Lexical and supra-lexical underspecification rooted in a dm-based theory of word-formation

Uwe Reyle, Antje Roßdeutscher, Hans Kamp and Torgrim Solstad

November 3rd, 2007
Research objectives of B4/D1

- **B4**: A theory of word-formation and interpretation in context
  - word formation is inspired by principles of the research program 'Distributed Morphology' (DM). Verbs and derived nominals are constructed from 'roots'
  - we assign the roots a semantics
  - constructions are assigned a compositional semantics, determined by their syntactic trees and selectional restrictions of argument phrases.

- **D1**: Underspecified semantic representations and their disambiguation in context
Phenomena in current focus

- range of possible readings of *ung*-nouns and past participles
- working hypothesis: two sides of the same coin.

- An *ung*-noun has a target state reading if and only if the past participle of the corresponding verb has one.
- an *ung*-noun has an other-reading if the corresponding verb is built from a sortal root.
Is the root class decisive?

<table>
<thead>
<tr>
<th>✓ trocken (dry), ✓ weit (wide)</th>
<th>✓ sauber (clean),</th>
<th>→</th>
<th>property of individuals</th>
<th>1 e, ts</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ bild_sort (build), ✓ samm_sort (collect)</td>
<td>✓ misch_sort (mix),</td>
<td>→</td>
<td>entity which is brought about by the event</td>
<td>2 : e, o</td>
</tr>
<tr>
<td>✓ pflaster_sort (pavement), ✓ würze_sort (spice), ✓ muster_sort (pattern)</td>
<td>→</td>
<td>entity which the internal argument is made to have</td>
<td>3 : e, ts, o</td>
<td></td>
</tr>
</tbody>
</table>

Expectation: the range of readings of ung-nouns and past participle depends on the class of the roots

Our experience: We find productive patterns along the lines 1, and 3.

Hypothesis:

Some roots can belong to more than one class at once; they adjust semantics accordingly.
Roots switch semantics wrt. sortal restrictions

1. \( \mathbf{rP} \)
   \[ \text{COMP} \]
   \[ \sqrt{\text{haufen}} \]
   \[ \lambda Y. \text{accumulated}(Y) \]
   \[ Y \sqsubseteq \text{quantity of goods or monetary} \]

2. \( \mathbf{rP} \)
   \[ \text{COMP} \]
   \[ \sqrt{\text{haufen}_{\text{sort}}} \]
   \[ z \]
   \[ \text{accumulation}(z) \]
   \[ Y \sqsubseteq \text{events} \]

3. die Häufung der Vorräte
   the accumulation of stocks

4. die Häufung der Unfälle
   the accumulation of the accidents

5. die wieder gehäuften Vorräte (restit.)
6. die Unfälle häufen sich wieder (repet.)
### Lexical and supra-lexical underspecification rooted in a dm-based theory of word-formation

<table>
<thead>
<tr>
<th>1</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>rP</td>
<td>PP=SC</td>
</tr>
<tr>
<td>COMP</td>
<td>√streichsort</td>
</tr>
<tr>
<td>√streich</td>
<td>P'</td>
</tr>
<tr>
<td>y ⊑ information</td>
<td>λzλy under(z,y)</td>
</tr>
<tr>
<td>y deleted(y)</td>
<td>P</td>
</tr>
<tr>
<td>λy.under(z,y)</td>
<td>y ⊑ 1D-object</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>die Streichung des Absatzes paragraph</td>
<td>die Unterstreichen der Zeile the underlining of the line</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>die Wand streichen, durch die Gegend streichen</td>
<td>the wall paint, through the area wander</td>
</tr>
</tbody>
</table>

---

Uwe Reyle, Antje Roßdeutscher, Hans Kamp and Torgrim Solstad
Roots switch semantics wrt. sortal restrictions

1. \[ \lambda y.\text{loose}(y) \]
   - Functions as binder

2. \[ \sqrt{\text{los}} \text{solution}(z) \]
   - \[ \lambda y.\lambda z.\text{HAVE}(y,z) \]
   - \[ y \subseteq \text{puzzle} \]

