

Chinese Quantifier Scope, Concord, and Lexical Resource Semantics

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1 Introduction

Chinese quantifier scope is one of the most provocative areas of Chinese linguistics. In this article, we will examine the universal *mei*-NP (every-NP), the existential *yi*-NP (one-NP), and the multi-functional adverb *dou* in Mandarin Chinese. *mei*-NPs take the form of *mei*-(*yi*)-CL-N (every-(one)-classifier-N), with the number *yi* (one) being optional. *yi*-NPs take the form of *yi*-CL-N (one-classifier-N).

Chinese quantifier scope is intriguing because of its cosmetic resemblance to logical form. Unlike in English, where both the surface scope reading and the inverse scope reading are available at all times (5), the availability of scopings in Chinese is asymmetric. When the existential quantifier phrase (QP) precedes the universal QP (6), only the surface reading is available; however, when the two QPs are flipped (8), the inverse reading becomes available. Furthermore, topicalisation drastically changes the reading availability (7b). What are the guiding principles that determine quantifier scope readings?

More controversially, the adverb *dou* (often glossed as ALL) often co-occurs with *mei* (4a). This co-occurrence is puzzling as both *mei* and *dou* imply a universal quantifier. In other languages, English for example, *every* and *all* cannot co-occur 4b. Furthermore, what is the semantic function of *dou*? Does it affect quantifier scope reading?

Wu (2019) explained Chinese quantifier scope as a product of principles of economy. Lin (1998) presented a decompositional analysis of *mei* and *dou* and argued that this phenomenon should be analysed as a matter of distributivity rather than quantifier scope. Liu (2021) more recently defended the opposite view. He argued for the necessity of a quantifier-scope analysis, and rendered *dou* as pragmatic. Here, we propose a novel theory that Chinese *dou* can be understood as a concord phenomenon of universality. We argue that the co-occurrence of *mei* and *dou* is analogous to the negative concord phenomenon in languages such as Polish; negation also exhibits scoping effects. This novel approach leads to a massively simplified analysis. Finally, we are able to present a simple but effective lexical resource semantics (LRS) analysis of Chinese quantifier scope.

2 Chinese Quantifier Scope

Principles of Economy and Topic Prominence Fox’s (2000) analysis based on the principles of economy is one of the theories proposed to explain quantifier scoping. He gave a detailed account of how an English sentence such as (5b) can yield both the surface scope ($\exists > \forall$) and the inverse scope ($\forall > \exists$) through a series of scope-shifting operations (SSO). The Chinese sentence (6) has a parallel syntax to its English counterpart (5b), however, and yet the inverse scope reading is not available for the Chinese sentence.

Wu (2019) argued that this mismatch is not a refutation of Fox’s (2000) theory. Instead, it suggests that “Mandarin matrix transitives do not have the same syntactic structure as English matrix transitives have.” Expanding upon the well-known observation that Chinese is a topic-prominent language (Chao, 1968), Wu (2019) further argues that Chinese is topic-prominent in the sense that there exists a TopP projection above the TP for matrix clauses. The presence of this extra layer of TopP makes the optional QR or QL impossible,

because they violate scope economy. As those optional QR and QL were the source of the quantifier scope ambiguity, the example (6) now becomes unambiguous.

The economy analysis on the other hand fails to predict the available quantifier scopings of the doubly topicalised sentence (7b). Since both QPs are topicalised, the semantic changing QR should be allowed to happen. Therefore, under Wu’s (2019) theory, (7b) should have both the surface and inverse quantifier scope readings. But this never comes to light — Wu (2019) intentionally limits itself to only analysing sentences in which the existential QP precedes the universal quantifier, and also ignores any sentences that have the multi-functional adverb *dou*. If these sentences are also considered, one can much easily find counterexamples to a principles-of-economy analysis. While (8) has the same linear order of parts of speech as (6), reversing only the quantifier placement (universal precedes existential), the sentence is scope-ambiguous. Wu (2019) argues that these sentences are not evidence of scope ambiguity, because the inverse scope reading implies the surface reading: if every student read the same book, then every student did read a book. The existence of the inverse reading is merely an instance of the more general reading. Under this view, many English sentences are also not scope-ambiguous, however.

Nevertheless, there are sentences in which only the surface reading of is available. Lin (2020) credits Huang (2005) with the observation that the co-occurrence of *dou* and *mei* is not always mandatory. When *dou* is omitted, the sentence (9) can only yield the surface-scope reading. This important observation shows that understanding the semantic function of *dou* and its interaction with the quantifier *mei* are crucial for analysing Chinese quantifier scope.

