Mandarin Particle *dou*: A Pre-exhaustification Exhaustifier

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Abstract This paper provides a uniform semantics to capture various functions of Mandarin particle *dou*, including the quantifier-distributor use, the free choice item (FCI) licenser use, and the scalar marker use. I argue that *dou* is a special exhaustifier: it triggers an additive presupposition, operates on sub-alternatives, and has a pre-exhaustification effect.

Keywords Mandarin · *dou* · exhaustification · quantification · free choice · scalar · Alternative Semantics

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1 Introduction

The Mandarin particle *dou* has various uses. Descriptively speaking, it can be used as a universal quantifier-distributor, a free choice item (FCI) licenser, a scalar marker, and so on.

First, in a basic declarative sentence, the particle *dou*, similar to English *all*, is associated with a preceding nominal expression and universally quantifies and distributes over the subparts of the item denoted by this expression, as exemplified in (1). Here and throughout the paper, I use [·] to enclose the item associated with *dou*.

(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.'

Moreover, under the quantifier-distributor use, *dou* brings up three more semantic consequences in addition to universal quantification, namely, a "maximality requirement," a "distributivity requirement," and a "plurality requirement." The "maximality requirement" means that *dou* forces the predicate denoted by the remnant VP to apply to the maximal element in the extension of the associated item (Xiang 2008). For instance, imagine that a large group of children, with one or two exceptions, went to the park. Then (2) can be judged as 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" means that if a sentence admits both collective and atomic/nonatomic distributive readings, applying *dou* to this sentence blocks the collective reading (Lin 1998). For instance, (3a) is infelicitous if John and Mary married each other, and (3b) is infelicitous if the considered individuals only participated in one house-buying event.

(3) a. [Yuehan he Mali] **dou** jiehun -le.
John and Mary DOU get-married -ASP
'John and Mary each got married.'
b. [Tamen] **dou** mai -le fangzi.
they DOU buy -PERF house
'They all bought houses.' (#collective)

The "plurality requirement" says that the item associated with *dou* must take a non-atomic interpretation. If the prejacent sentence of *dou* has no overt non-atomic term, *dou* needs to be associated with a covert non-atomic item. For example, in (4), since the spelled-out part of prejacent sentence has no non-singular term, *dou* is associated with a covert term such as *zhe-ji-ci* 'these times'.

(4) Yuehan [(zhe-ji-ci)] **dou** qu de Beijing.
John this-several-time DOU go DE Beijing
'For all the times, the place that John went to was Beijing.'

Second, as a well-known fact, *dou* can license a preverbal *wh*-item as a universal free choice item (FCI), as exemplified in (5). Moreover, I observe that *dou* in company with a possibility modal can license the universal FCI use of a preverbal disjunction, as shown in (6a). In particular, if the possibility modal *keyi* 'can' is dropped or replaced with a necessity modal *bixu* 'must', the presence of *dou* makes the sentence ungrammatical. For example, (6a) and (6c) are grammatical only in absence of *dou*, admitting only disjunctive interpretations.

(5) a. [Shui] *(**dou**) he -guo jiu.
who DOU drink -EXP alcohol
'Anyone/everyone has had alcohol.'

b. [Na-ge nanhai] *(**dou**) he -guo hejiu.
which-CL boy DOU drink -EXP alcohol
'Any/Every boy has had alcohol.'

(6) a. [Yuehan huozhe Mali] (**dou**) keyi jiao hanyu.
John or Mary DOU can teach Chinese
Without *dou*: 'Either John or Mary can teach Chinese.'
With *dou*: 'Both John and Mary can teach Chinese.'

b. [Yuehan huozhe Mali] (***dou**) jiao hanyu.
John or Mary DOU teach Chinese

c. [Yuehan huozhe Mali] (***dou**) bixu jiao hanyu.
John or Mary DOU must teach Chinese

Third, when associated with a scalar item, *dou* implies that the prejacent sentence (namely, the sentence embedded under *dou*) ranks relatively high in the considered scale. When *dou* has this use, its associated item can stay insitu but must be focus-marked. For example, in (7a), *dou* is associated with the numeral phrase *wu dian* 'five o'clock', and the alternatives are ranked in chronological order.[1,2]

(7) a. **Dou** [WU$_F$-dian] -le.
DOU five-o'clock -ASP
'It is five o'clock.' ⇝ Being five o'clock is a bit late.

[1] Stressed items are capitalized, focused items are marked with a subscript '$_F$'.
[2] '⇝ p' means that the Mandarin example implies p.

b. Ta **dou** lai -guo zher [LIANG$_F$-ci] -le.
he DOU come -EXP here two-time -ASP.
'He has been here twice.' ⇝ Being here twice is a lot.

The [*lian* Foc *dou* ...] construction is a special case where *dou* functions as a scalar marker. A sentence taking a [*lian* Foc *dou* ...] form has an *even*-like interpretation; it implicates that the prejacent proposition is less likely to be true than (most of) the contextually relevant alternatives.

(8) (Lian) [duizhang]$_F$ **dou** chi dao -le.
LIAN team-leader DOU late arrive -ASP
'Even [the team leader]$_F$ arrived late.'

In particular, 'one-CL-NP' can be licensed as a minimizer at the focus position of the [*lian* Foc *dou* NEG ...] construction, as shown in (9a). Notice that the post-*dou* negation is not always needed, as seen in (9b).

(9) 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.'
b. Yuehan (lian) [YI$_F$-fen qian] *(**dou**) (mei) yao.
John LIAN one-cent money DOU NEG request
Without negation: 'John doesn't want any money.'
With negation: 'Even if it is just one cent, John wants it.'

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. In (10a), where the prejacent of *dou* has no stressed item, *dou* functions as a quantifier and is associated with the preceding plural term *tamen* 'they', while in (10b) and (10c), *dou* functions as a scalar marker and is associated with the stressed item.

(10) 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 twice.' ⇝ Being here twice is a lot.

c. (Lian) [TAMEN]$_F$ **dou** lai -guo liang-ci -le.
LIAN they DOU come -EXP two-time -ASP
'Even THEY have been here twice.'

The goal of this paper is to provide a uniform semantics of *dou* to account for its seemingly diverse functions. I propose that *dou* is a special exhaustifier that operates on *sub-alternatives* and has a *pre-exhaustification effect*. The basic idea can be roughly described as follows. Assume that a *dou*-sentence is of the form "*dou*(ϕ_a)" where ϕ and a correspond to the prejacent sentence and the item contained within ϕ that is associated with *dou*, respectively. The meaning of "*dou*(ϕ_a)" is roughly 'ϕ_a and not only ϕ_b', where b' can be a proper subpart of a', a weaker scale-mate of a', and so on.[3] For example, "[A and B] dou came" means 'A and B came, not only A came, and not only B came'; "it's dou [five] o'clock" means 'it's 5 o'clock, not just 4, not just 3, . . .'.

