted, which has led many linguists to argue that there is no mass/count distinction in Chinese, and that all nouns in this language are classified as mass (see Bale and Barner (2012), Chierchia (1998), Gillon (1992, 1999), among others). I do not hold this view but will not elaborate further due to space limit. In short, the grammaticalisation of mass/count distinction in Chinese is reflected at the level of the classifier, rather than at the level of the noun. For a more detailed discussion, see Section 2.2 in Cheng and Sysbema (1999).

(21) *na yi-ci   he   ta   chifan   shi, wo   dou hen houhui
    that one-CL   with 3SG eat-meal time 1SG DOU very regretful

  (Intended: That time when having dinner with him, I always felt very regretful.)

(22) *mei yi-ci   he   ta   chifan   shi wo   dou hen houhui
    NEG one-CL with 3SG eat-meal time 1SG DOU very regretful

  (Intended: When having dinner with him, I never felt very regretful.)

Therefore, in the sentences under consideration here, *dou* can be analysed as the lexical representation of the M-Function in Chinese which requires a universal quantifier in its semantic composition. The presence of *dou* is licensed by either overt universal quantifiers such as *mei* 'every', or a covert universal quantifier in semantic representation of PRO/N-*men*. The GQT analysis PRO/N–*men* can capture its inherently ambiguity in (13a), while the analysis of *dou* as the M-Function explains the lack thereof in (13b), where *dou* gives rise to only a strong reading by acquiring a covert universal quantifier from *wo-men* and thus imposing maximality. Additionally, the covert universal quantification hypothesis accounts for the infelicity of (20)–(22), where *dou* is prohibited since there is truly no universal quantification process anywhere in the nominals.

In the meantime, alternative explanations present themselves: Would it be possible to analyse the strong reading that co-occurs *dou* without assuming covert universal quantification in the nominals? Can *dou* itself be a universal quantifier, or a universal quantifier plus the M-Function in these cases? The next section explores these possibilities, with the aim to show that the covert (universal) quantification analysis of PRO/N-*men* with *dou* as a quantifier licenser is not only sufficient but also more elegant to capture the observations we have discussed so far.

4. Against a Universal Quantifier Analysis of *Dou*

The covert universal quantification hypothesis that we have proposed for PRO/N-*men* is in direct conflict with the view that *dou* itself is a universal quantifier. This section aims to argue against the universal quantifier analysis of *dou*, which requires us to take a closer look at some of the previous analyses.

Literature on the semantics of *dou* is vast, to the extent that it would be impossible to provide a complete review of all the analyses that have been proposed. For the purpose of this paper, only those that are most relevant to our questions will be discussed in details. Specific to our question is the fact that many have related the use of *dou* to an A-Quantifier[8] with universal meaning (Cao, 2008; Cheng, 1995, 2009; Chiu, 1993; Jiang, 1998; Lee, 1986; Liu, 1997; Luo, 2011; Pan, 2000; Wu, 1999; a.o.). A potential alternative solution to the one proposed here is to assume that *dou* itself provides universal quantificational force, perhaps as a universal quantifier or a universal quantifier plus the M-Function. The following paragraphs are devoted to arguing against such a view with reference to three related issues: the compositionality problem of *mei* and *dou*, the ambiguity problem of PRO/N-*men*, and lack of economy.

First of all, analysing *dou* as a universal quantifier immediately runs into the compositionality problem: it is impossible for *mei* and *dou* to co-occur and be both quantifiers (Lin, 1998; Yang, 2001). One solution to this problem is to assume some kind of

---

[8] Definition follows that in Partee (1991), which originates from Partee, Bach, & Kratzer (1987).

type-shifting rules, as proposed by Luo (2011), where *dou* is analysed as having two semantic components, a standard universal quantifier plus a matching function[9]. He formally represents *dou* as follows:

