Deriving the ambiguity of mention-some questions by pre-exhaustifications[1]

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1. Introduction

- Mention-some (MS) questions like (1) admit both MS answers and mention-all (MA) answers (Groenendijk & Stokhof 1984). MA answers can take either a conjunctive form or a disjunctive form.

  (1) Where can we get gas?
  (*w: there are only two accessible stations, A and B.*)
  a. Station A. — MS
  b. Station A and Station B. — Conjunctive MA
  c. Station A or Station B. — Disjunctive MA

- **Proposal:** The MS/MA ambiguity in (1) comes from the absence/presence of a covert O_{DOU}-operator ($\approx$ Mandarin particle *dou*); using O_{DOU} derives disjunctive MA answers and blocks MS.

- Key data on *dou*:

  – In a $\Diamond$-question, presence of *dou* above the weak modal blocks MS.

  (2) Wo **dou** keyi zai [nali] mai kafei?
  I DOU can at where buy coffee
  'Where all can I buy coffee? ($^{\text{OK}}$MA, # MS)'

  – In a declarative, *Dou*+$\Diamond$ licenses the $\forall$-FC uses of pre-verbal disjunctions.

  (3) [Yuehan huozhe Mali] **dou** keyi jiao hanyu.
  John or Mary DOU can teach Chinese
  'Both John and Mary can teach Chinese.'

Roadmap:

§2 Basics of MS/MA ambiguity

§3 Defining Mandarin particle *dou*: a pre-exhaustification exhaustifier on sub-alternatives

§4 Using O_{DOU} to derive disjunctive MA answers

2. Basics of MS/MA ambiguity

2.1. The pragmatic view

- Complete answers are always exhaustive. MS answers are acceptable iff they are sufficient for the conversational goal behind the question. (Groenendijk & Stokhof 1984; Dayal 1996; van Rooij 2004; a.o.)

- See Xiang (2015, to appear a) for arguments against the pragmatic account.

[1] I thank Gennaro Chierchia, Danny Fox, Jim Huang, and the audience at Questions in Logic and Semantics Workshop at Amsterdam Colloquium for helpful comments and discussions. All errors are mine.

2.2. The semantic view

- Fox (2013) proposes that every *maximally informative* (MaxI) true answer counts as a complete true answer.

> (4) $\text{MaxI}(\alpha) = \{p : p \in \alpha \wedge \forall q \in \alpha[q \not\subset p]\}$
> (The set of members that are not asymmetrically entailed by any of the members)

(5) Who came to the party?
(w: only John and Mary came to the party.)
$Q_w = \{came'(j), came'(m), \underline{came'(j \oplus m)}\}$

(6) Who can chair the committee?
(w: only John and Mary can chair the committee; one chair only.)
$Q_w = \{\underline{\Diamond chair'(j)}, \underline{\Diamond chair'(m)}\}$

⇒ A question admits MS iff it can have multiple MaxI true answers.

⇒ A question admits only MA iff its answer space is closed under conjunction.

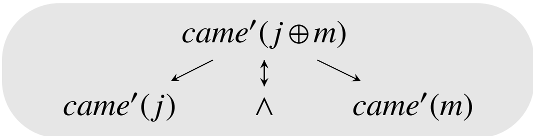


Fig. 1

- Fox (2013, 2015) attributes the MS/MA ambiguity of a $\Diamond$-question to the scope ambiguity of distributivity.
  - In German, presence of *alles* above the weak modal blocks MS.

(7) a. $\Diamond >$ *alles* [*MS possible*]
Was kann ich **alles** mit 3 Euros kaufen?
What can I all with 3 Euros buy

b. *alles* $> \Diamond$ [*MA only*]
Was **alles** kann ich mit 3 Euros kaufen?
What alles can I with 3 Euros buy

  - The *wh*-trace X is associated with a covert distributor Each; the answer space of a $\Diamond$-question is closed under conjunction iff $[X\ \text{Each}] > \Diamond$.

