Semantic Representation of Modal Subordination
Using Type Theory

Nicholas Asher\textsuperscript{1} \quad Sylvain Pogodalla\textsuperscript{2}

\textsuperscript{1}asher@irit.fr
CNRS, IRIT

\textsuperscript{2}sylvain.pogodalla@loria.fr
LORIA/INRIA Nancy–Grand Est

December 14 2009
Outline

1. About Modal Subordination
2. A Montagovian Treatment
3. Discussion and Alternative Proposals
4. Conclusion
Modal Subordination: Some Examples

Example

A wolf might walk in. It would growl.
Modal Subordination: Some Examples

Example

1. A wolf might walk in. It would growl.
2. A wolf might walk in. *It will growl.
Modal Subordination: Some Examples

1. A wolf might walk in. It would growl.
2. A wolf might walk in. *It will growl.
3. A wolf walks in. It would growl.
Modal Subordination: Some Examples

Example

1. A wolf might walk in. It would growl.
2. A wolf might walk in. *It will growl.
3. A wolf walks in. It would growl.

References: DRT and Dynamic Frameworks

- Accommodation of DRSs [Roberts(1989)]
- Modals presuppose their domain [Geurts(1999)]
- Anaphoric context references and graded modality [Frank and Kamp(1997)]
- Compositional DRT extension [Stone and Hardt(1997)]
- Two-dimensiononal approach, accessibility relation and world ordering [van Rooij(2005)]
- DPL and sets of epistemic possibilities [Asher and McCready(2007)]
DRT Based Account

Example

A wolf might walk in.
DRT Based Account

Example

A wolf might walk in.

\[ \diamond \quad \frac{x}{\text{wolf}(x)} \quad \frac{\text{enter}(x)}{} \]
DRT Based Account

Example

A wolf might walk in, it would growl.

\[ \begin{array}{c}
\Diamond \\
\frac{\ x 
}{\ \text{wolf}(x)} \\
\frac{\text{enter}(x)}{}
\end{array} \]
DRT Based Account

Example

A wolf might walk in. It would growl.

\[
\begin{array}{c}
\diamond \\
\frac{x}{\text{wolf}(x)} \\
\frac{\text{enter}(x)}{}
\end{array}
\]

\[
\begin{array}{c}
\square \\
\frac{y}{\text{growl}(y)}
\end{array}
\]
DRT Based Account

Example

A wolf might walk in. It would growl.

\[
\begin{array}{c}
\diamond
\hline
x \\
\text{wolf}(x) \\
\text{enter}(x)
\end{array}
\begin{array}{c}
\square
\hline
y \\
\text{growl}(y)
\end{array}
\]

Note:
- Accessibility conditions
DRT Based Account

Example

A wolf might walk in. It would growl.

\[
\begin{array}{c}
\phi x \\
\text{wolf}(x) \\
\text{enter}(x) \\
\end{array}
\]

\[
\begin{array}{c}
\box x \\
\text{growl}(y) \\
\end{array}
\]

Note:

- Accessibility conditions
DRT Based Account

Example
A wolf might walk in. It would growl.

\[
\begin{align*}
\text{wolf}(x) & \quad \text{enter}(x) \\
\text{growl}(y) & \quad \text{enter}(x) \\
\end{align*}
\]

Note:
- Accessibility conditions
DRT Based Account

Example

A wolf might walk in. It would growl.

Note:
- Accessibility conditions
- Modal base and accommodation
Our Aim

To consider modal subordination in [de Groote(2006)]’s framework:
- Taking advantages of this framework
- Implementing MS principles in lexical entries
- Without any change to the formal framework

The Steps

- Interpretation of (the syntactic type of) the sentences
- Combination rules
- The lexical semantics of MS
Interpretation of the Sentences

[de Groote(2006)]:  $[s] = \gamma \rightarrow (\gamma \rightarrow t) \rightarrow t$
Interpretation of the Sentences

[de Groote(2006)]: \([s] = \gamma \rightarrow (\gamma \rightarrow t) \rightarrow t\)

Here:
\([s] = \gamma \rightarrow \gamma \rightarrow (\gamma \rightarrow \gamma \rightarrow t) \rightarrow (\gamma \rightarrow \gamma \rightarrow t) \rightarrow (t \rightarrow t \rightarrow t) \rightarrow t\)
Interpretation of the Sentences

[de Groote (2006)]: \[ [s] = \gamma \rightarrow (\gamma \rightarrow t) \rightarrow t \]

