The partition semantics approach

Core assumption

The meaning of questions is defined based on **interrogative intension** (Groenendijk & Stokhof 1982).

Declarative intension: mapping a possible world to a truth value

(1) $[\![\text{Anna smiled}]\!] = \begin{bmatrix} w_0 & \rightarrow & 1 \\ w_1 & \rightarrow & 0 \\ w_2 & \rightarrow & 0 \end{bmatrix}$

Interrogative intension: mapping a possible world to the true answer in the world

(2) $[\![\text{did Anna smile}]\!] = \begin{bmatrix} w_0 & \rightarrow & \lambda w.\mathsf{smiled}_w(\mathsf{a}) \\ w_1 & \rightarrow & \lambda w.\neg\mathsf{smiled}_w(\mathsf{a}) \\ w_2 & \rightarrow & \lambda w.\neg\mathsf{smiled}_w(\mathsf{a}) \end{bmatrix}$

Partition

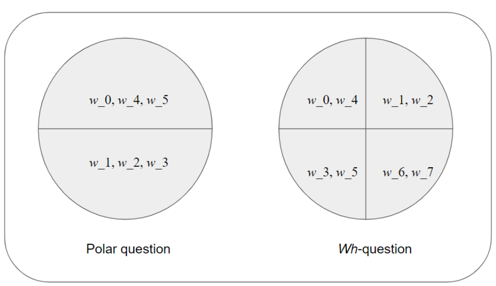
Suppose that Anna smiled in w_0, w_4, w_5 and Anna didn't smile in w_1, w_2, w_3

(3) $[\![\text{did Anna smile}]\!] = \lambda w \lambda w'.\mathsf{smiled}_w(\mathsf{a}) = \mathsf{smiled}_{w'}(\mathsf{a})$

$$= \begin{bmatrix} w_0 & \rightarrow & \{w_0, w_4, w_5\} \\ w_1 & \rightarrow & \{w_1, w_2, w_3\} \\ w_2 & \rightarrow & \{w_1, w_2, w_3\} \\ w_3 & \rightarrow & \{w_1, w_2, w_3\} \\ w_4 & \rightarrow & \{w_0, w_4, w_5\} \\ w_5 & \rightarrow & \{w_0, w_4, w_5\} \end{bmatrix}$$

Suppose that Anna and Becky smiled in w_0, w_4; only Anna smiled in w_3, w_5; only Becky smiled in w_1, w_2; no one smiled in w_6, w_7

(4) $[\![\text{who smiled}]\!]^{w_0}$
$= \lambda w \lambda w'.\{x \in \mathsf{h}_{w_0} \mid \mathsf{smiled}_w(x)\} = \{x \in \mathsf{h}_{w_0} \mid \mathsf{smiled}_{w'}(x)\}$

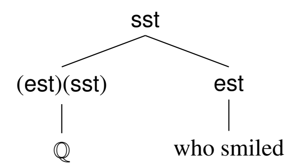


Composition

The interrogative intension is generated based on the 'categorial' denotation of a *wh*-constituent (Groenendijk & Stokhof 1982).

Question formation operator

(5) $[\![\mathbb{Q}]\!] = \lambda f \lambda w \lambda w'.\{\vec{x} \mid f(\vec{x})(w)\} = \{\vec{x} \mid f(\vec{x})(w')\}$ ($\vec{a}$st)(sst)
(Note: $\vec{x}$ is a sequence of variables)



Multiple-*wh* questions

(6) $[\![\text{who brought what}]\!]$ sst
$= [\![\mathbb{Q}]\!]\ (\lambda x \lambda y \lambda w.x \in \mathsf{t}_w \wedge y \in \mathsf{h}_w \wedge \mathsf{brought}_w(x)(y))$
$= \lambda w \lambda w'.\{\langle y, x\rangle \in \mathsf{h}_w \times \mathsf{t}_w \mid \mathsf{brought}_w(x)(y)\}$
$= \{\langle y, x\rangle \in \mathsf{h}_{w'} \times \mathsf{t}_{w'} \mid \mathsf{brought}_{w'}(x)(y)\}$

✓ All questions have a unified type.

