A Montagovian Treatment of Modal Subordination

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Modal Subordination (MS)

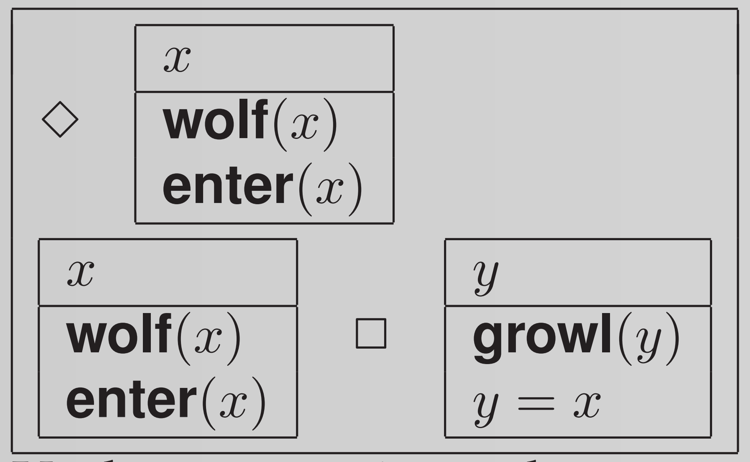
Related to the speaker's commitment to the truth of a sentence in the actual world: utterances in a *factual mood* or in a *nonfactual mood*. We are in particular interested in the interaction between MS and anaphora.

Examples

(1) If John bought a book, he'll be home reading it by now. *It's a murder mystery.
(2) If John bought a book, he'll be home reading it by now. It'll be a murder mystery.
(3) If John's at home he'll be reading a book. Actually, he's still at the office. *It'll be War and Peace.
(4) If John's at home he'll be reading a book. He is. It's War and Peace.
(5) A wolf enters. It growls.
(6) A wolf might enter. It would growl.
(7) A wolf might enter. *It will growl.
(8) A wolf enters. ?It would growl.

Former Analysis

1. Local Accomodation and Accessibility [7]



2. Update semantics and tests operators [5]
3. Anaphoric links to domain referents [8, 2]

DRT [4] / DPL [3]: Formal Shortcomings

- Destructive variable assignment
- Relation between states + deduction (axiomatisation)
- Non-standard interpretation of logical connectives
- New accounts require formalism and interpretation changes

A Type-Theoretic Approach to Discourse

Interpretation

Montague [6] interprets the syntactic type s (resp. np, n) for sentences (resp. noun phrases, noun) as proposition (resp set of properties, properties):

$$[\![s]\!] = t \qquad [\![np]\!] = (e \to [\![s]\!]) \to [\![s]\!] \qquad [\![n]\!] = e \to [\![s]\!]$$

In order to extend this approach to discourse, de Groote [1] proposes the following interpretation:

$$[\![s]\!] = \gamma \to (\gamma \to t) \to t \quad [\![np]\!] = (e \to [\![s]\!]) \to [\![s]\!] \quad [\![n]\!] = e \to [\![s]\!]$$

where γ is the type of the current context (*e.g.*list of accessible discourse referents) and $(\gamma \to t)$ is the type of the *continuation* of the sentence being evaluated.
A *discourse* is interpreted in the same way as a sentence. Combination of sentences in order to build discourses is interpreted as follows:

$$[\![S_1 \cdot S_2]\!] = \lambda e \phi.[\![S_1]\!]\, e\, (\lambda e'.[\![S_2]\!]\, e'\, \phi)$$

