

Alternations of logical functions: Mandarin particle *dou* as a pre-exhaustification exhaustifier

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Abstract Semantic variations of logical particles should be either non-existent or very limited, otherwise the logical system of the universal grammar would be too complex to acquire. Nevertheless, a number of functional particles possess various logical uses. Take the Mandarin particle *dou* for example. Varying by the item associated with and the prosodic pattern of the environment appearing in, *dou* can trigger a distributivity effect, license a universal free choice item, or evoke an *even*-like inference. To maintain the simplicity of the universal grammar, it is crucial to figure out which function or functions are primary, what parameters are responsible for the alternations of the logical functions, and how these alternations are conditioned.

In this paper, I argue that the seemingly unrelated functions of *dou* share the same source: *dou* is a pre-exhaustification exhaustifier operating on sub-alternatives. Uniformly, *dou* affirms the truth of its propositional prejacent, negates the exhaustification of each sub-alternative, and presupposes the existence of at least one sub-alternative. Function alternations result from minimal weakening operations on the semantics of sub-alternatives. In particular, sub-alternatives are primarily weaker alternatives, and thus the presupposition of *dou* yields a distributivity effect. Further, when the semantics of sub-alternatives is weakened under particular syntactic or prosodic conditions, *dou* gains its other logical functions.

1. Introduction

The Mandarin particle *dou* is known for its function diversity. As a rough classification, *dou* can be used as a quantifier-distributor, a universal free choice item (\forall -FCI) licenser, and an *even*-like scalar marker. This paper presents a uniform semantics of *dou* to capture its seemingly diverse functions. I propose that *dou* is a special exhaustifier with the following three characteristics:

- (i) *dou* operates on sub-alternatives;
- (ii) *dou* has a pre-exhaustification effect;
- (iii) *dou* presupposes the existence of at least one sub-alternative.

The basic idea of my proposal is as follows. For a *dou*-sentence of the form “*dou*(S_A)” where S is the prejacent clause and A is the associate of *dou*, its meaning is roughly ‘ S_A and not only $S_{A'}$ ’ where A' can be a proper subpart of A , a weak scale-mate of A , or a sub-domain alternative of A , and so on. For example, “John and Mary *dou* came” means that John and Mary came, not only John came, and not only Mary came; “it’s *dou* five o’clock” means that it’s five o’clock, not just four o’clock, not just three o’clock,

The function diversity of *dou* raises two fundamental questions for the semantics of natural languages (Chierchia 2016): what is the underlying logical system of the universal grammar (UG), and how is it developed? The underlying logical system of UG is the core system of the semantics of human languages. It is made up of connectives (such as negation, conjunction, disjunction,

conditional), quantifiers, and so on. This system should be simple and consistent, otherwise we wouldn't have been able to acquire it so easily. Nevertheless, cross-linguistically, many functional particles possess various basic functions. As Gil (2013) reports, 67% of world's languages possess such multi-functional particles. Typical examples include Mandarin particles *dou* and *ye*, and Japanese particles *ka* and *mo*,¹ and so on. For each of these particles, its diverse functions should have primarily the same source, otherwise the logical system of UG would be unrecognizable. The alternations of the functions should be triggered by minimal variations, otherwise function diversity would not be cross-linguistic.

The Mandarin particle *dou*, with a long history for at least 1800 years,² is an excellent case to study the development of the logical system in UG. In what follows, I will argue for the following development path for the functions of *dou* and the corresponding semantics of sub-alternatives:

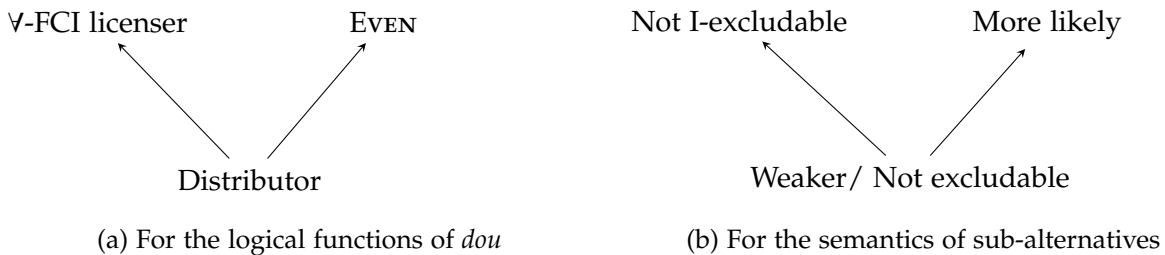


Figure 1: Developing paths for the logical functions of *dou* and the semantics of sub-alternatives

First, *dou* is primarily a pre-exhaustification exhaustifier defined purely based on logical strength. It operates on weaker (i.e., not excludable) alternatives and its additive presupposition yields a distributivity effect (section 5.1). Next, *dou* obtains its \forall -FCI-licenser use and *even*-like scalar marker use via two independent semantic weakening operations. In particular, the \forall -FCI-licenser use comes from a weakening operation from not being excludable to not being innocently excludable (section 5.2), while the *even*-like use comes from a weakening operation from being logically weaker to being more likely (section 5.3). These two weakening operations are partial and are only licensed under particular syntactic or prosodic conditions.

The rest of this paper is organized as follows. Section 2 describes the three basic uses of *dou*, including the quantifier-distributor use, the \forall -FCI licenser use, and the *even*-like scalar marker use. Section 3 discusses the advantages and problems of two representative approaches to the semantics of *dou*, including the distributor approach (Lin 1998) and the maximality operator approach (Giannakidou and Cheng 2006, Ming Xiang 2008). Section 4 starts with the canonical exclusive particle *only*, so as to introduce Alternative Semantics for focus and the theory of exhaustification. Then it outlines a preliminary treatment for the semantics of *dou* in parallel to that of *only*. Section 5 derives the three basic uses of *dou* and explains the relevant semantic effects. Section 6 discusses the alternations of the functions of *dou*.

¹There is a rich literature on the semantics of Japanese particles *ka* and *mo*. Representative works in contemporary semantics include: Kratzer and Shimoyama (2002); Mitrović (2014); Slade (2011); Szabolcsi (2010, 2015); Mitrovic and Sauerland (2014), among others.

²The quantifier-distributor use of *dou* emerged as early as the Eastern Han Dynasty (25-220) (Gu 2015).

2. Describing the uses of *dou*

2.1. Quantifier-distributor

In a basic declarative sentence, *dou* is associated with a preceding nominal expression and universally distributes over the subparts of the denotation of its associate, as exemplified in (1). This use of *dou* is similar to the post-nominal use of the English particle *all*. Here and throughout this paper, the associate of *dou* is enclosed in “[•]”.

- (1) a. [Tamen] **dou** dao -le.
they DOU arrive -ASP
'They all arrived.'
- b. [Tamen] **dou** ba naxie wenti da dui -le.
they DOU BA those question answer correct -ASP
'They all correctly answered these questions.'
- c. Tamen ba [naxie wenti] **dou** da dui -le.
they BA those question DOU answer correct -ASP
'They correctly answered all of these questions.'

Under the quantifier-distributor use, *dou* brings up three semantic consequences in addition to universal quantification, namely, a “maximality requirement,” a “distributivity requirement,” and a “plurality requirement.” Names of these requirements are quoted because they are used in a descriptive manner. Later, I will argue that both of the latter two requirements are illusions. The “maximality requirement” means that the presence of *dou* forces the predicate denoted by the remnant VP to be applied to the maximal element in the extension of *dou*'s associate (Ming Xiang 2008). For instance, in a discourse that a large group of children, with one or two exceptions, went to the park, the sentence in (2) is true only when *dou* is absent.

- (2) [Haizimen] (#**dou**) qu -le gongyuan.
children DOU go -PERF park
'The children (#all) went to the park.'

The “distributivity requirement” says that if a sentence admits both collective and (atomic or non-atomic) distributive readings, then adding *dou* to this sentence blocks the collective reading (Lin 1998). For instance, the presence of *dou* in (3) is infelicitous if the considered individuals all together participated in only one house-buying event.

- (3) (Context: the considered individuals all together bought one house.)
[Tamen] (#**dou**) mai -le fangzi.
they DOU buy -PERF house
'They (#all) bought house(s).'

The “plurality requirement” says that the associate of *dou*, overt or covert, must be non-atomic. If the preajacent clause of *dou* does not contain an overt non-atomic nominal item, *dou* has to be associated with a covert non-atomic item. For example, in (4), since the overt part of the preajacent clause has no non-atomic term, *dou* is associated with a covert item such as *mei-ci* ‘every time.’

- (4) Yuehan [(mei-ci)] **dou** qu de Beijing.
 John every-time DOU go DE Beijing
 ‘For all of the times, the place that John went to was Beijing.’

2.2. Scalar marker

There are two main cases where *dou* functions as a scalar marker: one is the [*lian* Foc *dou* ...] construction where *dou* is associated *lian*+DP, and the other is where *dou* is associated with an in-situ focused scalar item.

First, the [*lian* Foc *dou* ...] construction evokes an *even*-like inference, namely, it implies that the prejacent proposition is less likely than at least some of its contextually relevant alternatives, as exemplified in (5).³ In the [*lian* Foc *dou* ...] construction, the presence of *lian* is optional, but the associate of *dou* must be stressed.⁴

- (5) (Lian) [DUIZHANG]_F **dou** chi dao -le.
 LIAN team-leader DOU late arrive -ASP
 ‘Even [the team leader]_F arrived late.’
 ↗ *The team leader is less likely to arrive late (than a regular team member).*

In particular, the indefinite phrase ‘one-CL-NP’ can be licensed as a minimizer at the focal position in a [*lian* Foc *dou* NEG ...] construction, as shown in (6a). Interestingly, as C.-T. James Huang (pers. comm.) points out, the post-*dou* negation is sometimes optional, as seen in (6b). In presence of *dou*, (6b) means that John doesn’t want any money; in absence of *dou*, (6b) means that John is very greedy and wants to take any little amount of money.

- (6) a. Yuehan (lian) [YI_F-ge ren] *(**dou**) *(mei) qing.
 John LIAN one-CL person DOU NEG invite
 ‘John didn’t invite even one person.’

³↗ *p*’ means that the Mandarin sentence implies *p*. Here and throughout the paper, stressed items are capitalized, and focused items are marked with a subscript ‘*F*’.

⁴In many cases, a non-subject associate of *dou* can also be left in-situ, as exemplified in the following.

- | | |
|--|---|
| <p>(i) a. Ta (lian) [NANJ]_F dou qu -guo -le.
 he LIAN Antarctica DOU go -EXP -ASP
 b. Ta dou qu -guo [NANJ]_F -le.
 he DOU go -EXP Antarctica -ASP
 ‘He even has been to Antarctica.’</p> | <p>(ii) a. Ta (lian) [GAOZHONG]_F dou mei shang -guo.
 he LIAN high-school DOU NEG go -EXP
 b. Ta dou mei shang -guo [GAOZHONG]_F.
 he DOU NEG go -EXP high-school
 ‘He hasn’t even been to high school.’</p> |
|--|---|

But, there are still quite a few exceptions, which seem to be conditioned by the aspectual class of the sentence: to place the focused associate of *dou* in the in-situ position, the prejacent of *dou* has to express an accomplishment.

- | | |
|--|--|
| <p>(iii) a. Ta (lian) [ZHUXI]_F dou renshi.
 he LIAN chair DOU know
 ‘He even knows the chair.’
 b. *Ta dou renshi [ZHUXI]_F.
 he DOU know chair</p> | <p>(iv) a. Ta (lian) [NANJIZHOU]_F dou qu -guo (-le).
 he LIAN Antarctica DOU go -EXP -ASP
 ‘He even has been to Antarctica.’
 b. Ta dou qu -guo [NANJIZHOU]_F *(-le).
 he DOU go -EXP Antarctica -ASP</p> |
|--|--|

Since the aspectual system of Mandarin is very complex, we will not dive into this puzzle in this paper.

- b. Yuehan (lian) [YI_F-fen qian] *(**dou**) (mei) yao.
 John LIAN one-cent money DOU NEG request
 With negation: ‘John doesn’t want even one cent.’
 Without negation: ‘Even if it is just one cent, John wants it.’

Second, *dou* can also be associated with an in-situ scalar item. In this case, the presence of *dou* implies that its preadjacent proposition ranks relatively high with respect to the contextually relevant measurement. For example, in (7a), *dou* is associated with the numeral phrase *WU-dian* ‘five o’clock’, and the alternatives are ranked in chronological order. When *dou* takes this use, its associate can stay in-situ but must be focus-marked with stress.⁵

- (7) a. **Dou** [WU_F-dian] -le. b. Ta **dou** yijing lai -guo zher [LIANG_F-ci] -le.
 DOU five-o’clock -ASP he DOU already come -EXP here two-time -ASP.
 ‘It is five o’clock.’ ‘He has already been here twice.’
 ↪ *It’s too late.* ↪ *Being here twice is quite a lot (for him).*

2.3. FCI-licenser

As a well-known fact, when associated with a pre-verbal *wh*-item, *dou* evokes a universal free choice (∀-FC) inference, as exemplified in (8a-b).

- (8) a. [Shui] *(**dou**) keyi jiao jichu hanyu.
 who DOU can teach introductory Chinese
 ‘Anyone/everyone can teach Intro Chinese.’
 b. [Na-ge laoshi] *(**dou**) keyi jiao jichu hanyu.
 which-CL teacher DOU can teach introductory Chinese
 ‘Any/every teacher can teach Intro Chinese.’

