ESSLLI Summerschool 2014: Intro to Compositional Semantics

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Fifth Lecture: Propositions and Intensions

Intensional Contexts

[from Lecture 2]

LOGICAL [or FORMAL] SEMANTICS

The **meaning** of any expressions has (at least) **two components**, viz. its:

- **intension** $\approx$ its contribution to the content of expressions in which it occurs
- **extension**: $\approx$ its contribution to the reference of expressions in which it occurs
- . . . and maybe more (but not in this course)

In the simplest cases:

- Intension is content.
- Extension is reference.

Intensional Contexts

(1) a. Pfäffingen is larger than Breitenholz
b. Hamburg is larger than Cologne
c. John knows that Pfäffingen is larger than Breitenholz
d. John knows that Hamburg is larger than Cologne

(2) a. There are no thieves
b. There are no murderers
c. John is an alleged thief
d. John is an alleged murderer
e. The criminologist is looking for a thief
f. The criminologist is looking for a murderer

Cases and Propositions

(3) Four fair coins are tossed

(4) At least one of the 4 tossed coins lands heads up

(5) At least one of the 4 tossed coins lands heads down

(6) Exactly 2 of the 4 tossed coins land heads up

(7) Exactly 2 of the 4 tossed coins land heads down

Cases and Propositions

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(7) Exactly 2 of the 4 tossed coins land heads down

(3)

(4) (5)

(6) (7)

Cases and Propositions

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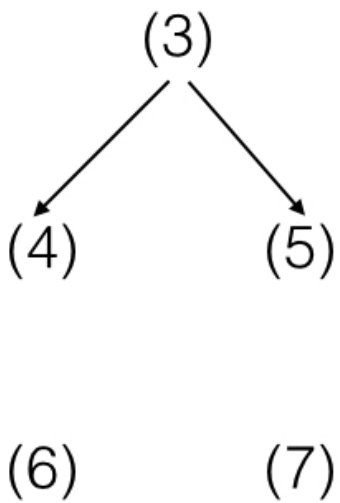

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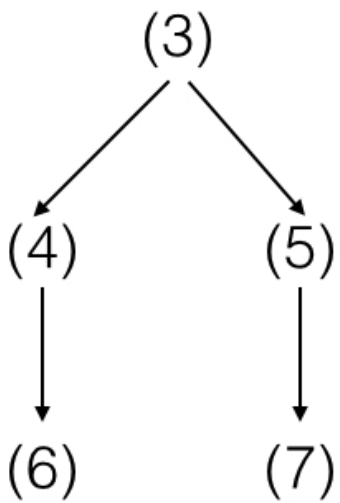

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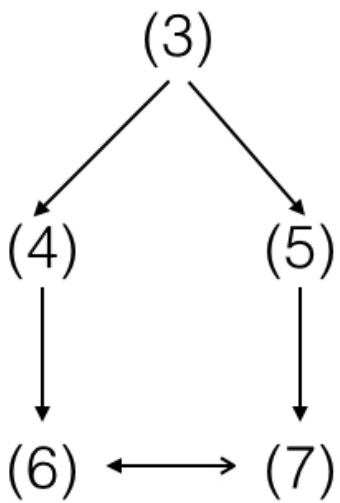

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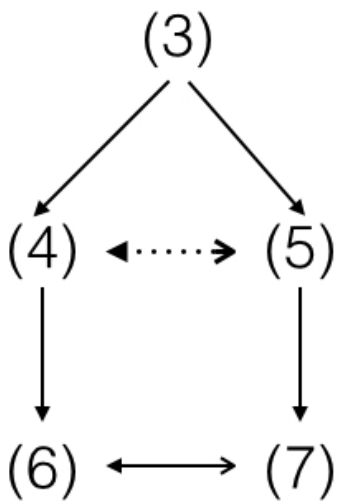


Cases and Propositions

(8) John knows that at least one of the 4 tossed coins lands heads up

(9) John knows that at least one of the 4 tossed coins lands heads down

(10) *Most Certain Principle*
If a (declarative) sentence S_1 is true and another sentence S_2 is false in the same circumstances, then S_1 and S_2 differ in meaning.