Example

$$\begin{aligned}
[\![\textit{A wolf enters}]\!] &= \lambda ik.\exists x.(\mathbf{wolf}\, x) \land ((\mathbf{enter}\, x) \land (k\,(x :: i)))\\
[\![\textit{It growls}]\!] &= \lambda ik.\mathbf{growl}\,(\mathtt{sel}\, i) \land k\, i\\
[\![(5)]\!] &= \lambda ik.[\![\textit{A wolf enters}]\!]\, i\,(\lambda i'.[\![\textit{It growls}]\!]\, i'\, k)\\
&\to_\beta \lambda ik.\exists x.(\mathbf{wolf}\, x) \land ((\mathbf{enter}\, x)\\
&\qquad \land((\lambda i'.[\![\textit{It growls}]\!]\, i'\, k)\,(x :: i)))\\
&\to_\beta \lambda ik.\exists x.(\mathbf{wolf}\, x) \land ((\mathbf{enter}\, x)\land\\
&\qquad ([\![\textit{It growls}]\!]\,(x :: i)\, k))\\
&\to_\beta \lambda ik.\exists x.(\mathbf{wolf}\, x) \land ((\mathbf{enter}\, x)\land\\
&\qquad ((\lambda ik.\mathbf{growl}\,(\mathtt{sel}\, i) \land k\, i)\,(x :: i)\, k))\\
&\to_\beta \lambda ik.\exists x.(\mathbf{wolf}\, x) \land ((\mathbf{enter}\, x)\land\\
&\qquad (\mathbf{growl}\,(\mathtt{sel}\,(x :: i)) \land k\,(x :: i)))
\end{aligned}$$

Features

- Accessibility is made explicit
- Standard interpretation and models

⇒ *two environments*

Our Proposal

Interpretation

Two environments: a *modal* context (of type γ) and a *actual* context (of type γ). *Two* continuations: one that contains facts about live possibilities described by the discourse, and one that contains facts about the actual world (of type $(\gamma \to \gamma \to t)$)

$$\begin{aligned}
[\![s]\!] &= \gamma \to \gamma \to (\gamma \to \gamma \to t) \to (\gamma \to \gamma \to t) \to (t \to t \to t) \to t\\
[\![S_1 \cdot S_2]\!] &= \lambda i_1 i_2 k_1 k_2 f.[\![S_1]\!]\, i_1\, i_2(\lambda i'_1 i'_2.[\![S_2]\!] i'_1 i'_2 k_1 k_2 \Pi_1)\, k_2\, f
\end{aligned}$$

Example (Embedding of Modals)

$$\begin{aligned}
[\![\textit{A wolf might enter}]\!] &= \lambda i_1 i_2 k_1 k_2 f.f(\Diamond(\exists x.(\mathbf{wolf}\, x) \land ((\mathbf{enter}\, x)\\
&\qquad \land(k_1\,(x :: i_1)\, i_2))))(k_2\, i_1\, i_2)\\
[\![\textit{It would growl}]\!] &= \lambda i_1 i_2 k_1 k_2 f.f(\Box((\mathbf{growl}\,(\mathtt{sel}(i_1 \cup i_2)))\\
&\qquad \land(k_1 i_1 i_2)))(k_2\, i_1 i_2)\\
[\![\textit{It will growl}]\!] &= \lambda i_1 i_2 k_1 k_2 f.f(k_1 i_1 i_2)((\mathbf{growl}\,(\mathtt{sel}\, i_2))(k_2\, i_1 i_2))\\
[\![(6)]\!] &= (\Diamond(\exists x.(\mathbf{wolf}\, x) \land ((\mathbf{enter}\, x)\\
&\qquad \land(\Box((\mathbf{growl}\,(\mathtt{sel}(x :: \mathtt{nil}) \cup \mathtt{nil})) \land \top)))))\\
&\qquad \land\top\\
[\![(7)]\!] &= (\Diamond(\exists x.(\mathbf{wolf}\, x) \land ((\mathbf{enter}\, x) \land \top)))\\
&\qquad \land(\mathbf{growl}\,(\mathtt{sel}\,\mathtt{nil}))
\end{aligned}$$

Example (Local Accomodation)

(9) A wolf might enter. It would growl. It would eat you first

$$\begin{aligned}
[\![(9)]\!] = {} & \Diamond\exists x.((\mathbf{wolf}\, x) \land (\mathbf{enter}\, x)\\
& \land\Box(((\mathbf{wolf}\, x) \land (\mathbf{enter}\, x)) \Rightarrow ((\mathbf{growl}\,(sel((x :: \mathtt{nil}) + \mathtt{nil})))\\
& \quad \land\Box(((\mathbf{wolf}\, x) \land (\mathbf{enter}\, x)) \Rightarrow ((\mathbf{eat}\,(sel((x :: \mathtt{nil}) + \mathtt{nil})))))\\
&)))
\end{aligned}$$

Future Work

- Including Veltman [9]'s semantics for epistemic modalities
- Exploring the anaphoric approaches using Ty2
- Studying the interaction with discourse structure
- Studying the interaction with presupposition

References

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