More interestingly, in Yimei Xiang (2016b), I observe that associating *dou* with a pre-verbal disjunction also evokes a ∀-FC inference, as shown in (9). Here, while the preadjacent clause is a disjunction, associating the pre-verbal disjunction with *dou* yields a conjunctive inference.

- (9) a. [Yuehan huozhe Mali] keyi jiao jichu hanyu.
 John or Mary can teach introductory Chinese
 ‘Either John or Mary can teach Intro Chinese.’

⁵We need to distinguish the scalar marker use of *dou* in (7) and the non-scalar use in the following sentences, where *dou* is associated with the main verb, which is clearly non-scalar. Intuitively, here *dou* suggests a contrast between the status where a change has taken place (such as the status where he has been here, or it starts raining) and the status where this changed hasn’t taken place (such as the status where he hasn’t been here, or the rain hasn’t started yet). So far, I don’t have a full story on this use of *dou*.

- (i) a. Ta **dou** [LAI]_F -guo zher yi-ci -le. b. Yu **dou** [TING]_F -le.
 he DOU come -EXP here one-CL -ASP rain DOU stop -ASP
 ‘He has been here once.’ ‘The rain has stopped.’

- b. [Yuehan huozhe Mali] **dou** keyi jiao jichu hanyu.
 John or Mary DOU can teach introductory Chinese
 Intended: 'Both John and Mary can teach Intro Chinese.'

To license a pre-verbal \forall -FCI, *dou* typically has to be followed by an existential modal, such as *keyi* 'can'. If *keyi* is dropped or replaced with a universal modal *bixu* 'must', the presence of *dou* makes the sentence ungrammatical. The following sentences illustrate the case of pre-verbal disjunctions: in an episodic sentence or a universally modalized sentence, associating *dou* with a pre-verbal disjunction causes ungrammaticality.

- (10) a. [Yuehan huozhe Mali] (***dou**) jiao -guo jichu hanyu.
 John or Mary DOU teach -EXP Intro Chinese
 b. [Yuehan huozhe Mali] (***dou**) bixu jiao introductory hanyu.
 John or Mary DOU must teach Intro Chinese

The licensing conditions of the \forall -FCI uses of pre-verbal *wh*-items, however, are subject to individual variations. I will return to this issue in section 5.2.1.

2.4. Disambiguation

If a sentence has multiple items that are eligible to be associated with *dou*, the function of *dou* and the association relation can be disambiguated by stress. Compare the following three sentences:

- (11) a. [Tamen] **DOU/dou** lai -guo liang-ci -le.
 they DOU/DOU come -EXP two-time -ASP
 'They ALL have been here twice.'
 b. Tamen **dou** lai -guo [LIANG_F-ci] -le.
 they DOU come -EXP two-time -ASP
 'They've been here for even twice.'
 \rightsquigarrow *Being here twice is a lot for them.*
 c. (Lian) [TAMEN]_F **dou** lai -guo liang-ci -le.
 LIAN they DOU come -EXP two-time -ASP
 'Even THEY have been here twice.'
 \rightsquigarrow *Compared with some other people, they are less likely to come here twice.*

In (11a), where the pre-jacent of *dou* has no stressed item, *dou* functions as a quantifier-distributor and is associated with the preceding plural term *tamen* 'they'. While in (11b) and (11c), *dou* functions as a scalar marker and is associated with the stressed item.

3. Previous studies

There are numerous studies on the syntax and semantics of *dou*. Earlier approaches treat *dou* as an adverb with universal quantification power (Ma 1983; Lee 1986; Cheng 1995; Pan 2006; Jiang 1998; among many others). Huang (1996) and Yuan (2005) treat *dou* as a sum operator operating on the

event variable. Portner (2002), Liao (2011), and Liu (2016b,c) analyze the scalar marker use of *dou* in a way similar to the inherent scalar semantics of the English focus sensitive particle *even*. Hole (2004) treats *dou* as a universal quantifier over the domain of alternatives. This section will review two representative studies on the semantics of *dou*, one is the distributor approach by Lin (1998), and the other is the maximality operator approach along the lines of Giannakidou and Cheng (2006) and Ming Xiang (2008). A more recent exhaustification-based treatment by Liu (2016b,c) will be discussed in footnote 22.

3.1. The distributor approach

Lin (1998) provides the first extensive treatment of the semantics of *dou*. He proposes that *dou* is an overt counterpart of the generalized distributor PART in the sense of Schwarzschild (1996), as defined in (12), where x stands for the associate of *dou* and P for the predicate that *dou* combines with.

(12) **Semantics of *dou* (Lin 1998)**

' x *dou* P ' is true iff $\text{PART}_C(P, x) = 1$
iff $\forall y \in C [y \leq x \rightarrow P(y)]$, where C is a cover of x .

Unlike the regular distributor *each* which distributes over an atomic domain, the generalized distributor PART distributes over the cover of the associated item, whose members can be atomic or non-atomic. A cover of an entity X is a set of subparts of X , as defined in (13). The value of a cover is determined by both linguistic and non-linguistic factors.

(13) C is a **cover** of x (formalized as ' $\text{Cov}(C, x) = 1$ ') iff

- a. C is a set of subparts of x ;
- b. every subpart of x belongs to some member in C .

When a cover is a set of atomic elements, the PART-operator distributes down to atoms, yielding an atomic distributive reading. When a cover is a singleton set, distributivity becomes trivial, and applying PART returns a collective reading. In other cases, applying PART gives rise to a non-atomic distributive reading. For example, if the cover of $a \oplus b \oplus c$ is $\{a \oplus b, c\}$, '*abc dou* bought houses' means that ab together bought a house and c alone bought a house.

(14) Possible covers of $a \oplus b \oplus c$ and the corresponding readings of *abc dou* bought houses:

$\{a, b, c\}$	Atomic distributive	' <i>abc</i> each bought houses'
$\{a \oplus b, c\}$	} Non-atomic distributive	
$\{a \oplus b, b \oplus c\}$		
...		
$\{a \oplus b \oplus c\}$	Collective	' <i>abc</i> together bought houses'

The distributor approach by Lin only considers the quantifier-distributor use of *dou*. It is unclear how to extend it to the other uses, such as the FCI-licenser use and the scalar marker use. Moreover, even for the quantifier use, this approach faces the following challenges.

First, *dou* evokes a distributivity requirement, but the generalized PART-distributor does not. For instance, as seen in (3) and repeated below, the presence of *dou* eliminates the collective reading of the preajcent sentence. As Ming Xiang (2008) argues, if *dou* were a generalized distributor, it should be compatible with a single cover reading (viz., the collective reading). For example, in (15), if *tamen* ‘they’ denotes the plural individual $a \oplus b \oplus c$, there can be a discourse under which the cover of *tamen* ‘they’ denotes a singleton set like $\{a \oplus b \oplus c\}$, and then Lin predicts *dou* to trivially distribute over this singleton set, yielding a collective reading, contra fact.

- (15) [Tamen] **dou** mai -le fangzi.
 they DOU buy -PERF house
 ‘They **dou** bought houses.’ (#collective)

Second, unlike English distributors like *each* and *all*,⁶ Mandarin *dou* can be associated with a distributive expression such as NP-*gezi* ‘NP each’.⁷

- (16) a. They each (*each/*all) has some advantages.
 b. [Tamen gezi] (**dou**) you yixie youdian.
 They each DOU have some advantage
 ‘They each **dou** has some advantages.’

3.2. The maximality operator analysis

Another representative approach, initiated by Giannakidou and Cheng (2006) and extended by Ming Xiang (2008), is to treat *dou* as a maximality operator. Briefly speaking, this approach proposes *dou* to have the following semantic characteristics: (i) it operates on a non-singleton cover of the associated item and returns the maximal plural element in this cover, and (ii) it presupposes the existence of this maximal plural element. I schematize this idea as follows:

- (17) **Semantics of *dou*** (based on Giannakidou and Cheng 2006 and Ming Xiang 2008)
 Let $Cov(C, x) = 1$, then $\llbracket dou \rrbracket(x) = |C| > 1 \wedge \exists y \in C[\neg \text{ATOM}(y) \wedge \forall z \in C[z \leq y]]$.
 $\iota y \in C[\neg \text{ATOM}(y) \wedge \forall z \in C[z \leq y]]$
 ($\llbracket dou \rrbracket(x)$ is defined only if the cover of x is non-singleton and has a unique non-atomic maximal element; when defined, the reference of $\llbracket dou \rrbracket(x)$ is this maximal element.)

⁶Champollion (2015) argues that *all* is a distributor that distributes down to subgroups, while that *each* distributes all the way down to atoms.

⁷Similar arguments have been reached in previous studies (Cheng 2009, among others), but they are mostly based on the fact that *dou* can be associated with the distributive quantificational phrase *mei-CL-NP* ‘every NP’, as exemplified in (i). This fact, however, cannot knock down the distributor approach for the quantifier use of *dou*: observe in (i) that stress falls on the distributive phrase *mei-CL-NP*, not the particle *dou*; therefore, here *dou* functions as a scalar marker, not a quantifier.

- (i) a. [MEI-ge ren] **dou** you youdian.
 every-CL person DOU have advantage
 ‘Everyone **dou** has some advantages.’
 b??[Mei-ge ren] **DOU** you youdian.
 every-CL person DOU have advantage

The maximality operator approach of *dou* is close to the standard treatment of the definite determiner *the* (Sharvy 1980, Link 1983): *the* picks out the unique maximal element in the extension of its NP-complement and presupposes the existence of this maximal element.

- (18) $\llbracket the \rrbracket(P_{\langle \alpha, t \rangle}) = \exists x_\alpha [x \in P \wedge \forall y \in P [y \leq x]]$.
 $\iota x_\alpha [x \in P \wedge \forall y \in P [y \leq x]]$
 ($\llbracket the \rrbracket(P_{\langle \alpha, t \rangle})$ is defined only if there is a unique maximal object x such that $P(x)$ is true (based on an ordering on elements of type α); when defined, the reference of $\llbracket the \rrbracket(P_{\langle \alpha, t \rangle})$ is this maximal element.)

The maximality operator approach has two advantages over the distributor approach. First, it captures the maximality requirement. Second, it can be extended to the scalar use of *dou* (see Ming Xiang 2008). Nevertheless, this approach still faces several conceptual or empirical problems. First, it predicts no distributivity effect at all. Under this approach, “[x] **dou** did f ” only asserts that the maximal element in the cover of x did f , not that each element in the cover of x did f . For instance, in (15), repeated below, if the cover of *tamen* ‘they’ is $\{a \oplus b, a \oplus b \oplus c\}$, then the asserted inference predicted by the maximality operator approach would simply be ‘ $a \oplus b \oplus c$ bought houses,’ which says nothing as to whether $a \oplus b$ bought houses.

- (19) [Tamen] **dou** mai -le fangzi.
 they DOU buy -PERF house
 ‘They **dou** bought houses.’ (#collective)

Second, the plurality requirement comes as a stipulation on the presupposition of *dou*: *dou* presupposes that the selected maximal element is non-atomic. It is unclear why this is so, because the definite article *the* does not trigger such a plural presupposition. Moreover, as we will see in section 5.1.2, the so-called “plurality requirement” is illusive. This plural presupposition is neither sufficient nor necessary for accounting for the relevant facts.

4. Defining *dou* as a special exhaustifier

This section will start with the semantics of the canonical exhaustifier *only*, and then define the Mandarin particle *dou* as a special exhaustifier. Briefly, *only* excludes excludable alternatives and presupposes the existence of an excludable alternative, while *dou* excludes pre-exhaustified sub-alternatives and presupposes the existence of a sub-alternative. Excludable alternatives and sub-alternatives are mostly complementary: excludable alternatives are the ones that are not entailed by the prejacent, while sub-alternatives are the ones that are asymmetrically entailed by the prejacent.

4.1. The canonical exhaustifier *only*

Alternative Semantics for focus (Rooth 1992) assumes that a focused sentence is associated with a set of focus alternatives, derived by replacing the focused item with contextually relevant items of the same semantic type. This set of alternatives grows point-wise (Hamblin 1973, Rooth 1992) till be used up by a focus-sensitive operator.

(20) **The set of (focus) alternatives**

a. *Simple expression*

$$\text{for any lexical entry } \alpha, \text{ALT}(\alpha) = \left\{ \begin{array}{ll} D_{\text{type}(\llbracket \alpha \rrbracket)} & \text{if } \alpha \text{ is focused} \\ \{\llbracket \alpha \rrbracket\} & \text{otherwise} \end{array} \right\}$$

b. *Complex expression*

$$\text{ALT}(\beta(\alpha)) = \{b(a) : b \in \text{ALT}(\beta), a \in \text{ALT}(\alpha)\}$$

The exclusive particle *only* is a canonical exhaustifier. It is standardly assumed that *only* presupposes the truth of its prejacent proposition (Horn 1969) and asserts an exhaustivity inference. This exhaustivity inference negates all the focus alternatives of the prejacent clause that are excludable, as schematized in (21a). An alternative is excludable as long as it is not entailed by the prejacent, as defined in (21b).

(21) **Semantics of *only*** (to be revised in (23))

a. $\llbracket \text{only} \rrbracket(p) = \lambda w [p(w) = 1. \forall q \in \text{EXCL}(p) [q(w) = 0]]$

b. $\text{EXCL}(p) = \{q : q \in \text{ALT}(p) \wedge p \not\subseteq q\}$

In addition to the prejacent presupposition, I argue that *only* also triggers an additive presupposition, namely, that the prejacent clause has at least one excludable alternative. Consider (22) for illustration of this additive presupposition:

(22) Which of John and Mary will you invite?