(23) $\llbracket DOU \rrbracket = \lambda x \, \lambda P \, \forall y \, (\, y \leq x \rightarrow \exists e \, (\, P \, (y) \, (e) \, \& \, \pi(x) = e \,))$, where P is a predicate, and π is a matching function

Based on this, a sentence that contains *dou* and N-*men* will receive the following representation:

(24) a.   xuesheng-men   dou lai   le.

   xuesheng-MEN   DOU come   PERF

   'All of the students came.'

   b. $\forall x \, (x \leq \iota \, y. \, \text{students} \, (y) \rightarrow \exists e \, (\text{come} \, (x) \, (e) \, \& \, \pi \, (x) = e \,))$

(24b) says that all parts of *xuesheng-men* 'the students' participated in a coming event. Since the predicate *lai* 'come' is atomic in nature, *dou* operates on atoms, so the sentence is true iff each student of a certain situationally anchored domain actually came. This successfully achieves the strong reading as we have observed earlier, although it says little about the ambiguity of the N-*men* when *dou* is absent. Luo (2011) claims that when *mei* and *dou* co-occur, *mei* is domain-shifted from a distributive quantifier into a determiner of type <et, e> and *dou* is a quantifier of type <e, <et, t>>. This suggestion sidesteps the compositionality problem, but it does so at the cost of assuming an additional rule of type-shifting, not to mention that type-shifting itself needs to be independently stipulated.

Another problem with Luo's (2011) analysis is that it remains controversial whether Chinese does actually have determiners, since it is often considered one of the "determinerless" languages (Chierchia, 1998; Yang, 2001). I side with Yang (2001) on the view that Chinese is determinerless, and thus *mei* is best analysed as a universal quantifier rather than a determiner. One piece of evidence for *mei* as a quantifier is that it cannot co-occur with the suffix -*men*:

(25) *mei-ge   jiaoshou-men

   every-CL professor-MEN

   (Intended: 'Each of the professors')

If -*men* indeed provides a quantifier covertly, this co-occurrence restriction can be easily explained by a compositionality issue – a quantifier cannot be saturated by another quantifier. Having established that *mei* is a universal quantifier, we are now in a position resolve the compositionality problem when *mei* and *dou* co-occur. The answer is straightforward: *dou* cannot be a universal quantifier itself but must be something that combines with a universal quantifier. Recall that in our discussion of (20), it is impossible for mass nouns to occur with *dou*, which reminds us of a similar co-occurrence constraint of *every*, the prototypical realisation of universal quantifiers in English:

(26) * Every water is clean.

Both *every* and *dou* are incompatible with mass nouns, but logically speaking, sharing the

---

[9] Luo's (2011) matching function is inspired by Rothstein (1995) by name; it is by definition an order-preserving, injective function defined as follows:

   (i)   Let A and B be sets, π: B A is a matching function iff

      (a) $\forall x \in A \, \exists! y \, (y \in B \rightarrow \pi(x) = y)$

      (b) For $\forall x_1, x_2 \in A$, $x_1 \leq x_2 \Rightarrow \pi \, (x_1) \leq \pi \, (x_2)$

      (c) $\forall x_1, x_2 \in A$: $x_1 \neq x_2 \Rightarrow \pi \, (x_1) \neq \pi \, (x_2)$

same semantic property that does not mean that *dou* itself is a universal quantifier, not to mention that *every* and *dou* are structurally distinct. Essentially, the reasons why *every* and *dou* are incompatible with mass nouns differ: mass nouns – which cannot be individuated, or at least not without massifiers in Chinese – cannot be universally quantified over, so it cannot appear with an overt universal quantifier like *every*. Meanwhile, the incompatibility between mass nouns and *dou* is a side effect that stems from the former's incompatibility and the latter's requirement for a universal quantifier, be it over or covert.

