Mention-some readings of questions: Complexities from number marking *

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Abstract

Despite the well-known fact that ◇-questions systematically accept mention-some answers, number marking on *wh*-complements adds two constraints to the distributional pattern of mention-some. First, a singular question admits a unique true answer and hence disallows mention-some. Second, a plural question disallows a mention-some answer that names only a singularity. I argue that the former constraint comes from a closure requirement on short answers, and the latter from the anti-presupposition of the plural morpheme.

1 Introduction

Generally speaking, good answers are exhaustive answers. For example, to properly answer (1), one needs to specify all the actual attendants to the party, as in (1a). We call exhaustive answers like (1a) "mention-all (MA) answers". If an addressee can name only some of the attendants, then to be cooperative, he would ignorance-mark his answer. For instance, he could state the ignorance inference explicitly as in (1b), or mark his answer with a prosodic rise-fall-rise couture as in (1c). If a non-exhaustive answer is not properly marked, it would be interpreted exhaustively.

(1) Who came the party?
(*w*: only John and Mary came to the party.)
a. John and Mary did.
b. John did. I'm not sure who else did.
c. JOHN did.
L H* L-H%

Contrary to (1), as firstly observed by Groenendijk & Stokhof (1984), *wh*-questions with an existential modal, called "◇-questions" henceforth, also admit non-exhaustive answers. For instance, one can naturally answer the ◇-question (2) by specifying one or all of the qualified candidates. The MA answer (2b) can be either a conjunction or a disjunction; in the disjunctive form, the MA answer takes a free choice interpretation. Crucially, the non-exhaustive answer (2a), unlike (1b-c), does not need to carry any ignorance-mark. To highlight this difference, we call (2a) "mention-some (MS) answers", while (1b-c) "partial answers".

(2) Who can chair the committee?
(*w*: the committee can and can only be chaired by John or Mary.)
a. John. [MS answer]
b. John and/or Mary. [MA answer]

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Moreover, number-marking on *wh*-complements adds two more pieces of complexities to the distributional pattern of MS. First, a singular question, namely a *wh*-question where the *wh*-complement is marked as singular, can have only one true answer. For instance, (3b) is incoherent because the second clause contradicts the uniqueness inference that *only one of the professors can chair*.

(3) a. Who can chair the committee? √ I know that several professors can.
b. Which professor can chair the committee? # I know that several professors can.
c. Which professors can chair the committee? √ I know that several professors can.

Second, a plural $\diamond$-question rejects an MS answer that names only an atomic individual. Compare (4) and (5). If the committee should have one chair but multiple members, an MS answer of (4) and (5), if it is available, names an atomic individual (e.g. *John*) and a sum (e.g. *John+Mary*), respectively. With this difference, while (5) admits both MS and MA answers, (4) accepts only the MA answer (4b) and requires the non-exhaustive answer (4a) to be ignorance-marked. The contrast between (4-5) is more salient in embedding contexts: (6a) requires John to know the MA answer of (4); while (6b) only requires John to know an MS answer of of (5).

(4) Which professors can chair the committee?
(w: the committee can and can only be chaired by either John or Mary.)
a. John. # (I'm not sure who else can.)
b. John and/or Mary.

(5) Which professors can form the committee?
(w: the committee can only be formed by any two professors among John, Mary, and Sue.)
a. John+Mary.
b. John+Mary, John+Sue, and/or Mary+Sue.

(6) a. John knows which professors can chair the committee.
b. John knows which professors can form the committee.

2 Previous Studies

2.1 Dayal (1996)

Uniqueness: the strongest true answer exists Dayal (1996) adopts the Hamblin-Karttunen semantics of questions and defines a presuppositional Ans_D-operator to derive good answers from the Hamblin denotation: $\text{Ans}_D(Q)(w)$ returns the unique strongest true answer of Q in w and presupposes its existence. The strongest true answer is the true answer that entails all the true answers.