- a. Only JOHN_F, (not Mary / not both).
- b. # Only BOTH_F.
- c. BOTH_F.

In this example, *only* has a restricted exhaustification domain $\{I \text{ will invite John, } I \text{ will invite Mary, } I \text{ will invite John and Mary}\}$. Contrary to the response in (22a), the one in (22b) is infelicitous because the additive presupposition of *only* is not satisfied: the prejacent proposition *I will invite both John and Mary* is the strongest one among the alternatives and thus it has no excludable alternative. As Martin Hackl (pers. comm.) points out, the additive presupposition of *only* can be reduced to a more general economy condition that an overt operator cannot be applied vacuously.⁸ For sake of

⁸The additive presupposition of *only* can be understood as a part of Al Khatib's (2013) *non-vacuity presupposition*, which says that some excludable alternative is such that its negation is not entailed by the assertion, as schematized in (ia). Another way to characterize this non-vacuity presupposition is as in (ib), which says that there is some alternative such that the prejacent entails neither this alternative nor the negation of this alternative,

(i) **Non-vacuity presupposition of *only*** (Al Khatib 2013)

a. *only* (*p*) presupposes $\exists q \in \text{EXCL}(p) [p \not\subseteq \neg q]$

b. *only* (*p*) presupposes $\exists q \in \text{ALT}(p) [p \not\subseteq q \wedge \boxed{p \not\subseteq \neg q}]$

The part in (ib) enclosed in a box is needed for predicting the infelicity of the answer in (ii): the prejacent ϕ_{EVERY} does not entail the alternative ϕ_{NO} itself but entails its negation ($\neg\phi_{\text{NO}} = \phi_{\text{SOME}}$).

- (ii) A: Did John see every student, or did he see no student(s)?
- B: # He only saw [every student]_F.

comparison, observe that the response in (22c) is felicitous, even though *BOTH* is focused and is associated with a covert exhaustifier. The reason is that covert exhaustification is free from the economy condition and does not trigger an additive presupposition.

To sum up, I define the semantics of *only* as follows: *only* presupposes the truth of its prejacent and the existence of an excludable focus alternative; when the presuppositions are satisfied, it negates the excludable focus alternatives of its prejacent clause.⁹

(23) **The meaning of *only***

$$\llbracket \textit{only} \rrbracket(p) = \lambda w [\underbrace{\textit{Excl}(p) \neq \emptyset}_{\text{additive pres.}} \wedge \underbrace{p(w) = 1}_{\text{prejacent pres.}} \cdot \underbrace{\forall q \in \textit{Excl}(p)[q(w) = 0]}_{\text{exhaustivity assertion}}]$$

- a. Additive presupposition: The prejacent has at least one excludable alternative.
- b. Prejacent presupposition: The prejacent proposition is true.
- c. Exhaustivity assertion: All the excludable alternatives are false.

4.2. Defining *dou* in analogous to *only*

In analogous, I define *dou* as special exhaustifier that operates on sub-alternatives and presupposes the existence of a sub-alternative, as schematized in (24):

(24) **The meaning of *dou***

$$\llbracket \textit{dou} \rrbracket(p) = \lambda w [\underbrace{\textit{Sub}(p) \neq \emptyset}_{\text{additive pres.}} \cdot \underbrace{p(w) = 1}_{\text{prejacent assertion}} \wedge \underbrace{\forall q \in \textit{Sub}(p)[\textit{O}(q)(w) = 0]}_{\text{anti-exhaustivity assertion}}]$$

- a. Additive presupposition: There is at least one sub-alternative.
- b. Prejacent assertion: The prejacent proposition is true.
- c. Anti-exhaustification assertion: The exhaustification of each sub-alternative is false.

The additive presupposition is motivated by the economy principle of overt functional particles, just like what we saw with the canonical exhaustifier *only*. The asserted component of *dou* is an “anti-exhaustification” inference. This inference differs from the assertion of *only* in two respects. First, while *only* operates on excludable alternatives, *dou* operates on sub-alternatives. Sub-alternatives are primarily weaker alternatives, or equivalently, the alternatives that are not excludable and are distinct from the prejacent, as schematized in (25).¹⁰ In section 5.2, I will show that the semantics of sub-alternatives are subject to minimal variations, which cause the function alternations of *dou*.

⁹For simplicity, this chapter treats all exhaustifiers as propositional operators. Following Rooth (1985, 1992, 1996), I define the semantics of *only* cross-categorically as follows. Here *f* and *P* correspond to the left argument (i.e., the restrictor) and the right argument (i.e., the scope), respectively. This definition can easily extend to other exhaustifiers.

(i) **Cross-categorical semantics of *only***

$$\llbracket \textit{only} \rrbracket(f_\alpha)(P_{\langle \alpha, st \rangle}) = \lambda w [\underbrace{P(f)(w) = 1}_{\text{prejacent pres.}} \wedge \underbrace{\exists f' \in \text{ALT}(f)[P(f) \not\subseteq P(f')]}_{\text{additive pres.}} \cdot \underbrace{\forall f' \in \text{ALT}(f)[P(f) \not\subseteq P(f') \rightarrow P(f)(w) = 0]}_{\text{exhaustivity assertion}}]$$

¹⁰The sign ‘-’ stands for set subtraction. Given two sets *A* and *B*, $A - B = \{x : x \in A \wedge x \notin B\}$.

(25) **Primary semantics of sub-alternatives**

$$\begin{aligned}\text{SUB}(p) &= \{q : q \in \text{ALT}(p) \wedge p \subset q\} \\ &= (\text{ALT}(p) - \text{EXCL}(p)) - \{p\}\end{aligned}$$

(The set of alternatives of p that are not excludable and distinct from the prejacent p .)

Second, *dou* has a pre-exhaustification effect, meaning that it does not negate the sub-alternatives, but rather the “exhaustification” of each sub-alternative, yielding an “anti-exhaustification” inference. In a basic case, the pre-exhaustification effect is realized by applying an *O*-operator to each sub-alternative.¹¹ The *O*-operator is a covert counterpart of the exclusive particle *only*, coined by the grammatical view of scalar implicatures (Fox 2007, Chierchia et al. 2012, Fox and Spector to appear, among others). As schematized in (26), this *O*-operator affirms the prejacent and negates all the excludable alternatives of the prejacent.

(26) **Semantics of the covert exhaustifier ‘O’** (Chierchia et al. 2012)

$$\begin{aligned}O(p) &= \lambda w[p(w) = 1 \wedge \forall q[q(w) = 1 \rightarrow p \subseteq q]] \\ &= \lambda w[p(w) = 1 \wedge \forall q \in \text{EXCL}(p)[q(w) = 0]]\end{aligned}$$

(The prejacent is true, while all the excludable alternatives are false.)

Consider (27) and (28) for simple illustrations of the proposed definition of *dou*.

(27) [John and Mary] **dou** arrived.

- a. $\text{ALT}(j \oplus m) = D_e$
- b. $\llbracket S \rrbracket = \text{arrive}(j \oplus m)$
- c. $\text{ALT}(S) = \{\text{arrive}(x) : x \in D_e\}$
- d. $\text{SUB}(S) = \{\text{arrive}(j), \text{arrive}(m)\}$
- e. $\llbracket \text{dou}(S) \rrbracket = \text{arrive}(j \oplus m) \wedge \neg O[\text{arrive}(j)] \wedge \neg O[\text{arrive}(m)]$

(28) [John] (***dou**) arrived.

- a. $\llbracket S \rrbracket = \text{arrive}(j)$
- b. $\text{SUB}(S) = \emptyset$
- c. $\llbracket \text{dou}(S) \rrbracket$ is undefined

In (27), the prejacent proposition and its alternative set are schematized as in (27b) and (27c), respectively. Among those alternatives, only the two in (27d) are asymmetrically entailed by the prejacent, which are therefore the sub-alternatives. The application of *dou* affirms the prejacent and negates the exhaustification of each sub-alternative, yielding the inference in (27e): John and Mary arrived, not only John arrived, and not only Mary arrived. The anti-exhaustification inference given by the *not only*-clauses is entailed by the prejacent and adds nothing new to the truth conditions.¹² In comparison, in (28), *dou* cannot be present and associated with an atomic

¹¹When *dou* is used as a scalar marker, the pre-exhaustification effect is realized by applying a scalar exhaustifier (\approx *just*) to the sub-alternatives. See section 5.3.

¹²One might wonder why *dou* is used even though it does not change the truth conditions. Such uses are observed cross-linguistically. For instance, in (i), the distributor *both* adds nothing to the truth conditions.

proper name *John* (unless *John* is stressed): the preajcent clause *S* has no sub-alternative, and hence the additive presupposition of *dou* cannot be satisfied.

Note that the *O*-operator is defined based on excludable alternatives, which complements sub-alternatives. Hence, we can define the lexical entry of *dou* purely based on sub-alternatives, as schematized in the following:

(29) **Defining *dou* based sub-alternatives**

- a. $O(q) = \lambda w[q(w) = 1 \wedge \forall r \in \text{EXCL}(q)[r(w) = 0]]$
 $= \lambda w[q(w) = 1 \wedge \forall r \in ((\text{ALT}(q) - \text{SUB}(q)) - \{q\})[r(w) = 0]]$
- b. $[[dou]](p) = \exists q \in \text{SUB}(p).\lambda w[p(w) = 1 \wedge \forall q \in \text{SUB}(p)[O(q)(w) = 0]]$
 $= \exists q \in \text{SUB}(p).\lambda w[p(w) = 1 \wedge$
 $\forall q \in \text{SUB}(p)[q(w) = 0 \vee \exists r \in ((\text{ALT}(q) - \text{SUB}(q)) - \{q\})[r(w) = 1]]]$

In the following, I will use the more intuitive definition in (24). But we should keep in mind that the meaning of *dou* is purely decided by the definition of sub-alternatives.

5. Deriving the uses of *dou*

5.1. The universal quantifier use

Recall that *dou* evokes three requirements when used as a quantifier-distributor: (i) the “maximality requirement,” namely, that *dou* forces maximality with respect to the domain denoted by the associated item; (ii) the “distributivity requirement,” namely, that the preajcent sentence cannot take a collective reading; (iii) the “plurality requirement,” namely, that the item associated with *dou* must take a non-atomic interpretation. This section will focus on the latter two requirements.

-
- (i) John and Mary *both* arrived.

One possibility, raised by the audience at LAGB 2015, is that *dou* and *both* are used for the sake of contrasting with non-maximal operators like *only part of* or *only one of*. If this is the case, the question under discussion for (27) and (i) would be ‘is it the case that John and Mary both arrived or that only one of them arrived?’ This idea is supported by the oddness of using *both/dou* in the following conversation:

- (ii) Q: “Who arrived?”
A: “John and Mary *#(both/dou)* arrived.”

Using *dou* makes the answer incongruent with the explicit question: if *dou* is present, the answer has an alternative “only John or only Mary arrived”, which is not in the Hamblin set of the explicit question (viz., $\{x \text{ arrived: } x \in D_e\}$).

This idea also explains the maximality requirement of *dou* under the quantifier-distributor use. Here let me just sketch out this idea informally: the assertion of the *dou*-sentence (iii) is identical to that of (iiia), which is tolerant of non-maximality; but (iii) also implicates the anti-non-maximality inference (iiib), giving rise to a maximality requirement.

- (iii) (Context: *The children, with only one or two exceptions, went to the park.*)

[Haizimen] (#**dou**) qu -le gongyuan.
children DOU go -PERF park
‘The children (#all) went to the park.’

- a. The children went to the park.
- b. Not [only part of the children went to the park.]

(See footnote 12 for a rough idea regarding to the maximality requirement.) I will argue that these two requirements are both illusions. Moreover, I will argue that all the facts that are thought to result from these two requirements actually result from the additive presupposition of *dou*.

5.1.1. Explaining the “distributivity requirement”

To generate sub-alternatives and satisfy the additive presupposition of *dou*, the prejacent of *dou* needs to be strictly stronger than some of its alternatives. In case that the associate of *dou* is an entity (of type e), this requirement is satisfied only when the predicate denoted by the remnant VP is (atomically or non-atomically) distributive or divisive. Consider the *dou*-sentence in (30) for illustration. For simplicity, I will follow the well-known cover-based treatment of generalized distributivity by Schwarzschild (1996), although this treatment has some undesired consequences in generating alternatives.¹³ The prejacent clause of *dou* is interpreted as in (30a), where a generalized distributor PART distributes over the contextually determined cover of $a \oplus b \oplus c$. The alternatives of this prejacent clause are derived by replacing $a \oplus b \oplus c$ with an individual of type e , as in (30b). The sub-alternatives are the ones that are formed based on the sum of some proper subset of the cover variable C , as in (30c).¹⁴ Shading marks sub-alternatives, box encloses the prejacent proposition, and arrows indicate entailment relations. If C is non-singleton, the prejacent clause of *dou* takes an atomic or non-atomic distributive reading and does have some weaker/sub- alternatives, which therefore satisfies the additive presupposition of *dou*. In contrast, if the prejacent clause takes a collective/single-cover reading for the following reason, it does not have a weaker/sub- alternative, making the use of *dou* undefined.

(30) **Dou** [_S $a \oplus b \oplus c$ bought houses]

- a. $\llbracket S \rrbracket = \text{PART}_C(f, a \oplus b \oplus c)$
 - b. $\text{ALT}(S) = \{\text{PART}_C(f, X) : X \in D_e\}$
 - c. $\text{SUB}(S) = \{\text{PART}_C(f, X) : X \in D_e \wedge \exists C' \subset C [X = \bigoplus C']\}$
- ✓ **Atomic distributive:** If $C = \{a, b, c\}$, then...

