# Formale Semantik 09. Tempus und Modalität

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

## Inhalt



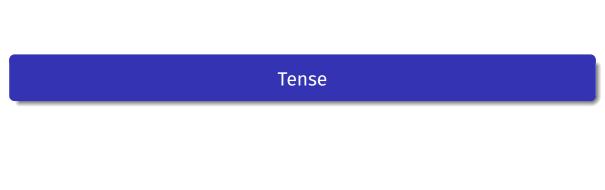




3 Embedding

## 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 ^.



## Will, was... and always

- 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... ( $\mathbf{G} = \neg \mathbf{F} \neg \phi$ )
- it was always the case... ( $\mathbf{H} = \neg \mathbf{P} \neg \phi$ )

#### **Evaluation**

- PD(a) 'Arno Schmidt (has?) died.'
- relative to the current  $\langle w, i \rangle$ :  $[\![\mathbf{PD}(a)]\!]^{\mathcal{M}, w, i, g}$
- ...is true iff there is some i',  $\langle i', i \rangle \in <$  and
- $\bullet \ \left[\!\!\left[\mathbf{P}\mathbf{D}(\mathbf{a})\right]\!\!\right]^{\mathcal{M},\mathbf{w},\mathbf{i}',\mathbf{g}} = 1$

#### Like it or not...

- tense operators (TOp) 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.

### New ps rules

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

### Quantification over instants

- $\llbracket \mathbf{P}TP \rrbracket^{\mathcal{M}, \mathsf{w}, \mathsf{i}, \mathsf{g}} = 1$
- iff among all  $\langle i_n, i \rangle \in \langle$
- ullet there is at least one s.t.  $[\![\mathit{TP}]\!]^{\mathcal{M}, \mathsf{w}, \mathsf{i}', \mathsf{g}} = 1$

#### Valuations as in Chierchia's M<sub>3</sub>

- 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 valuates  $\beta$  to a function from world-time pairs to the denotata of the predicate (sets of individuals, tuples of them, etc.)

#### Natural tenses

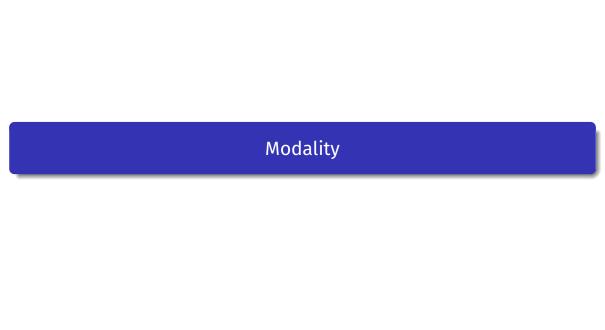
- NL tenses beyond TOp's:
- Arno Schmidt had already read Poe when he started writing 'Zettels Traum'.
- Gosh, I forgot to feed the cat.
- shifts of evaluation time

## Reichenbach

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	*er würde gehen		

#### Embedded tenses and adverbials

- 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)) ?



### 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 recognizable.

# The logical form of modal operators

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

### The background

- 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

## Root/Logical modality

- Agent Cooper cannot solve the mystery.
- translated into root modal IPC:  $\neg \lozenge S(c, m)$
- 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 ...

## **Epistemic modality**

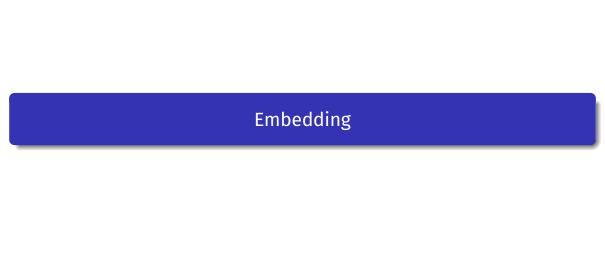
- Leo Johnson must be the murderer of Laura Palmer.
- in accordance with the known facts (e.g., in episode 7 of Twin Peaks):
  - ▶ Leo Johnson is a violent person.
  - Leo smuggles cocaine, Laura was addicted to it.
  - ► Leo is connected to Jacques Renault who is the bartender of *One Eyed Jack's* where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

## Deontic modality

- 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, ...)

### Sets of propositions

- 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:  $\bigcap g(\langle w, i \rangle)$



#### CP structures: that

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

#### Weak Infl and PRO

- gerunds:
   [IP Stockhausen has plans [IP 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:
   [IP Stockhausen has plans [IP PRO to write another 29 hour opera]]

### Propositional attitudes

- verbs like believe: propositional attitude verbs
- content of the believe: a pice 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

## Translating that as^

- value of propositional attitude (PA) verbs: functions  $[\langle w, i \rangle \to \langle u_n, p \rangle]$  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 ^ and ~ as designed by Montague next week
- 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.

#### Meet B.J. Ortcutt

- 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'

#### de dicto and de re

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

## Rigid designators

- Yuri Gagarin might now have been the first man in space.
- some Mickey Mouse LFs:
- \( \rightarrow \text{THE(first-man-in-space)(not-be-Gagarin)} \)
- at some  $\langle w_n, i_m \rangle$  the first individual in space is not Y.G.
- THE(first-man-in-space)(◊[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.

#### Chierchia's formalization

- 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 P
- John tries to sing.
- try(j, ^swim)

## Literatur I

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