(8) Who can chair the committee?
(w: only John and Mary can chair the committee; one chair only.)

a. $\Diamond > [X\ \text{Each}]$ [*MS*]
i. $Q = \{\Diamond\text{Each}(X)(\lambda x.chair'(x)) : X \in {}^*person'\}$
ii. $Q_w = \{\underline{\Diamond chair'(j)}, \underline{\Diamond chair'(m)}\}$

b. $[X\ \text{Each}] > \Diamond$ [*MA*]
i. $Q = \{\text{Each}(X)(\lambda x.\Diamond chair'(x)) : X \in {}^*person'\}$
ii. $Q_w = \{\Diamond chair'(j), \Diamond chair'(m), \underline{\Diamond chair'(j) \wedge \Diamond chair'(m)}\}$

- **But**, there should be other ways to capture the MS/MA ambiguity.
  (i) Although $\Diamond >$ *alles*, (7a) also admits MA.
  (ii) Fox's analysis cannot derive disjunctive MA answers grammatically.

2.3. Local exhaustification

- **Puzzle**: (9a), which is intuitively a good MS answer, is asymmetrically entailed by (9b).

(9) Who can serve on the committee?
(w: the committee can be made up of either Gennaro+Danny or Gennaro+Danny+Jim)
a. Gennaro and Danny. $\Diamond[serve'(g \oplus d)]$
$\Uparrow$
b. Gennaro, Danny, and Jim. $\Diamond[serve'(g \oplus d \oplus j)]$

Solution: Intuitively, (9a) means that *to form the committee, it is possible to have only Gennaro and Danny serve on the committee*. Thus I assume that the weak modal *can* embeds a covert exhaustivity *O*-operator associated with the *wh*-trace.

(10) $O(p) = p \wedge \forall q \in \text{NE}(p)[\neg q]$ where $\text{NE}(p) = \{q : q \in \mathcal{A}lt(p) \wedge p \nsubseteq q\}$ (Chierchia et al. 2012)

O creates a non-monotonic environment w.r.t. the *wh*-trace; thus both (9a-b) are MaxI true answers.

3. Mandarin particle *dou*

3.1. Data

- In a $\Diamond$-question, presence of *dou* above the weak modal blocks MS.[2]

(11) Wo **dou** keyi zai [nali] mai kafei?
I DOU can at where buy coffee
'Where all can I buy coffee?' (^{OK}MA; # MS)

- In declaratives, Mandarin *dou* has more uses than German *alles*: ∀-quantifier & distributor, scalar indicator, ∀-FCI licenser, minimizer-licenser.

– *∀-quantifier & distributor*

(12) [ABC] **dou** mai -le fangzi.
ABC DOU buy -ASP houses
'ABC **dou** bought houses.' (# collective; √ distributive; √ cumulative)

– *∀-FCI licenser*

(13) [Yuehan huozhe Mali] **dou** keyi jiao jichu hanyu.
John or Mary DOU can teach introductory Chinese
'Both John and Mary can teach Introductory Chinese.'

– *Scalar marker*

(14) Ta **dou** lai -guo [SAN] -ci -le.
he DOU come -EXP three time -ASP.
'He has been (here) three times.'
$\rightsquigarrow$ Being here three times is a lot.

– ...

[2] Under this use, *dou* must c-command the *wh*-item; but it appears after the subject if the subject isn't interrogative. This distribution shows that *dou* is located between IP and VP somewhere c-commands the *wh*-item.

3.2. Defining *dou* as a pre-exhaustification exhaustifier

- I define *dou* as a special exhaustifier: (i) *dou* operates on sub-alternatives; (ii) *dou* has a pre-exhaustification effect. (See more details in Xiang (to appear b))

(15) a. $\text{Sub}(p) = \{q : q \in \mathcal{A}lt(p) \wedge p \subset q\}$ (To be revised)
(the set of weaker alternatives)
b. $\textbf{dou}(p) = \exists q \in \text{Sub}(p).\ p \wedge \forall q \in \text{Sub}(p)[\neg O(q)]$
i. Presupposition: p has at least one sub-alternative.
ii. Assertion: p is true, the exhaustification of each p's sub-alternative is false.