(11) John knows that exactly two of the 4 tossed coins lands heads up

(12) John knows that exactly two of the 4 tossed coins lands heads down

(13) *Definition [to be revised]*
The **proposition** expressed by a sentence is the set of possible cases of which that sentence is true.

Cases and Propositions

(14)

possible cases	c_1	c_2	c_3	c_4
1	1	1	1	1
2	1	1	1	0
3	1	1	0	1
...	...	...	...	...
14	0	0	1	0
15	0	0	0	1
16	0	0	0	0

Logical Space

(15) a. Four coins were tossed when John coughed
b. Four coins were tossed and no one coughed

(16) *[Revised] Definition*
The **proposition** expressed by a sentence is the set of possible worlds of which that sentence is true.

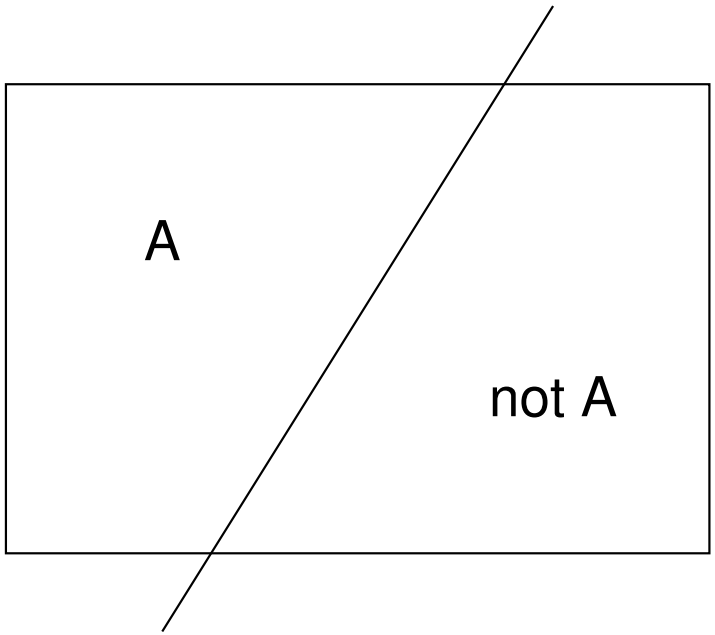
(17) *Definition*
A sentence S is **true of** [or **at**] a possible world w if and only if $[\![S]\!]_w = 1$.

(18) By $[\![S]\!]$ we mean the proposition expressed by S:
$[\![S]\!] := \{ w : [\![S]\!]_w = 1 \}$

(19) A sentence S is true of a possible world w if and only if $w \in [\![S]\!]$.

(20) $[\![S]\!]_w = 1$ iff $w \in [\![S]\!]$.

Logical Space



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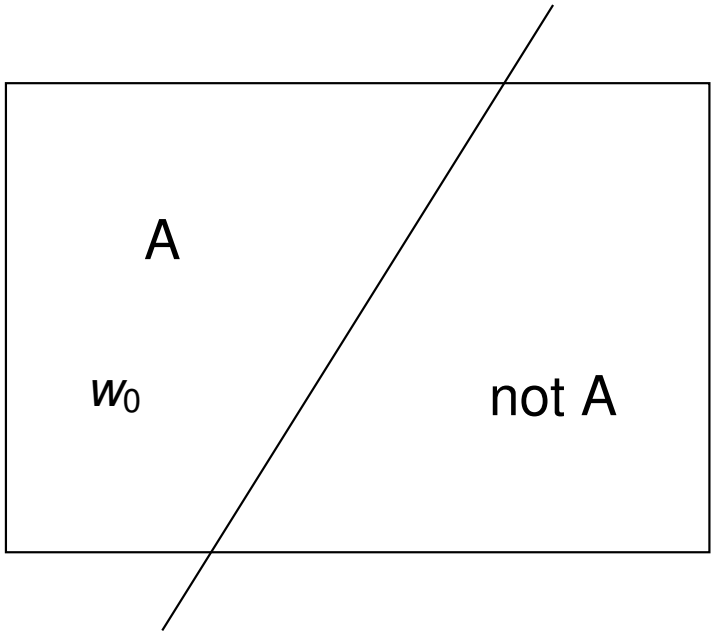

