Keeping *Dou* as a Simple Distributor*

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Abstract  
Against the *even* analysis of *dou*, this paper argues that a simple distributor semantics of *dou* can be maintained with two assumptions: (i) Mandarin sentences allow an optionally overt topic set [12]; (ii) scalar *dou*-sentences have an optionally overt preposition *lian* [1, 15].

1 Introduction  
The multi-functional particle *dou* has drawn immense attention from Chinese linguists. The two main uses exemplified in (1) and (2), with *dou* as a distributor and a focus operator *even*, respectively, raise an imminent question — what is the semantic core of *dou* that conditions its distribution?

(1) Tamén *dou* mai le yi liang che
They *dou* buy Asp one CL car

(2) Zhangsan *dou* xihuan Lisi
Zhangsan *dou* like Lisi

Linguists take two different routes to answer this question. The first route is to treat the distributive use as the core function of *dou* that subsumes the *even* reading as a special case [12]. To the contrary of the first, the second route is to analyze *dou* as *even* while attributing the distributive reading to a covert *dist* operator [11]. In this paper, I argue that analyses along the second route are on the wrong track, evidenced by a set of incorrect predictions made by the *even* analysis of *dou*. I show that a simple distributor semantics for *dou* can be maintained with a satisfactory account of its distribution in (1) and (2), if we make two assumptions. First, as a topic prominent language, Mandarin allows an optionally overt topic set in a sentence. Second, the *even*-sentences with *dou* have an optionally present preposition *lian* [1, 15] that makes non-trivial contribution to the scalar reading.

2 Flaws in the *even* analyses of *dou*
Mandarin Chinese *wh+dou* resembles the *indefinite+even* sequences found cross-linguistically. With a clause-mate negation, it gives rise to an NPI reading; with a generic predicate, it has a universal reading. The parallel is illustrated here with a comparison between Mandarin and Hindi,

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1As [10] points out, *dou* does not require to distribute down to atoms. I use *each* here for simplicity.

2All Hindi examples are from [7], glosses his. The same behavior of *indefinite+even* sequence is also found in Japanese, Korean, Bangla, Malayalam and many more languages. Due to space constraint, I only present Hindi examples in this paper for illustration.
Lahiri gives the same kind of semantics to one NP

...one NP

...the other alternatives. The two implicatures are thus satisfied as long as the prejacent is true.

...a downward-entailing environment. The prejacent, again, logically entails all other alternatives, the two implicatures are satisfied as long as the prejacent is true.

...an indefinite like ‘someone’ introduces a variable satisfying the kuch operator binds the variable introduced by

...motivated by an observation made by Fauconnier [3] that (8) and (9) mean the same.

...is an NPI and a universal reading is also exhibited by minimizers one NP+dou and one NP+even in Mandarin and Hindi, respectively, in (5)-(6). Given the similarities between Hindi indefinite+even and one NP+even, Lahiri [7] proposes to reduce the former to the latter. Specifically, an indefinite like ‘someone’ introduces a variable satisfying the cardinality predicate one and the NP restriction, i.e. one(x)∧person(x). In (4a), an existential closure closes off the the variable introduced by koi. The negation turns the existential statement into a negative one, serving as the prejacent of the focus operator bhii. Bhii activates the alternatives of its associate koi, each with one replaced with a different cardinality predicate two, three, etc. Moreover, bhii imposes two implicatures. The additive implicature says there is at least one true alternative distinct from the prejacent. The least likelihood implicature says the prejacent is the least likely one among its alternatives.

The same alternation between an NPI and a universal reading is also exhibited by minimizers one NP+dou and one NP+even in Mandarin and Hindi, respectively, in (5)-(6). Given the similarities between Hindi indefinite+even and one NP+even, Lahiri [7] proposes to reduce the former to the latter. Specifically, an indefinite like ‘someone’ introduces a variable satisfying the cardinality predicate one and the NP restriction, i.e. one(x)∧person(x). In (4a), an existential closure closes off the the variable introduced by koi. The negation turns the existential statement into a negative one, serving as the prejacent of the focus operator bhii. Bhii activates the alternatives of its associate koi, each with one replaced with a different cardinality predicate two, three, etc. Moreover, bhii imposes two implicatures. The additive implicature says there is at least one true alternative distinct from the prejacent. The least likelihood implicature says the prejacent is the least likely one among its alternatives. The formal representation of the prejacent, the alternative set and the two implicatures are given in (7). Since the prejacent logically entails all other alternatives, the two implicatures are satisfied as long as the prejacent is true.

