

# Formale Semantik

## 09. Tempus und Modalität

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Folien in Überarbeitung. Englische Teile (ab Woche 7) sind noch von 2007!

Stets aktuelle Fassungen: <https://github.com/rsling/VL-Semantik>

- 1 Tense
  - Priorian operators
  - Tense raising
  - Interpretation
  - Some problems
- 2 Modality
  - Realizations of modality

- Types of modality
- Modeling the background

- 3 Embedding
  - Syntax
  - Believe semantics
  - Ambiguities
  - Infinitives and gerunds

# Targets for this week

- Understand how simple tense logic can be represented by operators shifting  $i$  indices.
- See why tense operators are sentence operators.
- See why a multi-dimensional theory of tenses and a better handling of tense embedding are required.
- See how we restrict (different types of) propositional backgrounds.
- Understand how opaque contexts affect meaning (incl. *believe* type verbs).
- Get a first idea of why we need the *up* operator  $\hat{\phantom{x}}$ .

Tense

- **present**: no operator ( $\phi$  'it is the case that  $\phi$ ')  
• **past**: **P** (**P** $\phi$  'it was the case that  $\phi$ ')  
• **future**: **F** (**F** $\phi$  'it will be the case that  $\phi$ ')  
• it will always be the case... (**G** =  $\neg$ **F** $\neg\phi$ )  
• it was always the case... (**H** =  $\neg$ **P** $\neg\phi$ )

- $PD(a)$  'Arno Schmidt (has?) died.'
- relative to the current  $\langle w, i \rangle$ :  $\llbracket PD(a) \rrbracket^{\mathcal{M}, w, i, g}$
- ...is true iff there is some  $i'$ ,  $\langle i', i \rangle \in <$  and
- $\llbracket PD(a) \rrbracket^{\mathcal{M}, w, i', g} = 1$

- tense operators (T<sub>Op</sub>) are sentence (wff) Op's
- **raise** it to sentence-scopal position
- TP/IP position is motivated by copular/auxiliary elements
- *He **is** stupid.* vs. *Kare-wa bakarashi-**i**.*
- *He **was** stupid.* vs. *Kare-wa bakarashi-**katta**.*
- *What<sub>i</sub> **did** you expect t<sub>i</sub>?* vs. *Nani-o yokishi-**ta**-ka.*

- $T' \rightarrow TVP$  (adds tense to VP)
- $TP \rightarrow NP T'$
- $TP \rightarrow TP \text{ conj } TP$
- $TP \rightarrow \text{neg } TP$
- $[_{TP} NP T VP] \Rightarrow [_{TP} T NP VP]$  (T raising)



- $\llbracket \mathbf{PTP} \rrbracket^{\mathcal{M}, w, i, g} = 1$
- iff among all  $\langle i_n, i \rangle \in <$
- there is **at least one** s.t.  $\llbracket TP \rrbracket^{\mathcal{M}, w, i', g} = 1$

- $U$ : domain of quantification
- $V(\beta)$ : non-relativized function for all  $\beta$  which are not a proper name
- $V(\beta)(\langle w, i \rangle)$ :  $V$  evaluates  $\beta$  to a function from world-time pairs to the denotata of the predicate (sets of individuals, tuples of them, etc.)

- NL tenses beyond TOP's:
- *Arno Schmidt had already read Poe when he started writing 'Zettels Traum'.*
- *Gosh, I forgot to feed the cat.*
- shifts of evaluation time

	past ( $R < S$ )	present ( $R, S$ )	future ( $S < R$ )
anterior ( $E < R$ )	$E < R < S$ <i>er war gegangen</i>	$E < R, S$ <i>er ist gegangen</i>	$S < E < R$ $S, E < R$ $E < S < R$ <i>er wird gegangen sein</i>
simple ( $E, R$ )	$E, R < S$ <i>er ging</i>	$E, R, S$ <i>er geht</i>	$S < E, R$ <i>er wird gehen</i>
posterior ( $R < E$ )	$R < E < S$ $R < S, E$ $R < S, E$ $R < S < E$ <i>*er würde gehen</i>	$R, S < E$ <i>er wird gehen</i>	$S < R < E$ <i>*er wird gehen werden</i>

- *A man was born who will be king.*
- **P**(a man is born **F**(who be king)) ?
- *Yesterday, Maria woke up happy.*
- **Y**(**P**(Maria wake up happy)) ?

Modality

# Types of modal expressions

- **tense forms:** *I **eat** up to 100 nachos a minute.*
- **mood:** ***Responderet** alius minus sapienter.*
- **modal auxiliaries:** *Herr Webelhuth **can** look like Michael Moore.*
- **adverbs:** ***Maybe** Herr Keydana will show up.*
- **affixes:** *Frau Eckardt is recogniz**able**.*

# The logical form of modal operators

- like tense: **sentence operators**
- modal *Aux* in English is tense-insensitive (evidence for *Infl*)
- $\Box$  and  $\Diamond$  in intensional predicate calculi (IPC): exploit the full set of possible worlds
- in NL: evaluation of modal expressions against restricted **conversational backgrounds**



- different sets of possible worlds under consideration for different types of modal expressions
- different types of modality: different sets of admitted possible worlds
- we call the conversationally relevant background the set of  $\langle w, i \rangle$  pairs relevant to the interpretation of the sentence

- Agent Cooper *cannot* solve the mystery.
- translated into root modal IPC:  $\neg\Diamond S(c, m)$
- wrong interpretation: Under no possible circumstances can Cooper solve the mystery.
- usually, some *obvious facts constitute the background*:
  - ▶ he could, but some relevant information is missing
  - ▶ he could, but is sick
  - ▶ he could, but ...