Here:
\[ [s] = \gamma \rightarrow \gamma \rightarrow (\gamma \rightarrow \gamma \rightarrow t) \rightarrow (\gamma \rightarrow \gamma \rightarrow t) \rightarrow (t \rightarrow t \rightarrow t) \rightarrow t \]

- A modal environment and a factual environment
Interpretation of the Sentences

[de Groote(2006)]: \[[s]\] = γ → (γ → t) → t
Here: \[[s]\] = γ → γ → (γ → γ → t) → (γ → γ → t) → (t → t → t) → t

- A modal environment and a factual environment
- A modal continuation and a factual continuation (or a modal contribution and a factual contribution of the continuation)
Interpretation of the Sentences

\[ [s] = \gamma \rightarrow (\gamma \rightarrow t) \rightarrow t \]

Here:

\[ [s] = \gamma \rightarrow \gamma \rightarrow (\gamma \rightarrow \gamma \rightarrow t) \rightarrow (\gamma \rightarrow \gamma \rightarrow t) \rightarrow (t \rightarrow t \rightarrow t) \rightarrow t \]

- A modal environment and a factual environment
- A modal continuation and a factual continuation (or a modal contribution and a factual contribution of the continuation)
- A modal part and a factual part
Interpretation of the Sentences

[de Groote(2006)]: \[ s \] = \gamma \rightarrow (\gamma \rightarrow t) \rightarrow t
Here:
\[ s \] = \gamma \rightarrow \gamma \rightarrow (\gamma \rightarrow \gamma \rightarrow t) \rightarrow (\gamma \rightarrow \gamma \rightarrow t) \rightarrow (t \rightarrow t \rightarrow t) \rightarrow t

- A modal environment and a factual environment
- A modal continuation and a factual continuation (or a modal contribution and a factual contribution of the continuation)
- A modal part and a factual part

Note on pairs: \((t, t)\) as \((t \rightarrow t \rightarrow t) \rightarrow t\)

- A pair \((a, b)\) is interpreted as \(\lambda f . f \ a \ b\) (selecting two-place functions and applying them to the 1st and the 2nd component)
- An additional parameter:
  - How should the modal and the factual part be combined? Typically \(\lambda b_1 \ b_2 . b_1 \land b_2\)
  - When should they be combined? Possibility of a Reset operator that close the modal contribution.
Interpretation of the Sentences

[de Groote(2006)]: \([s] = \gamma \rightarrow (\gamma \rightarrow t) \rightarrow t\)
Here:
\([s] = \gamma \rightarrow \gamma \rightarrow (\gamma \rightarrow \gamma \rightarrow t) \rightarrow (\gamma \rightarrow \gamma \rightarrow t) \rightarrow (t \rightarrow t \rightarrow t) \rightarrow t\)

- A modal environment and a factual environment
- A modal continuation and a factual continuation (or a modal contribution and a factual contribution of the continuation)
- A modal part and a factual part
- \([np] = (e \rightarrow [s]) \rightarrow [s], [n] = e \rightarrow [s], \text{etc.}\)

**Note on pairs: \((t, t)\) as \((t \rightarrow t \rightarrow t) \rightarrow t\)**

- A pair \((a, b)\) is interpreted as \(\lambda f. f\ a\ b\) (selecting two-place functions and applying them to the 1st and the 2nd component)
- An additional parameter:
  - How should the modal and the factual part be combined? Typically \(\lambda b_1 b_2. b_1 \land b_2\)
  - When should they be combined? Possibility of a Reset operator that close the modal contribution.
Combinations

\[ S_1 S_2 \text{ when } S_2 \text{ has a factual mood} \]

\[
[S_1. S_2] = \lambda i_1 i_2 k_1 k_2 f. [S_1] i_1 i_2 k_1 (\lambda i_1' i_2'. [S_2] i_1' i_2' k_1 k_2 \Pi_2) f
\]
(with \( \Pi_2 = \lambda a b. b \) the second projection)
Combinations

\[ [S_1 . S_2] = \lambda i_1 i_2 k_1 k_2 f. [S_1] i_1 i_2 k_1 (\lambda i'_1 i'_2. [S_2] i'_1 i'_2 k_1 k_2 \Pi_2) f \]
(with \( \Pi_2 = \lambda ab. b \) the second projection)

\[ [S_1 . S_2] = \lambda i_1 i_2 k_1 k_2 f. [S_1] i_1 i_2 (\lambda i'_1 i'_2. [S_2] i'_1 i'_2 k_1 k_2 \Pi_1) k_2 f \]
(with \( \Pi_1 = \lambda ab. a \) the first projection)
Example

\[
[S_1.S_2] = \lambda i_1 i_2 k_1 k_2 f.[S_1] i_1 i_2 k_1 (\lambda i_1' i_2'.[S_2] i_1' i_2' k_1 k_2 \Pi_2) f
\]