Wh-coordination

(7) $[\![\mathrm{Q}_1 \text{ and } \mathrm{Q}_2]\!] = \lambda w \lambda w'.[\![\mathrm{Q}_1]\!](w)(w') \wedge [\![\mathrm{Q}_2]\!](w)(w')$

(8) $[\![\text{who came and who brought what}]\!]^{w_0}$
$= \lambda w \lambda w'.\{x \in \mathsf{h}_w \mid \mathsf{came}_w(x)\} = \{x \in \mathsf{h}_{w'} \mid \mathsf{came}_{w'}(x)\}$
$\wedge\ \{\langle y, x\rangle \in \mathsf{h}_w \times \mathsf{t}_w \mid \mathsf{brought}_w(x)(y)\} =$
$\{\langle y, x\rangle \in \mathsf{h}_{w'} \times \mathsf{t}_{w'} \mid \mathsf{brought}_{w'}(x)(y)\}$

Strong exhaustivity

Knowing a question amounts to knowing the strongly exhaustive answer of this question.

(9) $[\![\text{Jenny knows who smiled}]\!]$
$= \lambda w.\mathsf{know}_w(\lambda w'.\{x \mid \mathsf{smiled}_w(x)\} = \{x \mid \mathsf{smiled}_{w'}(x)\})(\mathsf{j})$

Suppose that Anna smiled but Becky didn't:

(10) $[\![(9)]\!] = \lambda w.\mathsf{know}_w(\lambda w'.\{x \mid \mathsf{smiled}_{w'}(x)\} = \{\mathsf{a}\})(\mathsf{j})$

(11) (9) $\rightsquigarrow$ Jenny knows only Anna smiled.

De re vs. De dicto

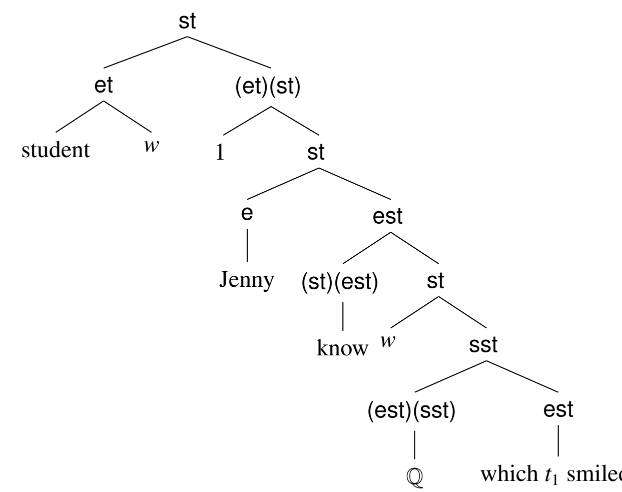
Ambiguity of embedded *wh*-questions

(12) Jenny knows which student smiled.
a. There are two students who smiled and Jenny knows they smiled. (de re)
b. Jenny knows who are students and also knows they smiled. (de dicto)

(13) a. For *de re*: Jenny knows who smiled $\rightsquigarrow$ (12)
b. For *de dicto*: Jenny knows who smiled $\not\rightsquigarrow$ (12)

Derivation of the de re reading

$\lambda w.\mathsf{know}_w(\lambda w'.\{x \in \mathsf{std}_w \mid \mathsf{smiled}_w(x)\}$
$= \{x \in \mathsf{std}_w \mid \mathsf{smiled}_{w'}(x)\})(\mathsf{j})$



Derivation of the de dicto reading

$\lambda w.\mathsf{know}_w(\lambda w'.\{x \in \mathsf{std}_w \mid \mathsf{smiled}_w(x)\}$
$= \{x \in \mathsf{std}_{w'} \mid \mathsf{smiled}_{w'}(x)\})(\mathsf{j})$

Conjunction and disjunction

(14) $[\![\text{what did Mary read and what did Jenny read}]\!]$
$= \lambda w \lambda w'.\{x \mid \mathsf{read}_w(x)(\mathsf{m})\} = \{x \mid \mathsf{read}_{w'}(x)(\mathsf{m})\} \wedge$
$\{x \mid \mathsf{read}_w(x)(\mathsf{j})\} = \{x \mid \mathsf{read}_{w'}(x)(\mathsf{j})\}$

(15) $[\![\text{what did Mary read or what did Jenny read}]\!]$
$= \lambda w \lambda w'.\{x \mid \mathsf{read}_w(x)(\mathsf{m})\} = \{x \mid \mathsf{read}_{w'}(x)(\mathsf{m})\} \vee$
$\{x \mid \mathsf{read}_w(x)(\mathsf{j})\} = \{x \mid \mathsf{read}_{w'}(x)(\mathsf{j})\}$

Discussion: what is the difference between (14) and (15)?