The rest of this paper is organized as follows. Section 2 will review two representative theories of the semantics of *dou*, namely, the distributor approach (Lin 1998) and the maximality operator approach (Giannakidou & Cheng 2008, Xiang 2008). Section 3 will define *dou* as a special exhaustifier and compare it with the canonical exhaustifier *only*. Section 4 will discuss the universal quantifier use of *dou*. I will show that the so called "distributivity requirement" and "plurality requirement" are both illusions, and that the facts usually thought to be related to these two requirements result from the additive presupposition of *dou*. Section 5 and 6 will be centered on the FCI-licenser use and the scalar marker use, respectively.

2 Previous Studies

There are numerous studies on the syntax and semantics of *dou*. Earlier approaches treat *dou* as an adverb with universal quantification power (Lee 1986, Cheng 1995, among others). Portner (2002) analyzes 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 more recent representative studies on the semantics of *dou*, one is the

[3] For any syntactic expression a, a' stands for the semantic value of a.

distributor approach by Lin (1996), and the other is the maximality operator approach along the lines of Giannakidou & Cheng (2006) and Xiang (2008).

2.1 The Distributor Approach

Lin (1996, 1998) provides the first extensive treatment of the semantics of *dou*. He proposes that *dou* is an overt counterpart of the generalized distributor D in the sense of Schwarzschild (1996). Unlike the regular distributor *each* which distributes over an atomic domain, the generalized D-operator distributes over the cover of the nominal phrase associated with *dou*. A cover of an individual x is a set of subparts of x, as defined in (11) and exemplified in (12). Its value is determined by both linguistic and non-linguistic factors.

(11) $Cov(\alpha, x)$ (read as "α is a cover of x") iff

a. α is a set of subparts of x;

b. every subpart of x is a subpart of some member in α.

(12) Possible covers of $a \oplus b \oplus c$ and corresponding readings:

$$\begin{array}{ll} \{a, b, c\} & \text{(atomic distributive)} \\ \left.\begin{array}{c} \{a \oplus b, c\} \\ \{a \oplus b, b \oplus c\} \\ \ldots \end{array}\right\} & \text{(nonatomic distributive)} \\ \{a \oplus b \oplus c\} & \text{(collective)} \end{array}$$

The semantics of *dou* is thus schematized as follows:

(13) $[\![dou]\!](P, x)$ is true iff
$D(\alpha)(P) = 1$, where $Cov(\alpha, x)$ iff
$\forall y \in \alpha[P(y) = 1]$, where $Cov(\alpha, x)$
(Given some contextually determined variable α such that α is a cover of x, every member of α is P.)

The distributor approach only considers the quantifier use of *dou*. It is unclear how this approach can be extended 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 *D*-distributor does not. For instance, as seen in (3b) and repeated below, the presence of *dou* eliminates the collective reading of the prejacent sentence. As Xiang (2008) argues, if *dou* were a generalized distributor, it should be compatible with a single cover reading (viz., the collective reading): there can be a discourse under which the cover of *tamen* 'they' denotes a singleton set like $\{a \oplus b \oplus c\}$; distributing over this singleton set yields a collective reading.

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

Second, unlike English distributors like *each* and *all*,[4] *dou* can be associated with a distributive expression such as NP-*gezi* 'NP each'.[5]

(15) 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.'

2.2 The Maximality Operator Analysis

Another popular approach, initiated by Giannakidou & Cheng (2006) and extended by Xiang (2008), is to treat *dou* as a presuppositional maximality operator. Briefly speaking, this approach proposes that *dou* operates on

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

[5]Similar 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

a non-singleton cover of the associated item, returns the maximal plural element in this cover, and presupposes the existence of this maximal plural element. I schematize this idea as follows:

(16) Let $Cov(\alpha, x) = 1$, then
$[\![dou]\!](x) = |\alpha| > 1 \wedge \exists y \in \alpha[\neg Atom(y) \wedge \forall z \in \alpha[z \leq y]].$
$\iota y \in \alpha[\neg Atom(y) \wedge \forall z \in \alpha[z \leq y]].$
($[\![dou]\!](x)$ is defined iff the cover of x is non-singleton and has a unique non-atomic maximal element; when defined, the reference of $[\![dou]\!](x)$ is this maximal element.)

This approach 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.

This approach is superior to the distributor approach in two respects: first, it captures the maximality requirement; and second, it can be extended to the scalar use of *dou* (see Xiang 2008). Nevertheless, this approach still faces several conceptual or empirical problems.

First, 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 4.3, this plural presupposition is neither sufficient nor necessary in dealing with the relevant facts.

Second, this approach 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 (14), if the cover of *tamen* 'they' is $\{a \oplus b, a \oplus b \oplus c\}$, the predicted assertion is simply '$a \oplus b \oplus c$ bought houses,' which says nothing as to whether $a \oplus b$ bought houses.

3 Defining *dou* as a Special Exhaustifier

This section will start with the semantics of the canonical exhaustifier *only*, and then define Mandarin particle *dou* as a special exhaustifier: *dou* is a pre-exhaustification exhaustifier that operates on sub-alternatives.

3.1 Canonical Exhaustifier *only*

The exclusive particle *only* is a canonical exhaustifier. Using Alternative Semantics for focus (Rooth 1985, 1992, 1996), we can summarize the standard treatment of the semantics of *only* in two parts. First, a focused element is associated with a set of focus alternatives. This alternative set grows point-wise (Hamblin 1973), as recursively defined in (17), adopted from Chierchia (2013:138).

(17) a. Basic Clause: for any lexical entry α, $Alt(\alpha) =$
(i) $\{[\![\alpha]\!]\}$ if α is lexical and does not belong to a scale;
(ii) $\{[\![\alpha_1]\!], \ldots, [\![\alpha_n]\!]\}$
if α is lexical and part of a scale $\langle[\![\alpha_1]\!], \ldots, [\![\alpha_n]\!]\rangle$.

b. Recursive Clause:
$Alt(\beta(\alpha)) = \{b(a) : b \in Alt(\beta), a \in Alt(\alpha)\}$

Second, the exclusive particle *only* presupposes the truth of its prejacent proposition (Horn 1969) and asserts an exhaustivity condition. This condition says that all the excludable alternatives of the prejacent clause are false. For any proposition p, an alternative of p is excludable as long as it is not entailed by p.

