Questions are higher-ordered: Solving the dilemma between uniqueness and mention-some

I propose a higher-ordered semantics of questions to address the following facts. **Fact 1:** singular-marked questions require uniqueness; for instance, (2) expects that a unique boy left, cf. (1). **Fact 2:** a $\diamond$-question (3) admits mention-some (MS) answers like (3a) (Groenendijk & Stokhof 1984). **Fact 3:** without an $\diamond$, a *wh*-question with a collective/anti-distributive predicate (4) admits only the mention-all (MA) answer (4a).

(1) Which boys left? a. $\surd$ w_1: only *a* left. b. $\surd$ w_2: only *a* and *b* left.

(2) Which boy left? a. $\surd$ w_1: only *a* left. b. # w_2: only *a* and *b* left.

(3) Who can chair the committee? (*w*: the committee can be chaired by *a* or *b*; co-chair is disallowed.)
a. $\surd$ *a* can chair. b. $\surd$ *a* or *b* can chair.

(4) Which boys are in the same team? (*w*: there are two teams, made up of *ab* and *cd*, respectively)
a. $\surd$ *ab* are in the same team, and *cd* are .... b. # *ab* are .... c. # *abcd* are ....

Dayal (1996) adopts the H(amblin)-K(arttunen) semantics of questions and defines an ANS_D-operator to derive good answers from the H-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 entailing all the true answers.

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

Dayal captures **Fact 1**. The singular term *boy* ranges over only atomic items. The true answers of the singular-marked question (2) in w_1 and w_2 are (6a) and (6b), respectively. The unique true answer in (6a) is the strongest, while neither of the members in (6b) is the strongest. The presupposition of ANS_D predicts that (2) is defined in w_1 but not in w_2. In contrast, the plural term *boys* ranges over both atomic and sum items; therefore the true answers of (1) in w_2 also include $L(j, a+b)$, which entails all the true answers.

(6) a. $\surd w_1 : \{L(j,a)\}$ b. $\# w_2 : \{L(j,a), L(j,b)\}$ c. $\surd w_2 : \{L(j,a), L(j,b), \underline{L(j,a+b)}\}$

Nevertheless, Dayal cannot capture **Fact 2-3**. For (3) and (4), if their question denotation are $\{\diamond C(x) : x \in \textbf{people}\}$ and $\{I(x) : x \in \textbf{boys}\}$ respectively, they have no strongest true answer in *w*. To avoid predicting a presupposition failure in (3-4), Dayal must let the answers closed under conjunction via a generalized distributivity operator PART (Schwarzschild 1996), as in (7). This solution, however, leads to two problems. First, it predicts that (3) primarily accepts only MA and thus has to attribute the acceptability of MS to pragmatic factors (e.g. von Rooij 2004). Second, it incorrectly predicts that (8) admits distributive answers like (8a); however, (8) disallows to distribute over *four boys* and accepts only answers in the form of (8b).

(7) $[\text{ANS}_D\ \lambda p$ [[which boys] λX [[C p] [[X PART_C] are in the same team]]]]

(8) Which four boys are in the same team? a. # *ab* and *cd* each are .... b. $\surd$ *abcd* are ....

Fox (2013) defines a weaker ANS_D to address **Fact 2**: $\text{ANS}_F(Q)(w)$ returns the set of maximally informative (MaxI) true answers of Q in w, as schematized in (9). Each of the MaxI true answers counts as a good answer. This analysis allows questions to have multiple good answers and to admit non-exhaustive answers. Accordingly, both the MS answers of the $\diamond$-question (3), i.e. $\diamond C(a)$ and $\diamond C(b)$, are good answers.

(9) $\text{ANS}_F(Q)(w) = \{p : w \in p \in Q \wedge \forall q[w \in q \in Q \rightarrow q \not\subset p]\}$
($\{p : p$ is a true answer of Q in w and is not asymmetrically entailed by any true answers of Q in w $\}$

Nevertheless, the definition (9) predicts that (2) behaves exactly the same as (3) and fails to address **Fact 1**: the singular answers in (6b) are logically independent and thus are both MaxI. Moreover, Fox cannot explaining **Fact 3**: depending on whether assuming the answers to be closed via distributivity, Fox either predicts (8) to admit distributive answers like (8a), or predicts (4) to admit partial answers like (4b).

S-requirement To solve the dilemma between **Fact 1-2**, I argue that the uniqueness requirement comes from the *S(umpremum)-requirement*: "Let Q = *Which P f ?*, D is an arbitrary subset of P s.t. all the answers in

$\{f(x) : x \in D\}$ are true in w. Then for Q being defined in w, the supremum of D ($^{\oplus}D$) must be a member of P." Accordingly, (2) is undefined in w_2 since $a+b \notin$ **boy**; in contrast, (1) is defined in w_2, since $a+b \in$ **boys**.

(10) If $D = \{x\}$, then $^{\oplus}D = x$; if $D = \{x1, x2, ..., xn\}$, then $^{\oplus}D = x1 + x2 + ... + xn$ Link (1983)

My proposal The S-requirement, however, cannot be checked under the H-K semantics: it is difficult for an ANS-operator to retrieve the individuals inside the answers, especially in modalized contexts. Therefore, I re-evaluate the question denotation s.t. its value is directly constrained by the S-requirement.

First, I assume that the LF of a question has a core constituent **Q** denoting *a family of possible answer sets*, as schematized in (11). In each answer set, the *wh*-item quantifies over an individual set that satisfies the S-requirement. Consider (1-b) for illustrations. Any subset of **boys** satisfies the S-requirement, thus the **Q** of (1) contains all the subsets of the Hamblin denotation, as in (12a). In contrast, only singleton subsets of **boy** satisfies the S-requirement, thus the **Q** of (2) is a family of singleton sets, as in (12b).