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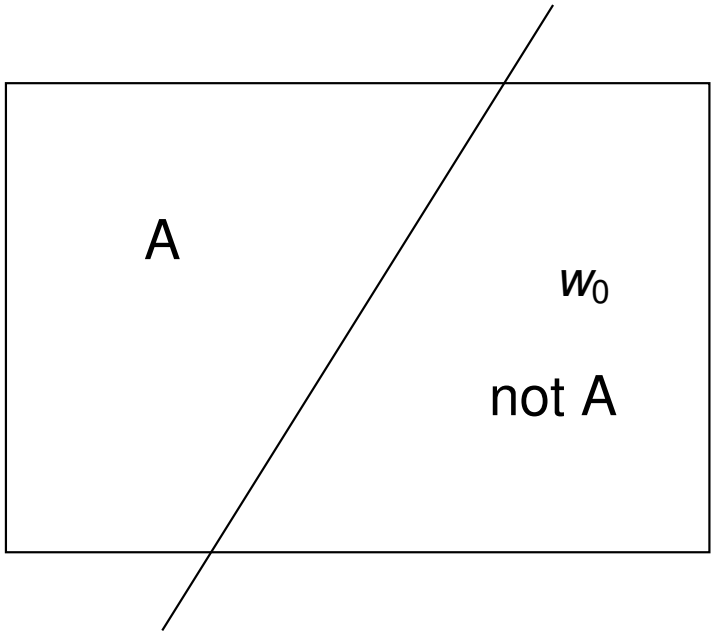


(21) Barschel was murdered[1]

[1] Uwe Barschel [1944–1987] was a German politician who had to resign as the prime minister of Schleswig-Holstein under scandalous circumstances (comparable to the Watergate affair) and who was found dead in the bathtub of his hotel room a few days after his resignation. The circumstances of his death could never be fully clarified.

From Propositions to Intensions

(22)

world	truth value
w_1	1
w_2	0
w_3	1
...	...
w_n	0
...	...

(23) *Definition*

The **intension** of α, written as $[\![\alpha]\!]$, is that function f such that for every possible world w, $f(w) = [\![\alpha]\!]_w$.

Composing Intensions

(24) *Principle of Intensional Compositionality*
The intension of a complex expression is a function of the intensions of its immediate parts and the way they are composed.

EXTENSIONAL CONSTRUCTIONS:

(25) For any world w:

$$\begin{aligned} & [\![\textit{Paul is sleeping}]\!] (w) \\ = \; & [\![\textit{Paul is sleeping}]\!]_w \\ = \; & [\![\textit{Paul}]\!]_w * [\![\textit{is sleeping}]\!]_w \\ = \; & [\![\textit{Paul}]\!] (w) * [\![\textit{is sleeping}]\!] (w) \end{aligned}$$

INTENSIONAL CONSTRUCTIONS

(26) a. John knows that [Hamburg is larger than Cologne]
b. John knows that [Pfäffingen is larger than Breitenholz]

(27) $[\![\textit{John knows that S}]\!]_w = 1$ iff $\langle [\![\textit{John}]\!]_w, [\![\text{S}]\!] \rangle \in [\![\textit{know}]\!]_w$

(28) For any world w:

$[\![\text{attitude verb + that + S}]\!]_w$

$= [\![\text{attitude verb}]\!]_w \overrightarrow{*} [\![\text{S}]\!]$

$= [\![\text{attitude verb}]\!] (w) \overrightarrow{*} [\![\text{S}]\!]$

INTENSIONAL CONSTRUCTIONS

(29) John is an alleged thief / murderer

(30) For any world w:
$[\![\text{intensional-adjective + noun}]\!]_w$
$= [\![\text{intensional-adjective}]\!]_w ([\![\text{noun}]\!])$