(7) $\text{Ans}_D(Q)(w) = \exists p[w \in p \in Q \wedge \forall q[w \in q \in Q \rightarrow p \subseteq q]].$
$\iota p[w \in p \in Q \wedge \forall q[w \in q \in Q \rightarrow p \subseteq q]]$

The presupposition of Ans_D captures the uniqueness requirement of singular questions: in a singular question, the presupposition of Ans_D is satisfied iff this question has a unique true answer which names a singularity. First, following Link (1983), Dayal assumes that a singular NP denotes a set of atomics, while a plural NP ranges over both atomic and sum domains. For instance, with two professors j and m taken into considerations, we have $professor' = \{j, m\}$ and $professors' = {*}professor' = \{j, m, j \oplus m\}$. Thus, the Hamblin set denoted by the plural question (8a) includes plural propositions, while the one denoted by the singular question (8b) does not. For simplicity, I use Q_w to represent the full set of true answers of Q in w: $Q_w = \{p : w \in p \in Q\}$. In a world where multiple professors came to the party, (8a) has a strongest true answer, namely the plural answer, but (8b) does not.Thus, finally, exercising Ans_D in (8b) gives rise to a presupposition failure.

(8) (w: among the professors, only John and Mary came to the party.)

a. Which professors came to the party?	b. Which professor came to the party?
$Q = \{came'(x) : x \in {*}professor'\}$	$Q = \{came'(x) : x \in professor'\}$
$Q_w = \{came'(j), came'(m), came'(j \oplus m)\}$	$Q_w = \{came'(j), came'(m)\}$
$\text{Ans}_D(Q)(w) = came'(j \oplus m)$	$\text{Ans}_D(Q)(w)$ is undefined

To sum up, Dayal's account of uniqueness predicts that a question is always defined iff its answer space is closed under conjunction, which ensures the existence of the strongest true answer.[1]

MS answers are partial answers Dayal's (1996) analysis predicts that a question primarily has only one good answer, namely the strongest true answer. But an MS answer cannot be the strongest, why is it acceptable in $\Diamond$-questions? Dayal (in prep: chapter 3) attributes the acceptability of MS to pragmatic factors and assumes that MS answers are special partial answers that are sufficient for the goal behind the question.[2] This idea follows the lines of Groenendijk & Stokhof (1984), van Rooij (2004), van Rooij & Schulz (2006), and among the others: a non-exhaustive answer does not have to carry an ignorance-mark as long as it suffices for the conversational goal of the question. For example, consider the question *where can I get gas?*. If the goal for the questioner is just to find a place to get gas, the addressee only needs to name one accessible gas station; in contrast, if the goal is to investigate the gas market in the considered area, the addressee needs to list out all the gas stations in the considered area. For simplicity, let us call the former goal a "mention-one" goal, while the latter a "mention-all" goal.

I agree that pragmatics plays a role in distributing MS; for instance, if a question is semantically ambiguous between MS and MA, a goal that calls for an exhaustive answer can block MS. But, I doubt that MS is derived pragmatically from the start. This claim has already been reached by George (2011) and Fox (2013). I provide two more empirical arguments against the pragmatic account of MS.

First, intermediate answers, which are more informative than MS answers, are partial answers and must be ignorance-marked. For instance, under a "mention-one" goal, the intermediate answer (9b), which names more than one but not all of the candidates, should be sufficient for the goal; nevertheless, (9b) must to be ignorance-marked, otherwise would be interpreted exhaustively.

(9) Who can chair the committee?
(w: the committee chair can and can only be either John, Mary, or Sue.)
  a. John. (I'm not sure who else can.)
  b. John and/or Mary. # (I'm not sure who else can.)
  c. John, Mary, and/or Sue.

More generally, the obligatory ignorance-mark on intermediate answers suggests that whether an answer admits a non-exhaustive reading is primarily determined by its grammatical structure: an unmarked individual answer can be non-exhaustive; while an unmarked disjunctive or conjunctive answer cannot.

[1]Note that closing the quantificational domain of the *wh*-item under sum does not guarantee the existence of the strongest true answer. In (1), *ab* and *cd* each formed a team does not entail *abcd* together formed one. To avoid overly predicting a presupposition failure, Dayal should include the conjunctive proposition $form'(a \oplus b) \wedge form'(c \oplus d)$ as a possible answer.