¹³In the alternatives, the value of C constantly equals to the contextually determined cover of the associated item in the prejacent (viz. the cover of $a \oplus b \oplus c$), and PART only distributes over C . (See Liao 2011: chap. 4.) For example, if $C = \{a, b, c\}$, the alternative $\text{PART}_C(f, d)$ is vacuously a tautology, and the alternative $\text{PART}_C(f, a \oplus b \oplus c \oplus d)$ is logically equivalent to $\text{PART}_C(f, a \oplus b \oplus c)$. These consequences are harmless for now. Nevertheless, problems arise if we want an operator to operate on excludable alternatives. For example, to derive the exhaustification inference of (i), ‘ b bought houses’ shall not be a tautology.

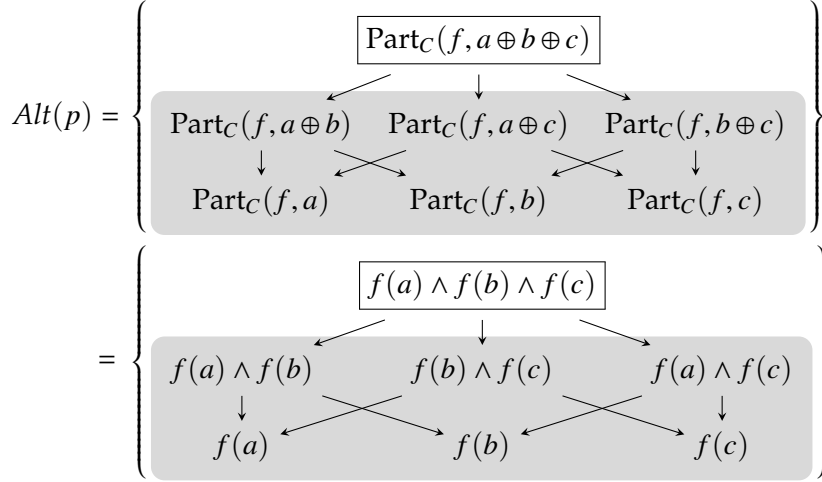
- (i) Only abc_F bought houses. $\rightsquigarrow d$ didn't bought houses.

See a solution in Liu (2016c) based on Link-Landman’s approach of encoding distributivity/collectivity distinction. Details regarding to Liu’s formal implementations are omitted due to the scope of this paper.

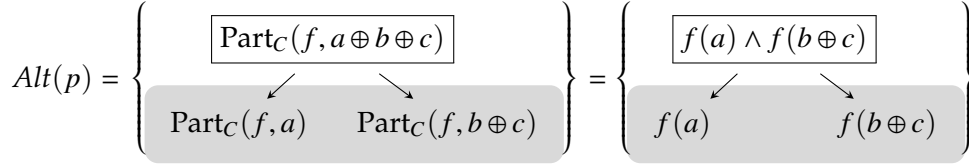
¹⁴More precisely, under the cover-based account of distributivity, sub-alternatives shall be formulated as follows:

- (i) $\text{SUB}(S) = \{\text{PART}_C(f, x) : x \in D_e \wedge \{y : y \leq x \wedge C(y)\} \subset C\}$

An alternative is a sub-alternative as long as it is based on an individual x such that the set of subparts of x that are members of C is a proper subset of C (or equivalently, C contains at least one member that is a subpart of x as well as one member that is not a subpart of x). In other words, as seen in footnote 13, it doesn’t matter whether x contains parts that are not members of C .



√ **Non-atomic distributive:** If $C = \{a, b \oplus c\}$, then...



× **Collective:** If $C = \{a \oplus b \oplus c\}$, then:

$$Alt(p) = f(a \oplus b \oplus c) \text{ and } Sub(p) = \emptyset$$

In sum, the particle *dou* itself is not a distributor. But in certain cases, its additive presupposition forces the application of a distributor, or any operation that makes the preajcent clause distributive. We can now easily explain why *dou* can be associated with the distributive expression NP-*gezi* ‘NP-each’. The presence of the distributor *gezi* ‘each’ is not redundant; instead, it is required for satisfying the additive presupposition of *dou*. If *gezi* is not overtly used, there would still be a covert distributor present in the LF.

- (31) [Tamen *gezi*] **dou** you yixie youdian.
They each **DOU** have some advantage
‘They each **dou** has some advantages.’

This account also explains why *dou* can occur in some collective sentences: *dou* can be applied to a collective statement as long as the collective predicate used in this statement is divisive.

- (32) P is **divisive** iff $\forall x[P(x) \rightarrow \exists y < x[P(y)]]$
(Whenever P holds of something x , it also holds of some proper subpart(s) of x .)

For instance, *dou* is compatible with divisive collective predicates such as *shi pengyou* ‘be friends’, *jithe* ‘gather’, and *jianmian* ‘meet’, as seen in (33a-c). Consider (33a) for a concrete example. Let *tamen* ‘they’ denote three individuals *abc*. The set of sub-alternatives is $\{ab$ are friends, bc are friends, ac are friends}. Applying *dou* yields inference that ‘*abc* are friends, not only *ab* are friends, not only bc are friends, and not only ac are friends.’ In comparison, *dou* cannot be applied to a collective statement if the predicate is not divisive, as shown in (33d).

- (33) a. [Tamen] (**dou**) shi pengyou.
 they DOU be friends
 ‘They are (all) friends.’
- b. [Tamen] (**dou**) zai dating jihe -le.
 they DOU at hallway gather -ASP
 ‘They (all) gathered in the hallway.’
- c. [Tamen] (**dou**) jian-guo-mian -le.
 they DOU see-EXP-face -ASP
 ‘They (all) have met.’
- d. [Tamen] (***dou**) zucheng -le zhe-ge weiyuanhui.
 they DOU form -ASP this-CL committee
 ‘They (*all) formed this committee.’

5.1.2. Explaining the “plurality requirement”

The “plurality requirement” says that the associate of *dou* has to take a non-atomic interpretation. I argue that this requirement is also illusive, and that the related facts all result from the additive presupposition of *dou*.

On the one hand, the plurality requirement is unnecessary: *dou* can be associated with an atomic item as long as the predicate denoted by the remnant VP is divisive. For instance, in (34a), *dou*’s associate *na-ge pingguo* ‘that apple’ has only an atomic interpretation. With a divisive predicate $\lambda x. John\ ate\ x$, the preajcent clause of *dou* does have some sub-alternatives formed based proper subparts of that apple, as schematized in (35a), which therefore supports the additive presupposition of *dou*. In contrast, in (34b), the predicate $\lambda x. John\ ate\ half\ of\ x$ is not divisive and hence the preajcent of *dou* has no sub-alternative, as shown in (35b), which therefore makes the presence of *dou* deviant.

- (34) a. Yuehan ba [na-ge pingguo] (**dou**) chi -le.
 John BA that-CL apple DOU eat -PERF
 ‘John ate that apple.’
- b. Yuehan ba [na-ge pingguo] (***dou**) chi -le yi-ban.
 John BA that-CL apple DOU eat -PERF one-half
 Intended: ‘John ate half of that apple.’
- (35) a. ‘John ate that apple.’ \Rightarrow ‘John ate *x*.’ (*x* is part of that apple)
 $SUB (John\ ate\ that\ apple) = \{John\ ate\ x: x < that\ apple\}$
- b. ‘John ate half of that apple.’ $\not\Rightarrow$ ‘John ate half of *x*.’ (*x* is part of that apple)
 $SUB (John\ ate\ half\ of\ that\ apple) = \emptyset$

On the other hand, the plurality requirement is insufficient. When applied to a statement with a divisive collective predicate, *dou* requires its associate to denote a group consisting of at least three distinct individuals, as exemplified in (36).

- (36) [Tamen -sa/*-lia] **dou** shi pengyou.
 they -three/-two DOU be friends
 ‘They three/*two are all friends.’

The proposed additive presupposition of *dou* also accounts for this fact. As schematized in (37), the proper subparts of a dual-individual (e.g., $a \oplus b$) are atomic individuals, which however are undefined for the collective predicate $\lambda x.be\text{-}friends(x)$. Hence, in (36), if the associate of *dou* denotes only a dual-individual, the preajacent clause of *dou* has no sub-alternative, which therefore leaves the additive presupposition of *dou* unsatisfied.

- (37) [*ab*] (***dou**) are friends.
 a. $\llbracket be\text{-}friends \rrbracket = \lambda x[\neg ATOM(x).be\text{-}friends(x)]$
 b. $SUB(ab\text{ are friends}) = \emptyset$

5.2. The \forall -FCI-licenser use

The particle *dou* can license the \forall -FCI uses of pre-verbal polarity items, *wh*-items, and disjunctions. In this section, I argue that the assertion of *dou* turns a disjunctive/existential statement into a conjunctive/universal statement, giving rise to an FC inference. I will also explain why the licensing of a \forall -FCI requires the presence of *dou*, as well as why the licensing of a \forall -FCI disjunction is subject to modal obviation.

5.2.1. Licensing conditions of Mandarin FCIs

In English, as shown in (38), the emphatic item *any* is licensed as a \forall -FCI when appearing in prior to an existential modal (e.g., *can*), but not licensed when appearing in an episodic sentence or before a universal modal. The fact that an existential modal helps to license FCIs is called *modal obviation*.

- (38) English \forall -FCI *any*
 a. Anyone can come in.
 b. * Anyone must come in.
 c. * Anyone came in.

It is crucial to distinguish \forall -FCIs from \exists -FCIs, which have different scope patterns and licensing conditions. First, \forall -FCIs occur pre-verbally and take scope above modals, while \exists -FCIs typically occur post-verbally and take scope below modals. Second, the licensing of a \forall -FCI requires the presence of an existential modal, while an \exists -FCI can be licensed under the scope of an existential modal or a universal modal. See details in Chierchia (2013: section 6.4).

- (39) English \exists -FCI *any*
 a. John can read any book.
 b. John must read any book.

- c. *John read any book.

In Mandarin, to license the \forall -FCI use of a pre-verbal disjunction, *dou* must be present and must be followed by an existential modal, as shown in (40).

- (40) a. [Yuehan huozhe Mali] **dou** keyi/*bixu jiao jichu hanyu.
 John or Mary DOU can/must teach intro Chinese
 Intended: 'Both John and Mary can/must teach Intro Chinese.'
- b. [Yuehan huozhe Mali] (***dou**) jiao -guo jichu hanyu.
 John or Mary DOU teach -EXP intro Chinese
 Intended: 'Both Johan and Mary have taught Intro Chinese.'

To license of the \forall -FCI uses of *wh*-items and polarity items (e.g., *renhe* 'any'), *dou* also must be present. But the licensing requirements related to modal obviation are quite unclear. For instance, as Giannakidou and Cheng (2006) claim, the bare *wh*-word *shei* 'who' can be licensed as a \forall -FCI in an episodic *dou*-sentence, as exemplified in (41a). Nevertheless, this distributional pattern is very unproductive. For example, the episodic sentence in (41b) sounds to me very odd. Hence, there must be something special with the interactions between Mandarin *wh*-words and the experiential maker *-guo*. I leave this puzzle as an open question.

- (41) a. [Shei] **dou** jiao -guo jichu hanyu. b. ?? [Shei] **dou** jinlai -le.
 who DOU teach -EXP intro Chinese. who DOU enter -ASP.
 'Everyone has taught Intro Chinese.' Intended: 'Everyone came in.'

The licensing conditions of *na*-CL-NP 'which-NP' and *renhe*-NP 'any-NP' are even harder to tell. Giannakidou and Cheng (2006) claim that the \forall -FCI uses of these items are only licensed in a pre-*dou*+ \diamond position. Their judgements are illustrated in (42). Nevertheless, it is difficult to justice the data because judgements on (42) vary greatly among native speakers.

- (42) a. [Na-ge/Renhe -ren] **dou** keyi/?bixu jinlai.
 which-CL/anywhat -person DOU can/must enter
 Intended: 'Everyone can/must come in.'
- b. ? [Na-ge/Renhe -ren] **dou** shou dao -le yaoqing.
 which-CL/anywhat -person DOU get arrive -asp invitation
 Intended: 'Everyone got an invitation.'

Given the variations in the judgments and unproductiveness of \forall -FCIs in sentences without an existential modal, I will neglect the variations among the Mandarin \forall -FCIs with respect to modal obviation, and say that Mandarin \forall -FCIs need to occur in pre-*dou*+ \diamond positions. For other recent studies on Mandarin \forall -FCIs, see Liao (2011), Cheng and Giannakidou (2013), and Chierchia and Liao (2015).

5.2.2. Predicting the universal FC inferences

Wh-items are standardly treated as existential indefinites (Karttunen 1977). Thus in (41a), repeated below, the pre-jacent proposition of *dou* is a disjunction, and the sub-alternatives are the disjuncts.

Applying *dou* affirms the prejacent and negates the exhaustification of each disjunct, yielding a \forall -FC inference. In a word, *dou* turns a disjunction into a conjunction.

(43) [Shei] *(**dou**) can teach Intro Chinese.

(Consider only two individuals *a* and *b*.)