Example

\[
[A \text{ wolf might walk in}] = \lambda i_1 i_2 k_1 k_2 f.f (\diamond (\exists x. (\text{wolf } x) \land ((\text{enter } x) \land (k_1 (x :: i_1) i_2)))) (k_2 i_1 i_2)
\]
Example

\[
[S_1.S_2] = \lambda i_1 i_2 k_1 k_2 f. \left[ S_1 \right] i_1 i_2 k_1 (\lambda i_1' i_2'. \left[ S_2 \right] i_1' i_2' k_1 k_2 \Pi_2) f
\]

Example

\[
\left[ A \text{ wolf might walk in} \right] = \lambda i_1 i_2 k_1 k_2 f. f \\
\left[ It \text{ would growl} \right] = \lambda i_1 i_2 k_1 k_2 f. f
\]

\[
(\Diamond (\exists x. (\text{wolf } x) \land ((\text{enter } x) \land (k_1 (x :: i_1) i_2)))) \\
(k_2 i_1 i_2)
\]

\[
(\Box ((\text{growl} (\text{sel}(i_1 \cup i_2))) \land (k_1 i_1 i_2))) \\
(k_2 i_1 i_2)
\]
Example

\[[S_1 \cdot S_2] = \lambda i_1 i_2 k_1 k_2 f. [S_1] i_1 i_2 k_1 (\lambda i'_1 i'_2. [S_2] i'_1 i'_2 k_1 k_2 \Pi_2) f\]

Example

\[\begin{align*}
[A \text{ wolf might walk in}] &= \lambda i_1 i_2 k_1 k_2 f. f \\
(\Diamond (\exists x. (\text{wolf } x) \land ((\text{enter } x) \land (k_1 (x :: i_1) i_2)))) & (k_2 i_1 i_2) \\
\end{align*}\]

\[\begin{align*}
[It \text{ would growl}] &= \lambda i_1 i_2 k_1 k_2 f. f \\
(\Box ((\text{growl} (\text{sel}(i_1 \cup i_2))) \land (k_1 i_1 i_2))) & (k_2 i_1 i_2) \\
\end{align*}\]

\[\begin{align*}
[It \text{ will growl}] &= \lambda i_1 i_2 k_1 k_2 f. f \\
(k_1 i_1 i_2) ((\text{growl} (\text{sel} i_2))) \\
\end{align*}\]
Example

\[
[S_1.S_2] = \lambda i_1 i_2 k_1 k_2 f. [S_1] i_1 i_2 k_1 (\lambda i'_1 i'_2. [S_2] i'_1 i'_2 k_1 k_2 \Pi_2) f
\]

Example

\[
\begin{align*}
\text{[A wolf might walk in]} & \quad = \lambda i_1 i_2 k_1 k_2 f. f \\
\text{[It would growl]} & \quad = \lambda i_1 i_2 k_1 k_2 f. f \\
\text{[It will growl]} & \quad = \lambda i_1 i_2 k_1 k_2 f. f \\
\end{align*}
\]

(\bigcirc (\exists x. (\text{wolf } x) \land ((\text{enter } x) \land (k_1 (x :: i_1) i_2))))

\[
\begin{align*}
(k_2 i_1 i_2) \\
(\Box ((\text{growl } (\text{sel } (i_1 \cup i_2))) \land (k_1 i_1 i_2))) & \quad (k_2 i_1 i_2) \\
(k_1 i_1 i_2) & \quad ((\text{growl } (\text{sel } i_2))) \\
\end{align*}
\]

Let:

- \textbf{Nil} be the empty environment (\text{sel } \textbf{Nil} always fails)
- \textbf{T} be the trivial continuation (\lambda i_1 i_2. \text{\textbf{T}})
- \textbf{Conj} be the conjunction (\lambda b_1 b_2. b_1 \land b_2)
Example

$$[S_1.S_2] = \lambda i_1 i_2 k_1 k_2 f.[S_1] i_1 i_2 k_1 (\lambda i'_1 i'_2.[S_2] i'_1 i'_2 k_1 k_2 \Pi_2) f$$