(18) a. $[\![only]\!](p) = \lambda w[q(w) = 1.\forall q \in Excl(p)[q(w) = 0]]$
(To be revised in (20))

b. $Excl(p) = \{q : q \in Alt(p) \wedge p \nsubseteq q\}$

In addition to the prejacent presupposition, I argue that *only* also triggers an additive presupposition, namely, that the prejacent has at least one excludable alternative. In (19), *only* has a restricted exhaustification domain, namely, {*I will invite John*, *I will invite Mary*, *I will invite John and Mary*}. Contrary to the case of (19a), (19b) is infelicitous because the prejacent *I will invite both John and Mary* is the strongest one among the alternatives and 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. For sake of comparison, observe that (19c) is felicitous, which is because covert exhaustification is free from the economy condition and so does not trigger an additive presupposition.

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

a. Only JOHN$_F$, (not Mary / not both).

b. #Only BOTH$_F$.

c. BOTH$_F$.

In sum, I schematize the semantics of *only* as follows: it presupposes the truth of its prejacent and the existence of an excludable alternative; it negates each excludable alternative.

(20) $$[\![only]\!](p) = \lambda w.[p(w) = 1 \wedge \exists q \in Excl(p)].$$
$$\lambda w.\forall q \in Excl(p)[q(w) = 0]$$ (Final version)

a. Prejacent presupposition: p

b. Additive presupposition: $\exists q \in Excl(p)$

c. Assertion: $\lambda w.\forall q \in Excl(p)[q(w) = 0]$

3.2 Special Exhaustifier *dou*

I define *dou* as a pre-exhaustification exhaustifier over sub-alternatives, as schematized in (21): it presupposes an additive inference; it affirms the prejacent and negates the exhaustification of each sub-alternative.

(21) $$[\![dou]\!](p) = \exists q \in Sub(p).$$
$$\lambda w[p(w) = 1 \wedge \forall q \in Sub(p)[O(q)(w) = 0]]$$

The additive presupposition is motivated by the economy condition, just as we saw with the canonical exhaustifier *only*. The anti-exhaustification inference asserted by *dou* differs from that asserted by *only* in two respects. First, *only* operates on excludable alternatives, but *dou* operates on *sub-alternatives*. For now we can understand sub-alternatives as weaker alternatives, or equivalently, the alternatives that are not excludable (viz., not entailed by the prejacent) and are distinct from the prejacent, as schematized in (22). The sign '−' stands for set subtraction. A revision will be made in section 5.

(22) $$Sub(p) = \{q : q \in Alt(p) \wedge p \subsetneq q\}$$ (To be revised in (44c))
$$= (Alt(p) - Excl(p)) - \{p\}$$

Second, *dou* has a pre-exhaustification effect: it negates the "exhaustification" of each sub-alternative. The pre-exhaustification effect is realized by applying an *O*-operator to each sub-alternative.[6] 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 & Spector to appear, among others). This *O*-operator affirms the prejacent and negates all the excludable alternatives of the prejacent.

(23) $O(p) = \lambda w[p(w) = 1 \wedge \forall q \in Excl(p)[q(w) = 0]]$
(Chierchia et al. 2012)

Consider (24) for a simple illustration of the present definition. The prejacent proposition and its alternative set are (24a) and (24b), respectively. Only the two alternatives in (24c) are asymmetrically entailed by the prejacent, which are therefore the sub-alternatives. The use of *dou* affirms the prejacent and negates the exhaustification of each sub-alternative, as in (24d), yielding the following inference: 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.[7]

[6] In section 6, we will see other options to derive the pre-exhaustification effect. For instance, when *dou* is used as a scalar marker, the pre-exhaustification effect is realized by applying a scalar exhaustifier ($\approx$ *just*) to the sub-alternatives.

[7] One 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.

(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 (24) 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*. Here let me just sketch out

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

a. $p = A(j \oplus m)$
b. $Alt(p) = \{A(x) : x \in D_e\}$
c. $Sub(p) = \{A(j), A(m)\}$
d. $[\![dou]\!](p) = A(j \oplus m) \wedge \neg O[A(j)] \wedge \neg O[A(m)]$

4 The Universal Quantifier Use

Recall that *dou* evokes three requirements when used as a universal quantifier: (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 prejacent 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. (See footnote 7 for a rough idea on 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*.

4.1 Explaining the "Distributivity Requirement"

To generate sub-alternatives and satisfy the additive presupposition of *dou*, the prejacent of *dou* needs to be monotonic with respect to the item associated with *dou*,[8] which therefore gives rise to the "distributivity re-

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) (Scenario: 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.]

[8] If α is of type δ and A is a constituent that contains α, then A is monotonic with respect to α iff the function $\lambda x.[\![A[\alpha/v_\delta]]\!]^{g[v_\delta \to x]}$ is monotonic (adapted from Gajewski 2007). Here $A[\alpha/v]$ stands for the result of replacing α with v in A.

quirement." For instance, (25) rejects a collective reading because under this reading the prejacent proposition of *dou* is non-monotonic with respect to the subject position and hence has no sub-alternative, as shown in (25a). In contrast, when taking an atomic or a non-atomic distributive reading, the prejacent of *dou* is monotonic with respect to the subject position and does generate some sub-alternatives, as shown in (25b) and (25c).[9]

(25) [*abc*] **dou** bought houses.

a. *Collective* #
   (i) *abc* together bought houses.
   $\not\Rightarrow$ *ab* together bought houses.
   (ii) $Sub(abc\ together\ bought\ houses) = \varnothing$

b. *Atomic distributive* $\surd$
   (i) *abc* each bought houses. $\Rightarrow$ *ab* each bought houses.
   (ii) $Sub(each(x)(BH)) = \{each(x)(BH) \colon x \lneq abc\}$

c. *Nonatomic distributive* $\surd$
   (i) members of C_{abc} each bought houses.
   $\Rightarrow$ members of X each bought houses ($X \subsetneq C_{abc}$)
   (ii) $Sub(D(C_{abc})(BH)) = \{D(X)(BH) : X \subsetneq C_{abc}\}$

Hence, *dou* itself is not a distributor; but in certain cases, the additive presupposition of *dou* evokes the use of a distributor (a covert *each* or a covert generalized distributor). We can now easily explain why *dou* can be associated with a distributive expression NP-*gezi* 'NP-each': the presence of the distributor *gezi* 'each' is actually required for the sake of satisfying the additive presupposition of *dou*; if *gezi* is not overtly used, a covert distributor is still present in the logical form.

(26) [Tamen gezi] **dou** you yixie youdian.
they each DOU have some advantage
'They each **dou** has some advantages .'

Moreover, *dou* can be applied to a collective statement as long as this statement satisfies the monotonicity requirement, namely, is monotonic

[9] C_{abc} in (25c) stands for a free variable that is a cover of *abc*.

with respect to the item associated with *dou*. For instance, *dou* is compatible with monotonic collective predicates (e.g., *shi pengyou* 'be friends', *jihe* 'gather', *jianmian* 'meet'), as shown in (27). Consider, for instance, (27a). Let *tamen* 'they' denote three individuals *abc*. The set of sub-alternative sets is {*ab are friends*, *bc are friends*, *ac are friends*}; applying *dou* yields the following inference: *abc* are friends, not only *ab* are friends, not only *bc* are friends, and not only *ac* are friends.