(16) '[John and Mary] **dou** came.'
a. $\text{Sub}(came'(j \oplus m)) = \{came'(j), came'(m)\}$
b. $\textbf{dou}(came'(j \oplus m)) = came'(j \oplus m) \wedge \underline{\neg O[came'(j)] \wedge \neg O[came'(m)]}$

- **Quantifier & Distributor:** The presupposition of *dou* captures the distributivity effect (cf. Lin 1996): to generate sub-alternatives, the prejacent of *dou* must be monotonic wrt the position associated with *dou*.

(12a′) '*abc* **dou** bought houses.'
× Collective:
abc together bought houses.$\not\Rightarrow$ *ab* together bought houses.
Sub(*abc together bought houses*) = ∅

√ Distributive:
abc each bought houses. ⇒ *ab* each bought houses.
Sub(*abc each bought houses*) = {*x each bought-houses* : $x < abc$}

√ Cumulative:
Cov(*abc*) each bought houses. ⇒ *D* each bought houses, where $D \subset \text{Cov}(abc)$
Sub(Cov(*abc*) *each bought houses*) = {*D each bought-houses* : $D \subset \text{Cov}(abc)$}

- **∀-FCI licenser:** Applying *dou* to a disjunction negates the pre-exhaustified domain (D)-alternatives, yielding a ∀-FC inference.

(17) [John or Mary] **dou** can teach Introductory Chinese.
a. $\text{Sub}(\Diamond f(j) \vee \Diamond f(m)) = \{\Diamond f(j), \Diamond f(m)\}$
b. $[\![\textbf{dou}[\Diamond f(j) \vee \Diamond f(m)]]\!] = [\Diamond f(j) \vee \Diamond f(m)] \wedge \neg O \Diamond f(j) \wedge \neg O \Diamond f(m)$
$= [\Diamond f(j) \vee \Diamond f(m)] \wedge [\Diamond f(j) \rightarrow \Diamond f(m)] \wedge [\Diamond f(m) \rightarrow \Diamond f(j)]$
$= \Diamond f(j) \wedge \Diamond f(m)$

- **!Problem:** In (17), the D-alternatives are stronger than the disjunction, how could they be sub-alternatives?
Revision: Sub-alternatives can be non-weaker, but not innocently (I)-excludable.

(18) **I-excludable alternatives** (Fox 2007)
$\text{IExcl}(p) = \{q : q \in \mathcal{A}lt(p) \wedge \neg\exists q' \in \text{NE}(p)[p \wedge \neg q \rightarrow q']\}$ where $\text{NE}(p) = \{q : q \in \mathcal{A}lt(p) \wedge p \not\subseteq q\}$
({q: affirming p and negating q doesn't entail any alternative that is not entailed by p})

(19) **Sub-alternatives** (final version)
$\text{Sub}(p) = \mathcal{A}lt(p) - \text{IExcl}(p) - \{p\}$
(the set of alternatives excluding I-excludable alternatives and the prejacent)

The D-alternatives of $\Diamond f(j) \vee \Diamond f(m)$ are not I-excludable: $[\Diamond f(j) \vee \Diamond f(m)] \wedge \neg \Diamond f(j) \rightarrow \Diamond f(m)$

4. Deriving disjunctive MA via a covert *dou*

(20) "Where can I get gas?" "From station A or station B."