(1) Who formed a team? # $Q_w : \{form'(a \oplus b), form'(c \oplus d)\}$

[2]Dayal (in prep: chapter 3) adds the following condition to capture the distributional pattern of MS in plural questions: an MS answer should be able to be used as an MA answer of the given question in a compatible world. She claims that there is no world where a proposition naming a singularity could be used as an MA answer of a plural question. Accordingly, (4a) is not qualified to be an MS answer because it cannot be an MA answer of (4).

First, in embedding contexts, good answers are always mention-one or mention-all, as in (10a) and (10b), respectively. But a conversational goal can be naming any amount of chair candidates. For instance, the following scenario has a "mention-three" goal: the dean wants to make plans for a committee and wants to meet three people who can chair this committee. In this scenario, a pragmatic account incorrectly predicts (10) to take the odd reading (10c): (10) is true iff John knows three or more candidates, and false if John knows less than three candidates. A semantic account, on the other hand, can easily handle the unacceptability of (10c): good answers generated from logical forms are either mention-one or mention-all, not intermediate.

(10) John knows who can chair the committee.

a. For some individual x who can chair, John knows that x can chair. √

b. For every individual x who can chair, John knows that x can chair. √

c. For some three individuals xyz who each can chair, John knows that xyz each can chair. ×

2.2 Fox (2013)

MS answers are maximally informative true answers To capture MS grammatically, Fox (2013) proposes a weaker Ans_F-operator: $\text{Ans}_F(Q)(w)$ returns the set of *maximally informative* (MaxI) true answers of Q in w, each of which is a good answer. A true answer is MaxI iff it is not asymmetrically entailed by any true answers. A cross-categorical definition for MaxI is given in (12).

(11) $\text{Ans}_F(Q)(w) = \{p : w \in p \in Q \wedge \forall q[w \in q \in Q \rightarrow q \not\subset p]\} = \text{MaxI}(Q_w)$ (First version)

(12) $\text{MaxI}(\alpha_{\langle\tau,t\rangle}) = \{a_\tau : a \in \alpha \wedge \forall b[b \in \alpha \rightarrow b \not\subset a]\}$

Next, Fox proposes that a question admits MS iff the output set of exercising Ans_F can be non-singleton. Compare (13-14). Underlining highlights their MaxI true answers. The basic *wh*-question (13) can have only one MaxI true answer; while the ◇-question (14) can have multiple ones, which are all MS answers.

(13) Who came to the party last night?
(w: only John and Mary came to the party yesterday.)

a. $Q_w = \{came'(j), came'(m), \underline{came'(j \oplus m)}\}$

b. $\text{Ans}_F(Q)(w) = \{came'(j \oplus m)\}$

(14) Who can chair the committee?
(w: the committee can and can only be chaired by either John or Mary.)

a. $Q_w = \{\underline{\Diamond chair'(j)}, \underline{\Diamond chair'(m)}\}$

b. $\text{Ans}_F(Q)(w) = \{\Diamond chair'(j), \Diamond chair'(m)\}$

Compared to Dayal (1996), Fox's analysis predicts that a non-exhaustive answer can be a good answer, and that a question can have multiple good answers.

Uniqueness: the IE-exhaustification of some answer is true The Ans_F-operator defined in (11), however, cannot capture the uniqueness requirement of singular questions. For instance, both the true answers in (15a) are MaxI. Thus, (11) incorrectly predicts that a singular question is an MS question.

(15) Which professor came to the party last night?
(w: among the professors, only John and Mary came to the party yesterday.)

a. $Q_w = \{\underline{came'(j)}, \underline{came'(m)}\}$

b. $\text{Ans}_F(Q)(w) = \{came'(j), came'(m)\}$ Problem!