(31) The criminologist is looking for a thief / murderer

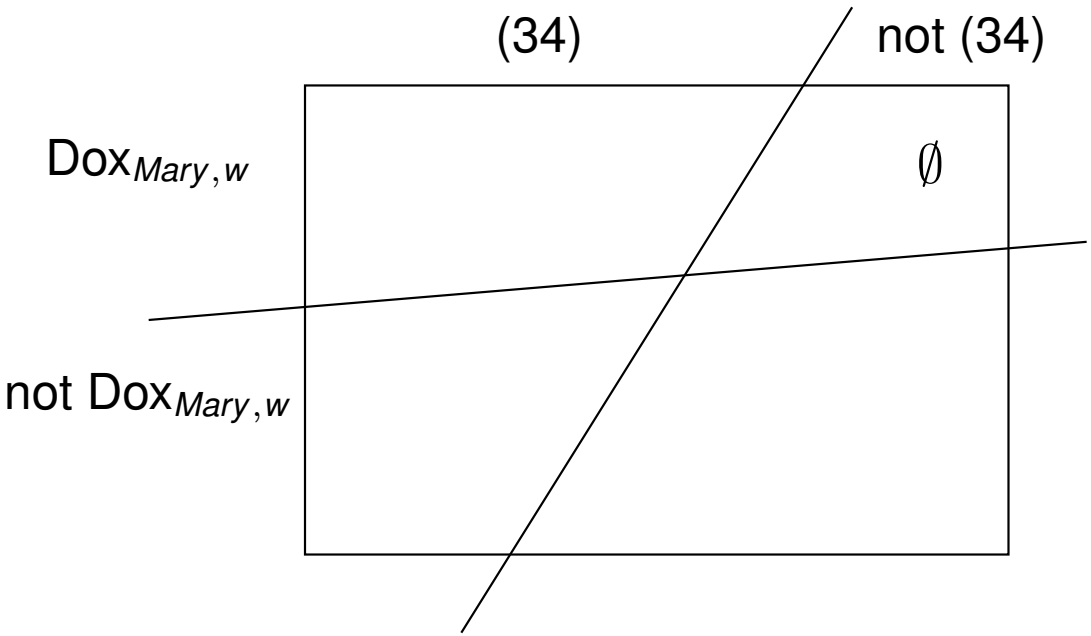
(32) For any world w:
$[\![\text{opaque verb + quantifier phrase}]\!]_w$
$= [\![\text{opaque verb}]\!]_w \overrightarrow{*} [\![\text{quantifier phrase}]\!]$

Hintikka's Attitudes

(33) Mary thinks that John is in Rome

(34) John is in Rome

(35)



Hintikka's Attitudes

(36) $[\![\text{think}]\!]_w = \{\langle x, p\rangle : Dox_{x,w} \subseteq p\}$

(37) $[\![\text{know}]\!]_w = \{\langle x, p\rangle : Epi_{x,w} \subseteq p\}$

(38) $[\![\text{want}]\!]_w = \{\langle x, p\rangle : Bou_{x,w} \subseteq p\}$

(39) Mary knows that Bill snores
$\models$ Mary thinks that Bill snores

(40) a. $\text{Epi}_{Mary,w} \subseteq [\![\text{Bill snores}]\!]$
b. $\text{Dox}_{Mary,w} \subseteq [\![\text{Bill snores}]\!]$

(41) $\text{Dox}_{x,w} \subseteq p$ whenever $\text{Epi}_{x,w} \subseteq p$.

(42) $\text{Dox}_{x,w} \subseteq \text{Epi}_{x,w}$

(43) Mary knows that Bill snores
⊨ Bill snores

(44) #Mary knows that Bill snores, but Bill doesn't snore

[Cf.: Mary believes that Bill snores, but (in fact) Bill doesn't snore]

(45) $w \in \text{Epi}_{x,w}$

(46) Mary doesn't know that Bill snores
⊨ Bill snores

(47) Mary thinks that Bill has two or three children
⊨ Mary thinks that the number of Bill's children is prime