- *Leo Johnson must be the murderer of Laura Palmer.*
- in accordance with the **known facts** (e.g., in episode 7 of *Twin Peaks*):
  - ▶ Leo Johnson is a violent person.
  - ▶ Leo smuggles cocaine, Laura was addicted to it.
  - ▶ Leo is connected to Jacques Renault who is the bartender of *One Eyed Jack's* where Laura worked as a prostitute.
  - ▶ ...
- which constitute the epistemic background, the sentence is true
- known facts narrow down the root background

- *Agent Cooper must not solve the mystery.*
- assume:
  - ▶ there is some U.S. law which allows a local sheriff to ask the FBI to keep out of local murder investigations
  - ▶ Sheriff Truman has asked the FBI headquarters to keep out of the Palmer investigation
  - ▶ as a special agent, Cooper is required to obey Bureau policy
- Deontic backgrounds are narrowed down by **normative rules** and **moral ideals**.
- statable in propositional form (ten commandments, law, ...)

- specify the kind of background against which you evaluate under the given situation
- we need:  
a function from  $\langle w, i \rangle$  to the relevant background set of  $\langle w_n, i_m \rangle$
- reuse  $g$ :  
 $g(\langle w, i \rangle) = \{p_1, p_2, \dots, p_n\} = \{\langle w, i \rangle_1, \langle w, i \rangle_2, \dots, \langle w, i \rangle_n\}$
- such that **all** possible worlds are:  $\bigcap g(\langle w, i \rangle)$

Embedding

- *that* is a **complementizer**, it **turns a sentence into an argument**.
- ps rule:  $CP \rightarrow C IP$
- $[_{IP} \text{Racine believes } [_{CP} \text{that } [_{IP} \text{theatre rules}]]]$
- CP (fully fledged sentence) receives theta role by *believe* under government.

- gerunds:  
*[<sub>IP</sub> Stockhausen has plans [<sub>IP</sub> to write another 29 hour opera]]*
- incomplete embedded IP, **no subject**
- internal theta role of *has plans*: to IP
- external theta role of *write*: to ?
- **PRO, controlled** by the subject of *has plans*:  
*[<sub>IP</sub> Stockhausen has plans [<sub>IP</sub> PRO to write another 29 hour opera]]*



- verbs like *believe*: **propositional attitude verbs**
- content of the believe: a piece of information held to be true by the believer, hence a proposition, a  $\langle w_n, i_m \rangle$
- signalling one element in the background assumed by the believer
- belief:  $\langle w, i \rangle$  is an element of the proposition of CP

- value of propositional attitude (PA) verbs: functions  $[\langle w, i \rangle \rightarrow \langle u_n, p \rangle]$  with  $u_n \in U$ ,  $p$  a proposition (set of  $\langle w_n, i_m \rangle$ ) and compatible to  $u_n$ 's background
- $up(\hat{\chi})$ : an operator which gives the intension of an expression  $\chi$
- the full logic of  $\hat{\phantom{x}}$  and  $\sim$  as designed by Montague next week
- $\hat{\phantom{x}}$  rids us of the problem that the belief content looks truth-conditional (a sentence) but doesn't contribute to the embedding sentence's truth-value. PA verbs take intensions as arguments.

- Quine's story: Ralph knows...
- Bernard J.Ortcutt, the nice guy on the beach.
- He sees a strange guy with a hat in the dark alley - a spy?
- Ortcutt just likes to behave funny on the way to his pub...
- and actually is sinister guy in the alley!
- Only Ralph doesn't know.

# Is Ralph insane?

- What's the truth value of...
- *Ralph believes that the guy from the beach is a spy.*
- true: since Ortcutt and the guy in the hat are one individual
- false: since Ralph doesn't know that and in a way 'doesn't believe it'

- the Russelian interpretation for *the* like  $\exists$  with a uniqueness condition (as a GQ):  
 $\lambda Q \lambda P [\exists x [Q(x) \wedge P(x)] \wedge \forall y [Q(y) \leftrightarrow y = x]]$
- in a raising framework: ambiguity between *THE* and *believe*
- $[_{IP} \text{ the guy from the beach}_i [_{IP} \text{ Ralph believes } [_{CP} \text{ that } x_i \text{ is a spy}]]]$
- makes the sentence true: the *de re* reading
- Ralph believes  $[_{CP} \text{ that } [_{IP} \text{ the guy from the beach}_i [_{IP} x_i \text{ is a spy}]]]$
- makes the sentence false: the *de dicto* reading

- *Yuri Gagarin might now have been the first man in space.*
- some Mickey Mouse LFs:
- $\Diamond$  THE(first-man-in-space)(not-be-Gagarin)
- at some  $\langle w_n, i_m \rangle$  the first individual in space is not Y.G.
- THE(first-man-in-space)( $\Diamond$ [not-be-Gagarin])
- at  $\langle w, i \rangle$  the first individual in space (definitely Y.G.) is not Y.G. in an accessible world
- Names are rigid designators across world-time-pairs, definite descriptions aren't.

- CP has its own subject, *to*-IPs don't (PRO)
- PRO must be interpreted, in our examples by coindexation with the matrix subject
- infinitive embedding verbs: *functions from world-time pairs to sets of individuals which have a certain property*, the intension of a predicate  $\hat{P}$
- *John tries to sing.*
- *try(j,  $\hat{\text{swim}}$ )*





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