(27) 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.'

By comparison, *dou* cannot be applied to a collective statement that does not satisfy the monotonicity requirement, as shown in (28).

(28) [Tamen] (***dou**) zucheng -le lia er-ren-zu.
they DOU form -ASP two two-person-group
'They (*all) formed two pairs.'

We have to distinguish the case in (28) from the following ones, where the prejacent sentences actually admit non-collective (viz., non-atomic distributive) readings and thus satisfy the monotonicity requirement.

(29) [Tamen] **dou** zucheng -le er-ren-zu.
they DOU form -ASP two-person-group
'They all formed pairs.'

(30) [Women he tamen] **dou** zucheng -le lia er-ren-zu.
we and they DOU form -ASP two two-person-group
'We formed two pairs, and they formed two pairs.'

In (29), the extension of the predicate *formed pairs* (FP) is closed under sum, just like any plural term: FP$(a \oplus b) \wedge$ FP$(c \oplus d) \Rightarrow$ FP$(a \oplus b \oplus c \oplus$

d) (see Kratzer 2008 for the question of pluralizing verbal predicates); hence the prejacent sentence admits a covered/cumulative reading. In (30), although the predicate *formed two pairs* (F2P) is non-monotonic, the subject *we and they* can be interpreted as a generalized conjunction, each conjunct of which yields a sub-alternative. A schematized derivation for the sub-alternatives in (30) is given in (31).

(31) a. $[\![we\ and\ they]\!] = \lambda P_{et}[P(we) \wedge P(they)]$
b. $[\![we\ and\ they\ F2P]\!] = F2P(we) \wedge F2P(they)$
c. $Sub(we\ and\ they\ F2P) = \{F2P(we), F2P(they)\}$

4.2 Explaining the "Plurality Requirement"

I argue that the "plurality requirement" of *dou* is illusive, and that the related facts all result from the additive presupposition of *dou*.

First, the plurality requirement is unnecessary: *dou* can be associated with an atomic item as long as the predicate denoted by the remnant VP is predicate.

(32) P is divisive iff $\forall x[P(x) = 1 \rightarrow \forall y \leq x[P(y) = 1]]$
(A predicate is divisive iff whenever it holds of something, it also holds of each of its subparts.)

For instance, in (33a), the associated item *that apple* takes only an atomic interpretation; with a divisive predicate $\lambda x.\ John\ ate\ x$, the prejacent sentence of *dou* has sub-alternatives, as schematized in (34a), which therefore supports the additive presupposition of *dou*. In contrast, in (33b), the predicate $\lambda x.\ John\ ate\ half\ of\ x$ is not divisive and hence is incompatible with the use of *dou*.

(33) 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.'

(34) a. 'John ate that apple.' $\Rightarrow$ 'John ate x.' ($x \lneq$ that apple)
$Sub(John\ ate\ that\ apple) = \{John\ ate\ x : x \lneq that\ apple\}$

b. 'John ate half of that apple.'
$\not\Rightarrow$ 'John ate half of x.' ($x \lneq$ that apple)
$Sub(\textit{John ate half of that apple}) = \varnothing$

Second, the plurality requirement is insufficient. When followed by a monotonic collective predicate, *dou* requires its associated item to denote a group consisting of at least three members, as shown in (35).

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

This fact is also predicted by the additive presupposition. As schematized in (36), the proper subparts of an dual-individual are atomic individuals, which, however, are undefined for the collective predicate 'be friends'. Consequently, if the item associated with *dou* in (35) denotes only a dual-individual, the prejacent of *dou* has no sub-alternative, which therefore leaves the presupposition of *dou* unsatisfied.

(36) [*ab*] (***dou**) are friends.

a. $[\![\textit{be friends}]\!] = \lambda x[\neg Atom(x).\textit{be-friends}(x)]$
b. $Sub(\textit{ab are friends}) = \varnothing$

5 The Universal FCI-licenser Use

Dou can license the universal FCI use of polarity items, *wh*-items, and preverbal disjunctions. In this section, I argue that the asserted component of *dou* converts a disjunctive/existential statement into a conjunctive/universal statement, giving rise to a free choice (FC) inference. I will also explain why the licensing of universal FCIs requires the presence of *dou*, and why the licensing of a preverbal disjunction as a universal FCI exhibits the effect of modal obviation.

5.1 Licensing Conditions of Mandarin FCIs

In Mandarin, the licensing of a universal FCI requires the presence of *dou*. For instance, in (37), the bare *wh*-word *shei* 'who' is licensed as a universal FCI only when it precedes *dou*.

(37) [Shei] *(**dou**) jiao -guo jichu hanyu.
who DOU teach -EXP intro Chinese.
'Everyone has taught Intro Chinese.'

To license the universal FCI use of a disjunction, *dou* must be present and followed by a possibility modal, as shown in (38) and (39).

(38) [Yuehan huozhe Mali] **dou** keyi/*bixu jiao jichu hanyu.
John or Mary DOU can/must teach intro Chinese
'Both John and Mary can teach Intro Chinese.'

(39) [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.'

This requirement is also observed with English emphatic item *any*: as shown in (40), *any* is licensed as a universal FCI when it precedes a possibility modal, but not licensed when it appears in an episodic statement or before a necessity modal.

(40) a. *Anyone came in.
b. Anyone can/*must come in.

The licensing conditions of *na*-CL-NP 'which-NP' and *renhe*-NP 'any-NP' are less clear. Giannakidou & Cheng (2006) claim that the universal FCI uses of these items are only licensed in a pre-*dou*+$\Diamond$ position; their judgements are illustrated in (41). Nevertheless, it is difficult to do justice to the data because judgements of (41) vary greatly among native speakers.

(41) a. [Na-ge/Renhe -ren] **dou** keyi/?bixu lai.
which-CL/anywhat -person DOU can/must come
Intended: 'Everyone can/must come.'
b. ?[Na-ge/Renhe -ren] **dou** lai -guo.
which-CL/anywhat -person DOU come -ASP
Intended: 'Everyone has been here.'

Despite the variation in the judgments, the licensing conditions of universal FCIs in Mandarin can be summarized as follows. First, every universal FCI requires the presence of *dou*. Second, every universal FCI can be licensed before *dou*+$\Diamond$. Third, in absence of the possibility modal, 'which'/'any'-NP is less likely to be licensed than bare *wh*-words, but more likely to be licensed than disjunctions. For other recent studies, see Liao 2011, Cheng & Giannakidou 2013, and Chierchia & Liao 2015.

