The propositional set approach

Core assumption

The meaning of questions is defined based on possible **propositional** answers (Hamblin 1973).

(1) $[\![\text{which girl smiled}]\!]^{w_0} = \left\{ \begin{array}{l} \lambda w.\mathsf{smiled}_w(\mathsf{a}), \\ \lambda w.\mathsf{smiled}_w(\mathsf{b}), \\ \lambda w.\mathsf{smiled}_w(\mathsf{c}) \end{array} \right\}$

(2) $[\![\text{which girl smiled}]\!]^{w_0} = \{\lambda w.\mathsf{smiled}_w(x) \mid x \in \mathsf{human}_{w_0}\}$

Answerhood

(3) A: Which girl smiled?
B: (i) Anna. (ii) Anna smiled.

Deriving true propositional answers (Dayal 1996):

$$\boxed{\mathsf{Ans}_{w_0}(Q) = \iota p.p \in Q \wedge p(w_0) \wedge \forall q \in Q.q(w_0) \rightarrow p \subseteq q}$$

i.e., The unique strongest true answer

Information maximality

Fact: John, Mary, and Sue were at the party, but Bob wasn't.

(4) A: Who was at the party?
B: John, Mary, and Sue were at the party.
$\rightsquigarrow$ no one else were at the party.

(5) Peter knows who was at the party.
$\rightsquigarrow$ Peter knows J+M+S were at the party and B was not.

Minimal answers (Beck & Rullmann 1999)

(6) A: How many eggs are sufficient to bake this cake?
B: Five eggs are sufficient.
$\rightsquigarrow$ Five are the smallest number.

Deriving short answers

(7) Anna [~~smiled~~] (syntactic ellipsis)

Can short answers are derived semantically?

(8) $[\![\text{which girl smiled}]\!]^{w_0} = \left\{ \begin{array}{l} \{w_0, w_2, w_3\}, \\ \{w_1, w_2, w_4\}, \\ \{w_3, w_4, w_5\} \end{array} \right\}$

✓ Individuals cannot be extracted from a set of sets of possible worlds. (see also Groenendijk & Stokhof 1989)

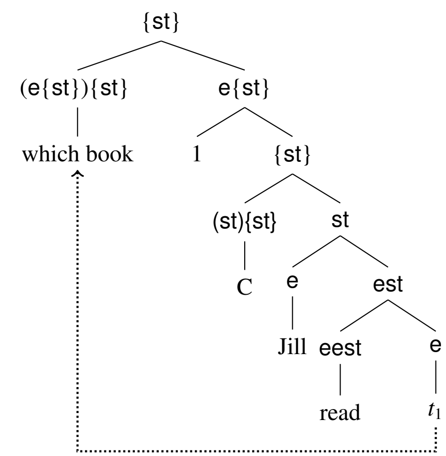
Composition

Wh-expressions denote existential quantifiers (Cresti 1995; cf. Karttunen 1977).

(9) $[\![\text{which book}]\!]^{w_0} = \lambda f \lambda p.\exists x \in \mathsf{book}_{w_0}(x) : f(x)(p)$
$(\mathsf{e}\{\mathsf{st}\})\{\mathsf{st}\}$ ($\{\mathsf{st}\}$: a set of propositions)

Interrogative complementizer:

(10) $[\![\mathrm{C}]\!] = \lambda p \lambda q.p = q$ $(\mathsf{st})\{\mathsf{st}\}$



Multiple-*wh* questions

(11) $[\![\text{who brought what}]\!]^{w_0}$ $\{\mathsf{st}\}$
$= [\![\text{who}]\!]^{w_0} \lambda x.[\![\text{what}]\!]^{w_0} \lambda y.[\![\mathrm{C}]\!]([\![\text{brought}]\!](y)(x))$
$= \lambda p \exists x. \in \mathsf{hmn}_{w_0} : \exists y. \in \mathsf{tng}_{w_0} : p = \lambda w.\mathsf{read}_w(y)(x)$

✓ All questions have a unified type.

Wh-coordination

Point-wise coordination:

(12) $[\![\mathrm{Q}_1 \text{ and } \mathrm{Q}_2]\!] = \{p \wedge q \mid p \in [\![\mathrm{Q}_1]\!], q \in [\![\mathrm{Q}_2]\!]\}$

(13) $[\![\text{who came and who brought what}]\!]^{w_0}$
$= \left\{ \lambda w.\mathsf{came}_w(x) \wedge \mathsf{brought}_w(z)(y) \;\middle|\; \begin{array}{l} x \in \mathsf{hmn}_{w_0}, \\ y \in \mathsf{hmn}_{w_0}, \\ z \in \mathsf{tng}_{w_0} \end{array} \right\}$

Uniqueness

A single-*wh* question in which the *wh*-expression is singular can have exactly one true answer.

(14) Which student laughed? #I heard many did.

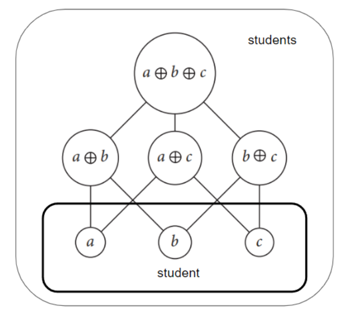
(15) Which students laughed? I head many did.

(16) Who laughed? I heard many did.

Single vs. Plural *wh*-expressions

(17) $[\![\text{which student}]\!]^{w_0} = \lambda f \lambda p \exists x \in \mathsf{std}_{w_0} : f(x)(p)$

(18) $[\![\text{which students}]\!]^{w_0} = \lambda f \lambda p \exists x \in {}^{*}\mathsf{std}_{w_0} : f(x)(p)$



Suppose that Anna and Bob laughed:

(19) $[\![\text{which students laughed}]\!]^{w_0}$
$= \left\{ \begin{array}{l} \lambda w.\mathsf{laughed}_w(\mathsf{a}), \lambda w.\mathsf{laughed}_w(\mathsf{b}), \\ \lambda w.\mathsf{laughed}_w(\mathsf{c}), \mathsf{laughed}_w(\mathsf{a} \oplus \mathsf{b}), \\ \ldots, \lambda w.\mathsf{laughed}_w(\mathsf{a} \oplus \mathsf{b} \oplus \mathsf{c}) \end{array} \right\}$

(20) $[\![\text{which student laughed}]\!]^{w_0}$
$= \left\{ \begin{array}{l} \lambda w.\mathsf{laughed}_w(\mathsf{a}), \lambda w.\mathsf{laughed}_w(\mathsf{b}), \\ \lambda w.\mathsf{laughed}_w(\mathsf{c}) \end{array} \right\}$

Applying Ans_{w_0} to (19) and (20):

- Ans_{w_0}(19) $= \lambda w.\mathsf{laughed}_w(\mathsf{a} \oplus \mathsf{b})$
- Ans_{w_0}(20) is undefined!

Discussion: A *which*-NP is the interrogative counterpart of a definite expression (Rullmann & Beck 1998).

(21) $[\![\text{which student}]\!]^{w_0}$ (the uniqueness requirement of ι)
$= \lambda f \lambda p \exists x \in D_e : f(\iota y.\mathsf{std}_{w_0}(y) \wedge y = x)(p)$