3. \[ \sqrt{\text{los sort}} \text{PP=} \text{SC} \]
   - \[ \text{die Lösung des Rätsels} \]
   - \[ \text{the solution of the puzzle} \]
<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>rP</td>
<td>rP</td>
<td>PP=SC</td>
</tr>
<tr>
<td></td>
<td>COMP</td>
<td>COMP</td>
<td>P</td>
</tr>
<tr>
<td></td>
<td>√offen</td>
<td>√offensort</td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>λy.Offen(y)</td>
<td>y have hole-like region</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>has or is barrier to accessibility</td>
<td>y have hole-like region</td>
<td>HOLE(x)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>die Öffnung der Tür</td>
<td>die Öffnung eines Loches in der Wolkendecke</td>
<td>die Öffnung einer Leiche</td>
</tr>
<tr>
<td></td>
<td>the open+ung of the door</td>
<td>unbroken cloud</td>
<td>'a postmortem on a body'</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>die Öffnung einer Leiche</td>
<td>die Öffnung eines Loches in der Wolkendecke</td>
<td></td>
</tr>
<tr>
<td></td>
<td>’a postmortem on a body’</td>
<td>unbroken cloud</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>die wieder geöffnete Tür</td>
<td>wieder hat sich ein Loch in der Wolkendecke geöffnet</td>
<td></td>
</tr>
</tbody>
</table>

Uwe Reyle, Antje Roßdeutscher, Hans Kamp and Torgrim Solstad

Lexical and supra-lexical underspecification rooted in a dm-based theory of
die Tür öffnen

\[ \langle \{ s' : \neg \text{OFFEN}(y) \} \rangle \langle e, \square \rangle \]

\[ \langle e, y \rangle \]

\[ \langle s, \text{die Tür}(y) \rangle \]

\[ \langle y, \text{die Tür}(y) \rangle \]

\[ \lambda y. \text{OFFEN}(y) \]

\( y \sqsubseteq \) has or is barrier to accessibility

Uwe Reyle, Antje Roßdeutscher, Hans Kamp and Torgrim Solstad
ein Loch sich öffnen

Uwe Reyle, Antje Roßdeutscher, Hans Kamp and Torgrim Solstad
Lexical and supra-lexical underspecification rooted in a dm-based theory of word-formation
Lexical and supra-lexical underspecification rooted in a dm-based theory of word-formation
Aim: one single underspecified lexical entry for the verbal stem öffn-

-ung and ge- operators defined on this entry yield underspecified semantics for Öffnung and geöffnet

\[
\begin{align*}
\text{öffn}_1 + \text{ung} & \quad \text{Öffnung}_1 &1 &\text{e, ts} \\
\text{öffn}_{2,\text{sort}} + \text{ung} & \quad \text{Öffnung}_{2,\text{sort}} &2 &\text{e, o} \\
\text{öffn}_{3,\text{sort}} + \text{ung} & \quad \text{Öffnung}_{3,\text{sort}} &3 &\text{e, ts, o} \\
\end{align*}
\]

(die) Öffnung der Leiche
(die) Öffnung eines Loches
Underspecified representation of öffn-sort and Öffnung_sort

\[ \text{öffent_sort} \mapsto \left\{ \begin{array}{l} z \\ z \subseteq \text{region} \end{array} \right\}' \]

\[ \text{öffnung_sort} \mapsto \left\{ \begin{array}{l} z \\ z \subseteq \text{region} \end{array} \right\}' \langle \alpha, \left\{ \begin{array}{l} (\alpha = e) \lor (\alpha = s) \lor (\alpha = x) \\ e \text{ CAUSE } s \\ s: \text{ HOLE}(x) \\ x \subseteq (\text{skin of}) z \end{array} \right\} \rangle \]
Underspecified entry for Öffnung including its non-sortal reading