- a. $\llbracket \text{shei can teach IC} \rrbracket = \diamond f(a) \vee \diamond f(b)$ $f = \lambda x. \text{teach-IC}(x)$
 b. $\text{SUB}(\text{shei can teach IC}) = \{\diamond f(a), \diamond f(b)\}$
 c. $\llbracket \text{dou [shei can teach IC]} \rrbracket$
 $= [\diamond f(a) \vee \diamond f(b)] \wedge \neg O \diamond f(a) \wedge \neg O \diamond f(b)$
 $= [\diamond f(a) \vee \diamond f(b)] \wedge [\diamond f(a) \rightarrow \diamond f(b)] \wedge [\diamond f(b) \rightarrow \diamond f(a)]$
 $= [\diamond f(a) \vee \diamond f(b)] \wedge [\diamond f(a) \leftrightarrow \diamond f(b)]$
 $= \diamond f(a) \wedge \diamond f(b)$

Now, a problem arises as to why disjunctions are treated as sub-alternatives. In section 4.2, I defined sub-alternatives as weaker alternatives, namely, the alternatives that are not excludable and are distinct from the prejacent. But, in (43), the disjuncts are stronger than the disjunction, how can they be treated as sub-alternatives? This problem can be solved by a minor revision from “excludability” to “innocent (I)-excludability,” a notion coined by Fox (2007) for deriving FC inferences via exhaustifications. As schematized in (44), an alternative is I-excludable iff it is included in every maximal set of alternatives *A* such that affirming the prejacent is consistent with negating all the alternatives in *A*.¹⁵

(44) a. **Innocently (I)-excludable alternatives** (Fox 2007)

$$\text{IEXCL}(p) = \bigcap \{A : A \text{ is a maximal subset of } \text{ALT}(p) \text{ s.t. } A \cup \{p\} \text{ is consistent}\},$$

where $A^\neg = \{\neg q : q \in A\}$

(The intersection of the maximal sets of alternatives of *p* such that the exclusion of each such maximal set is consistent with *p*.)

b. **Sub-alternatives** (An alternative definition)

$$\text{SUB}(p) = (\text{ALT}(p) - \text{IEXCL}(p)) - \{p\}$$

(The set of alternatives excluding the I-excludable alternatives and the prejacent itself)

In (43), the disjuncts of a disjunction are not I-excludable to this disjunction: affirming the disjunction and negating both of its disjuncts yield a contradiction (formally, $\{\diamond f(a), \diamond f(b)\}^\neg \cup \{\diamond f(a) \vee \diamond f(b)\}$ is inconsistent, because $[\diamond f(a) \vee \diamond f(b)] \wedge \neg \diamond f(a) \wedge \neg \diamond f(b) = \perp$). Hence, by the weakened definition in (44b), the sub-alternatives of a disjunction are the disjuncts.

Weaker alternatives are clearly not I-excludable: affirming a prejacent and negating a weaker alternative yield a contradiction. Hence, for basic cases where *dou* is associated with an individual

¹⁵Another commonly seen definition of I-excludable alternatives is (i), which is however inadequate. For example, in sentence “EVERY student came,” where the prejacent is the strongest among the alternatives and thus has no excludable alternative, the condition underlined in (i) is vacuously satisfied; therefore, the definition in (i) predicts that every alternative of *p* is I-excludable, which is apparently implausible.

(i) $\text{IEXCL}(p) = \{q : q \in \text{ALT}(p) \wedge \neg \exists q' \in \text{EXCL}(p) [\underline{p \wedge \neg q} \rightarrow q']\}$

(The set of alternatives *p* such that affirming *p* and negating *q* does not entail any excl-alternatives)

or a generalized conjunction, the new definition of sub-alternatives in (44b) yields the same consequence as what the previous one in (25) does.

Now, we can summarize the definition of *dou* as follows:

(45) a. **Semantics of *dou***

$$\llbracket dou \rrbracket(p) = \lambda w[\exists q \in \text{SUB}(p).p(w) = 1 \wedge \forall q \in \text{SUB}(p)[O(q)(w) = 0]]$$

- i. *Presupposition*: p has at least one sub-alternative.
- ii. *Assertion*: p is true, while the exhaustification of each sub-alternative of p is false.

b. **Sub-alternatives**

i. *Strong Definition*

$$\text{SUB}(p) = (\text{ALT}(p) - \text{EXCL}(p)) - \{p\}$$

(The set of alternatives that are not excludable and are distinct from the prejacent)

ii. *Weak Definition*

$$\text{SUB}(p) = (\text{ALT}(p) - \text{IEXCL}(p)) - \{p\}$$

(The set of alternatives that are not I-excludable and are distinct from the prejacent)

Consider the two definitions of sub-alternatives. The strong definition (45b-i) is only compatible with the quantifier-distributor use of *dou*, while the weak definition (45b-ii) also captures the \forall -FCI licenser use of *dou*. There are two possible ways to understand the semantics of sub-alternatives, as described in the following:

- **The uniform approach** The semantics of sub-alternatives is uniformly as weak as in (45b-ii). The strong definition in (45b-i) is simply a special case of (45b-ii) where all the I-excludable alternatives happen to be excludable.
- **The weakening approach** The semantics of sub-alternatives is primarily as strong as in (45b-i), while the weaker semantics in (45b-ii) is used when a semantic weakening from non-excludability to non-I-excludability is licensed. This weakening operation should be partial. For example, it is licensed only when the associate of *dou* is an existential quantifier or a disjunction.

These two approaches yield different predictions with respect to the derivational paths of the functions of *dou*. The uniform approach predicts that the quantifier-distributor use and the \forall -FCI licenser use are both primary. In contrast, the weakening approach predicts the quantifier-distributor use of *dou* to be primary, while the \forall -FCI licenser use to be secondary, and that historically, the \forall -FCI licenser use should emerge much later than the quantifier-distributor use.

The weakening approach is more preferable than the uniform approach for the following two reasons. First, empirically, the quantifier-distributor use of *dou* emerged as early as the Eastern Han Dynasty (25AC-220AC) (Gu 2015), while the other uses of *dou* came much later. So far, there hasn't been any reliable evidence showing that *dou* could function as a \forall -FCI licenser or a scalar marker before Ming Dynasty. Second, theoretically, the scalar marker use of *dou* can be derived easily by weakening the strong definition of sub-alternatives in (45b-i), but not the weak definition in (45b-ii). Hence, if we follow the uniform approach, it would be hard to explain the alternation between the scalar marker use and the other two uses. I will get back to this point in section 6.

Readers who are familiar with the grammatical view of exhaustifications might find that *dou* is similar to the operation of recursive exhaustifications proposed by Fox (2007). The recursive exhaustification (abbreviated as ' O_R ') has two major characteristics. First, exhaustification negates only alternatives that are I-excludable. Second, exhaustification is applied recursively. Using the notations in (45), we can formulate the semantics of O_R as follows:¹⁶

$$(46) \quad O_R(p) = \lambda w[p(w) = 1 \wedge \forall q \in \text{SUB}(p)[O(q)(w) = 0] \wedge \forall q' \in \text{IEXCL}(p)[q'(w) = 0]]$$

It can be easily observed that *dou* is semantically weaker than O_R : *dou* does not negate the I-excludable alternatives, and therefore applying *dou* to a disjunction does not generate an exclusive inference. For instance, the sentence (40a) 'John or Mary *dou* can teach Intro Chinese' does not imply the exclusive inference that only John and Mary can teach Intro Chinese. For a detailed comparison of the exhaustifiers that have been employed for deriving FC (including the recursive exhaustifier by Fox (2007), the pre-exhaustification exhaustifier for domain alternatives by Chierchia (2013), and the covert counterpart of the Mandarin particle *dou* by Xiang (2016a,c)), see Xiang (2016a: chap. 2 Appendix).

5.2.3. Explaining the licensing conditions of Mandarin \forall -FCIs

Recall the two licensing conditions of Mandarin \forall -FCIs. First, to license the \forall -FCI use of a pre-verbal *wh*-item, *dou* must be present and associated with this *wh*-item. Second, the licensing of the \forall -FCI use of a pre-verbal disjunction (probably also that of a pre-verbal *wh*-item) is subject to modal obviation, namely that this use is licensed only when *dou* is followed by an existential modal. This section explains these two conditions.

I. Why is it that the presence of *dou* is mandatory in a *wh* \forall -FCI-declarative?

Following Liao (2011) and Chierchia and Liao (2015), I assume that the sub-alternatives associated with a Mandarin *wh*-word are obligatorily activated when this *wh*-word takes a non-interrogative use, and that these sub-alternatives must be used up via employing a c-commanding exhaustifier.¹⁷ Hence, if the particle *dou* is absent, these sub-alternatives would have to be used by a basic O -exhaustifier, as in (47b). Nevertheless, as to be shown in the following, the application of an O -exhaustifier has an undesired semantic consequence.

- (47) [Shei] *(**dou**) can teach Intro Chinese.
- a. The LF in presence of *dou*:
dou [shei_[+D]] can teach Intro Chinese]
 - b. The LF in absence of *dou*:
 O [shei_[+D]] can teach Intro Chinese]

¹⁶In particular cases, the definition for O_R in (46) yields inferences different from what Fox's proposal would expect: if the exhaustification of a sub-alternative is still not innocently excludable, the exhaustification of this sub-alternative would not be negated by O_R under Fox's original definition. See details in Xiang (2016a: footnote 38).

¹⁷In the case of disjunctions or existential indefinites, sub-alternatives are simply what usually call "domain alternatives," evoked by domain widening (Krifka 1995; Lahiri 1998; Chierchia 2006, 2013).

Compare the computation in (48) with (43). In (43), applying *dou* to a disjunction returns a conjunction. While in (48), applying an *O*-exhaustifier to a disjunction affirms this disjunction and negates both of its disjuncts, yielding a contradiction and making the *wh*-declarative ungrammatical.

(48) (Consider only two individuals *a* and *b*.)

- a. $\llbracket \text{shei can teach IC} \rrbracket = \diamond f(a) \vee \diamond f(b)$ $f = \lambda x. \text{teach-IC}(x)$
 b. $\text{SUB}(\text{shei can teach IC}) = \{\diamond f(a), \diamond f(b)\}$
 c. $\llbracket O[\text{shei}_{[+D]} \text{ can teach IC}] \rrbracket = [\diamond f(a) \vee \diamond f(b)] \wedge \neg \diamond f(a) \wedge \neg \diamond f(b) = \perp$

The case of disjunctions is a bit different. Unlike those of *wh*-items, the sub-alternatives of disjunctions are not mandatorily activated (Chierchia 2006, 2013). Hence, in absence of *dou*, a sentence with a pre-verbal disjunction will simply take an (inclusive or exclusive) disjunctive interpretation.

The explanation above faces the following challenge: why is it that the sub-alternatives of a *wh*-declarative cannot be used by a covert pre-exhaustification exhaustifier, such as the O_{DOU} -operator proposed by Xiang (2016c) and Xiang (2016a: chap. 2) for the interpretation of mention-some questions? A covert O_{DOU} -operator cannot be placed here due to a fundamental principle for the architecture of human languages, roughly, “Language-particular choices win over universal tendencies” or “Don’t do covertly what you can do overtly.” (Chierchia 1998). We consider an exhaustification over the sub-alternatives of a polarity item as a grammatical operation. Given that *dou* must be associated with a preceding item in most declaratives, we predict the following distributional pattern of covert and overt *dou*, illustrated by the polarity item *renhe* ‘any’:

- | | |
|--|---|
| <p>(49) a. <i>Renhe</i> as a \forall-FCI</p> <p>Ni [renhe-ren] *(dou) keyi jian.
 You any-person DOU can meet.
 ‘You can meet anyone.’</p> <p>a’. ${}^{\text{OK}}\text{dou}/{}^{\text{OK}}O_{\text{DOU}}$ [you can meet anyone]</p> | <p>b. <i>Renhe</i> as an \exists-FCI</p> <p>Ni (*dou) keyi jian [renhe-ren].
 You DOU can meet any-person
 ‘You can meet anyone.’</p> <p>b’. ${}^{\text{OK}}\text{dou}/{}^{\text{OK}}O_{\text{DOU}}$ [you can meet anyone]</p> |
|--|---|

If *renhe* appears in or can be overtly raised to a pre-verbal position, the sub-alternatives of *renhe* can be exhaustified by the overt particle *dou*, which therefore blocks the use of a covert O_{DOU} -operator, as exemplified in the \forall -FC sentence in (49a). In contrast, when an exhaustification operation cannot be done by *dou* due to other syntactic constraints (such as that *dou* in general cannot be associated with an item appearing on its right side), a covert pre-exhaustification exhaustifier would be feasible, as exemplified in the \exists -FC sentence in (49b). In one word, since *dou* is Mandarin-particular, the covert O_{DOU} cannot be used whenever the overt *dou* can be used.

II. Why is it that the licensing of a \forall -FC disjunction is subject to modal obviation?

- (50) a. * [Yuehan huozhe Mali] **dou** jiao -guo jichu hanyu.
 John or Mary DOU teach -EXP intro Chinese
 Intended: ‘Both Johan and Mary have taught Intro Chinese.’

- b. [Yuehan huozhe Mali] **dou** keyi jiao jichu hanyu.
John or Mary **DOU** can/must teach intro Chinese
Intended: ‘Both John and Mary can teach Intro Chinese.’
- c. * [Yuehan huozhe Mali] **dou** bixu jiao jichu hanyu.
John or Mary **DOU** can/must teach intro Chinese
Intended: ‘Both John and Mary can teach Intro Chinese.’

First of all, let us see why the \forall -FCI use of a disjunction is not licensed in the episodic sentence (50a). Disjunctions, as weak scalar items, evoke scalar implicatures. Hence, in presence of *dou*, the episodic sentence (50a) yields two inferences that contradict each other, as stated in the following:

- (51) John or Mary **dou** taught Intro Chinese.
- a. *FC inference*: ‘John and Mary have taught Intro Chinese.’
- b. *Scalar implicature*: ‘Not that both John and Mary have taught Intro Chinese.’