In a generic sentence (4b), Lahiri gives the same kind of semantics to kuch bhii. The generic operator binds the variable introduced by kuch, which locates in the restrictor of the universal generic quantifier, a downward-entailing environment. The prejacent, again, logically entails all the other alternatives. The two implicatures are thus satisfied as long as the prejacent is true.

Lee and Horn [8] have very similar ideas as Lahiri, who argue that English NPI any NP is underlyingly one NP+even in negative sentences. In generic sentences, however, they argue that any is a superlative plus even, motivated by an observation made by Fauconnier [3] that (8) and (9) mean the same.

Alfred will eat any food.

Alfred will eat the most awful food.

Given the resemblance between Chinese wh+dou and Hindi indefinite+even, it is tempting to carry over the aforementioned two theories to the Chinese data. Despite the temptation, however, I will show that their theories make incorrect predictions on the Chinese data.
Another recent even theory of dou is proposed by Liu [11], who assumes the same semantics for dou as that given by Karttunen and Peters [3] to English even, (10). The even-sentences with dou are thus captured without ado.

As for a distributive sentence like (1), Liu assumes a covert dist operator [14] is present. The alternatives are formed by replacing the plurality associated with dou with its subparts. The prejacent logically entails all other alternatives, as shown in Figure 1, making the least likelihood automatically satisfied, wherefore the even flavor of dou is not sensed. I will show that this theory also makes incorrect predictions.

2.1 Problems with Lahiri’s theory

Reducing wh+dou to one NP+dou in Chinese cannot explain their different grammatical status in (11) or (12) as an NPI. When Lisi forgot to count the cardinality of the students, (11b) is a grammatical complaint but (11a) is not. When Lisi held his debut in his hometown instead of any big city, (12a) is a grammatical description but (12b) is not.

Moreover, wh+dou and one NP+dou behave differently in their universal uses. When discussing who can be the President, (13a) is a grammatical statement but (13b) is not. When evaluating the weight of a table, (14b) is a grammatical report but (14a) is not.

2.2 Problems with Lee and Horn’s theory

Lee and Horn [8] account for the NPI use of English any in the same spirit as Lahiri [7], analyzing any as underlyingly indefinite+even argued to be semantically equivalent to the minimizer one NP+even. The same problem plaguing Lahiri’s theory on the NPI use thus carries over. As for the generic use, Lee and Horn take any as a superlative plus even, a theory that has its own problem.
(15) a. Any set is a subset of itself.     b. *Even the biggest set is a subset of itself.
(16) a. shei dou you shengmu
     who DOU have biological mom
     Anyone has a biological mother.
b. *zuilaode ren dou you shengmu
     oldest pers. DOU have biological mom
     Even the oldest one has a biological mother.

(15a) states an axiom in Mathematics. The satisfaction of the predicate only has to do with the property of being a set, without activating any kind of scalar relationship between the sets. Actually, an attempt to impose such a scale will fail, (15b). Likewise, the predicate ‘has a biological mother’ only concerns the NP restriction person of who in (16) without reference to any scale. Hence the contrast between (16a) and (16b).

2.3 Problem with Liu’s theory

Liu [11] ascribes the absence of the even flavor in distributive dou-sentences to the automatic satisfaction of the least likelihood presupposition imposed by dou. This analysis predicts the even flavor of dou to be subdued whenever the prejacent logically entails all other alternatives. While it seems to be true in the distributive (1), the prediction is not borne out in a collective sentence (17), even if the latter exhibits the same logical entailment relations between the prejacent and the alternatives as the former, see Figure 2\(^3\).