5.2 Predicting Universal FC Inferences

Wh-items are generally considered as existential indefinites; thus in (37), repeated in (42), the prejacent sentence 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 universal FC inference. In a word, *dou* turns a disjunction into a conjunction.

(42) [Shei] *(**dou**) has taught Intro Chinese.

a. $p = f(a) \vee f(b)$

b. $Sub(p) = \{f(a), f(b)\}$

c. $[\![dou]\!](p)$
$= [f(a) \vee f(b)] \wedge \neg O f(a) \wedge \neg O f(b)$
$= [f(a) \vee f(b)] \wedge [f(a) \rightarrow f(b)] \wedge [f(b) \rightarrow f(a)]$
$= [f(a) \vee f(b)] \wedge [f(a) \leftrightarrow f(b)]$
$= f(a) \wedge f(b)$

What makes the use of *dou* mandatory in (37)? Following Liao (2011) and Chierchia & Liao (2015), I assume that the sub-alternatives associated with a Mandarin *wh*-word are obligatorily activated when this *wh*-word has a non-interrogative use, and that they must be used up via employing a c-commanding exhaustifier.[10] If *dou* is absent, these sub-alternatives would be used by a basic exhaustifier (23), repeated in (43a), which has no pre-exhaustification effect. As schematized in (43b), a basic O-operator affirms the prejacent disjunction and negates both disjuncts, yielding a contradiction.[11]

(43) a. $O(p) = \lambda w[p(w) \wedge \forall q \in Excl(p)[q(w) = 0]]$

b. $O(f(a) \vee f(b)) = [f(a) \vee f(b)] \wedge \neg f(a) \wedge \neg f(b) = \bot$

[10] In the case of disjunctions, sub-alternatives are simply what usually call "domain alternatives," evoked by domain widening (Krifka 1995, Lahiri 1998, Chierchia 2006).

[11] Disjunctions are free from this problem, because they do not mandatorily evoke sub-alternatives. See Chierchia 2006 for discussions on activations of alternatives.

Now, a problem arises as to the definition of sub-alternatives: in section 3, I defined sub-alternatives as weaker alternatives, namely, alternatives that are not excludable and distinct from the prejacent; but in (42) the disjuncts are semantically stronger than the disjunction.

This problem can be solved by a simple move from excludability to *innocent excludability*, a notion proposed by Fox (2007): an alternative is innocently excludable iff the inference of affirming the prejacent and negating this alternative is consistent with negating any excludable alternative. Thus, we can say that sub-alternatives are alternatives that are not *innocently excludable* and are distinct from the prejacent.

(44) a. **Excludable alternatives** (Chierchia et al. 2012)
$Excl(p) = \{q : q \in Alt(p) \wedge p \nsubseteq q\}$
(The set of alternatives that are entailed by the prejacent)

b. **Innocently excludable alternatives** (Fox 2007)
$IExcl(p) = \{q : q \in Alt(p) \wedge$
$\neg\exists q' \in Excl(p)[(\lambda w[p(w) = 1 \wedge q(w) = 0]) \subseteq q']\}$
(The set of alternatives p such that affirming p and negating q does not entail any excludable alternatives)

c. **Sub-alternatives** (Final version, cf. (22))
$Sub(p) = (Alt(p) - IExcl(p)) - \{p\}$
(The set of alternatives excluding the innocently excludable alternatives and the prejacent)

In (42), the disjuncts are not innocently excludable to the disjunction: as schematized below, affirming the disjunction and negating one of the disjuncts entail the other disjunct; in other words, affirming the disjunction and negating both disjuncts would yield a contradiction. Hence, the sub-alternatives of a disjunction are the disjuncts.

(45) $[[f(a) \vee f(b)] \wedge \neg f(a)] \Rightarrow f(b)$

Note that weaker alternatives are not innocently excludable: affirming a prejacent and negating a weaker alternative yield a contradiction, which entails any proposition. Hence, for cases where *dou* functions as a distributor, the new definition of sub-alternatives (44c) has the same consequence as the previous one in (22), which defines sub-alternatives as weaker alternatives.

A full definition of *dou* is schematized as follows:

(46) a. $[\![dou]\!](p) = \exists q \in Sub(p).$
$$\lambda w[p(w) = 1 \wedge \forall q \in Sub(p)[O(q)(w) = 0]]$$
(i) Presupposition: p has some sub-alternatives.
(ii) Assertion: p is true, while the exhaustification of each sub-alternative of p is false.

b. $Sub(p) = (Alt(p) - IExcl(p)) - \{p\}$
(The set of alternatives excluding the innocently excludable alternatives and the prejacent)

Readers who are familiar with the grammatical view of exhaustifications might find that *dou* is similar to the operation of recursive exhaustifications (abbreviated as 'O_R') proposed by Fox (2007). This operation has two major characteristics: first, exhaustification negates only alternatives that are innocently excludable; second, exhaustification is applied recursively. Using the notations in (46), I schematize the semantics of O_R as follows:[12]

(47) $$O_R(p) = \lambda w[p(w) = 1 \wedge \forall q \in Sub(p)[O(q)(w) = 0] \wedge \forall q' \in IExcl(p)[q'(w) = 0]]$$

Thus *dou* is weaker than O_R: *dou* does not negate the innocently excludable alternatives; therefore, applying *dou* to a disjunction does not generate an exclusive inference. For instance, (38) does not imply the exclusive

[12] In particular cases, the definition of O_R in (47) yields inferences different from what Fox's idea would expect: if the exhaustification of a sub-alternative is not innocently excludable, the exhaustification of this sub-alternative would not be negated by O_R under Fox's original definition. See (i) for a concrete example.

(i) (Among Andy and Billy,) only Andy came or only Billy came.

a. Prejacent: $O\phi_a \vee O\phi_b$; $Sub(O\phi_a \vee O\phi_b) = \{O\phi_a, O\phi_b\}$

b. By definition (47), applying O_R yields a contradiction:
$[O\phi_a \vee O\phi_b] \wedge \neg OO\phi_a \wedge \neg OO\phi_b = [O\phi_a \vee O\phi_b] \wedge \neg O\phi_a \wedge \neg O\phi_b = \bot$

c. By Fox's original definition, O_R would be applied vacuously:
$O_R[O\phi_a \vee O\phi_b] = O\phi_a \vee O\phi_b$

inference that only John and Mary can teach Intro Chinese.

5.3 Modal Obviation

Recall the contrast between disjunctions and bare *wh*-words with respect to the licensing conditions of their FCI uses: *dou* alone is sufficient for licensing the universal FCI use of a bare *wh*-word, but not that of a disjunction; to license this use of a disjunction, *dou* must be followed by a possibility modal. To capture this contrast, I assume that disjunctions evoke scalar implicatures, while bare *wh*-words do not (cf. Liao 2011, Chierchia & Liao 2015). Compare the following two episodic sentences. *Dou* must be present in (48a) but must be absent in (48b).