The contradiction between these two inferences makes the presence of *dou* ungrammatical in (50a) (à la Chierchia’s (2013) explanation on the licensing of English FCI *any*). In absence of *dou*, the sub-alternatives of a disjunction are not activated, and then (50a) simply means that John or Mary but not both has taught Intro Chinese.

Next, what about the modal obviation effect in (50b)? In particular, why is it that an existential modal obviates the ungrammaticality while a universal modal does not? I propose that the scalar implicature of a pre-verbal disjunction can be assessed within a circumstantial modal base: the modal base is restricted to the set of worlds where the scalar implicature is satisfied. For instance, the \diamond -sentence in (50b) intuitively suggests that the speaker is only interested in cases where exactly one person teaches Intro Chinese. To be more concrete, assume that the property *teach Intro Chinese* denotes the set of the three world-individual pairs in (52a). For instance, the pair $\langle w_1, \{j\} \rangle$ is read as ‘only John teaches Intro Chinese in w_1 .’ The scalar implicature evoked by the pre-verbal disjunction restricts the modal base M to the set of worlds where **not** both John and Mary teach Intro Chinese. In an existentially modalized context, employing *dou* yields the \forall -FC inferences in (52c), which is true relative to M . In contrast, in a universally modalized context, employing *dou* yields the inference in (52d), which is false under M .

- (52) a. $f = \{ \langle w_1, \{j\} \rangle, \langle w_2, \{m\} \rangle, \langle w_3, \{j, m\} \rangle \}$
- b. $M = \{w_1, w_2\}$
- c. $\llbracket dou \rrbracket [\diamond f(j) \vee \diamond f(m)] = \diamond f(j) \wedge \diamond f(m)$ True under M
- d. $\llbracket dou \rrbracket [\square f(j) \vee \square f(m)] = \square f(j) \wedge \square f(m)$ False under M

More broadly, there is no eligible modal base, except the empty one, under which the FC inference in (52d) is true. Therefore, universal modals cannot obviate the contradiction between the FC inference and the scalar implicature.

Alternative approaches of modal obviation in the realm of exhaustifications include Dayal (2009) and Chierchia (2013). Dayal assumes a *Fluctuation Constraint*: in an *any*-sentence, the intersection of the restriction and the scope that verifies the sentence should not be constant across

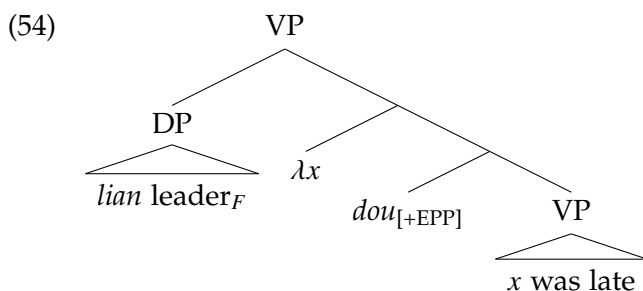
the accessible worlds. Chierchia assumes a *Modal Containment Constraint*: the FC implicature and the scalar implicature are assessed based on different modal bases; in particular, the one for the FC implicature is a proper subset of the one for the scalar implicature. This paper does not attempt to do full justice to these discussions, but just to add one more accessible story to the market.

5.3. The [(*lian*) ... *dou* ...] construction

The [(*lian*) Foc *dou* ...] construction has an *even*-like reading, as exemplified in (53).

- (53) **Lian** [LINGDAO]_F **dou** chidao -le.
 LIAN leader DOU late -ASP
 ‘Even the leader was late.’

I assume a toy surface structure for the [(*lian*) Foc *dou* ...] construction as in (54). In this structure, *dou* selects for the entire VP, and *lian* is a focus marker which takes the focused phrase (or a phrase that contains the semantic focus) as its complement. To check off the [+EPP] feature of *dou*, *lian* together with the focused phrase (or the focus-containing phrase) moves to the left edge of VP.



In the following, I will start with the semantics of English *even* (section 5.3.1), and then derive the *even*-like reading of the [(*lian*) Foc *dou* ...] construction based on the proposed semantics of *dou* (section 5.3.2). In section 5.4, I will show how this analysis accounts for the minimizer-licensing effect of the [(*lian*) MIN *dou* ...] construction.

5.3.1. The semantics of *even*

There are two popular views on the semantics of the English particle *even*, different with respect to whether the scalar presupposition of *even* is universal or existential. One view, initiated by Karttunen and Peters (1979), assumes that *even* has a universal scalar presupposition and a vacuous assertion, as schematized in (55): *even* asserts the truth of its propositional argument, and presupposes that the propositional argument of *even* is the less likely than **all** of its contextually relevant alternatives. Here the variable *C* is a set of contextually relevant alternatives.

- (55) **Semantics of *even*** (Karttunen and Peters 1979)
 $\llbracket \textit{even} \rrbracket(p) = \forall q \in C [p \neq q \rightarrow q >_{\text{likely}} p] \cdot p$
 $\llbracket \textit{even} \rrbracket(p)$ is defined only if *p* is less likely than *all* of its alternatives that are not identical to it; when defined, $\llbracket \textit{even} \rrbracket(p) = p$

The universal scalar presupposition seems to be too strong. The following examples taken from Kay (1990) show that *even*-sentences can also describe non-extreme cases:

- (56) a. Not only did Mary win her first round match, she even made it to the semi-finals.
 b. The administration was so bewildered that they even had lieutenant colonels making policy decisions.

Hence, I adopt the alternative view by Bennett (1982) and Kay (1990) that the scalar presupposition of *even* is existential. This presupposition says that the propositional argument of *even* is less likely than **some** of its contextually relevant alternatives.

(57) **Semantics of *even*** (Bennett 1982; Kay 1990)

$$\llbracket \textit{even} \rrbracket(p) = \exists q \in C[q >_{\text{likely}} p] \cdot p$$

($\llbracket \textit{even} \rrbracket(p)$ is defined only if p is more likely than *some* contextually relevant alternative;
 when defined, $\llbracket \textit{even} \rrbracket(p) = p$)

5.3.2. Deriving the *even*-like interpretation

When *dou* is associated with *lian*-DP, the measurement used for ordering alternatives gets shifted from logical strength to likelihood. This shift brings changes to both the meaning of sub-alternatives as well as the exhaustifier encoded within the lexicon of *dou* used for pre-exhaustification. First, since a proposition that is logically weaker is more likely to be true, sub-alternatives of the prejacent propositional argument of *dou* are thus the alternatives that are more likely than this prejacent proposition. Second, the pre-exhaustification effect of *dou* is realized by the inclusive scalar exhaustifier **JUST** (rather than the exclusive *O*-exhaustifier). As schematized in (58b), analogous to the *O*-operator, **JUST** affirms the prejacent p and further states a scalar exhaustivity condition that no true alternative of p is more likely than p .¹⁸ Hence, when *dou* occurs in a [*lian* Foc *dou* ...] construction, its semantics would be adapted to (58c).

(58) **Semantics of *dou*** (in the [*lian* Foc *dou* ...] construction)

- a. $\text{SUB}(p) = \{q : q \in \text{ALT}(p) \wedge q >_{\text{likely}} p\}$
 (The set of alternatives of p that are more likely than p)
 b. $\text{JUST}(q) = \lambda w[q(w) = 1 \wedge \forall r \in \text{ALT}(q)[r(w) = 1 \rightarrow p \geq_{\text{likely}} r]]$
 (q is true, and q is the most likely proposition among its true alternatives.)

¹⁸As seen in (29), the semantics of the exhaustifier can be defined based on the semantics of sub-alternatives. Hence, compared with the primary lexical entry of *dou* in (45), the only parameter gets changed in the new lexical entry in (58) is semantics of sub-alternatives, or more specifically, the measurement of ordering alternatives.

- (i) $O(q)$
 $= \lambda w[q(w) = 1 \wedge \forall r \in ((\text{ALT}(q) - \text{SUB}(q)) - \{q\})[r(w) = 0]]$
 $= \lambda w[q(w) = 1 \wedge \forall r \in ((\text{ALT}(q) - \{r' : r' \in \text{ALT}(q) \wedge r' >_{\text{likely}} q\}) - \{q\})[r(w) = 0]]$
 $= \lambda w[q(w) = 1 \wedge \forall r \in \text{ALT}(q)[r <_{\text{likely}} q \rightarrow r(w) = 0]]$
 $= \lambda w[q(w) = 1 \wedge \forall r \in \text{ALT}(q)[r(w) = 1 \rightarrow p \geq_{\text{likely}} r]]$
 $= \text{JUST}(q)$

- c. $\llbracket dou \rrbracket(p) = \exists q \in \text{SUB}(p). \lambda w [p(w) = 1 \wedge \forall q \in \text{SUB}(p) [\text{JUST}(q)(w) = 0]]$
 ($\llbracket dou \rrbracket(p)$ is defined only if p has at least one sub-alternative. When defined, $\llbracket dou \rrbracket(p)$ means ‘ p , and for any sub-alternative q , not just q .’)

As schematized in (59), we can further simplify the assertion of *dou*. The anti-exhaustification condition provided by the *not just*-clause (underlined in (59)) that ‘every alternative that is more likely than p is more likely than some true alternative of p ,’ is asymmetrically entailed by the rest asserted part that ‘ p is true.’ [Proof: Whenever p is true, then any alternative of p that is more likely than p is less likely than some true alternative r , where $r = p$. End of proof.] Hence, the asserted component of *dou* simply affirms its propositional argument, or equivalently, is vacuous. Finally, we get a *dou* semantically equivalent to *even*: the additive presupposition of *dou* is equivalent to the existential scalar presupposition of *even*, and the assertion is vacuous.

$$\begin{aligned}
 (59) \quad & \llbracket dou \rrbracket(p) \\
 & = \exists q \in \text{SUB}(p). \lambda w [p(w) = 1 \wedge \forall q \in \text{SUB}(p) [\text{JUST}(q)(w) = 0]] \\
 & = \exists q \in \text{SUB}(p). \lambda w [p(w) = 1 \wedge \forall q \in \text{SUB}(p) \exists r \in \text{ALT}(q) [r(w) = 1 \wedge q >_{\text{likely}} r]] \\
 & = \exists q \in \text{ALT}(p) [q >_{\text{likely}} p]. \\
 & \quad \lambda w [p(w) = 1 \wedge \underbrace{\forall q \in \text{ALT}(p) [q >_{\text{likely}} p \rightarrow \exists r \in \text{ALT}(q) [r(w) = 1 \wedge q >_{\text{likely}} r]]}_{\text{vacuous}}] \\
 & = \exists q \in \text{ALT}(p) [q >_{\text{likely}} p]. p \\
 & (\llbracket dou \rrbracket(p) \text{ is defined only if } p \text{ is less likely than at least one of its contextually relevant} \\
 & \text{alternatives; when defined, } \llbracket dou \rrbracket(p) = p.) \\
 & = \llbracket even \rrbracket(p)
 \end{aligned}$$

Thus, it is plausible to say that the *even*-like interpretation of the [*lian* Foc *dou* ...] construction comes from the additive presupposition of *dou* (Portner 2002, Shyu 2004, Paris 1998, Liao 2011, Liu 2016c), while that the particle *lian* is simply a focus marker and is present just for syntactic purposes. I define *lian* as follows: it asserts the denotation of its argument, and presupposes that this argument is focused. Following Rooth (1985, 1992, 1996), we say an expression α is focused as long as it has at least one focus alternative distinct from itself.

$$(60) \quad \llbracket lian(\alpha) \rrbracket = \llbracket \alpha \rrbracket, \text{ defined only if } \{\llbracket \alpha \rrbracket\} \supset \text{Alt}_F(\alpha).$$

5.4. Minimizers-licensing

Minimizers (including also emphatic weak scalar items such as *YI-ge ren* ‘ONE person’) can occur at the focal position in the [*lian* Foc *dou*...] construction. Usually, to license a minimizer, a post-*dou* negation must be present, as exemplified in (61). But, there are also cases where the post-*dou* negation is optional, as seen in (62).

- (61) Yuehan (*lian*) [YI-ge ren]_F **dou** *(bu) renshi.
 John LIAN one-CL person DOU NEG know
 ‘John doesn’t know anyone.’
- (62) Yuehan (*lian*) [YI-fen qian]_F **dou** (bu) yao.
 John LIAN one-cent money DOU NEG request

Without negation: ‘John doesn’t even want one cent. (\approx John doesn’t want any money.)’
 With negation: ‘John wants it even if it is just one cent. (\approx John wants any amount of money, however small amount it is.)’

In what follows, I will show that the distributional pattern of Mandarin minimizers in [*lian* MIN *dou*...] constructions mirrors the distributional pattern of English minimizers and emphatic weak scalar items in *even*-sentences. Next, I extend Crnič (2011, 2014a)’s analysis of minimizer-licensing in English *even*-sentences to minimizer-licensing in Mandarin [*lian* ... *dou* ...] constructions.

5.4.1. Monotonicity

There are three basic monotonicity patterns, including downward-entailing, upward-entailing, and non-monotonic. An environment is downward-entailing if it supports downward inferences, and is upward-entailing if it supports upward inferences. An environment is non-monotonic if it supports neither downward nor upward inferences. For instance, observe an upward inference holds from a set *semanticist* to its superset *linguist* in the positive sentence (63a), while a downward inference from *linguist* to its subset *semanticist* holds under the semantic scope of negation, as in (63b). Hence, we say that “Mary is a *P*” is upward-entailing with respect to *P*, while “Mary isn’t a *P*” is downward-entailing with respect to *P*. Moreover, since negation reverses the entailment direction of its propositional argument, we call negation a downward-entailing operator. In comparison, as shown in (63c), neither inferences hold in the second argument of *iff*, which suggests that *iff* is non-monotonic in its second argument.