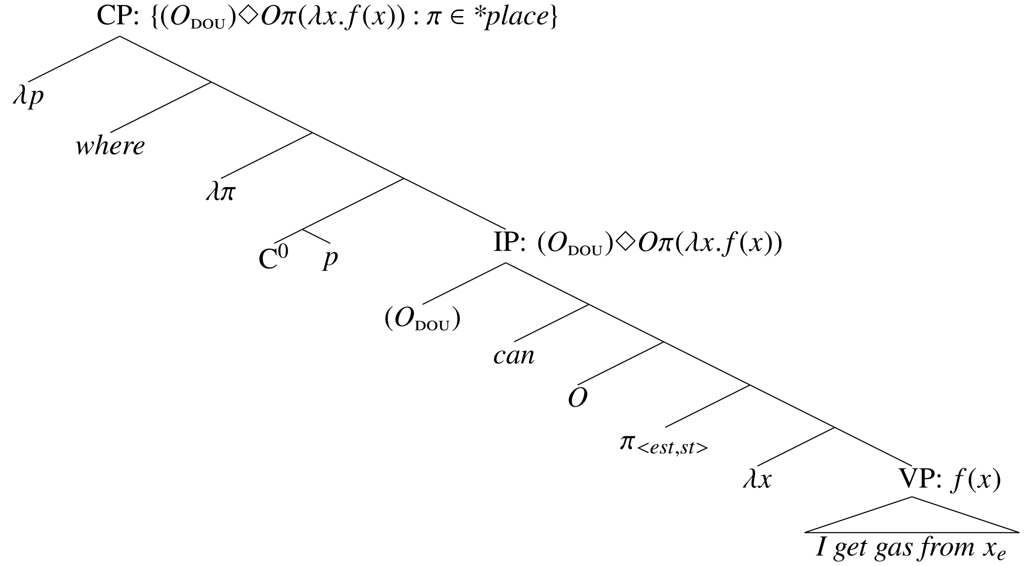
  (i) You can get gas from A or B, the choice is up to you. [Complete (MA)]

  (ii) You can get gas from A or B, I don't remember which. [partial]

- **Proposal**: A $\Diamond$-question admits only MA when an O_{DOU}-operator (the covert counterpart of *dou*) is present above the weak modal and associated with the *wh*-trace.

I. **Logical form:**

(21) Where can I get gas?



– The *wh*-item takes QR to π and then takes *wh*-movement to the spec of interrogative CP. The higher-order *wh*-trace π can denote a generalized quantifier like *a or b*:

(22) $[\![a \text{ or } b]\!] = \lambda P_{<e,st>}.\lambda w_s.P_w(a) \vee P_w(b)$

– Optionally, there exists an O_{DOU}-operator associated with the *wh*-trace π across the weak modal.

(23) $O_{\text{DOU}}(p) = p \wedge \forall q \in \text{Sub}(p)[\neg O(q)]$

II. **Answer space:**

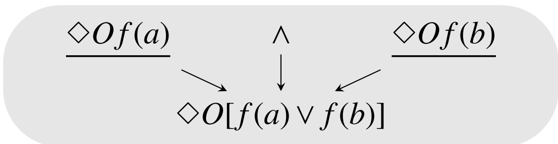


Fig. 2: MS (without O_{DOU})

⇒

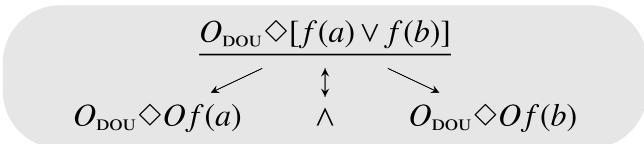


Fig. 3: MA (with O_{DOU})

(i) *Without* O_{DOU}:
  – Both individual answer are MaxI true answers, which therefore yields MS.
  – The disjunctive answer is asymmetrically entailed by the individual ones and hence is incomplete.

(ii) *With* O_{DOU}:
  – The disjunctive answer is strengthened into an FC statement, which is semantically equivalent to the conjunction of the individual answers. (See (24))
  – The answer space is closed under conjunction, which therefore blocks MS.