Noticing this problem, Fox (2013) adds two more assumptions to his initial proposal. First, based on Spector's (2007, 2008) observations on $\Box$-questions, Fox adds higher-order disjunctive and conjunctive answers to the answer spaces of number-neutral and plural *wh*-questions. Spector (2007, 2008) observes that an elided disjunctive answer can completely answer a $\Box$-question. For instance in (16b), the disjunction can be interpreted as scoping below the universal modal, which yields a free choice interpretation that *John can read Syntax or MP, and he has to read one of them.*

(16) a. What does John have to read?
b. *Syntax* or *MP*. ($^{\text{OK}}$*or > have to*; $^{\text{OK}}$ *have to > or*)

(17) a. Which books does John have to read?
b. The French books or the English books. ($^{\text{OK}}$*or > have to*; $^{\text{OK}}$ *have to > or*)

To capture this reading, Spector proposes that a *wh*-question is semantically ambiguous between an individual reading and a higher-order reading. Under the latter reading, the *wh*-item lives on a set of upward monotone generalized quantifiers like $s \vee m$ (i.e. an existential generalized quantifier over the set $\{s, m\}$), producing answers like $\Box read'(j, s \vee m)$. Moreover, contrary to the cases in (16) and (17), Fox observes that a disjunctive answer of a singular $\Box$-question can only take an ignorance reading. For instance, (18b) can only mean *John either has to read Syntax or has to read MP.*

(18) a. Which book does John have to read?
b. *Syntax* or *MP*. ($^{\text{OK}}$*or > have to*; # *have to > or*)

Given the contrast between (16-17) and (18), Fox assumes that singular *wh*-phrases live on a set of atomic individuals, while bare *wh*-words and plural *wh*-phrases are semantically ambiguous: they either live on a set of individuals A, or a set of conjunctions and disjunctions (i.e. generalized universal or existential quantifiers over subsets of A). Accordingly, the true answer set of (19a) includes a higher-order disjunctive answer, while that of (19b) contains only individual answers.

(19) (w: the committee can and can only be chaired by either John or Mary.)
a. Which professor can chair the committee? $Q_w = \{\Diamond chair'(j), \Diamond chair'(m)\}$
b. Who can chair the committee? $Q_w = \{\Diamond chair'(j), \Diamond chair'(m), \Diamond chair'(j \vee m)\}$

Second, Fox (2013) proposes a weaker presupposition for the Ans_F-operator: $\text{Ans}_F(Q)(w)$ presupposes that there exists a possible answer whose *innocently exclusive (IE)-exhaustification* is true in w.

(20) $\text{Ans}_F(Q)(w) = \exists p \in Q[w \in \text{IE-Exh}(p, Q)].\text{MaxI}(Q_w)$ (Final version)

Unlike the traditional exhaustification (21) which negates all the non-weaker alternatives (see Chierchia et al. 2012 for a review), IE-exhaustification negates only innocently excludable alternatives, as defined in (22) (Fox 2007). An alternative q is innocently excludable to p iff affirming p and negating q is consistent with negating any other non-weaker alternatives of p.

(21) $\text{Exh}(p, Q) = p \wedge \forall q \in \text{Excl}(p, Q)[\neg q]$, where $\text{Excl}(p, Q) = \{q : q \in Q \wedge p \not\subseteq q\}$

(22) a. $\text{IE-Exh}(p, Q) = p \wedge \forall q \in \text{IExcl}(p, Q)[\neg q]$
b. $\text{IExcl}(p, Q) = \{q : q \in Q \wedge \neg\exists q' \in \text{Excl}(p, Q)[p \wedge \neg q \rightarrow q']\}$

In (19b), among the three true answers, the individual ones are not innocently excludable to the disjunctive one, because $\neg\Diamond chair'(j) \wedge \neg\Diamond chair'(m)$ contradicts $\Diamond chair'(j \vee m)$; the IE-exhaustification of $\Diamond chair'(j \vee m)$ does not negate any of the true answers and thus is true. In contrast, (19b) has no answer whose IE-exhaustification is true: IE-exhaustifying $\Diamond chair'(j)$ yields the negation of the other true answer $\Diamond chair'(m)$, and vice versa.

Challenges from quantified questions The presupposition of Ans_F, however, is still too strong to rule in individual MS readings of questions with a universal quantifier. The question (23) has two types of MS readings: (i) an individual MS reading, namely that *tell me one of the places where everyone can get gas*; and (ii) a pair-list MS reading, namely that *for each individual, tell me one of the places where he can get gas*. Let us focus on the individual MS reading. Note that the answers where *every* scopes below *can* are all false in w.