Let:

- Nil be the empty environment (sel Nil always fails)
- $T$ be the trivial continuation ($\lambda i_1 i_2.T$)
- Conj be the conjunction ($\lambda b_1 b_2.b_1 \land b_2$)

We can then evaluate (Nil Nil $T$ $T$ Conj parameters are omitted):

Example (A wolf might walk in. It would growl)

$$[S] = (\Diamond (\exists x.(\text{wolf } x) \land ((\text{enter } x) \land (k_1 (x :: i_1) i_2)))) (k_2 i_1 i_2)$$
Example (A wolf might walk in. It will growl)

\[[S] = (◊(∃x.(\text{wolf } x) \land ((\text{enter } x) \land T))) \land \text{growl}(\text{sel Nil})\]
Example (cont’d)

Example (A *wolf* might walk in. *It will* growl)

\[
[S] = (\diamond(\exists x. (\text{wolf } x) \land ((\text{enter } x) \land T))) \land (\text{growl} (\text{sel Nil}))
\]

Example (A *wolf* walks in. *It might* growl)

\[
[S] = \exists x. (\diamond((\text{howl} (\text{sel (Nil } \cup (x :: \text{Nil})))) \land T) \land ((\text{wolf } x) \land ((\text{enter } x) \land T))
\]
Example (A wolf might walk in. It will growl)

\[ [S] = (\Box (\exists x. (\text{wolf } x) \land ((\text{enter } x) \land T))) \land (\text{growl } (\text{sel } \text{Nil})) \]

Example (A wolf walks in. It might growl)

\[ [S] = \exists x. (\Box (\text{howl } (\text{sel } (\text{Nil } \cup (x :: \text{Nil})))) \land T) \land ((\text{wolf } x) \land ((\text{enter } x) \land T)) \]

Lexical Semantics

\[ [\text{might}] = \lambda vs. \lambda i_1 i_2 k_1 k_2 f. f (\Box (v s i_1 i_2 k_1 k_2 \Pi_1))(k_2 i_1 i_2) \]
Example (cont’d)

Example (A wolf might walk in. It will growl)

\[ [S] = (\Diamond (\exists x. (\text{wolf } x) \land ((\text{enter } x) \land \top))) \land (\text{growl}(\text{sel Nil})) \]

Example (A wolf walks in. It might growl)

\[ [S] = \exists x. (\Diamond (\text{howl}(\text{sel}(\text{Nil} \cup (x :: \text{Nil})))) \land \top)) \land ((\text{wolf } x) \land ((\text{enter } x) \land \top)) \]

Lexical Semantics

\[
\begin{align*}
[might] &= \lambda vs.\lambda \lambda i_1 i_2 k_1 k_2 f. f (\Diamond (v s i_1 i_2 k_1 k_2 \Pi_1))(k_2 i_1 i_2) \\
[a_{nf}] &= \lambda PQ.\lambda \lambda i_1 i_2 k_1 k_2 f. \exists x. P x (x :: i_1) i_2 (\lambda ij. Q x i j k_1 k_2 \Pi_1) k_2 f
\end{align*}
\]
Example (A wolf might walk in. It will growl)

\[ S = (\Diamond (\exists x. (\text{wolf } x) \land ((\text{enter } x) \land T))) \land (\text{growl} (\text{sel Nil})) \]

Example (A wolf walks in. It might growl)

\[ S = \exists x. (\Diamond ((\text{howl} (\text{sel (Nil } \cup (x :: \text{ Nil})))) \land T)) \land ((\text{wolf } x) \land ((\text{enter } x) \land T)) \]

Lexical Semantics

\[
\begin{align*}
[\text{might}] &= \lambda vs. \lambda i_1 i_2 k_1 k_2 f . f (\Diamond (v s i_1 i_2 k_1 k_2 \Pi_1))(k_2 i_1 i_2) \\
[a_{nf}] &= \lambda PQ. \lambda i_1 i_2 k_1 k_2 f . \exists x. P \times (x :: i_1) i_2 (\lambda ij. Q \times i j k_1 k_2 \Pi_1) k_2 f \\
[a_f] &= \lambda PQ. \lambda i_1 i_2 k_1 k_2 f . \exists x. P \times i_1 (x :: i_2) k_1 (\lambda ij. Q \times i j k_1 k_2 \Pi_2) f
\end{align*}
\]
Example (A wolf might walk in. It will growl)

\[
[S] = (\Box (\exists x. (\text{wolf } x) \land ((\text{enter } x) \land \top))) \land (\text{growl (sel Nil)})
\]

