Parsing with Linguistic Features

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Today’s lecture

1. Earley parsing with feature structures
2. Semantic features
3. Homework 4
Incorporating features into a parser

How would we parse with feature structures?

- *these pens*
- *this pens*

NP → ● DT Nom
Incorporating features into a parser

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NP → • DT Nom

\[
\begin{align*}
\text{DT} & \left[ \text{head} \left[ \text{agr} \left[ \text{number} \quad \text{SG} \right] \right] \right] \\
& \quad \square
\end{align*}
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\text{NP} \rightarrow \bullet \text{DT Nom}
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\text{head} \begin{bmatrix}
\text{agr} \begin{bmatrix}
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\end{bmatrix}
\end{bmatrix}
\end{bmatrix} \\
\text{NP} & \begin{bmatrix}
\text{head 1}
\end{bmatrix} \\
\text{DT} & \begin{bmatrix}
\text{head 2}
\end{bmatrix} \\
\text{Nom} & \begin{bmatrix}
\text{head 1 agr 2}
\end{bmatrix}
\end{align*}
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Incorporating features into a parser

NP → DT • Nom

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\begin{align*}
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\end{align*}
\]

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

NP $\rightarrow$ DT • Nom

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\text{Nom} & \quad \text{head} \ [\text{agr} \ [\text{number} \ PL]]]
\end{align*}
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Incorporating features into a parser

NP → DT • Nom

NP → head [1] head [agreement 2 [number singular]]
DT → head [agreement 2 [number singular]]
Nom → head [agreement 2]
Nom → head [agreement [number plural]]

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What makes a good feature?

- **person**: *I go, you go, he goes*
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- **person**: *I go, you go, he goes*
- **number**: *he dances, they dance*
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- **evidentiality** (e.g., Shipibo)
- **noun class** (e.g., Chinese)
Tense in Cocama-Cocamilla

Example

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

Example

Ritama- ca tutsu- icua’
town- to go- HEST.PST
‘I went to town yesterday/a few days ago.’

Example

Ritama- ca tutsu- tsuri
town- to go- REM.PST
‘I went to town a long time ago.’
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Posit a feature when there is some contrast in the grammar.

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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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  these cats
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- person feature on verbs
  I know.
  *I knows.
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  I know.
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- 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.
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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Example

?The dogs feathers were plucked.
## Semantic features

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**Example**

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**Example**

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

**Example**

?Colorless green ideas sleep furiously.
Semantic feature inventory

Mant types of semantic features have been posited:

- animacy: inanimate, animate
- natural gender: male, female, neuter
- natural kind: artifact, vegetable, solid object, red thing
- size: large, average, small, tiny
- spatial: 0D, 1D, 2D, 3D

Example:
The woman said she was ill.
The woman said he was ill.
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Example

The woman said she was ill.

?The woman said he was ill.
More examples

Example

the woman finished the race in ten minutes.
?the woman finished the race for ten minutes.
More examples

Example
the woman finished the race in ten minutes .
?the woman finished the race for ten minutes .

Example
The Sherpa reached the summit in ten minutes .
?The Sherpa reached the summit for ten minutes.
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A possible semantic feature is **event contour** with values
\( \langle \text{instantaneous, durational, inceptive, . . .} \rangle \)
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 $\langle \text{Animate}, \text{Inanimate} \rangle$
More examples

Example

the water is in the glass .
?the waters are in the glass .
More examples

Example

the water is in the glass.
?the waters are in the glass.

A possible semantic feature is **Countability** with values \(\langle \text{Countable, Uncountable} \rangle\)
More examples

Example

the water is in the glass.
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A possible semantic feature is **Countability** with values \(\langle \text{Countable}, \text{Uncountable} \rangle\)

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.
?horses eat rocks.

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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Example

(Old men) and (women) play bingo.
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Example
(Sleeping men) and (books) lie flat.
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Example
? (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