(11) For *Which P f?*, $\mathbf{Q} = \{\{f(x) : x \in D\} : D \subseteq P \wedge {}^{\oplus}D \in P\}$

(12) a. $\mathbf{Q} = \{\{L(x) : x \in D\} : D \subseteq \mathbf{boys} \wedge {}^{\oplus}D \in \mathbf{boys}\} = \{\alpha : \alpha \subseteq \{L(x) : x \in \mathbf{boys}\}\}$

b. $\mathbf{Q} = \{\{L(x) : x \in D\} : D \subseteq \mathbf{boy} \wedge {}^{\oplus}D \in \mathbf{boy}\} = \{\{L(x)\} : x \in \mathbf{boy}\}$

Next, I define a response-operator $\mathfrak{R}$ to derive good answers from **Q**: $\mathfrak{R}$ picks out the minimal "strongest true answer set" in **Q** and presupposes its existence; every MaxI member of this set is a good answer.

(13) a. $\mathfrak{R}(\mathbf{Q})(w) = \text{MIN}[\textsc{str}(\mathbf{Q})(w)]$, if $\text{MIN}[\textsc{str}(\mathbf{Q})(w)]$ exists; undefined otherwise.

b. $\textsc{str}(\mathbf{Q})(w) = \{\alpha : \alpha \in \mathbf{Q} \wedge \alpha(w)_{\text{pw}} \wedge \forall \beta \in \mathbf{Q}[\beta(w)_{\text{pw}} \rightarrow \alpha \vDash \beta]\}$

$\{\alpha$: α is in **Q**; α is point-wise true in w; α entails all the point-wise true answer sets of **Q** in w)

(i) $\alpha(w)_{\text{pw}}$ iff $\forall p \in \alpha[p(w)]$ (ii) $\alpha \vDash \beta$ iff $\forall q \in \beta \exists p \in \alpha[p \Rightarrow q]$

Consider the plural-marked MA question (1) for an illustration. Every point-wise true set containing $L(a+b)$ is a strongest true set in w_2, as list in (14). $\mathfrak{R}(\mathbf{Q})(w_2)$ returns the minimal one $\{L(a+b)\}$. Therefore, I predict that (1) admits only the MA answer $L(a+b)$.

(14) $\textsc{str}(\mathbf{Q})(w_2) = \{\underline{\{L(a+b)\}}, \{L(a), L(a+b)\}, \{L(a), L(a+b)\}, \{L(a), L(b), L(a+b)\}\}$

Fact 1: (15) and (16) illustrate the case of the singular-marked question (2) in w_1 and w_2, respectively: (2) has a minimal strongest true answer set in w_1 but not in w_2, and thus (2) is only defined in w_1. More generally speaking, I predict that a question has a uniqueness requirement iff its **Q** consists of only singletons.

(15) a. set(s) true in w_1: $\{L(a)\}$ b. $\textsc{str}(\mathbf{Q})(w_1)$=$\{\{L(a)\}\}$ c. $\mathfrak{R}(\mathbf{Q})(w_1)$=$\{L(a)\}$

(16) a. set(s) true in w_2: $\{L(a)\}, \{L(b)\}$ b. $\textsc{str}(\mathbf{Q})(w_2) = \emptyset$ c. $\mathfrak{R}(\mathbf{Q})(w_2)$ is undefined

Fact 2: (17) illustrates the case of the $\diamond$-question (3) in w: (3) has a unique strongest true answer set, which consists of the true MS answers. Based MaxI (Fox 2013), both of the MS answers are good answers.

(17) a. sets true in w: $\{\diamond C(a)\}, \{\diamond C(b)\}, \{\diamond C(a), \diamond C(b)\}$ b. $\textsc{str}(\mathbf{Q})(w) = \{\{\diamond C(a), \diamond C(b)\}\}$

Fact 3: I assume that a question always takes some form of distributivity; distributivity can come from either the lexicon of the predicate, a VP-PART (18a), or a DP-PART (18b). With an anti-distributive predicate, (4) and (8) must chose the DP-PART, as in (19) and (20), respectively. All the answer sets in (19) are closed under conjunction; therefore (4) admits only MA. In (20), D as well as D' can only be singletons of some **4-boys** (e.g. $a+b+c+d$); (8a) is not a possible answer for (8) since it requires D' to be $\{a+b, c+d\}$.

(18) a. $\textsc{Part}_{\text{VP}} = \lambda f.\lambda x.Cov(C,x) \wedge \forall y \in C[f(y)]$ b. $\textsc{Part}_{\text{DP}} = \lambda D.\lambda f.\forall x \in D[f(x)]$

(19) $\mathbf{Q} = \{\{\textsc{Part}_{\text{DP}}(D')(I) : D' \subseteq D\} : D \subseteq \mathbf{boys} \wedge {}^{\oplus}D \in \mathbf{boys}\}$

(20) $\mathbf{Q} = \{\{\textsc{Part}_{\text{DP}}(D')(I) : D' \subseteq D\} : D \subseteq \mathbf{4\text{-}boys} \wedge {}^{\oplus}D \in \mathbf{4\text{-}boys}\} = \{\{I(x)\} : x \in \mathbf{4\text{-}boys}\}$

SELECTED REFERENCES **Dayal, V. 1996.** *Locality in wh quantification*. **Fox, D. 2013.** Mention-some readings of questions, class notes. **Schwarzschild, R. 1996.** *Pluralities*.