Example (A wolf walks in. It might growl)

\[
[S] = \exists x. (\Box ((\text{howl (sel (Nil } \cup (x :: \text{Nil})))) \land \top)) \land ((\text{wolf } x) \land ((\text{enter } x) \land \top))
\]

Lexical Semantics

\[
\begin{align*}
\text{might} & \quad = \lambda vs. \lambda i_1 i_2 k_1 k_2 f. f (\Box (v s i_1 i_2 k_1 k_2 \Pi_1))(k_2 i_1 i_2) \\
\text{af} & \quad = \lambda PQ. \lambda i_1 i_2 k_1 k_2 f. \exists x. P x (x :: i_1) i_2 (\lambda ij. Q x i j k_1 k_2 \Pi_1) k_2 f \\
\text{Reset} & \quad \triangleq \lambda S. \lambda e_1 e_2 k_1 k_2 f. f (k_1 e_1 e_2) \quad (S e_1 e_2 \top k_2 \text{ Conj})
\end{align*}
\]
Discussion

Example (A wolf might walk in. It would growl)

\[
[S] = (\Diamond (\exists x.(\text{wolf } x) \land ((\text{enter } x) \land (\Box((\text{growl}(\text{sel}(x :: \text{Nil}) \cup \text{Nil})) \land T)))))) \land T
\]

- □ under the scope of ◊
- But what if in the accessed worlds, \text{wolf } x is false?
Discussion

Example (*A wolf might walk in. It would growl*)

\[ [S] = (\Box(\exists x. (\text{wolf } x) \land (\text{enter } x) \land (\Box((\text{growl (sel}(x :: \text{Nil}) \cup \text{Nil})) \land T)))) \land T \]

- \(\Box\) under the scope of \(\Box\)
- But what if in the accessed worlds, \text{wolf } x is false?

⇒ Modal base and local accommodation: we would like to have

\[ [S] = (\Box(\exists x. (\text{wolf } x) \land (\text{enter } x) \land (\Box((\text{wolf } x) \land (\text{enter } x)) \Rightarrow (\text{growl (sel}(x :: \text{Nil}) \cup \text{Nil})) \land T)))) \land T \]
Discussion

Example (A wolf might walk in. It would growl)

\[
[S] = (\Diamond (\exists x. (\text{wolf} \ x) \land ((\text{enter} \ x) \land (\Box ((\text{growl} (\text{sel}(x :: \text{Nil}) \cup \text{Nil})) \land \top)))))) \land \top
\]

- □ under the scope of ◇
- But what if in the accessed worlds, \text{wolf} \ x is false?

⇒ Modal base and local accommodation: we would like to have

\[
[S] = (\Diamond (\exists x. (\text{wolf} \ x) \land ((\text{enter} \ x) \land \\
(\Box(((\text{wolf} \ x) \land (\text{enter} \ x)) \Rightarrow (\text{growl} (\text{sel}(x :: \text{Nil}) \cup \text{Nil})) \land \top)))))) \land \top
\]

Alternative Proposal

\[
[S] = \gamma \rightarrow \gamma \rightarrow (\gamma \rightarrow \gamma \rightarrow t \rightarrow \kappa \rightarrow t) \rightarrow (\gamma \rightarrow \gamma \rightarrow t \rightarrow \kappa \rightarrow t) \rightarrow (t \rightarrow t \rightarrow t \rightarrow t) \rightarrow t
\]

with \( \kappa \overset{\Delta}{=} t \rightarrow t \rightarrow t \) (typically \( \lambda b_1 b_2. b_1 \land \Diamond (b_1 \Rightarrow b_2) \))
Accommodation: Example

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

\[ \Diamond \exists x. ((\text{wolf } x) \land (\text{enter } x)) \land \]
\[ \Box (((\text{wolf } x) \land (\text{enter } x)) \Rightarrow ((\text{growl } (\text{sel}((x :: \text{Nil}) + \text{Nil}))) \land \]
\[ \Box (((\text{wolf } x) \land (\text{enter } x)) \Rightarrow ((\text{eat you } (\text{sel}((x :: \text{Nil}) + \text{Nil}))))))) \]
We used $\gamma$ as a list of entities

But we could introduce $s$ the type of worlds and move to TY2

- $Sel$ function on worlds and explicit reference to worlds (context referents)

- Example: ($\lambda e_1 e_2 k w. \exists w'. (R w w') \land (\exists x. (\text{wolf } x w') \land (\text{enter } x w' k (w' :: e_2 w)))$)

- Flexibility on factual and nonfactual world interaction

- Example: John might buy a house $x$. He earns enough to get a mortgage. He could rent it $x$ out for the festival.