(23) Where can everyone get gas?
(w: everyone can get gas from station A, and everyone can get gas from station B. But both A and B have very limited stock, and thus it is impossible that everyone gets gas)

a. $Q = \{\forall y \in man'[\Diamond get\text{-}gas'(y, x)] : x \in {}^*place'\}$

b. $Q_w = \left\{ \begin{array}{l} \forall y \in man'[\Diamond get\text{-}gas'(y, a)] \\ \forall y \in man'[\Diamond get\text{-}gas'(y, b)] \\ \forall y \in man'[\Diamond get\text{-}gas'(y, a \vee b)] \end{array} \right\}$

c. $\text{Ans}_F(Q)(w)$ is undefined Problem!

Unlike the case in (19a), here the true individual answers are innocently excludable to the true disjunctive answer. Thus IE-exhaustifying the disjunctive answer negates the individual ones, yielding a false inference that *some but not all of the people can get gas from A, the others can get gas from B*. Therefore, the new definition of Ans_F in (20) predicts a presupposition failure in (23), contra the fact. This problem extends to other quantified questions, for instance:

(24) a. Where can half of your friends get gas?
b. Where can most of your friends get gas?

2.3 Interim summary

To sum things up for this section, both Dayal (1996) and Fox (2013) attribute the uniqueness requirement of singular questions to an existential presupposition of the Ans-operator. In particular, the Ans_D-operator by Dayal requires the existence of the strongest true answer. This requirement leaves no space for MS. The Ans_F-operator by Fox requires the existence of a possible answer that has a true IE-exhaustification inference. This requirement is still too strong to allow for individual MS readings in several quantified questions.

3 My Analysis

Uniqueness requirement: a closure requirement on true short answers We are now in a dilemma between uniqueness and MS: Dayal's (1996) account of uniqueness predicts that a question is not subject to uniqueness if the answer space is closed under conjunction; while Fox's (2013) MaxI-based account of MS predicts that MS is available only in an answer space that is not closed under conjunction. These two predictions are clearly contradictory.

To solve this dilemma, I will keep the basics of Fox's account of MS and revise Dayal's account of uniqueness as the following: **the conjunction of any true *short answers* must be a possible short answer.** This condition predicts that a question is not subject to uniqueness iff the set of short answers is closed under conjunction, regardless of whether the set of full answers is also closed.

The intuition is quite simple. (25a) cannot take both J and M as true short answers because it cannot take *J and M* as a possible short answer (cf. (25b)); likewise, (26a) cannot take both *J+M* and *J+S* as true short answers because it cannot take *J+M and J+S* as a possible short answer (cf. (26b)).

(25) a. Which professor came?
b. Which professors came?

(26) a. Which two professors formed a committee?
b. Which professors formed a committee?

Conjunction and disjunction are defined cross-categorically as in (27), à la *meet* and *join* in Inquisitive Semantics (Ciardelli & Roelofsen 2014).

(27) a. $\alpha_\tau \wedge \beta_\tau = \{\langle P_{\langle\tau,st\rangle}, w\rangle : P_w(\alpha)\} \cap \{\langle P_{\langle\tau,st\rangle}, w\rangle : P_w(\beta)\} = \lambda P_{\langle\tau,st\rangle}.\lambda w.P_w(\alpha) \wedge P_w(\beta)$
b. $\alpha_\tau \vee \beta_\tau = \{\langle P_{\langle\tau,st\rangle}, w\rangle : P_w(\alpha)\} \cup \{\langle P_{\langle\tau,st\rangle}, w\rangle : P_w(\beta)\} = \lambda P_{\langle\tau,st\rangle}.\lambda w.P_w(\alpha) \vee P_w(\beta)$

There are various linguistic methods to retrieve the short answers. Syntactically, short answers can be retrieved from full answers by ellipsis. Semantically, we can firstly extract a *topical property* out of the Hamblin set, as schematized in (28): $P_{\langle\tau,st\rangle}$ is a topical property of Q iff **(a)** P has the same set of partitions as Q; and **(b)** some possible answer of Q equals to some $P(\alpha)$.