Decompositional Account of *mei* and *dou* Liu (2021) considers “the puzzle of co-occurring *mei* and *dou*.” Both the quantifier *mei* and the multi-functional adverb *dou* introduce universal quantifiers, and therefore it is puzzling why *mei* and *dou* need to co-occur, let alone that the co-occurrence is mandatory in some situations. After all, the co-occurrence of *every* and *all* is not allowed in English (4).

One intriguing solution to this puzzle is presented by Lin (1998, 2020). He suggests that *mei* is not inherently quantificational. In his framework, *mei* has a semantics similar to the definite article *the*, which marks an NP to its maximal plural entity. Then Lin (1998) defines *dou* as a distributive operator (Link, 1987). Thus, the puzzle is solved by analysing the sentences not through the lens of quantifier scoping, but through distributivity.

- (1) a. $[[mei]] = f$, such that $\forall P \in D_{\langle e,t \rangle}, f(P) = \cup\{P\}$ (Lin (1998), (68))
 b. $[[dou]] = \lambda P.\lambda x.\forall y.[y \leq_{atom} x \rightarrow P(y)]$ (Link, 1987)

Presuppositional Account of *dou* Liu (2021) posited an opposite view to Lin’s (1998) decompositional solution, after laying out a detailed list of damning evidence that *mei*-NPs must indeed be quantificational. While we cannot reiterate all of the evidence here, one interesting observation is that when *mei*-NPs appear in a post-verbal position, *dou* is not allowed to appear, cf. example (6).

Having concluded that *mei* is quantificational, Liu (2021) posits that “*dou* is truth-conditionally vacuous but carries a presupposition that its prejacent is the strongest among its alternatives.” This comes very close to claiming that the appearance of *dou* is optional, however, and yet we know that the co-occurrence of *mei* and *dou* is often mandatory (6, 4a). To address the phenomenon of obligatory *dou*, Liu (2021) resorts to a pragmatic analysis of *obligatory presupposition* (Amsili and Beyssade, 2010).

There are certain aspects of the occurrence of *dou* that cannot be purely explained with pragmatics. Firstly, the scope-reading difference between (8) and (9) cannot be explained as a difference between whether presuppositions are specified. The semantic difference between the two suggests that *dou* possesses a genuinely semantical import. Secondly, while (10a) is ungrammatical regardless of whether *dou* occurs, (10b) is grammatical only with an obligatory *dou*. The only difference between the two sentences is that the subject of (10a) is existentially quantified, and (10b) has a proper noun as its subject that does not introduce any new quantification. But the two sentences have no difference in their propositional alternatives, as the existential quantifier does not introduce plurality, and therefore according to Liu (2021), both sentences should be grammatical with an obligatory *dou*.

3 “Universal Concord”

Both Lin (1998) and Liu (2021) saw the co-occurrence of *mei* and *dou* as a puzzling anomaly that is unique to Chinese, and yet the phenomenon of multiple words being allowed or even required to repeat a single semantic contribution in different parts of a sentence is commonplace in many languages. For example, negative concord (Sailer and Richter, 2021; Richter and Sailer, 2004) is a well-known phenomenon expressed typically in Polish (11a). Polish n-words (such as *nikt*, nobody) inherently express negativity. When an n-word appears in a clause, however, the verb must be marked by the Polish negative marker *nie*, often glossed as NM. Furthermore, the repeated negation does not yield a doubly negated reading ($\neg\neg(\exists x.\text{human}(x) \wedge \text{came}(x))$), but rather only a *negative-concord* reading ($\neg(\exists x.\text{human}(x) \wedge \text{came}(x))$) that is semantically equivalent to a simple negation. Negative concord is expressed colloquially in English as well; (11b) is logically equivalent to “I don’t know anything.”

Liu (2021) and Lin (1998) both used the incompatibility of *every* and *all* in English as evidence that the co-occurrence of *mei* and *dou* are problematic, and indeed concord can be idiosyncratic. For example, Chinese expresses no negative concord; (11c) can only have the doubly negated reading ($\neg\neg(\exists x.\text{human}(x) \wedge \text{came}(x))$), in which “everybody came.” A language expresses concord as the result of language-specific constraints. For instance, the Polish negative concord is expressed as the imposition of the *negation complexity constraint* (2) (Richter and Sailer, 2004). Similarly, we here impose a *closest quantifier constraint* (CQC; 3). The reason that we only constrain quantifications between the verb and the QPs to its left is that *dou* is a VP-external adverb that only associates with items to its left (Liu, 2021). This observation is consistent with our observation that the doubly topicalised example (7b) has an obligatory *dou*, but its untopicalised counterpart (6) is forbidden to have *dou*.