- Example: If John's at home he'll be reading a book $x$. Actually he's still at the office. $\ast$ It $x$'ll be War and Peace $x$. 
We used $\gamma$ as a list of entities
But we could introduce $s$ the type of worlds and move to TY2
- Sel function on worlds and explicit reference to worlds (context referents)

Example (*a wolf might walk in*)

$$
\lambda e_1 e_2 k w. \exists w'. (R w w') \land (\exists x. (\text{wolf } x w') \land (\text{enter } x w') \land (k ((w', x) + e_1)(w' :: e_2) w)))
$$
We used $\gamma$ as a list of entities

But we could introduce $s$ the type of worlds and move to TY2

- $\text{Sel1}$ function on worlds and explicit reference to worlds (context referents)

Example (*a wolf might walk in*)

\[
\lambda e_1 e_2 k w. \exists w'. (R w w') \land (\exists x. (\text{wolf } x w') \land ((\text{enter } x w') \land (k ((w', x) + e_1)(w' :: e_2) w)))
\]

- Flexibility on factual and nonfactual world interaction
\( \gamma \) as a Macro Definition

- We used \( \gamma \) as a list of entities
- But we could introduce \( s \) the type of worlds and move to TY2
  - \( \mathrm{Sel} \) function on worlds and explicit reference to worlds (context referents)

Example (a wolf might walk in)

\[
\lambda e_1 e_2 k w. \exists w'. (R w w') \land (\exists x. (\text{wolf} x w') \land ((\text{enter} x w') \land (k ((w', x) + e_1)(w' :: e_2) w)))
\]

- Flexibility on factual and nonfactual world interaction

Example

John might buy a house\( _x \). He earns enough to get a mortgage. He could rent it\( _x \) out for the festival.
\( \gamma \) as a Macro Definition

- We used \( \gamma \) as a list of entities
- But we could introduce \( s \) the type of worlds and move to TY2
  - Sel function on worlds and explicit reference to worlds (context referents)

\[ \lambda e_1 e_2 k w. \exists w'. (R w w') \land (\exists x. (\text{wolf } x w') \land (\text{enter } x w') \land (k ((w', x) + e_1)(w' :: e_2) w)))) \]

- Flexibility on factual and nonfactual world interaction

Example (*a wolf might walk in*)

Example

John might buy a house\(_x\). He earns enough to get a mortgage. He could rent it\(_x\) out for the festival.

Example

If John’s at home he’ll be reading a book\(_x\). Actually he’s still at the office. *It\(_x\)*’ll be *War and Peace*. 
Conclusion

Wrapping Up

- Modal subordination in [de Groote(2006)]’s framework
- Flexibility of the approach
- Role of the lexical semantics
- Modal and/or type theory
Conclusion

Wrapping Up
- Modal subordination in [de Groote(2006)]’s framework
- Flexibility of the approach
- Role of the lexical semantics
- Modal and/or type theory

Future Work
- Dynamic modal logic?
- Negation and counterfactuals
- [Veltman(1996)]’s testing and filtering
- Interaction with discourse structure (factual explanations of nonfactual possibilities)
- Hob and Nob sentences
N. Asher and E. McCready.
Were, would, might and a compositional account of counterfactuals.

P. de Groote.
Towards a montagovian account of dynamics.

A. Frank and H. Kamp.
On Context Dependence in Modal Constructions.
http://www.cl.uni-heidelberg.de/~frank/papers/salt-online.pdf.

B. Geurts.
*Presuppositions and Pronouns*.

C. Roberts.
Modal subordination and pronominal anaphora in discourse.
Available at http://www.ling.ohio-state.edu/~croberts/modalsub89.pdf.
M. Stone and D. Hardt.
Dynamic discourse referents for tense and modals.

R. van Rooij.
A modal analysis of presupposition and modal subordination.

F. Veltman.
Defaults in update semantics.