(28) TP$\langle Q, P_{\langle\tau,st\rangle}\rangle$ iff

(a) $\forall w \forall w'[[\lambda\alpha_\tau.P_w(\alpha) = \lambda\alpha_\tau.P_{w'}(\alpha)] \leftrightarrow [Q_w = Q_{w'}]]$
(P has the same set of partitions as Q: for any two worlds w and w', the items having the property P are the same in w and w' iff the true answers of Q are the same in w and w'.)

(b) $\exists p \exists \alpha_\tau[p \in Q \wedge p = P(\alpha)]$
(For some p that is a possible answer of Q, there is some α s.t. p equals to $P(\alpha)$.)

Condition **(a)** makes use of Partition Semantics (Groenendijk & Stokhof 1984). But since a property and its negative counterpart (e.g. $\lambda x.\lambda w.came_w(x)$ vs. $\lambda x.\lambda w.\neg came_w(x)$) have the same set of partitions, we also need the Hamblin style condition **(b)** to rule out undesired properties.

Given a topical property P, a true short answer of Q in w is an item true for P in w (i.e. $\{\alpha : P_w(\alpha)\}$), and a possible short answer of Q is an item true for P in some world (i.e. $\{\alpha : \exists w[P_w(\alpha)]\}$). We can now state the closure requirement as in (29).

(29) **Closure (C)-Requirement**
For Q being defined in w, it must have a topical property P s.t. the conjunction of any items that are true for P in w is also true for P in some world.
$\exists P_{\langle\tau,st\rangle}[\text{TP}\langle Q, P\rangle \wedge \forall\alpha_\tau\forall\beta_\tau[P_w(\alpha) \wedge P_w(\beta) \rightarrow P(\alpha \wedge \beta) \neq \bot]]$

First, C-requirement predicts that a question requires uniqueness iff the conjunction of any two distinct short answers is not a possible short answer. The singular question (25a), under a *de re* or *de dicto* reading, provides the topical properties in the form of (30a) or (30b), respectively. (30a/b) maps an actual/possible professor to a possible answer. Since non-atomic item is false for *professor*′ in every world, and thus both (30a-b) map a non-atomic item to a contradiction. Therefore, the C-requirement is met in w iff (30a/b) holds for a unique atomic item in w.

(30) Which professor came?
a. $\lambda\alpha.\lambda w.\alpha \in professor'_{w_@} \wedge came'_w(\alpha)$ — *De re* reading
b. $\lambda\alpha.\lambda w.\alpha \in professor'_w \wedge came'_w(\alpha)$ — *De dicto* reading

Second, C-requirement and that a question is not subject to uniqueness iff the set of short answers is closed under conjunction. Given the fact that number-neutral and plural *wh*-questions can take elided conjunctions and disjunctions as complete answers, I assume that bare *wh*-words and plural *wh*-phrases live on a set $^{\text{INT}}{*P}$, which consists of not only members of the *wh*-complement $*P$, but also disjunctions and conjunctions. For instance, if $*professor' = \{a, b, a \oplus b\}$, then $^{\text{INT}}{*professor'} = \{a, b, a \oplus b, a \vee b, a \wedge b, a \vee (a \oplus b), a \vee b \vee (a \oplus b), ..., a \vee (a \wedge b), a \wedge (a \vee b), ...\}$. Thus the topical properties of the plural question (25b) are like (31a-b). They map a conjunction of actual/possible professors to a possible answer. Thus the C-requirement is always satisfied. Obviously, this prediction also applies to quantified questions.

(31) Which professors came?

a. $\lambda\alpha.\lambda w.\alpha \in {}^{\textsc{Int}}{*}professor'_{w_@} \wedge came'_w(\alpha)$ *De re* reading

b. $\lambda\alpha.\lambda w.\alpha \in {}^{\textsc{Int}}{*}professor'_{w} \wedge came'_w(\alpha)$ *De dicto* reading

My Ans_X-operator is thus defined as the following: $\text{Ans}_X(Q)(w)$ presupposes the C-requirement and the existence of at least one MaxI true answer of Q in w[3]; when defined, $\text{Ans}_X(Q)(w)$ returns the set of of MaxI true answers of Q in w.