(17) Yuehan, John and Bill together DOU can squeeze into this cl box. more neg need shuo Yuehan he Mali liang ge ren le say John and Mary two CL people SFP even J, M and B together can squeeze into the box. Let alone the two of J and M.

\[
\text{Figure 1: Distributive (1) } \quad \begin{array}{ccc}
\text{Dist}(f, a + b + c) & | & \text{Dist}(f, a + b) \\
\text{Dist}(f, a + c) & | & \text{Dist}(f, b + c) \\
\text{Dist}(f, a) & | & \text{Dist}(f, b) \\
\text{Dist}(f, c) & | & \text{Dist}(f, c)
\end{array}
\]

\[
\text{Figure 2: Collective (17) } \quad \begin{array}{ccc}
\text{Dist}(f, a + b + c) & | & \text{Dist}(f, a + b) \\
\text{Dist}(f, a + c) & | & \text{Dist}(f, b + c) \\
\text{Dist}(f, a) & | & \text{Dist}(f, b) \\
\text{Dist}(f, c) & | & \text{Dist}(f, c)
\end{array}
\]

2.4 Interim conclusion

Analyzing dou as even obligates a scalar relationship between the alternatives triggered by the focus associate of dou. This requirement, however, clashes with the unordered set denoted by a singular wh-indefinite in wh+ dou constructions. In the NPI use, this clash is obscured when the predicate is distributive (3a), but is foregrounded when the predicate is collective relative to the indefinite (11a). In the universal use, this clash is also veiled by a distributive predicate (3b), but is spotlighted when the predicate comes with an obligatory scalar requirement on the argument indefinite (14b). Reducing wh-indefinite+ dou to a scalar phrase+ dou, be it a minimizer or a superlative, therefore, cannot explain the drastic differences in their compatibility/incompatibility with the same predicate.

\(^3\)f in Figure 1 and Figure 2 refers to the predicate in the respective sentences.
The distinction between Chinese wh+dou and one NP/superlative+dou is also corroborated by an old observation in English by Heim [4], who classified NPIs into ones with an inherent even and ones without. The former type includes any/ever and the latter includes minimizers one NP+even. Heim shows that minimizers are only grammatical in sentences that facilitate the satisfaction of their scalar implicatures, but any does not have such requirement. Hence the contrast between (18a) and (18b).

(18) a. ??Every restaurant that charges so much as a dime for iceberg lettuce happens to have four stars in the handbook.
   b. Every restaurant that advertises in any of these papers happens to have four stars in the handbook.

Since wh+dou behaves in line with English any in its NPI and universal use, the conclusion drawn by Heim [4] casts further doubt on the even analyses of dou. In light of all the incorrect predictions made by the current even theories of dou and the corroboration from English data, I argue that the even analyses of dou are on the wrong track.

3 Dou as a simple distributor

I propose that dou can be treated as a simple distributor once we make two assumptions, both having been argued for elsewhere by other linguists. First, Mandarin Chinese allows a covert topic set present in sentences [12]. Second, the even-sentences with dou always have a semantically active preposition lian, overt or covert [15]. The semantic entry for dou in this proposal is as in (19).

(19) \([dou]^g = \lambda P_{x\tau}, \lambda Q_{x\tau}, \forall x[Q(x) \rightarrow P(x)]\]^4

3.1 The distributive sentences with dou

Chinese subjects are moved to the topic position by default [9], shown by the felicitous insertion of topic markers between the subject and the predicate (20). Moreover, with contextual support, it’s free to drop the topic (21), wherefore the semantic equivalence of the following two sentences in the given context.

Context: You ask John whether the students have come for class. John answers:

(20) Xueshengmen a/na dou lai le student TOP DOU come SFP

(21) dou lai le DOU come SFP

Students have all come.

Students have all come.

In a simple distributive sentence like (1), dou distributes over the subject topic they. Suppose they denotes the set of John and Mary. We get the truth condition in (22) accordingly. When the topic set is covert whose value is determined by the context like (21), dou does the same job. Suppose the covert topic has an index j, we get the truth condition in (23) accordingly.