Secondly, the universal quantifier analysis of *dou* offers no solution to the ambiguity in (13a). Why is there ambiguity in the first place? Why does the ambiguity disappear in (13b) with the presence of *dou*, which seems to be licensed even in the absence of any overt universal quantifier in the sentence? To account for the unambiguous reading in (13b), we may resort to *dou* as either a universal quantifier or the M-Function, such that it forces a strong reading of PRO/N-*men* in these sentences. However, we must also explain why the ambiguity arises in the first place. To this end, the covert (universal) quantification hypothesis provides a novel perspective on the quantificational domain of Chinese nominals that contain the suffix *-men*. As shown by the GQT analysis in Section 3, PRO/N-*men* can be analysed as parallel to *most of the X*, which fulfills the "significant subpart" requirement and consequently derives two possible interpretations as well as a plural presupposition of the nominal.

Finally, I argue that the covert (universal) quantification analysis offers a more economical solution compared to the universal quantifier analysis of *dou*. Under this hypothesis, no type-shifting rules are needed to explain the co-occurrence constraint between *mei* and *dou*, which would otherwise need to be independently motivated. As for the semantics of *dou*, it is simply a contentless M-Function that requires to be combined with a universal quantifier, and this requirement can be captured with reference to the key properties of universal quantifiers in GQT terms. The M-Function analysis of *dou* effectively explains why maximality is imposed and leads to the strong reading of PRO/N-*men*, which are inherently ambiguous in their semantic denotation, and all of these problems can be overcome without assuming any additional type-shifting rules for either *mei* or *dou*.

In sum, in this section I have argued that it is more profitable to think of *dou* as a quantifier licenser rather than a universal quantifier itself. As the lexical realisation of the M-Function, *dou* is a complex modifier that requires either an overt or a covert universal quantifier in the nominals. The covert universal quantification analysis sidesteps the issues that arise from previous accounts of *-men* and *dou* by offering a more economical solution.

5. Conclusions & Implications

To conclude, in this paper I have argued that the *-men* suffix in Chinese is neither a simple collective marker nor a straightforward plural marker. Crucially, in addition to contributing definiteness, *-men* has a "significant subpart" requirement for the interpretation of the nominal it attaches to and is inherently ambiguous between a strong and a weak reading. The plurality of PRO/N-men is then a side effect that stems from this "significant subpart" requirement, similar to *most of the X*. These observations motivate the covert universal quantification hypothesis, which analyses the semantics of *-men* in GQT terms in a parallel fashion to *most of the X*. Moreover, the interaction between PRO/N-*men* and *dou* further suggests that nominals with *-men* have a covert (universal) quantifier. In the current analysis, the ambiguity of PRO/N-*men* is borne out, and the compositionality problem of *dou* that arises from previous analyses can be avoided without assuming any rules for type-shifting.

The current analysis offers a more economical and parsimonious solution to some of the persisting questions that are central to the syntax and semantics of quantification in Chinese nominals. One closely related question arises from the well-known observation that the reduplication of classifiers in Chinese involves universal quantification:

(27) zheli de   xuesheng, ge-ge   *(dou)   hen   congming

here POSS student   CL-CL   DOU   very smart

'Every student here is very smart.'

This may suggest a covert universal quantificational process similar to the one proposed here for PRO/N-*men*, although note that in (27), *dou* is obligatory, suggesting that a strong quantifier is involved in reduplicated classifiers. While Cheng (2009, 2012) has explored the syntax of reduplicated classifiers, one may ask what kind of semantic theory of classifier is needed in order to capture these observations. Why do certain nominal expressions seem to be able to provide a covert universal quantifier? If both weak and strong quantifiers are possible in these covert quantificational processes, are there any restrictions on which nominals can provide a covert quantifier? Going beyond Chinese, how do other languages manifest this broad notion of "quantification without (overt) quantifiers"? Such related questions, although cannot be entertained here due to space limits, will be followed up as they may cast new light into the mapping between the syntax and semantics of quantification in the nominal domain.