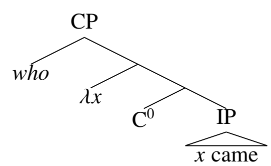
(32) $\text{Ans}_X(Q)(w)$ is defined iff (i) $\exists P_{\langle\tau,st\rangle}[\text{TP}\langle Q,P\rangle \wedge \forall\alpha\forall\beta[P_w(\alpha) \wedge P_w(\beta) \rightarrow P(\alpha \wedge \beta) \neq \bot]]$, and (ii) $\exists p \in \text{MaxI}(Q_w)$. When defined, $\text{Ans}_X(Q)(w) = \text{MaxI}(Q_w)$

MS/MA ambiguity: scope ambiguity of the higher-order *wh*-trace Unlike Dayal (1996), the C-requirement leaves space for MS: the conjunctive closure within the short answers can take scope at any propositional level within IP, and thus closing the set of short answers under conjunction does not necessarily close the set of full answers under conjunction. I argue that a $\Diamond$-question admits an MS reading when the conjunctive closure of the short answers takes scope below the existential modal.

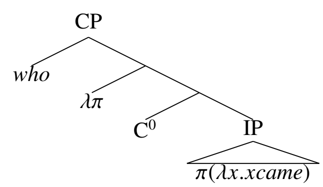
Recall that bare *wh*-word and plural *wh*-phrases live on a set consisting items of various types. Thus, the *wh*-trace of a bare *wh*-word or a plural *wh*-phrase is type flexible: if *who* is moved directly from a theta position, as in (33a), the *wh*-trace is of type *e*; if the *who* undertakes one or multiple QRs before moving to the spec of the interrogative CP, as in (33b), the *wh*-trace takes a higher type.

(33) Who came?

a.



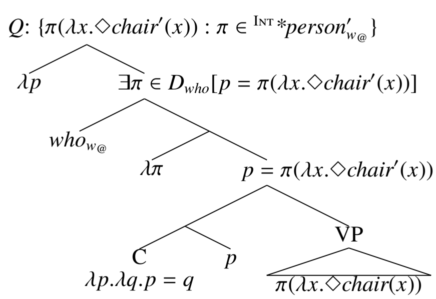
b.



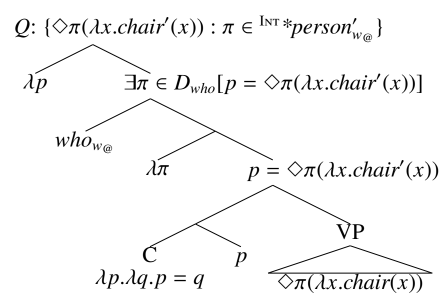
In the case of a number-neutral or plural $\Diamond$-question, the higher-order trace π can take scope above or below the weak modal, as illustrated in (34a) and (34b), respectively. I argue that MS is available if π scopes below the existential modal.[4][5]

(34) Who can chair the committee?
(w: the committee can and can only be chaired by John or Mary.)

a.



b.



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[3] The existential presupposition is to capture the negative island effects of degree questions.

[4] Here I only consider conjunctive MA answers. See Xiang (2015b) for discussions on disjunctive MA answers.

[5] This idea is close to Fox (2013) in several respects. Fox assumes that the *wh*-trace x has a phrase-mate EACH, and argues that a $\Diamond$-question can take MS when [x EACH] scopes below $\Diamond$. Compared to Fox (2013), the present analysis has advantages in analyzing questions with a collective predicate. For instance, *who formed a team?* needs conjunctive answers like $form'(a \oplus b) \wedge form'(c \oplus d)$; this answer can be derived from $form'(a \oplus b \wedge c \oplus d)$, but not from $\text{EACH}(a \oplus b \oplus c \oplus d)(form')$.

If the trace π scopes above *can*, exercising Ans_X returns the unique MaxI true answer, namely the conjunctive MA answer, as schematized in (35). Alternatively, if the *wh*-trace π scopes below *can*, the conjunctive and disjunctive closures scope below the weak modal. The set of true answers in (36a) has two MaxI members, both are MS answers. Note that the conjunctive answer $\Diamond chair'(j \wedge m)$ is false, since there can be only one chairing-event for the considered committee.

