Parsing with Linguistic Features

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Today's lecture

1. Earley parsing with feature structures
2. Semantic features
3. Homework 4

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Incorporating features into a parser

How would we parse with feature structures?

- *these pens*
- **this pens*

NP $\rightarrow$ • DT Nom

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NP $\longrightarrow$ • DT Nom

$$\begin{bmatrix} \text{DT} \begin{bmatrix} \text{head} \begin{bmatrix} \text{agr} \begin{bmatrix} \text{number} & \text{SG} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \quad \sqcup$$

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NP $\rightarrow$ • DT Nom

$$\left[\text{DT}\left[\text{head}\left[\text{agr}\left[\text{number}\quad \text{SG}\right]\right]\right]\right] \quad \sqcup$$

$$\left[\begin{array}{ll} \text{NP} & \left[\text{head}\ \boxed{1}\right] \\ \text{DT} & \left[\text{head}\left[\text{agr}\ \boxed{2}\right]\right] \\ \text{Nom} & \left[\text{head}\ \boxed{1}\left[\text{agr}\ \boxed{2}\right]\right] \end{array}\right]$$

Incorporating features into a parser

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$$\left[\text{Nom } \left[\text{head } \left[\text{agr } \left[\text{number } \text{PL}\right]\right]\right]\right]$$

Incorporating features into a parser

NP → DT • Nom

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These structures will not unify, so no new structure will be entered into chart by completer.

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What makes a good feature?

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- **person**: *I go, you go, he goes*
- **number**: *he dances, they dance*

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- **person**: *I go, you go, he goes*
- **number**: *he dances, they dance*
- **case**: *he brings John, John brings him*

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- **noun class** (e.g., Chinese)

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Tense in Cocama-Cocamilla

Example

Ritama- ca tuts- ui
town- to go- HOD.PST
'I went to town today.'

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Example

Ritama- ca tutsu- tsuri
town- to go- REM.PST
'I went to town a long time ago.'

What makes a good feature?

Posit a feature when there is some contrast in the grammar.

Example

*Ritama- ca tuts -
town- to go- PST
'I went to town.'

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In Cocama-Cocamilla, there seems to be a required **remoteness** feature, orthogonal to but dependent on the tense feature, cf. the remote future to the remote past.

Morphosyntactic features

Definition

A **morphosyntactic feature** is a grammatical feature that influences the morphological or syntactic behavior of the units it associates with.

Some English grammatical phenomena

- number feature on nouns
  these cats
  *these cat

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- person feature on verbs
  I know.
  *I knows.
- case feature on object pronouns
  We like him.
  *We like he.
- countable feature on nouns
  I am going to get my hair cut .
  ?I am going to get my hairs cut .

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Semantic features

Definition

A **semantic feature** is a grammatical feature that influences the semantic behavior of the units it associates with. By *semantic behavior* I refer to the way meaning is constructed (more on that in a later lecture).

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?The dogs feathers were plucked.

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?The lamp is on the corner. (corner of room)

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Example

?Colorless green ideas sleep furiously.

Semantic feature inventory

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- **spatial**: 0D, 1D, 2D, 3D

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Example

The woman$_i$ said she$_i$ was ill .
?The woman$_i$ said he$_i$ was ill .

More examples

Example

the woman finished the race in ten minutes .

?the woman finished the race for ten minutes .

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the woman finished the race in ten minutes .
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Example

The Sherpa reached the summit in ten minutes .
?The Sherpa reached the summit for ten minutes.

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Phelps held his breath for ten minutes .
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A possible semantic feature is **event contour** with values $\langle \textit{instantaneous}, \textit{durational}, \textit{inceptive}, \ldots \rangle$

More examples

Example

bald men and rocks are smooth .

?bald men and rocks are smooth .

More examples

Example

bald men and rocks are smooth .
?bald men and rocks are smooth .

A possible semantic feature is **Animacy** with values $\langle Animate, Inanimate \rangle$

More examples

Example

the water is in the glass .

?the waters are in the glass .

More examples

Example

the water is in the glass .
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A possible semantic feature is **Countability** with values $\langle Countable, Uncountable \rangle$

More examples

Example

the water is in the glass .
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A possible semantic feature is **Countability** with values $\langle Countable, Uncountable \rangle$

Example

horses eat hay .
?horses eat rocks .

More examples

Example

the water is in the glass .
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A possible semantic feature is **Countability** with values $\langle Countable, Uncountable \rangle$

Example

horses eat hay .
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A possible semantic feature is **Edibility** with values $\langle Edible, Inedible \rangle$

Semantic features and parsing

Semantic features can be useful for parsing, e.g., adjective scoping:

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Semantic features and parsing

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Example

(Old men) and (women) play bingo.

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Example

(Old (men and women)) play bingo.

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(Old (men and women)) play bingo.

Example

(Sleeping men) and (books) lie flat.

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? (Sleeping (men and books) lie flat.

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Homework 4

- Worth 10 pts. (10% of grade)
- Write a grammar using various morphosyntactic and semantic features
- Parse simple sentences using the feature-enabled Earley chart parser
- Return no parse for ungrammatical sentences