Formale Semantik
09. Tempus und Modalität

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stets aktuelle Fassungen: `https://github.com/rsling/VL-Deutsche-Syntax`

Inhalt

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 $\hat{}$.

Tense

Will, was... and always

- present: no operator (ϕ 'it is the case that ϕ')
- past: $\mathbf{P}$ ($\mathbf{P}\phi$ 'it was the case that ϕ')
- future: $\mathbf{F}$ ($\mathbf{F}\phi$ 'it will be the case that ϕ')
- 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

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

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$_i$ **did** you expect t_i?* vs. *Nani-o yokishi-**ta**-ka.*

New ps rules

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

Quantification over instants

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

Valuations as in Chierchia's M_3

- U: domain of quantification
- $V(\beta)$: non-relativized function for all β which are not a proper name
- $V(\beta)(\langle w, i \rangle)$: V valuates β 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

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

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)) ?

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 recognizable.*

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

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: $\neg\Diamond S(c, m)$
- 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 ...

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:
  $g(\langle w, i \rangle) = \{p_1, p_2, \ldots, p_n\} = \{\langle w, i \rangle_1, \langle w, i \rangle_2, \ldots, \langle w, i \rangle_n\}$
- such that all possible worlds are: $\bigcap g(\langle w, i \rangle)$

Embedding

CP structures: *that*

- *that* is a complementizer, it turns a sentence into an argument.
- ps rule: $CP \rightarrow C\ IP$
- $[_{IP}$ *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 $\hat{}$

- 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 χ
- the full logic of $\hat{}$ and $\check{}$ as designed by Montague next week
- $\hat{}$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$_i$ $[_{IP}$ 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$_i$ $[_{IP}$ x$_i$ 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:
- $\Diamond$ 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.

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 $\hat{}P$
- *John tries to sing.*
- $try(j, \hat{}swim)$

Literatur I

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