(35) MA reading: ($\pi > \Diamond$)

a. $Q_w = \{\Diamond chair'(j), \Diamond chair'(m), \Diamond chair'(j) \vee \Diamond chair'(m), \Diamond chair'(j) \wedge \Diamond chair'(m)\}$

b. $\text{Ans}_X(Q)(w) = \{\Diamond chair'(j) \wedge \Diamond chair'(m)\}$

(36) MS reading: ($\Diamond > \pi$)

a. $Q_w = \{\Diamond chair'(j), \Diamond chair'(m), \Diamond[chair'(j) \vee chair'(m)]\}$

b. $\text{Ans}_X(Q)(w) = \{\Diamond chair'(j), \Diamond chair'(m)\}$

Another question arises with the case of local conjunction. In (37), the local conjunctive answer (37a-i) is true and asymmetrically entails the individual answer (37a-ii). But intuitively the individual answer *Mary can help* is a good MS answer. In responding to this problem, I propose that the weak modal *can* optionally embeds an Exh-operator (defined in (21)) associated with the *wh*-trace, given that *Mary can help* intuitively means *Mary alone can help*. The Exh-operator creates a non-monotonic environment with respect to the *wh*-trace, breaking up the entailment relation from (i) to (ii), as schematized in (37b). Thus both the conjunctive answer and the individual answer are preserved as MaxI true answers.

(37) Who can help John?

(w: only Mary helps John in w_1, both Mary and Sue help John in $w2$)

a. (i) $\Diamond[help'(m, j) \wedge help'(s, j)] \quad \Rightarrow$ (ii) $\Diamond help'(m, j)$

b. (i) $\Diamond\text{Exh}[help'(m, j) \wedge help'(s, j)] \Rightarrow$ (ii) $\Diamond\text{Exh}[help'(m, j)]$

Anti-presuppositions of plural questions Recall that a plural question rejects an MS answer that names only a singularity: in (38), only (38b) admits MS, which names a sum.

(38) a. Which professors can chair the committee? (# MS, $^{\text{OK}}$ MA)

b. Which professors can form the committee? ($^{\text{OK}}$ MS, $^{\text{OK}}$ MA)

Sauerland et al. (2005) make use of the principle of *Maximize Presupposition* (MP) (Heim 1991) to analyze inferences evoked by plural-markings. This MP principle requires that out of two sentences which are presuppositional alternatives and which are contextually equivalent, the one with the stronger presuppositions must be used if its presuppositions are met in the context. Accordingly, Sauerland et al. (2005) argue that singulars are more presuppositional than plurals, and thus that plural-morphemes implicate an "anti-presupposition" that *the singular counterpart is undefined*.

Following this idea, I propose that the plural-morpheme on the *wh*-complement implicates an anti-presupposition: *the corresponding singular question is undefined*. Further, in spirit of the question-answer congruence, I propose that a proper answer of a plural question entails the anti-presupposition.

(39) A proposition p properly answers Q_{PL} in w iff

a. $p \in \text{Ans}_X(Q_{\text{PL}})(w)$; and b. $p \subseteq \lambda w. \text{Ans}_X(Q_{\text{SG}})(w)$ is undefined.

Accordingly, the plural question (38a) rejects MS because an MS answer does not entail the anti-presupposition that *the singular question 'which professor can chair the committee' is undefined*. In contrast, (38b) admits MS because its MS answers do entail the anti-presupposition that *the singular question 'which professor can form the committee' is undefined*.

4 Conclusions

This paper investigates the interactions between the distributional pattern of MS answers and the number-markings on *wh*-complements. First, I argue that the presuppositions of Dayal's (1996) and Fox's (2013) Ans-operators are both too strong to capture MS. Alternatively, I propose to account for the uniqueness requirement of singular questions with a closure requirement on short answers: the set of true short answers must be closed under $\cup$ or $\cap$. Second, I show that the MS/MA ambiguity of a $\diamond$-question can be explained by the scope ambiguity of the higher-order *wh*-trace: a $\diamond$-question admits MS when the higher-order *wh*-trace scopes below the existential modal. Last, I argue that a good answer to a plural question needs to entail the anti-presupposition of the plural morpheme.

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