(22) \([1][g] = 1 \text{ iff } \forall x[x \in \{j, m\} \rightarrow \exists y[\text{car}(y) \land \text{bgt}(y)(x)]\]

(23) \([21][g] = 1 \text{ iff } \forall x[x \in g(j) \rightarrow \text{come}(x)]\]

As pointed out before, dou does not require to distribute down to atoms [10]. Here, I give this entry to simplify the illustration. A more rigorous entry is as in (i), where C is a cover on the plurality associates with dou in the sense of Schwarzchild [14].

\(i \quad [dou]^g = \lambda P_{x\tau}, \lambda Q_{x\tau}, \forall x[Q(x) \land C(x) \rightarrow P(x)]\)
The composition of distributive sentences with *dou* is quite straightforward. We now turn to the scalar *even* sentences with *dou*.

### 3.2 The *even* sentences with *dou*

In an *even* sentence with *dou*, the topic set is again optionally overt. Moreover, a preposition *lian* literally meaning ‘including’ that precedes the focus associate is optionally present as well. As a result, the following four sentences all mean the same in the given context.

**Context:** John thinks Mary is the most popular student in their class because Bill, the aloofest student, likes her.

(24) tamenban lian Bi’erF dou xihuan Mali (25) tamenban Bi’erF dou xihuan Mali (In their class), even Bill likes Mary. (In their class), even Bill likes Mary.

(26) lian Bi’erF dou xihuan Mali (27) Bi’erF dou xihuan Mali (In their class), even Bill likes Mary. (In their class), even Bill likes Mary.

Since *dou* is not *even*, as we have concluded, the semantic contribution of *even* is naturally shifted to *lian*.

I propose a semantic entry for *lian* as in (28). Specifically, its semantics is broken down to three ingredients. I name them likelihood presupposition, membership condition and property condition respectively.

\[
\begin{align*}
[l\text{ian}[^w]^g &= \lambda x \lambda Y \lambda P : \\
\forall z (z \in (F-\text{Alt}(x) \cap Y) \land z \neq x) \rightarrow \lambda w'.P_w(Y\{\{x\}\}) >_{\text{likely}} \lambda w'.P_w(Y\{\{z\}\})]
\end{align*}
\]

\[
\begin{align*}
x \in Y & \quad \land \quad P_w(Y) \\
\text{likelihood presupposition} & \quad \land \quad \text{property condition}
\end{align*}
\]

Take (24), whose logical form is given in Figure 3 for example. Suppose ‘their class’, the topic set, denotes the set of students \{john, mary, bill, sue\}. The focus alternatives F-Alt(John) is the set of all elements of the same type as John, i.e. \(D_e\) \[13\]. The topic set confines the quantificational domain of *lian* to the members in it only.

The composition of (24) is shown in (29).

(29) a. \([\text{25}][^w,g] = \lambda Q, \forall x [x \in Q \rightarrow \text{like}(w)(m)(x)]\]

b. \([\text{25}][^w,g] = \lambda P : \\
\forall z (z \in \{j, m, b, s\}) \rightarrow \lambda w'.P_w(\{j, m, b, s\}) >_{\text{likely}} \lambda w'.P_w(\{j, m, b, s\}\{\{z\}\})]
\]

\[
\begin{align*}
b \in \{j, m, b, s\} & \quad \land \quad P_w(\{j, m, b, s\}) \\
\text{likelihood presupposition} & \quad \land \quad \text{property condition}
\end{align*}
\]

\[\]
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c. \(\exists^w \gamma = 1 \iff \forall z (z \in \{j, m, s\}) \rightarrow \forall y \in \{j, m, s\}[\text{like}(y)] > \text{likely} \forall y \in \{j, m, b, s\}\{z\}[\text{like}(m)(y)]\).