- (63) a. *Upward-entailing*
 i. Mary is a linguist.
 ↑
 ii. Mary is a semanticist.
- b. *Downward-entailing*
 i. Mary isn’t a linguist.
 ↓
 ii. Mary isn’t a semanticist.
- c. *Non-monotonic*
 i. We will invite Mary iff she is a linguist.
 ↑ ↓
 ii. We will invite Mary iff she is a semanticist.

Following von Stechow (1999) and Gajewski (2007), I define downward-entailing environments as in (64), where the arrow ‘ \Rightarrow ’ stands for generalized entailment.¹⁹ Upward-entailing and non-monotonic functions and environments are defined analogously.

¹⁹Generalized entailment is cross-categorically defined for items of any *entailing type*. Entailing types are defined recursively as in (i). Accordingly, t , $\langle e, t \rangle$, $\langle e, et \rangle$, and any type of the form $\langle \dots t \rangle$ are entailing types.

- (i) **Entailing type** (Chierchia 2013: 204)
 a. t is a basic entailing type.
 b. If τ is an entailing type, then for any type σ , $\langle \sigma, \tau \rangle$ is an entailing type.
- (ii) **Generalized entailment** ‘ \Rightarrow ’ (von Stechow 1999)
 a. If ϕ, ψ are of type t , then: $\phi \Rightarrow \psi$ iff ϕ is false or ψ is true.
 b. If β, γ are of an entailing type $\langle \sigma, \tau \rangle$, then: $\beta \Rightarrow \gamma$ iff for all α such that α is of type σ : $\beta(\alpha) \Rightarrow \gamma(\alpha)$.

(64) a. **Downward-entailing functions**

A function f of type $\langle \sigma, \tau \rangle$ is downward-entailing iff for all x and y of type σ such that $x \Rightarrow y$: $f(y) \Rightarrow f(x)$.

b. **Downward-entailing environments**

If α is of type δ and \mathbf{A} is a constituent that contains α , then \mathbf{A} is downward-entailing with respect to α iff the function $\lambda x. \llbracket \mathbf{A}[\alpha/\mathbf{v}_\delta] \rrbracket^{g[\mathbf{v}_\delta \rightarrow x]}$ is downward-entailing.

$[\mathbf{A}[\alpha/\mathbf{v}]]$ is the result of replacing α with trace \mathbf{v} in \mathbf{A} .

For example, since *semanticist* \Rightarrow *linguist*, the entailment pattern in (63b) suggests that the function $\lambda P. \llbracket \text{Mary isn't a } \mathbf{v}_{\langle e,t \rangle} \rrbracket^{g[\mathbf{v}_{\langle e,t \rangle} \rightarrow P]}$ is downward-entailing, and hence that “Mary isn’t a P ” is downward-entailing with respect to P . Moreover, since *Mary is a semanticist* \Rightarrow *Mary is a linguist*, the entailment pattern in (63b) also suggests that the function $\lambda p. \llbracket \text{not } \mathbf{v}_{\langle s,t \rangle} \rrbracket^{g[\mathbf{v}_{\langle s,t \rangle} \rightarrow p]}$ is downward-entailing, and hence that “not S ” is downward-entailing with respect to the sentence S .

5.4.2. Minimizer-licensing in *even*-sentences: scalar presupposition + operator movement

In English, a minimizer (including canonical minimizers such as *lift a finger* as well as emphatic weak scalar items like *ONE video*) can appear under the scope of *even* only if the propositional complement of *even* is downward-entailing or non-monotonic with respect to this minimizer (Crnič 2011, 2014a). Consider the distribution of the emphatic weak scalar item *ONE video* in *even*-sentences for illustration. It is licensed only if the *even*-sentence involves a downward-entailing operator such as negation *n't*, as in (65b), or a non-monotonic predicate such as the desire predicate *hope*, as in (65c).

- (65) a. *John made even ONE video.
b. John didn't make even ONE video.
c. I **hope** to someday make even ONE video of that quality.

Crnič (2011, 2014a) adopts the semantics of *even* from Bennett (1982) and Kay (1990), repeated below, and argues that the distributional pattern of minimizers in *even*-sentences is a consequence of the existential scalar presupposition of *even*.

(66) **Semantics of *even*** (Bennett 1982; Kay 1990)

$\llbracket \text{even} \rrbracket(p) = \exists q \in C[q \text{ >likely } p].p$

$\llbracket \text{even} \rrbracket(p)$ is defined only if p is more likely than *at least one* of its contextually relevant alternative; when defined, $\llbracket \text{even} \rrbracket(p) = p$

Further, Crnič bridges logical strength and likelihood with the following principle:

The basic case (iia) is defined based on truth values: a truth-value entails another iff it is not the case that the first is true and the second is false. In a generalized case, as schematized in (iib), a function entails another iff the result of applying the first function to any argument entails the result of applying the second function to the same argument. For example, *smart student* and *student* are functions of type $\langle e, t \rangle$. *smart student* \Rightarrow *student*, because for any x of type e , *smart student*(x) \Rightarrow *student*(x). All these cases can also be understood from a set-theoretic perspective: for any two sets A and B , $A \Rightarrow B$ iff A is a subset of B (written as ' $A \subseteq B$ ').

(67) **Entailment and scalarity** (Crnič 2011: 15)

If $p \subset q$, then $p <_{\text{likely}} q$.

(if a proposition p asymmetrically entails a proposition q , then p is less likely than q .)

According to this principle, to satisfy the existential scalar presupposition of *even*, the propositional prejacent of *even* must have at least one alternative that does not entail the prejacent.

This prediction immediately accounts for the ungrammaticality of (65a). With a focus-mark on the weak scalar item *ONE*, the focus alternatives of the prejacent proposition of *even* are formed by replacing *ONE* with other positive integers: $C = \{\text{John made } n \text{ videos} : n \in \mathbb{N}^+\}$. Hence, the existential scalar presupposition of *even* requires the prejacent proposition to be more likely than, and thus not entailed by, at least one of the focus alternatives. Nevertheless, because the prejacent is entailed by all the alternatives in C , this requirement cannot be satisfied, leaving the use of *even* infelicitous and the minimizer unlicensed.

(68) *John made even ONE video.

Upward-entailing

a. Even_C [John made one_F video]

b. The scalar presupposition is unsatisfied, because: the prejacent of *even* is weaker than all the other alternatives, and hence is **more likely** than the other alternatives:

John made 1 video.	\supset John made 2 videos.
	\supset John made 3 videos.
	\supset John made n videos. ($n > 1$)

As for the grammatical cases in (65b-c), Crnič proposes that the LFs of these sentences involve a covert movement of the focus-sensitive operator *even*. This operator movement does not leave a trace, but makes *even* interpreted with a wide scope (e.g., above *not* and *hope*). When *even* is associated with a minimizer across a downward-entailing operator (e.g., *not*), its scalar presupposition gets trivially satisfied: the prejacent is logically stronger than all the other alternatives, and hence is less likely than all the other alternatives.

(69) John didn't make even ONE video.

Downward-entailing

a. Even_C [**not** [~~even_C~~ [John made one_F video]]]

b. The scalar presupposition is satisfied, because: the prejacent of *even* is stronger than all the other alternatives, and hence is **less likely** than the other alternatives:

not [John made 1 video].	\subset not [John made 2 videos].
	\subset not [John made 3 videos].
	\subset not [John made n videos]. ($n > 1$)

When *even* is associated with a minimizer across a non-monotonic operator (e.g., the desire predicate *hope*, as argued by Heim (1992)) the prejacent is logically independent from other alternatives, and it can be less likely than (at least some of) the other alternatives in proper context.

(70) I **hope** to someday make even ONE video of that quality.

Non-monotonic

a. Even_C [I **hope** to [~~even_C~~ [someday make one_F video of that quality]]]

- b. The scalar presupposition can be satisfied, because: The prejacent of *even* is logically independent from all the other alternatives. In a proper context, the prejacent can be **less likely** than (some of) the other alternatives:

I **hope** to [... make 1 video ...]. $\not\Leftarrow \not\Leftarrow$ I **hope** to [... make 2 videos ...].
 $\not\Leftarrow \not\Leftarrow$ I **hope** to [... make 3 videos ...].
 $\not\Leftarrow \not\Leftarrow$ I **hope** to [... make n videos ...]. ($n > 1$)

5.4.3. Minimizer-licensing in [*lian ... dou*] constructions: scalar presupposition + focus reconstruction

Similar to the minimizer-licensing condition in English *even*-sentences, in Mandarin, the minimizer in a [*lian MIN dou...*] construction is licensed iff the prejacent clause of *dou* is downward-entailing or non-monotonic with respect to this minimizer. Briefly, the post-*dou* negation *bu* in (61) provides a downward-entailing environment, while the desire predicate *yao* ‘want’ in (62) provides a non-monotonic environment.

Since the Mandarin particle *dou* in [*lian ... dou ...*] construction is semantically identical to English *even*, we can easily extend Crnič’s (2011, 2014) analysis of minimizer-licensing in English *even*-sentences to minimizer-licensing in Mandarin [*lian ... dou ...*] constructions. Briefly, the minimizer-licensing condition is a logical consequence of the additive presupposition of *dou*, which requires the propositional argument of *dou* to be less likely than some of the alternatives, and hence not to be weakest proposition among the alternatives. The only difference between my treatment of *dou* and Crnič’s of *even* is the following: while Crnič assumes an operator movement of *even* over a non-upward-entailing operator, I assume that the minimizer undergoes reconstruction and gets interpreted below the non-upward-entailing operator.

In (61), the additive presupposition of *dou* forces the minimizer *YI-ge ren* ‘one person’ to take reconstruction and get interpreted below negation, as shown in (71): *there is at least one person that John didn’t invite* is weaker than alternatives of the form *there are at least n people that John didn’t invite* where $n > 1$; while *not [John invited at least one person]* is stronger than alternatives of the form *not [John invited at least n people]* where $n > 1$. Hence, without negation or if the minimizer scopes above negation, the propositional argument of *dou* would be logically the weakest among its alternatives, leaving the presupposition of *dou* unsatisfied.

(71) Yuehan (*lian*) [YI_F-ge ren] **dou** *(*bu*) renshi.
 John LIAN one-CL person DOU NEG know
 ‘John doesn’t even know ONE person.’

- a. * **Dou** [_{UE} [**lian** (**one_F person**)]_i NOT [John knows t_i]] MIN > NEG
 for any $n > 1$: $\exists 1x \neg [\text{know}'(j, x)] \Leftarrow \exists nx \neg [\text{know}'(j, x)]$
- b. **Dou** [_{DE} NOT [John knows **lian** (**one_F person**))] NEG > MIN
 for any $n > 1$: $\neg \exists 1x [\text{know}'(j, x)] \Rightarrow \neg \exists nx [\text{know}'(j, x)]$

The focus reconstruction-based analysis is supported by the ungrammaticality of (72): a minimizer cannot be licensed if it cannot be reconstructed to a position below negation. In (72), the minimizer *YI-ge ren* ‘one person’ serves as the subject, whose surface position and reconstructed position

are both higher than negation *bu*, and hence the ungrammaticality of (72) cannot be salvaged by reconstruction.

- (72) * (Lian) [YI-ge ren]_F **dou** bu renshi Yuehan.
 LIAN one-CL person DOU NEG know John.
 Intended ‘no one knows John.’

The optional presence of a post-*dou* negation in (62) can also be accounted for in the same way. The desire predicate *yao* ‘want to have’ is a non-monotonic operator (Heim 1992, a.o.). Hence, if the minimizer [*YI-fen qian* ‘one cent’ takes scope below *yao*, as in (73b), the alternatives of the propositional argument of *dou* would be semantically independent from each other. In a proper context, such as where John is unlikely to be interested in a small amount of money, the prejacent *John wants to have one cent* would be less likely than alternatives such as *John wants to have two cents*. Therefore, the additive presupposition of *dou* can be satisfied even in absence of the post-*dou* negation.

- (73) a. Yuehan (lian) [YI-fen qian]_F **dou** yao.
 John LIAN one-cent money DOU want
 ‘John wants to have even one cent.
 (Intended: John wants any money, however little money it is.)’
 b. [**dou** [John_i wants_{NM} [**lian (one_F-cent)** λx [e_i has x]]]]

5.5. Association with a scalar item

Associating *dou* with a in-situ scalar item implies that the prejacent proposition ranks relatively high with respect to some contextually relevant measurement. A simple way of thought would be to order the alternatives based on the contextually relevant measurement, and to define the sub-alternatives as the ones that rank lower than the prejacent proposition with respect to this measurement. For instance, in (74), sub-alternatives are propositions that rank lower than the prejacent in chronological order. The pre-exhaustification effect of *dou* is realized by the scalar exhaustifier JUST.

- (74) **Dou** [WU-dian] -le.
 DOU five-o’clock -ASP
 ‘It is **dou** [FIVE] o’clock.’ \rightsquigarrow *It’s too late.*
 a. SUB(*it’s 5 o’clock*) = {*it’s 4 o’clock*, *it’s 3 o’clock*, ...}
 b. [[**dou** [*it’s 5 o’clock*]]] = ‘it’s 5, not just 4, not just 3, ...’

We thus get a definition of *dou* as schematized in (75) for its general scalar marker use.

