Features & Unification

Chapter 11

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Problem

• When writing a grammar the number of rules increases with each phenomenon that must be accounted for.

• We soon start to miss generalizations
  – For example - we have to write a lot of NP rules, depending on, person, number, case, etc.

• This is difficult to maintain.
Features

- Features help by breaking grammatical categories into a small set of atomic units
- Features organized into feature charts
Feature Paths

- Feature Charts can be displayed as directed graphs
Unification

- Features can be combined through Unification

\[
\begin{bmatrix}
\text{NUMBER} & \text{sg} \\
\end{bmatrix} \sqcup \begin{bmatrix}
\text{PERSON} & 3rd \\
\end{bmatrix} = \begin{bmatrix}
\text{NUMBER} & \text{sg} \\
\text{PERSON} & 3rd \\
\end{bmatrix}
\]
Unification

• Two FS can be unified if their features are specified identically

$$
\begin{align*}
\text{AGREEMENT} & \left[ \begin{array}{c}
\text{NUMBER} \quad sg \\
\text{AGREEMENT} & \left[ \begin{array}{c}
\text{NUMBER} \quad sg \\
\text{NUMBER} \quad sg \\
\end{array} \right] \\
\text{AGREEMENT} & \left[ \begin{array}{c}
\text{PERSON} \quad 3 \\
\text{NUMBER} \quad sg \\
\end{array} \right] \\
\text{SUBJECT} & \left[ \begin{array}{c}
\text{NUMBER} \quad sg \\
\text{AGREEMENT} & \left[ \begin{array}{c}
\text{PERSON} \quad 3 \\
\end{array} \right] \\
\end{array} \right] \\
\end{align*}
$$
Unification

- Fails if features are specified differently

```
Unification

<table>
<thead>
<tr>
<th>AGREEMENT</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUMBER</td>
<td>sg</td>
</tr>
<tr>
<td>PERSON</td>
<td>3</td>
</tr>
</tbody>
</table>

Fails!
```
Unification in Grammar

- The rule $S \rightarrow NP \ VP$ can be augmented with $<NP \ Agreement> = <VP \ Agreement>$
- Following the Feature Path requires that NP and VP agree in person and number, otherwise the feature structures will not unify
Unification in Grammar

- Features organize lexical entries effectively

\[
\text{Verb} \rightarrow \text{want} \\
\langle \text{Verb HEAD SUBCAT FIRST CAT} \rangle = \text{VP} \\
\langle \text{Verb HEAD SUBCAT FIRST FORM} \rangle = \text{infinitive}
\]

\[
\begin{bmatrix}
\text{ORTH} & \text{want} \\
\text{CAT} & \text{Verb} \\
\text{HEAD} & \text{SUBCAT} & \left\langle \left[ \text{CAT NP} \right], \left[ \text{CAT VP} \right. \right. \\
& & \text{HEAD} \left[ \text{VFORM infinitival} \right] \left. \right] \right\rangle
\end{bmatrix}
\]