The membership condition says Bill is a member of the topic set of students. The property condition says *dou-VP* holds of the topic set, i.e. every student in the topic set likes Mary. We deduce from the two conditions that Bill likes Mary. The likelihood presupposition says for every other student \(z\) distinct from Bill in the topic set, the likelihood that *dou-VP* holds of the topic set with Bill subtracted from the set is higher than the likelihood that *dou-VP* holds of the topic set with \(z\) subtracted from it. If \(z\) is Sue, the likelihood presupposition is reduced to (30), i.e. the likelihood that Sue likes Mary is greater than the likelihood that Bill likes Mary. Iterating through all the other students will lead to the conclusion that Bill is the least likely one among the students to like Mary.

\[
(30) \forall y \in \{j, m, b, s\}\{s\}[\text{like}(m)(y)] > \text{likely} \forall y \in \{j, m, b, s\}\{s\}[\text{like}(m)(y)]
\]

\[
\text{like}_w(m)(j) \land \text{like}_w(m)(m) \land \text{like}_w(m)(s) > \text{likely} \text{like}_w(m)(j) \land \text{like}_w(m)(m) \land \text{like}_w(m)(b)
\]

\[
p_j \times p_m > p_j \times p_m \\
p_s > p_b
\]

(\(p_s\) stands for the likelihood that \(x\) likes Mary)

The proposed semantics for *lian* can easily explain the *even* sentences with *dou* when the focus associate is a scalar term. In (31), the topic set is the set of time instants that have arrived, a set with the utterance time as the ending element \(\{u \in \ldots \epsilon \ldots \}u\). A covert *lian* is assumed to be present, giving the logical form as in (32). The truth condition derived for this sentence is in (33).

(31) \text{wudian} \text{dou dao le, zemne hai mei hao} 5 o’clock DOU arrive Asp, how come still NEG good 

Even 5 o’clock has arrived. How come you are still not done?

(32) \text{LF: } [\forall x \{u \in \ldots \epsilon \ldots \}u \text{ [dou } x\text{ [dou has arrived]]}

(33) \[\exists^w \gamma = 1 \iff \forall z (z \in \{u \in \ldots \epsilon \ldots \}) \rightarrow \forall y \in \{u \in \ldots \epsilon \ldots \}[\text{arr}(y)] > \text{likely} \forall y \in \{u \in \ldots \epsilon \ldots \}\{z\}[\text{arr}(y)]\).

The membership condition says 5 o’clock is at least as early as the utterance time. The property condition says the utterance time and all the instants preceding it have arrived. From these two conditions, we know that 5 o’clock has arrived. The likelihood presupposition requires the likelihood of the instants in the topic set with 5 o’clock subtracted having all arrived be higher than the likelihood of the instants in the topic set with any non-5 o’clock instant subtracted having all arrived. This presupposition can only be satisfied when 5 o’clock is itself the utterance time. If 5 is not the utterance time, the likelihood that the instants in the topic set with 5 subtracted have all arrived is the same as the likelihood that the utterance time has arrived (due to the fact that for an instant to have arrived means for this instant and every instant preceding it to have arrived). As a result, for any instant \(t\) in the topic set that is distinct from 5, the likelihood presupposition is reduced to (34). If \(t\) is not the utterance time,
the likelihood on either side will be the same, both being the likelihood of the utterance time having arrived. If \( t \) is the utterance time, the likelihood on the left will be smaller, not greater than the likelihood on the right, as the utterance time is later than any instant in the topic set with itself subtracted. In other words, when 5 is not the utterance time, the likelihood presupposition cannot be satisfied for any instant \( t \) distinct from 5, be it the utterance time or not.

\[
(34) \quad \lambda w'. arr_w'(u) >_{\text{likely}} \forall y \in \{..., u\} \setminus \{t\} [\lambda w'. arr_w'(y)]
\]

If 5 is the utterance time, however, \( t \) has to be an instant preceding 5. The likelihood presupposition for any \( t \) is accordingly reduced to (35). A later instant having arrived entails any earlier instant having arrived, thus is less likely. Since the utterance time 5 o’clock is later than any instant in the topic set with 5 subtracted, the presupposition is satisfied in this case.

\[
(35) \quad [\forall y \in \{..., 5\} \setminus \{5\} [\lambda w'. arr_w'(y)]] >_{\text{likely}} [\lambda w'. arr_w'(5)]
\]

I have shown that we can keep \textit{dou} as a simple distributor with the semantics in (19), as long as two assumptions are adopted. First, Mandarin Chinese allows a covert topic set. Second, in even sentences with \textit{dou}, a focus operator \textit{lian} is always present, covertly or overtly. These two assumptions have been argued for in previous literature and are not concocted specifically for the current proposal on \textit{dou}.