- (2) *Negation complexity constraint*: for each sign, there may be at most one negation that is a component of the TOP [EXCONT] value and has the MAIN value as its component. (Richter and Sailer, 2004)
- (3) *Closest quantifier constraint*: except for the case of dependent indefinites (Lin, 2020), every preverbal universal QP must have the same quantification as the verb (for example, with *dou*), and the verb must have the same quantification as the first QP to its left.

Our analysis of universal concord of Chinese is analogous to Polish negative concord in many different respects. For example, in Polish, any presence of an n-word will trigger the requirement of an NM for the verb, no matter how far the distance between the n-word and the verb. The presence of any universal QP to the left of the verb will require the verb to be modified by *dou*. From our previous analysis, it is obvious that if the verb is preceded immediately by a universal QP, then *dou* is obligatory (4a,7,8). Sentence (10b) is the evidence that a universal QP further away from the verb imposes the same kind of requirement as a QP closer to the verb.

Why is (10a) ungrammatical regardless of the presence of *dou*? To answer this question, let us return to the simpler example of (6). In this example, *dou* cannot appear. This is because the only QP to the left of the verb is existentially quantified, and therefore there is no reason for *dou* to appear. Also, as we mentioned previously, since there is a universal QP in (7) to the left of the verb, *dou* must occur. For both sentences, it is also true that the closest QP to the left of the verb is the universal QP; therefore, according to CQC, *dou* must occur. In (10a), however, there is a universal QP to the left of the verb, so *dou* must occur, and yet the closest QP to the verb is existentially quantified, so there is a contradiction, bestowing upon *yige xuesheng* the status of an intervenor. The sentence is ungrammatical regardless of whether *dou* occurs. The proper noun *Zhangsan* in (10b), on the other hand, is not quantified, and therefore the closest QP to the verb is the only QP *mei-ben shu* (every book).

The only special case for our constraint is the case of dependent indefinites. Dependent indefinites are discussed at length in Lin (2020). A dependent indefinite QP takes the form of *mei-num-CL* (12a). When the number is greater than one, then the QP is unambiguously dependent indefinite. Sentences with these dependent indefinite QPs perform drastically different from the regular *mei*-NPs that we have been analysed so far. For dependent-indefinite QPs, *dou* is forbidden, and they cannot undergo any topicalisation (12b). They are also more restrictive about the order in which their quantification can be read relative to other QPs:

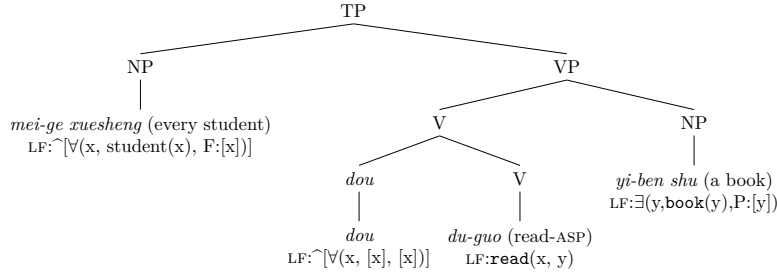


Figure 1: LRS analysis of (8) *mei-ge xuesheng dou du-guo yi-ben shu* (‘every student read a book’). The sentence has both the surface scope reading and the inverse scope reading possible.

only universal preceding existential is allowed (12c). Because of all of these differences and, more crucially, the lack of the presence of *dou*, it remains exceptional. It is also worth noting that when the number is one in *mei-num-CL*, the QP is ambiguous between being a dependent indefinite, or a regular *mei*-NP; recall that *yi* (one) is optional in regular *mei*-NPs.

4 Lexical Resource Semantics

Universal concord provides a framework to analyse scope ambiguity. We propose that scope ambiguity is introduced by having the option to introduce universality at either end of the concord. The universal scope can either be introduced by *dou*, or by the universal QP. If the sentence has a leading existential QP, then both options generate a ($\exists > \forall$) reading, which is the surface reading. However, if there is a leading universal QP, then there will be two readings available. When *dou* introduces the universal scope to the verb, the universal scope stays at the inner most scope (the predicate will always stay at the end of the logic form (LF)) and the inverse-scope reading is generated. However, if the universal QP generates the universal scope, it must occur at the outermost layer of the quantifier scope, and the surface reading will be generated. Interestingly, this framework can also explain the unambiguous dependent-indefinite sentences. Without the universal-bearing *dou*, the universal scope can only stay on the outermost layer, and therefore only the surface reading is permitted.