(24) a. The embedded O uses up the scalar alternative and the focus alternatives.

$$\Diamond O[f(a)\vee f(b)] = \Diamond[[f(a)\vee f(b)]\wedge\neg[f(a)\wedge f(b)]\wedge\neg f(c)]$$
$$= \Diamond[[f(a)\wedge\neg f(b)\wedge\neg f(c)]\vee[f(b)\wedge\neg f(a)\wedge\neg f(c)]]$$
$$= \Diamond[Of(a)\vee Of(b)]$$

b. Applying O_{DOU} uses up the D/sub-alternatives, yields an FC inference:

$$O_{\text{DOU}}\Diamond O[f(a)\vee f(b)] = \Diamond[Of(a)\vee Of(b)]\wedge\neg O\Diamond Of(a)\wedge\neg O\Diamond Of(b)$$
$$= \Diamond[Of(a)\vee Of(b)]\wedge[\Diamond Of(a)\rightarrow\Diamond Of(b)]\wedge[\Diamond Of(b)\rightarrow\Diamond Of(a)]$$
$$= \Diamond[Of(a)\vee Of(b)]\wedge[\Diamond Of(a)\leftrightarrow\Diamond Of(b)]$$
$$= \Diamond Of(a)\wedge\Diamond Of(b)$$

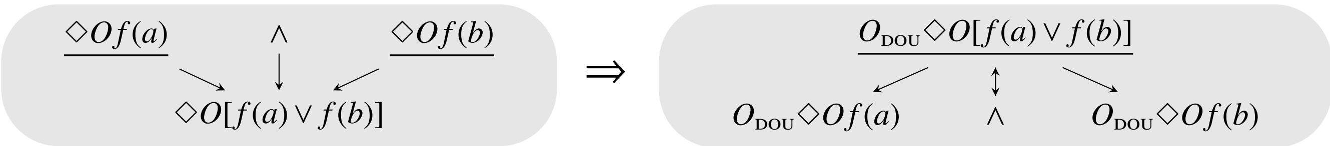
5. Conclusions

- A question takes a MA reading iff its answer space is closed under conjunction, otherwise takes MS.
- The Mandarin particle *dou* is a pre-exhaustification exhaustifier operating on sub-alternatives.

(25) a. $\textbf{dou}(p) = \exists q\in\text{Sub}(p).p\wedge\forall q\in\text{Sub}(p)[\neg O(q)]$

b. $\text{Sub}(p) = \mathcal{A}lt(p) - \text{IExcl}(p) - \{p\}$

- The MS/MA ambiguity of a $\Diamond$-question comes from the absence/presence of the O_{DOU}-operator.



  - In absence of O_{DOU}, a $\Diamond$-question can have multiple MaxI true answers, yielding MS.
  - O_{DOU} strengthens disjunctives into FC statements, making the answer space closed under conjunction and therefore blocking MS.

Appendix I: Disjunctive answers in other questions

- **Fact 1**: In a non-modalized question, a disjunctive answer can also be strengthened into a conjunctive answer via O_{DOU}, as in (27). Why is that it cannot be complete?

(26) "Where did John get gas?" "Station A or station B." [Partial only]

(27) $O_{\text{DOU}}f(a\vee b) = [f(a)\vee f(b)]\wedge\neg Of(a)\wedge\neg Of(b) = f(a)\wedge f(b)$

Explanation: For p being a complete answer, $O(p)$ must be non-contradictory (à la Spector 2007).

In (27), the scalar alternative hasn't been used; exhaustifying (27) affirms the FC inference and negates the scalar alternative (and the focus alternatives), yielding a contradiction.

(28)
$$O[O_{\text{DOU}}f(a\vee b)] = O_{\text{DOU}}(f(a)\vee f(b))\wedge\neg[f(a)\wedge f(b)]\wedge\neg f(c)$$
$$= [f(a)\wedge f(b)]\wedge\neg[f(a)\wedge f(b)]\wedge\neg f(c)$$
$$= \bot$$

This type of contradiction doesn't arise in $\Diamond$-questions: in (24), the scalar alternative has been used by the local O-operator; therefore applying exhaustification to (24) is semantically vacuous.