Öffnung ⇝

\[\left\{ \begin{array}{c} z \\
z \subseteq \text{region} \end{array} \right\}, \left\langle \alpha, \begin{array}{c} e \ s \ x \\
(\alpha = e) \lor (\alpha = s) \lor (\alpha = x) \\
e \ \text{CAUSE} \ s \\
s: \ \text{HOLE}(x) \\
x \subseteq (\text{skin of}) \ z \end{array} \right\} \]

\[\lor \]

\[\left\{ \begin{array}{c} y \\
y \subseteq \text{has or is barrier to accessibility} \end{array} \right\}, \left\langle \alpha, \begin{array}{c} e \ s \\
(\alpha = e) \lor (\alpha = s) \\
e \ \text{CAUSE} \ s \\
s: \ \text{OFFEN}(y) \end{array} \right\} \]
Trees for the sortal readings of Öffnung $DP_{gen}$

**Relation $\rho$ between the referent $y$ of $DP_{gen}$ and either event, target state $s$ or object $x$ of Öffnung**

**Internal Argument:** $\rho$ given by lexical entry for Öffnung

**Non-Argument:** $\rho$ is some kind of 'POSS'-relation
We require the \( DP_{gen} \) to establish a non-identity relation between its referential argument, \( \text{refArg}(DP_{gen}) \), and that of the preceding NP.

\[
\| \text{NP} \quad DP_{gen} \| = \frac{\rho}{\rho(\text{refArg} (\text{NP}), \text{refArg} (DP_{gen} ))} \| \text{DP}_{gen} \|
\]

**Internal Argument**

\[
\lambda e \lambda y \\
\text{e CAUSE s} \\
\lambda s \lambda y \\
\text{HOLE}(x) \\
y = x \lor \\
x \subseteq \text{skin of y}
\]

\[
\lambda e \lambda y \\
\text{e CAUSE s} \\
\lambda s \lambda y \\
\text{HOLE}(x) \\
x \subseteq \text{skin of y}
\]

\[
\lambda e \lambda y \\
\text{e CAUSE s} \\
\lambda s \lambda y \\
\text{HOLE}(x) \\
y = x \lor \\
x \subseteq \text{skin of y}
\]
Underspecified Analysis of phrases of the form $NP \, DP_{gen}$

\[
|| NP \, DP_{gen} || =
\]
\[
|| NP || ; \left\{ \begin{array}{c}
\rho \\
\rho(\text{refArg}(NP),\text{refArg}(DP_{gen}))
\end{array} \right\} || DP_{gen} ||
\]

Non-Argument

- For non-relational nouns $|| NP ||$ has the form $N(\alpha)$ and $\rho$ typically instantiates to $\text{POSS}$ or is resolved in the global discourse context.
- For relational nouns $N(\text{refArg(DP}_{gen}),\alpha)$ we normally have $\rho = N$
- For nominalisations, $\rho = N$ and $N$ is typically determined by the underlying verb.
Resolution "z ⇝ y" is consistent with "z ⊆ region".

where ρ is either POSS or one of (i), (ii), (iii)
(i) λeλy(∃s(eCAUSEs ∧ s : ∃x(HOLE(x) ∧ x ⊆ (skin of) y )) ),
(ii) λsλy(s : ∃x(HOLE(x) ∧ x ⊆ (skin of) y ))),
(iii) λxλy(x ⊆ (skin of) y )
Assumption: Loch(y) ⊑ y ⊑ hole-like. This is incompatible with “z ⊑ region with skin”. So z can’t be resolved to y.

Internal Argument:
\[ y = x \Rightarrow \begin{cases} \alpha = s & ; \text{Öffnung of type 2} \\ \alpha = x & ; \text{'disjoint reference'} \end{cases} \]

Remains:
\[ \lambda \epsilon \lambda y (e \textit{CAUSE}s \land s : \exists x (\text{HOLE}(x) \land x \subseteq (\text{skin of} y)) ) \]

Non-Argument:
\[ \rho \text{ is POSS} \]
Without assumption ’y ⊑ hole-like’ all of e, s, o possible
Conclusion

- DRT-based lexical semantics for word-structures:
  - compositional semantics for words determined by their roots and structures
  - structural ambiguity of verbs and ung-nouns as determined by different types of roots
  - predictions of the meaning ranges of ung-nouns from their root based structure

- Underspecified lexical entries for verbs and ung-nouns:
  - Reduction of lexical underspecification in context
  - in particular: reduction through interaction between underspecified ung-nouns and their DP-complements/adjuncts
  - different analyses of the same expression can yield the same final interpretation