Underspecified grammars such as Lexical Resource Semantics (LRS, Penn and Richter (2004)) have long been used to analyse quantifier scope (Penn and Richter, 2004) and concord (Richter and Sailer, 2004). Because it is well-suited to analysing complex semantic phenomena, we rendered our own analysis of Chinese quantifier scope as universal concord with LRS. As an example, we present an LRS analysis of sentence (8) in Figure 1. To enable universal concord, we encode universal quantifiers as (improper) subterms. Subterms are especially well-suited to this situation as duplication of universal quantifiers will be resolved automatically. The subterm analysis also introduces ambiguity: either *dou* can introduce the universal subterm and attach it to the verb (inverse scope reading), or the *mei*-NP can add it at the top of the tree (surface scope reading).

5 Conclusion

Using a novel concord-based analysis of Chinese quantifier scope, we address some of the limitations of previous work, and reconcile the co-occurrence of *mei* and *dou*. Future research will hopefully use our LRS case study as a starting point to expand on the topic of Chinese quantifier scope. There are many more possible quantifiers than universal and existential. Do they also have a special scope-bearing adverb like *dou*? Is the same concord-based analysis amenable to the other quantifiers? Liu (2021) has also pointed out there are other adverbs such as *ye* (also) and *you* (again) that exhibit a similar behaviour as *dou*. Can we perform a similar analysis on those adverbs as well? These are all intriguing questions to be answered on this very topic.

Data

- (4) a. 每个 三年级 学生 *(都) 来了
 mei-ge sannianji xuesheng *(dou) lai-le
 every-CL third-grade student DOU come-ASP
 ‘Every third grade student came.’
 b. Every third grade student (*all) came. (Liu (2021), ex.6)
- (5) a. Every student read a book.
 $(\forall > \exists) (\exists > \forall)$
 b. A student read every book.
 $(\exists > \forall) (\forall > \exists)$
- (6) 一个 学生 读过 每本 书
 yi-ge xuesheng du-guo mei-ben shu
 one-CL student read every-CL book
 $(\exists > \forall) (*\forall > \exists)$
- (7) a. 一本书 每个 学生 *(都) 读过
 yi-ben shu mei-ge xuesheng dou du-guo
 one-CL book every-CL student DOU read-ASP
 $(\exists > \forall) (*\forall > \exists)$
 b. 一个 学生 每本 书 *(都) 读过
 yi-ge xuesheng mei-ben shu dou du-guo
 one-CL student every-CL book DOU read-ASP
 $(\exists > \forall) (*\forall > \exists)$
- (8) 每个 学生 都 读过 一本书
 mei-ge xuesheng dou du-ASP yi-ben shu
 every-CL student DOU read one-CL book
 $(\forall > \exists) (\exists > \forall)$
- (9) 每个 学生 读过 一本书
 mei-ge xuesheng du-ASP yi-ben shu
 every-CL student read one-CL book
 $(\forall > \exists) (*\exists > \forall)$
- (10) a. *每本 书 一个 学生 (都) 读过
 mei-ben shu yi-ge xuesheng dou du-guo
 every-CL book one-CL student DOU read-ASP
 b. 每本 书 张三 *(都) 读过
 mei-ben shu zhangsan dou du-guo
 every-CL book Zhangsan DOU read-ASP
- (11) a. Nikt nie przyszedł.
 nobody NM came
 ‘Nobody came.’
 b. I don’t know nothing.
 c. 没 人 没 来
 mei ren mei lai
 NM person NM come
 ‘Nobody didn’t come.’
- (12) a. 每三个 学生 (*都) 读过 一本书
 mei-san-ge xuesheng (*dou) du-guo yi-ben shu
 every-3-CL student DOU read-ASP one-CL book
 $(\forall > \exists) (*\exists > \forall)$
 b. *一本书 每三个 学生 读过
 yi-ben shu mei-san-ge xuesheng du-guo
 one-CL book every-3-CL student read-ASP
 c. *一个 学生 读过 每三本 书
 yi-ge xuesheng du-guo mei-san-ben shu
 one-CL student read-ASP every-3-CL book
 d. 每(一)个 学生 (都) 读过 一本书
 mei-(yi)-ge xuesheng (dou) du-guo yi-ben shu
 every-(1)-CL student DOU read-ASP one-CL book

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