(48) a. [Shei] *(**dou**) jiao -guo jichu hanyu.
who DOU teach -EXP intro Chinese
With *dou*: 'Everyone has taught Intro Chinese.'

b. [Yuehan huozhe Mali] (***dou**) jiao -guo jichu hanyu.
John or Mary DOU teach -EXP intro Chinese
Without *dou*: 'John or Mary has taught Intro Chinese.'

In both sentences, the use of *dou* yields an FC inference that John and Mary/everyone have/has taught Intro Chinese. But in (48b), with a disjunction, the prejacent clause of *dou* also evokes the following scalar implicature, which contradicts to the FC inference: it is not the case that both John and Mary have taught Intro Chinese. Hence, *dou* cannot be used in (48b) because it yields a universal FC inference which contradicts the scalar implicature (*à la* Chierchia's (2013) explanation of the licensing condition of the FCI *any*). By contrast, in absence of *dou*, the sub-alternatives of a disjunction are not activated, and then (48b) would take a simple disjunctive reading.

A preverbal disjunction is licensed as a universal FCI when it appears before *dou*+$\Diamond$. This effect is called "modal obviation," namely, that the presence of a possibility modal eliminates the ungrammaticality. This effect is also observed with English *any*, as seen in (40).

(49) a. [Yuehan huozhe Mali] **dou** keyi jiao jichu hanyu.
John or Mary DOU can teach intro Chinese
'Both John and Mary can teach Intro Chinese.'

b. [Yuehan huozhe Mali] (***dou**) bixu jiao jichu hanyu.
John or Mary DOU must teach intro Chinese
'Both John and Mary must teach Intro Chinese.'

There have been plenty of discussions on the phenomenon of Modal Obviation involved in licensing universal FCIs. Representative works include Dayal 1998, 2013, Giannakidou 2001, Chierchia 2013, among others. This paper is not in a position to do full justice to these discussions, but just adds one more accessible story to the market.

I propose that the scalar implicature of a preverbal 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, (49) intuitively suggests that the speaker is only interested in cases where exactly one person teaches Intro Chinese. Assume that the property *teach Intro Chinese* denotes only three world-individual pairs, as in (50a). For instance, the pair $\langle w1, \{j\}\rangle$ is read as 'only John teaches Intro Chinese in $w1$'. The scalar implicature of the preverbal disjunction restricts the modal base M to the set of worlds where not both John and Mary teach Intro Chinese, as in (50b). Exercising *dou* yields the universal FC inferences in (50c) and (50d). Crucially, only (50c) is true with respect to M.

(50) a. $f = \{\langle w1, \{j\}\rangle, \langle w2, \{m\}\rangle, \langle w3, \{j, m\}\rangle\}$
b. $M = \{w1, w2\}$
c. $[\![dou]\!]\ [\Diamond f(j) \vee \Diamond f(m)] = \Diamond f(j) \wedge \Diamond f(m)$ True w.r.t. M
d. $[\![dou]\!]\ [\Box f(j) \vee \Box f(m)] = \Box f(j) \wedge \Box f(m)$ False w.r.t. M

Broadly speaking, there is no modal base, except the empty one, with respect to which (50d) is true; therefore necessity modals cannot obviate the contradiction between the FC inference and the scalar implicature.

If I am on the right track, as for the licensing conditions for the universal FCI uses of *na*-CL-NP and *renhe*-NP, whether a speaker accepts (41) in absence of the possibility modal is determined by whether he interprets these items with scalar implicatures.

6 Scalar Marker

When *dou* is associated with a scalar item or occurs in the focus construction [*lian* Foc *dou* ...], it functions as a scalar marker. In such a case, sub-alternatives are the alternatives ranking strictly lower than the prejacent with respect to a contextually relevant probability measure, and the pre-exhaustification effect is realized by the scalar exhaustifier JUST. In the following, I will firstly sketch out the semantics of the scalar *dou*, and then capture the *even*-like interpretation and the licensing conditions of minimizers in the [*lian* Foc/Min *dou* ...] construction.

6.1 Association with a Scalar Item

When *dou* is associated with a scalar item, the sub-alternatives are alternatives that rank lower than the prejacent proposition on the relevant scale, as schematized in (51), where $q \lneq_\mu p$ says that q ranks strictly lower than p with respect to some contextually relevant probability measure μ. $Alt_C(p)$ stands for the set of contextually relevant alternatives of p. For instance, in (52), repeated from (7a), sub-alternatives are propositions that rank lower than the prejacent in chronological order.

(51) $Sub(p) = \{q : q \in Alt_C(p) \wedge q \lneq_\mu p\}$
(The set of contextually relevant alternatives of p that rank lower than p with respect to μ)

(52) **Dou** [WU$_F$-dian] -le.
DOU five-o'clock -ASP
'It is **dou** FIVE$_F$ o'clock.'
a. $Sub(\textit{it's 5 o'clock}) = \{\textit{it's 4 o'clock, it's 3 o'clock}, \ldots\}$
b. $[\![dou[\textit{it's 5 o'clock}]]\!]$ = 'it's 5, not just 4, not just 3, ...'

To generate sub-alternatives and satisfy the additive presupposition of *dou*, the prejacent clause of *dou* needs to rank relatively high in the relevant scale. For instance, in (53), *dou* can be associated with *many*-NP but not with *few*-NP, because the prejacent of *dou* must be relatively strong among the quantificational statements.

(53) [Duo/*Shao -shu -ren] **dou** lai -le.
many/less -amount -person DOU come -ASP
'Most/*few people **dou** came.'

Since the alternatives of (52) are ordered based on their strength in the considered scale, the pre-exhaustification effect of *dou* is realized by the scalar exhaustifier $\textsc{just}$. As schematized in (54), the semantics of $\textsc{just}$ is analogous to that of the *O*-operator: $\textsc{just}$ affirms the prejacent p and further states a scalar exhaustivity condition that there is no true alternative of p that ranks higher than p with respect to the contextually relevant measurement. Hence, when *dou* functions as a scalar marker, its semantics would be adapted to (55).

(54) $\textsc{just}(p) = \lambda w[p(w) = 1 \wedge \forall q \in Alt_C(p)[q(w) = 1 \rightarrow q \leq_\mu p]]$
(*p* is true; every contextually relevant true alternative of *p* ranks not higher than *p* with respect to μ.)

(55) $[\![dou]\!](p) = \exists q \in Sub(p).$
$\lambda w[p(w) = 1 \wedge \forall q \in Sub(p)[\textsc{just}(q)(w) = 0]]$
(*p*, and for any sub-alternative *q*, not just *q*; defined iff *p* has a sub-alternative.)