The current analysis also re-opens the debate about whether or not Chinese has number morphology expressed on the noun, given that -*men* does seem to have certain properties of plural marking. It also raises the question of where number is generated in Chinese nominals: we know for sure that number belongs to the superstructure of the noun (Ritter, 1989), and it has been suggested that classifiers in Chinese are responsible for expressing number and are closely related to quantification (Cheng & Sybesma, 1999), but the details of this proposal remain unclear; while some claim that the numeral and the classifier form "a dual head" of Classifier Phrase (Tang, 1990, p. 403; see also Cheng & Sybesma, 1998), others argue that there is a Number Phrase higher than the Classifier Phrase (Li, 1998; Cheng & Sybesma 2009; Cheng, 2012). A more thorough investigation of the Chinese number morphology is needed in order to answer some of the semantic questions concerned here.

References

Bale, A. C., & Barner, D. (2012). Semantic triggers, linguistic variation and the mass-count distinction. In D. Massam (Ed.), *Count and mass across languages* (pp. 238-260). Oxford University Press.

Barwise, J., & Cooper, R. (1981). Generalized quantifiers and natural language. In J. Kulas, J. H. Fetzer, & T. L. Rankin (Eds.), *Philosophy, Language, and Artificial Intelligence* (pp. 241-301). Springer Netherlands.

Cao, H. (2008). On mei 'every' and dou 'all' in Mandarin Chinese. *UCL Working Papers in Linguistics, 1*.

Chao, Y. R. (1968). *A Grammar of Spoken Chinese*. Berkeley: University of California Press.

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

Cheng, L. L. (2009). On every type of quantificational expression in Chinese. In A. Giannakidou, & M. Rathert (Eds.), *Quantification, Definiteness, and Nominalization* (pp. 53-75). Oxford University Press.

Cheng, L. L. S. (2012). Counting and classifiers. In D. Massam (Ed.), *Count and mass across languages* (pp. 199-219). Oxford University Press.

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

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

Chierchia, G. (1998). Plurality of mass nouns and the notion of "semantic parameter". In S. Rothstein (Ed.), *Events and grammar* (pp. 53-103). Springer Netherlands.

Chiu, H. C. (1990). A case of quantifier floating in Mandarin Chinese. Paper presented at *the 2nd North American Conference on Chinese Linguistics*, University of Pennsylvania, Philadelphia.

Cowper, E., & Hall, D. C. (2012). Aspects of individuation. In D. Massam (Ed.), *Count and mass across languages* (pp. 27-53). Oxford University Press.

Doetjes, J. (1996). Mass and count: Syntax or semantics. *Proceedings of Meaning on the HIL*, *1*, 34-52.

Gao, M. C. (1994). Dou as a wide scope universal quantifier. *Australian Journal of Linguistics*, *14*(1), 39-62.

Giannakidou, A., & Cheng, L. L. (2006). (In)definiteness, polarity, and the role of wh-morphology in free choice. *Journal of Semantics, 23*(2), 135-183.

Gil, D. (1995). Universal quantifiers and distributivity. In E. Bach, E. Jelinek, A. Kratzer, & B. B. Partee (Eds.), *Quantification in natural languages* (pp. 321-362). Springer Netherlands.

Gillon, B. S. (1992). Towards a common semantics for English count and mass nouns. *Linguistics and Philosophy*, *15*(6), 597-639.

Gillon, B. S. (1999). The lexical semantics of English count and mass nouns. In E. Viegas (Ed.), *Breadth and depth of semantic lexicons* (pp. 19-37). Springer Netherlands.

Hsieh, R. M. (1994). Dou and universal quantification in Chinese. Presented at *the 6th North American Conference on Chinese Linguistics*, University of Southern California, Los Angeles.

Huang, S. (1996). *Quantification and predication in Mandarin Chinese: A case study of dou.* Doctoral dissertation, University of Pennsylvania.

Iljic, R. (1994). Quantification in Mandarin Chinese: Two markers of plurality. *Linguistics, 32*(1), 91–116.

Iljic, R. (2001). The Problem of the Suffix –men in Chinese Grammar. *Journal of Chinese Linguistics, 29(1)*, 11-68.