- (75) [[**dou**]](*p*) = λw[SUB(*p*) ≠ ∅ . *p*(*w*) = 1 ∧ ∀*q* ∈ SUB(*p*)[JUST(*q*)(*w*) = 0]]
 a. SUB(*p*) = {*q* : *q* ∈ *C* ∧ *q* <_μ *p*}
 (The set of contextually relevant alternatives of *p* that rank lower than *p* w.r.t. μ)
 b. JUST(*q*) = λw[*q*(*w*) = 1 ∧ ∀*r* ∈ Alt(*p*)[*r*(*w*) = 1 → *r* ≥_μ *q*]]
 (*r* is true; *r* ranks the highest w.r.t. μ among its true alternatives.)

To generate sub-alternatives and satisfy the additive presupposition of *dou*, the prejacent statement needs to be relatively strong among the quantificational statements. For instance, in (76), *dou* can be associated with ‘many-NP’ but not with ‘few-NP’. Likewise, in (77), *dou* can be associated with ‘twice’ but not with ‘once’.

- (76) [Duo/*Shao -shu -ren] **dou** lai -le.
 many/less -amount -person DOU come -ASP
 ‘Most/*few people **dou** came.’
- (77) Ta **dou** yijing lai -guo zher [LIANG/*YI_F-ci] -le.
 he DOU already come -EXP here two/one-time -ASP.
 ‘He has already been here twice/*once.’

6. Sorting the parameters

We’ve defined *dou* uniformly an exhaustifier that negates pre-exhaustified sub-alternatives. The function of *dou* varies purely by the meaning of sub-alternatives. Among the three variants for the definition of sub-alternatives, the first two are based on logical strength, varying with respect to the type of excludability, and the third is based on likelihood.

	Definition of sub-alternatives	Function of <i>dou</i>
Def (a)	Alternatives that are weaker than the prejacent	Distributor
Def (b)	Alternatives that are not I-excludable	\forall -FCI-licenser
Def (c)	Alternatives that are more likely than the prejacent	EVEN

Table 1: Definitions of sub-alternatives and the corresponding functions of *dou*

Now we have two urgent questions: how are these variants related, and which variant is primary? I argue that definition (a) is primary, while that definitions (b) and (c) are derived from (a) by two independent semantic weakening operations, as illustrated in Figure 2.

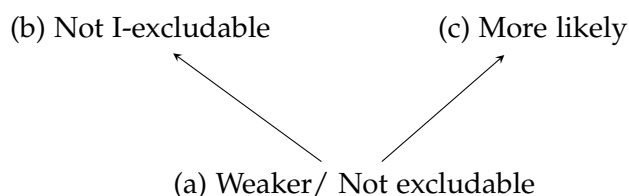


Figure 2: Development path for sub-alternatives

In particular, definition (b) is derived from definition (a) by weakening unexcludability to un-I-excludability. As seen in section 5.2.2, any alternative that is not excludable is not I-excludable, while it is not the case that every alternative that is not I-excludable alternative is not excludable. For example, in the case of a disjunction, the disjuncts are excludable but not I-excludable. Definition (c) is derived from (a) by weakening logical strength to likelihood. Due to Entailment-

Scalarity Principle (seen in (67), repeated in (78)), any alternative that is logically weaker than the prejacent is also more likely than the prejacent, but a less likely alternative is not necessarily logically weaker.

(78) **Entailment-Scalarity Principle** (Crnič 2011: 15)

If $p \subset q$, then $p <_{\text{likely}} q$.

For example, as seen in (70), *I hope to someday make two videos of that quality* is logically independent from the prejacent *I hope to someday make one video of that quality*, it can still be more likely (or less likely) than the prejacent.

The proposed derivational path for sub-alternatives yields two predictions. First, the distributor use of *dou* is primary, while the other uses are derived, as illustrated in Figure 3.

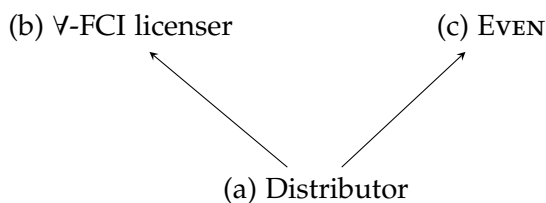


Figure 3: Development path for the uses of *dou*

This prediction is supported by diachronic evidence: the two derived uses emerged much later than the primary use. In particular, the distributor use of *dou* emerged as early as the Eastern Han Dynasty (25-220AC) (Gu 2015), while so far there is no reliable evidence to show that *dou* could function as an *even*-like scalar marker or a \forall -FCI licenser before the Ming Dynasty.

Second, the likelihood-based semantics of *dou* (i.e., the one defined based on definition (c) of sub-alternatives) shall be strictly more restrictively used than the logical strength-based semantics of *dou* (i.e., the one defined based on definition (a) of sub-alternatives). More concretely, the logical strength-based semantics should be widely available, while the likelihood-based one is only licensed under particular syntactic or prosodic conditions, such as when *dou* appears in a [(*lian*) ... *dou* ...] construction or is associated with a stressed item.²⁰ This prediction is supported by the distribution of *dou* in basic declaratives and [(*lian*) ... *dou* ...] constructions, as summarized in the following table:

If the prejacent of <i>dou</i> is ...	Can the presupposition of <i>dou</i> be satisfied in ...	
	... basic declaratives?	... [(<i>lian</i>) ... <i>dou</i> ...] constructions?
stronger than some alternative(s)	Yes	Yes
the weakest alternative	No	No
if else	No	Yes

Table 2: Distribution of *dou* in declaratives and [(*lian*) ... *dou* ...] constructions

²⁰For the same reason, we expect that the unexcludability-based semantics of *dou* (i.e., the one defined based on definitions (b) of sub-alternatives) is more restrictively used than the logical strength-based one. For example, the unexcludability-based semantics is licensed only when *dou* is associated with an existential or disjunctive quantifier.

The table above considers three conditions regarding to the logical strength of the propositional argument of *dou*. Let us go through them one by one, and keep in mind that *dou* presupposes that its prejacent has at least one sub-alternative. First, if the prejacent is logically stronger than one of more of its alternatives, then due to the Entailment-Scalarity Principle, the additive presupposition of *dou* is satisfied not only under the logical strength-based definition, but also trivially satisfied under the likelihood-based definition. For example, in (79a-b), compared with the prejacent *John can eat up three bowls of rice*, scalar alternatives such as *John can eat up two bowls of rice* are not only more likely but also weaker than the prejacent, making the additive presupposition of *dou* satisfied under both semantics. In particular, the logical strength-based semantics yields the quantifier-distributor use of *dou* in (79a), and the likelihood-based semantics yields the *even*-like use in (79b).²¹

- (79) a. Yuehan [(zhe) san-wan fan] **DOU** chi-de-wan.
 John DEM three-bowl rice DOU eat-mod-finish
 ‘John can eat up (these) three bowls of rice.’
 b. Yuehan (lian) [SAN_F-wan fan] **dou** chi-de-wan.
 John LIAN three-bowl rice DOU eat-mod-finish
 ‘John can even eat up THREE bowls of rice.’

Second, as illustrated in (80a-b), if the prejacent is logically weaker than all the other alternatives, *dou* suffers a presupposition failure under both semantics. For example, as seen in (80a), *dou* cannot be associated with the non-emphatic ‘(the) one person’ when functioning as a quantifier-distributor, because the prejacent proposition is the logically weakest alternative. Likewise, as seen in the [(lian)...*dou*...] sentence (80b), in absence of a non-upward-entailing operator, *dou* cannot be associated with an emphatic ‘one person’ and function as an *even*-like minimizer-licenser, because the prejacent proposition of *dou* is the logically weakest as well as the most likely alternative.

- (80) a. Yuehan [(zhe) *yi/san-ge ren] **dou** renshi.
 John DEM one/three-CL person DOU know
 ‘John knows all the *one/three people.’
 b. Yuehan (lian) [YI_F-ge ren] **dou** *(bu) renshi.
 John LIAN one-CL person DOU NEG know
 ‘John does*(n’t) even know ONE person.’

Last and the most important, under the “if else” condition that the prejacent proposition is logically independent from every other alternative, *dou* can be felicitously used in [(lian) ... *dou* ...] constructions but not in basic declaratives. Consider the following two pairs of sentences:

- (81) a. *John **dou** arrived.
 b. (Lian) JOHN **dou** arrived.
 (82) a. They **dou** bought houses. (#collective, √distributive)
 b. (Lian) THEY **dou** bought houses. (√collective, √distributive)

²¹There is a minor difference between the two examples in (79): *san-wan fan* ‘three bowls of rice’ receives a referential interpretation in the basic declarative (79a) but a generic interpretation in the [(lian) ... *dou* ...] sentence (79b).

The basic declarative (81a) is ungrammatical due to a presupposition failure: the prejacent of *dou* has no logically weaker alternative. In contrast, the [(*lian*) Foc *dou* ...] sentence (81b) is grammatical, because propositions of the form “*x* arrived” can be less likely than the prejacent *John arrived* in proper contexts, which therefore makes the presupposition of *dou* satisfied. In (82), although both sentences are grammatical, the prejacent clause *they bought houses* admits a collective reading in the [(*lian*) Foc *dou* ...] sentence (82b) but not in the basic declarative (82a). When taking a collective reading, the prejacent of *dou* is logically independent from all the alternatives, but it can be more likely than some of its alternatives in proper contexts. The above contrasts suggest a crucial prediction: the likelihood-based semantics of *dou*, which allows sub-alternatives to be logically independent from the prejacent, is available in [(*lian*) Foc *dou* ...] constructions but not in basic declaratives. In other words, the distribution of the likelihood-based semantics of *dou* is more restrictive than that of the logical strength-based semantics of *dou*.²²

7. Conclusions

This paper offered a uniform semantics to capture the seemingly diverse functions of the Mandarin particle *dou*, including the quantifier-distributor use, the \forall -FCI-licenser use, and the *even*-like scalar use. I define *dou* as a special exhaustifier that operates on sub-alternatives and has a pre-exhaustification effect: *dou* presupposes the existence of at least one sub-alternative, asserts

²²This prediction makes my account more preferable than a recent account in Liu (2016b,c), which was developed in parallel with the proposed account, as witnessed by preliminary presentations of the two accounts (Xiang 2015, 2016b; Liu 2016a). Although both Liu’s and mine accounts use Alternative Semantics, we ended up with views contradictory with respect to which function(s) and semantics of *dou* are primary. Briefly, Liu assumes that *dou* is primarily equivalent to the likelihood-based particle *even*, and that it takes a distributor-like use when the scalar presupposition of *even/dou* is trivially satisfied. In contrast, my account predicts that the *even*-like use of *dou* is secondary: it is employed only when the semantics of sub-alternatives is weakened from logical strength to likelihood.

The prediction of my account is advantageous due to the following argument: if the likelihood-based semantics were the default semantics, *dou* should be licensed whenever the presupposition of its likelihood-based semantics is satisfied, and hence should have the same distribution in basic declaratives and [(*lian* ... *dou* ...] constructions, contra fact. For example, for the basic declarative (82a), if *they bought houses together* is contextually more likely than *the others bought houses together*, the likelihood-based semantics of *dou* should have been defined even if the prejacent takes a collective reading.

I summarize Liu’s account as follows. First of all, Liu adopts the semantics of *even* by Karttunen and Peters (1979), which is encoded with a universal scalar presupposition, and defines *dou* as equivalent to *even*. This *even*-like definition directly predicts the *even*-like use of *dou*.

(i) **Semantics of *dou*** (Liu 2016b,c)

$$\llbracket \textit{dou} \rrbracket(p) = \forall q \in \textit{Alt}(p)[p \neq q \rightarrow p <_{\textit{likely}} q].p$$

(*dou* is truth conditionally vacuous but presupposes that its prejacent is the most unlikely proposition among its alternatives.)

Second, as for the distributor use of *dou*, Liu argues that the universal scalar presupposition of *dou* is trivially satisfied when the propositional argument of *dou* takes a distributive reading. Under a distributive reading, the propositional argument of *dou* entails all of its alternatives, and hence is not less likely than any of its alternatives. This way of getting distributivity has been reached by Liao (2011: chap. 4), but Liu improves the treatment of distributivity/collectivity in the derivation of alternatives. See footnote 13 for an introduction of this issue.

Liu so far has no written work on the \forall -FCI licenser use of *dou*. But he suggested to me an attempt through a private conversation, described as follows. When the propositional argument of *dou* is existential or disjunctive, the plain value of this propositional argument is too weak to satisfy the additive presupposition of *dou*; therefore, the propositional argument of *dou* is forced to be recursively exhaustified, giving rise to an FC interpretation.

the truth of the prejacent and the negation of each pre-exhaustified sub-alternative.

The semantics of *dou* exhibits minimal alternations caused by semantic weakenings on the definition of sub-alternatives, giving rise to different uses. By default, sub-alternatives are the alternatives that are weaker than the prejacent, or equivalently, the ones that are not excludable and distinct from the prejacent. Under this definition of sub-alternatives, *dou* obtains its primary use as a distributor. Further, with a weakening from unexcludability to un-I-excludability, *dou* gains its \forall -FCI licenser use. Alternatively, with a weakening from logical strength to likelihood, *dou* becomes semantically equivalent to English *even* and functions as a scalar marker. The derivational path for the functions of *dou* is supported by both diachronic and synchronic evidence.

The anti-exhaustivity assertion of *dou* is responsible for the derivation of universal FC inferences. The additive presupposition of *dou* explains the distributional pattern of *dou* and many of its semantic consequences, such as the requirements regarding to distributivity and plurality, the *even*-like interpretation of the [*lian* Foc/Min *dou* ...] construction, the distributional pattern of the post-*dou* negation in licensing minimizers, and so on.

Acknowledgement

[To be added ...]

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