We can further simplify the assertion, because the anti-exhaustification condition provided by the *not just*-clause is entailed by the remnant prejacent condition. [Proof: If q is an alternative of p that ranks lower than p with respect to μ, then p is an alternative of p that ranks higher than q with respect to μ. Hence, if p is true, there exists a true alternative of p that ranks higher than q with respect to μ, namely, p. End of proof.]

(56) Simplify the assertion of $[\![dou]\!](p)$:
$\lambda w[p(w) = 1 \wedge \forall q \in Sub(p)[\textsc{just}(p)(w) = 0]]$
$= \lambda w[p(w) = 1 \wedge \forall q \in Sub(p) \exists q' \in Alt_C(p)[q'(w) = 1 \wedge q \gnsim_\mu q']]$
$= \lambda w[p(w) = 1 \wedge$
$\forall q \in Alt_C(p)[q \lnsim_\mu p \rightarrow \exists q' \in Alt_C(p)[q'(w) = 1 \wedge q \gnsim_\mu q']]]$
$= p$

The semantics of the scalar marker *dou* is finally defined as follows:

(57) $[\![dou]\!](p) = \exists q \in Alt_C(p)[q \lnsim_\mu p].p$
(*p*; defined iff there is a contextually relevant alternative of *p* that ranks lower than *p* with respect to μ.)

6.2 The [*lian* Foc *dou* ...] Construction

In the [*lian* Foc *dou* ...] construction, alternatives are ordered with respect to likelihood. Sub-alternatives are focus alternatives that are more likely to be true than the prejacent, as schematized in (58). This definition is a natural transition from informativity to likelihood: a proposition that is less informative (viz., weaker) is more likely to be true.[13]

(58) $Sub(p) = \{q : q \in Alt_C(p) \wedge q \gnsim_{\text{likely}} p\}$
(The set of contextually relevant alternatives of p that are more likely to be true than p)

For instance, in (59), alternatives are propositions of the form "x was late" where x is a relevant individual. In a context that a team leader is less likely to be late than a team member, sub-alternatives are *the team member A was late*, *the team member B was late*, etc. Thus (59) means 'the team leader was late, not just that a team member was late.'

(59) **Lian** [duizhang]$_F$ **dou** chidao -le.
LIAN team-leader DOU late -ASP
'Even the team leader was late.'

Extending the definition of *dou* to the [*lian* Foc *dou* ...] construction, I schematize the meaning of *dou* in (60). Just like what we saw in (56), the anti-exhaustification condition is asymmetrically entailed by prejacent condition and hence is neglected in the end.

(60)
$$\begin{aligned}
&[\![dou]\!](p)\\
&= \exists q \in Sub(p).\lambda w[p(w) = 1 \wedge \forall q \in Sub(p)[\textsc{just}(p)(w) = 0]]\\
&= \exists q \in Sub(p).\lambda w[p(w) = 1 \wedge\\
&\qquad\qquad \forall q \in Sub(p)\exists q' \in Alt_C(p)[q'(w) = 1 \wedge q \gnsim_{\text{likely}} q']]\\
&= \exists q \in Alt_C(p)[q \gnsim_{\text{likely}} p].\\
&\quad \lambda w[p(w) = 1 \wedge \forall q \in Alt_C(p)[q \gnsim_{\text{likely}} p \rightarrow\\
&\qquad\qquad \exists q' \in Alt_C(p)[q'(w) = 1 \wedge q \gnsim_{\text{likely}} q']]]\\
&= \exists q \in Alt_C(p)[q \gnsim_{\text{likely}} p].p
\end{aligned}$$

[13] To be consistent with the general definition in (51), we can use "unlikelihood" as the probability measurement and define sub-alternatives as the ones that are less unlikely to be true than the prejacent.

(*p* is true; defined only if *p* has a contextually relevant alternative that is more likely to be true than *p*.)

Notice that the presupposition of the scalar marker *dou* is identical to the scalar presupposition of the additive scalar focus-sensitive operator *even*, according to the tradition initiated by Bennett (1982) and Kay (1990): the prejacent proposition is less likely to be true than at least one contextually relevant alternative.[14] 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, Liu to appear), while the particle *lian* is semantically vacuous and is present only for syntactic purposes.

6.3 Association with a Minimizer

Observe that, in licensing a minimizer, the post-*dou* negation is mandatory in (61a) but optional in (61b).

(61) a. Yuehan (lian) [YI-ge ren]$_F$ *(**dou**) *(bu) renshi.
John LIAN one-CL person DOU NEG know
'John doesn't know anyone.'

b. Yuehan (lian) [YI-fen qian]$_F$ *(**dou**) (bu) yao.
John LIAN one-cent money DOU NEG request
Without negation: 'John even doesn't want one cent.'
With negation: 'John wants it even if it is just one cent.'

I argue that the distributional pattern of the post-*dou* negation in a [*lian* MIN *dou* (NEG) ...] construction is also constrained by the additive presupposition of *dou*.

The additive presupposition of *dou* requires the prejacent not to be weakest proposition among the alternatives. In (61a), this requirement forces the minimizer *one person* to take reconstruction and gets inter-

[14]Note that this additive presupposition says nothing about the truth value of any subalternative, as shown in (i).

(i) **Lian** [Yuehan]$_F$ **dou** jige -le, qita-ren zenme mei -you?
LIAN John DOU pass -ASP, other-person how NEG -ASP.
'Even [John]$_F$ passed the exam, why is that the others didn't?'

preted below negation, as in (62b): without reconstruction, the prejacent would be *There is at least one person whom John didn't invite*, which is weaker than any alternatives of the form *There are at least n people whom John didn't invite* ($n > 1$); in contrast, under the LF in (62b) which involves reconstruction of *one person*, the prejacent ¬[*John invited at least one person*] is stronger than alternatives of the form ¬[*John invited at least n people*] ($n > 1$).

(62) a. ***Dou** [**one person**$_i$ NEG [John knows t_i]]
b. **Dou** [NEG [John knows **one person**]]

This reconstruction-based analysis is supported by the contrast in (63): when the minimizer *one person* serves as a subject, its surface position and reconstructed position are both higher than negation; therefore, the ungrammaticality in (63a) cannot be salvaged by reconstruction.

(63) a. *[YI-ge ren]$_F$ **dou** bu renshi Yuehan.
one-CL person DOU NEG know John.
Intended 'no one knows John.'
b. Yuehan [Yi-ge ren]$_F$ **dou** bu renshi.
John one-CL person DOU NEG know
'John doesn't know anyone.'

In (61b), however, under the assumption that John shouldn't want the money if the amount of money is too little, we expect that *John wants one cent* is more unlikely to be true than *John wants two cents*; therefore, the additive presupposition of *dou* can be satisfied even in absence of the post-*dou* negation.