4 Discussion

Taking \textit{dou} as a distributor in (19) necessarily implements a universal quantification over the topic set. Recall that in (24), the property condition imposed by \textit{lian} requires that every student in the class like Mary. Two reviewers wonder whether the universal quantification is overly strong, considering especially the fact that linguists [2, 5, 6] have encoded the quantification in the presupposition rather than the assertion of English even. Moreover, a sentence like (36) seems to be felicitous in a context where the speaker expresses her surprise that other people who are more punctual than John are late.

(36) Even John has arrived. How come the other people are still not here?

I do not have a satisfactory answer to this question yet and leave it for future research.

Another reviewer raises the question of how to account for a free choice sentence with \textit{dou} (37) using the current proposal. While a complete discussion of the free choice \textit{wh+dou} construction in Chinese is beyond this paper, I give the main idea of how the proposed theory will explain (37) here.

(37) Yuehan huo zhe Mali \textit{dou} keyi dang zongtong

John or Mary \textit{dou} can be president

John can be the president and Mary can be the president.

The disjunctive marker \textit{or} forms a set out of its flanking arguments. The subject topic in (37), therefore, is a set of John and Mary \{\( j, m \)\}. The VP that \textit{dou} takes as its first input is a modal one — ‘can be the president’, which is interpreted as a set of individuals, with each individual being the president in an epistemically accessible world, formally represented in (38). \textit{Dou} then claims that each member in the subject topic set is in the set denoted by the VP, giving a truth condition as in (39).

\footnote{Rooth [13] treats the quantification of the alternatives as part of the conventional implicature of even, similar to my stance in this paper. However, he argues for an existential quantification rather than a universal one.}
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(38) \(\lambda x.\exists w'[w' is epistemically accessible to \(w_0 \land President(x) in \ w]\)

(39) \([\{37\}] = 1 \iff \\
\forall x [x \in \{j,m\} \rightarrow \exists w'[w' is epistemically accessible to \(w_0 \land President(x) in \ w']]

Still another question from the reviewers is why a negation can be inserted before *dou* in a simple distributive sentence (40), but not in an *even* sentence (41). The answer has two parts. First of all, the negation is a focal negation locating syntactically higher in the structure with an optional focal marker *shi* after it. Second, the negation follows the topic set. In (40), the topic set is overt but in (41) it is covert. An analogous *even* sentence to be compared to (40) should be the grammatical (42) rather than the ungrammatical (41).

(40) Tamenban bu (shi) dou xihuan Mali (41) *Lian Yuehan bu dou xihuan Mali
they class NEG FOC DOU like Mary LIAN John NEG DOU like Mary
Their class don’t all like Mary. It’s not that even John likes Mary.

(42) (tamenban) bu (shi) lian Yuehan dou xihuan Mali
t heir class NEG FOC LIAN John DOU like Mary
Among their class, it is not the case that even John likes Mary.

5 Conclusion

This paper discusses the multi-functional particle *dou* in Mandarin Chinese. Specifically, I argue to keep *dou* as a simple distributor. The recent *even* theories of *dou* have been shown to make incorrect predictions on the (un)grammaticality of the NPI and universal use of *wh*-*dou* constructions with certain predicates as well as on the presence/absence of the *even* flavor of a *dou*-sentence. Adopting two assumptions that have been argued for in Mandarin — Mandarin Chinese allows a covert topic set and *even*-sentences in Mandarin allow an optionally overt focus operator *lian* — I propose a simple distributor semantics of *dou* and shift the labor of *even* to the focus operator *lian*. The proposal is able to capture the distributive and *even* sentences with *dou*. The question of whether it is too strong to make a universal assertion in the *even* sentences with *dou* that the predicate holds of all the members in the topic set is left for future research.

References