- **Fact 2**: In a singular-marked question, a disjunctive answer can only be partial. (Fox 2013)

  (29) "Which book is John allowed to read?" "*Semantics* or *Pragmatics*."

  (30) "Which book is John required to read?" "*Semantics* or *Pragmatics*."

  Explanation: A singular *wh*-phrase lives on a set consisting of only atomic elements (Fox 2013), thus the Hamblin set of a singular-marked question consists of only propositions naming singularities.

  Related, the overt particle *dou* cannot be used in singular-marked questions: propositions naming singularities have no sub-alternatives; thus the presupposition of *dou* is not satisfied.

  (31) Dou [na -xie/*-ge ren] lai -le?
  DOU what -CL_{pl}/-CL_{sg} person come -ASP
  'Which people all came?'/'*Which person all came?'

Appendix II: Cf. extending Fox (2007)

- One may suggest to analyze *dou* as Fox's (2007) recursive exhaustification operator O_R: (i) exhaustification negates only innocently excludable alternatives; (ii) exhaustification applies recursively.

  In (32), 1st exhaustification negates scalar alternatives and focus alternatives;D-alternatives are not innocently excludable. 2nd exhaustification negates the pre-exhaustified D-alternatives.

  (32) $O_R\Diamond[f(a) \vee f(b)]$

  a. First exhaustification:
  $O\Diamond[f(a) \vee f(b)] = \Diamond[f(a) \vee f(b)] \wedge \neg\Diamond[f(a) \wedge f(b)] \wedge \neg\Diamond f(c)$ ~~$\wedge \neg\Diamond f(a) \wedge \neg\Diamond f(b)$~~

  b. Second exhaustification:
  $$\begin{aligned} O'O\Diamond[f(a) \vee f(b)] &= O\Diamond[f(a) \vee f(b)] \wedge \neg O\Diamond f(a) \wedge \neg O\Diamond f(b) \\ &= O\Diamond[f(a) \vee f(b)] \wedge [\Diamond f(a) \rightarrow \Diamond f(b)] \wedge [\Diamond f(b) \rightarrow \Diamond f(a)] \\ &= O\Diamond[f(a) \vee f(b)] \wedge [\Diamond f(a) \leftrightarrow \Diamond f(b)] \\ &= \Diamond f(a) \wedge \Diamond f(b) \wedge \neg\Diamond[f(a) \wedge f(b)] \wedge \neg\Diamond f(c) \end{aligned}$$

- O_R makes the answers mutually exclusive. Thus $O_R\Diamond[f(a) \vee f(b)]$ can be a complete answer.

  (33) "What is John allowed to read?" "Book A or Book B."

  a. $Q = \{O_R\Diamond\pi(\lambda x.read'(x)) : x \in *thing'\}$

  b. $Q_w = \{O_R\Diamond f(a \vee b)\}$

  c. $Ans(Q)(w) = \{O_R\Diamond[f(a) \vee f(b)]\}$

  $O_R\Diamond f(a) \quad \vee \quad O_R\Diamond f(b)$

  $O_R\Diamond[f(a) \vee f(b)]$

- But, exhaustifying with O_R yields a strongly exhaustive (SE) reading, which is too strong in many cases. A more commonly available MA reading is the intermediately exhaustive (IE) reading (Klinedinst & Rothschild 2011; Cremers & Chemla 2014; Uegaki 2015; Xiang to appear a)[3]

  (34) "John predicated who came."

  a. *SE*: $\forall x$ [x came $\rightarrow$ J pred x came] $\wedge$ $\forall x$ [x didn't come $\rightarrow$ **not** [J pred x came]]

  b. *IE*: $\forall x$ [x came $\rightarrow$ J pred x came] $\wedge$ $\forall x$ [x didn't come $\rightarrow$ J pred x did**n't** come]

[3] One might suggest to insert an O below the weak modal so as to use up the F-alternatives locally: $O_R\Diamond Of(a \vee b)$. But local exhaustification is not available in a non-modalized question.

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