7 Conclusions

In this paper, I offered a uniform semantics to capture the seemingly diverse functions of the Mandarin particle *dou*, including the quantifier use, the FCI-licenser use, and the scalar use. I proposed that *dou* is 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 the truth of the prejacent and the negation of each pre-exhaustified sub-alternative.

Basically, sub-alternatives are alternatives that are not innocently excludable and are distinct from the prejacent. The pre-exhaustification effect is realized by a basic exhaustifier (viz., the *O*-operator). Depending on the meaning of its associated item, *dou* functions either as a universal quantifier/distributor or as a universal FCI-licenser.

When *dou* is associated with a scalar item, sub-alternatives are the ones that rank lower than the prejacent sentence with respect to the contextually relevant measurement, and the pre-exhaustification effect is realized by the scalar exhaustifier JUST. In particular, in a [*lian* Foc *dou* …] sentence, sub-alternatives are the alternatives that are more likely (viz., less unlikely) to be true than the prejacent.

The additive presupposition of *dou* explains the distributional pattern of *dou* and many of its semantic consequences, such as the requirements regarding to distributivity, plurality, and monotonicity, 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.

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References

Bennett, Jonathan. 1982. Even if. *Linguistics and Philosophy* 5(3). 403–418.

Champollion, Lucas. 2015. Stratified reference: The common core of distributivity, aspect, and measurement. *Theoretical Linguistics* 41(3–4). 109–149.

Cheng, Lisa L-S. 2009. On every type of quantificational expression in Chinese. In Monika Rathert & Anastasia Giannakidou (eds.), *Quantification, definiteness, and nominalization*, 53–75. Oxford University Press.

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

Cheng, Lisa Lai-Shen & Anastasia Giannakidou. 2013. The non-uniformity of *wh*-indeterminates with polarity and free choice in Chinese. In Stephen Harlow Kook-Hee Gil & George Tsoulas (eds.), *Strategies of quantification*, vol. 44, 123–154. Oxford University Press.

Chierchia, Gennaro. 2006. Broaden your views: Implicatures of domain widening and the “logicality” of language. *Linguistic Inquiry* 37(4). 535–590.

Chierchia, Gennaro. 2013. *Logic in grammar: Polarity, free choice, and intervention*. Oxford University Press.

Chierchia, Gennaro, Danny Fox & Benjamin Spector. 2012. The grammatical view of scalar implicatures and the relationship between semantics and pragmatics. In Claudia Maienborn, Klaus von Heusinger & Paul Portner (eds.), *Semantics: An international handbook of natural language meaning*, vol. 3, 2297–2331. Berlin: De Gruyter.

Chierchia, Gennaro & Hsiu-Chen Liao. 2015. Where do Chinese *wh*-items fit. In Luis Alonso-Ovalle & Paula Menéndez-Benito (eds.), *Epistemic indefinites: Exploring modality beyond the verbal domain*, 31–59. Oxford University Press.

Dayal, Veneeta. 1998. *Any* as inherently modal. *Linguistics and Philosophy* 21(5). 433–476.

Dayal, Veneeta. 2013. *A viability constraint on alternatives for free choice*. Basingstoke: Palgrave Macmillan.

Fox, Danny. 2007. Free choice and the theory of scalar implicatures. In Sauerland, Uli & Penka Stateva (ed.), *Presupposition and implicature in compositional semantics*, 71–120. Basingstoke: Palgrave Macmillan.

Fox, Danny & Benjamin Spector. to appear. Economy and embedded exhaustification. *Natural Language Semantics* .

Gajewski, Robert J. 2007. Neg-raising and polarity. *Linguistics and Philosophy* 30(3). 289–328.

Giannakidou, Anastasia. 2001. The meaning of free choice. *Linguistics and Philosophy* 24(6). 659–735.

Giannakidou, Anastasia & Lisa Lai-Shen Cheng. 2006. (in)definiteness, polarity, and the role of *wh*-morphology in free choice. *Journal of Semantics* 23(2). 135–183.

Hamblin, Charles L. 1973. Questions in Montague English. *Foundations of Language* 10(1). 41–53.

Hole, Daniel. 2004. *Focus and background marking in Mandarin Chinese: System and theory behind* cai, jiu, dou *and* ye. Taylor & Francis.

Horn, Laurence. 1969. A presuppositional analysis of *only* and *even*. *Chicago Linguistics Society (CLS)* 5. 98–107.

Kay, Paul. 1990. Even. *Linguistics and Philosophy* 13(1). 59–111.

Kratzer, Angelika. 2008. On the plurality of verbs. In Johannes Dölling, Tatjana Heyde-Zybatow & Martin Schäfer (eds.), *Event structures in linguistic form and interpretation*, 269–300. Berlin: De Gruyter.

Krifka, Manfred. 1995. The semantics and pragmatics of polarity items. *Linguistic Analysis* 25(3-4). 209–257.

Lahiri, Utpal. 1998. Focus and negative polarity in Hindi. *Natural Language Semantics* 6(1). 57–123.

Lee, Thomas Hun-tak. 1986. *Studies on quantification in Chinese*. Los Angeles, CA: University of California dissertation.

Liao, Hsiu-Chen. 2011. *Alternatives and exhaustification: Non-interrogative uses of Chinese* wh-*words*. Cambridge, MA: Harvard University dissertation.

Lin, Jo-Wang. 1998. Distributivity in Chinese and its implications. *Natural Language Semantics* 6(2). 201–243.

Link, Godehard. 1983. The logical analysis of plurals and mass terms: A lattice-theoretical approach. In Rainer Bäuerle, Christoph Schwarze & Arnim von Stechow (eds.), *Meaning, use, and interpretation of language*, 302–323. Berlin: De Gruyter.

Liu, Mingming. to appear. Varieties of alternatives: Mandarin focus particles. *Linguistics and Philosophy* .

Paris, Marie-Claude. 1998. Focus operators and types of predication in Mandarin. *Cahiers de Linguistique Asie Orientale* 27(2). 139–159.

Portner, Paul. 2002. Topicality and (non-)specificity in Mandarin. *Journal of Semantics* 19(3). 275–287.

Rooth, Mats. 1985. *Association with focus*. Amherst, MA: University of Massachusetts dissertation.

Rooth, Mats. 1992. A theory of focus interpretation. *Natural Language Semantics* 1(1). 75–116.

Rooth, Mats. 1996. Focus. In Shalom Lappin (ed.), *The handbook of contemporary semantic theory*, 271–297. Oxford: Blackwell Publishers.

Schwarzschild, Roger. 1996. *Pluralities*. Dordrecht: Springer Science & Business Media.

Sharvy, Richard. 1980. A more general theory of definite descriptions. *The Philosophical Review* 89(4). 607–624.

Shyu, Shu-Ing. 2004. Asymmetries between Mandarin Chinese *lian-dou* and *shenzhi*. *Journal of Chinese Linguistics* 81–128.

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