Jiang, Y. (1998). Pragmatic Reasoning and the Syntactic/Semantic Characterization of DOU.

Modern Foreign Language: Linguistics and Applied Linguistics, 1, 10 - 24.

Lee, H. T. (1986). *Studies on quantification in Chinese*. Doctoral Dissertation, UCLA.

Li, C. N., & Thompson, S. A. (1989). *Mandarin Chinese: A functional reference grammar*. Berkeley: University of California Press.

Li, Y. A. (1998). Argument determiner phrases and number phrases. *Linguistic Inquiry, 29*(4), 693-702.

Li, Y. H. A. (1999). Plurality in a classifier language. *Journal of East Asian Linguistics*, *8*(1), 75-99.

Lin, J. W. (1996). *Polarity licensing and wh-phrase quantification in Chinese.* Doctoral Dissertation, University of Massachusetts at Amherst.

Lin, J., & Landman, F. (1998). Distributivity in Chinese and its implications. *Natural Language Semantics, 6*(2), 201-243.

Liu, F. H. (1996). *Scope dependency in English and Chinese*. Doctoral Dissertation, UCLA.

Liu, F. H. (1997). *Scope and specificity* (Vol. 16). John Benjamins Publishing.

Luo, Q. P. (2011). *Mei* and *dou* in Chinese: a tale of two quantifiers. *Taiwan Journal of Linguistics, 9*(2), 111-158.

Norman, J. (1988). *Chinese*. Cambridge: Cambridge University Press.

Pan, H. (2000, Jan). Implicit Arguments, Collective Predicates, and Dou Quantification in Chinese. Presented at *the 74th Annual Meeting of the Linguistic Society of America*, Chicago, IL.

Pan, H. (2005). On *mei* and *dou*. Paper presented at *the 2005 Annual Research Forum of Linguistic Society of Hong Kong*, City University of Hong Kong.

Parsons, T. (1990). *Events in the Semantics of English*. Cambridge, MA: MIT Press.

Partee, B. H. (1991, February). Adverbial quantification and event structures. In *Annual Meeting of the Berkeley Linguistics Society*, *17*(1), 439-456.

Partee, B. H., Bach, E., & Kratzer, A. (1987). "Quantification: A Cross-linguistic Perspective", NSF proposal, UMass, Amherst.

Partee, B. H., ter Meulen, A. G., & Wall, R. (2012). *Mathematical methods in linguistics* (Vol. 30). Springer Science & Business Media.

Rothstein, S. (1995). Adverbial quantification over events. *Natural Language Semantics, 3*(1), 1-31.

Rygaloff, A. (1973). *Grammaire Elementaire du Chinois*. Paris: Presses Universitaire de France.

Scha, R. (1984). Distributive, collective and cumulative quantification. *Truth, Interpretation, and Information, GRASS*, *2*, 131-158.

Schwarzschild, R. (1991). On the meaning of definite plural NPs. Doctoral dissertation, University of Massachusetts, Amherst.

Wu, J. (1999). A minimal analysis of dou-quantification. Ms., University of Maryland, College Park,

Xiang, M. (2008). Plurality, maximality and scalar inferences: A case study of Mandarin dou. *Journal of East Asian Linguistics, 17*(3), 227-245.

Xiang, Y. (2016). Mandarin Particle DOU: A Pre-exhaustification Exhaustifier. In C. Piñón (Ed.), *Empirical Issues in Syntax and Semantics 11*. Paris: Colloque de Syntaxe et Sémantique à Paris (CSSP).

Yang, R. (2001). *Common nouns, classifiers, and quantification in Chinese.* Doctoral dissertation, Rutgers, the State University of New Jersey.

Yorifuji, A. (1976). A study of the suffix *-men*. *Area and Culture Studies, 26*, 73-88.

Zhang, L. (2007). *A semantic study of universal quantification in Chinese*. Doctoral dissertation, City University of Hong Kong.