Natural Language Processing
CMSC 723 (spring, 2001)

April 25 - May 2, 2001

- Chapter 16: Lexical-Semantics
- Meaning of Words
- Lexical Relations
- WordNet
- Thematic Roles

Definitions
- What is the lexicon?
- What is a lexeme?
- What is a (word) sense?
- What is a dictionary?
- What is a computational lexicon?

Lexical Relations I: Homonymy

What is homonymy?

- A bank holds investments in a custodial account
- Agriculture is burgeoning on the east bank

Variants:

- homophones - “read” and “red”
- homographs - “bass” and “bass”
Lexical Relations II: Polysemy

What is polysemy?

- The bank is constructed from red brick
- I withdrew the money from the bank

Lexical Relations III: Metaphor and Metonymy

- What is metaphor?
  That doesn’t scare Digital.

- What is metonymy?
  GM killed the Fiero.

Extension of existing senses to a new meaning.

Word Sense Disambiguation

For any given lexeme, how can its senses be reliably distinguished?

Lexical Relations IV: Synonymy

What is synonymy? Substitutability.

- How big is that plane?
- How large is that plane?

Compare:

- A big fat apple
- A large fat apple

Influences on substitutability:
1. subtle shades of meaning differences
2. polysemy
3. register
4. collocational constraints
**Lexical Relations V: Hyponomy (Ontology, Taxonomy)**

What is **hyponomy**?

General: **hyponym**

Specific: **hypernym**

- Example: “car” is a **hypernym** of “vehicle” and “vehicle” is a **hyponym** of “car.”

- Test: “That is a car” implies “That is a vehicle”

What is **ontology**?

What is **taxonomy**?

What is **object hierarchy**?

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**Format of WordNet Entries**

[Figure 16.2]

WordNet sense entries consist of a set of synonyms, a dictionary-style definition (or gloss), and some example uses.

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**WordNet**

[Figure 16.1]

WordNet is the most widely used hierarchically organized lexical database for English — Fellbaum (1998).

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**Distribution of Senses among WordNet Verbs**

[Figure 16.3]
Lexical Relations in WordNet

[Figure 16.4]

[Figure 16.5]

[Figure 16.6]

Hyponomy in WordNet

[Figure 16.7]

Synsets in WordNet

WordNet is organized around the notion of synset.

{chump, fish, fool, gull, mark, patsy, fall guy, sucker, schlemiel, shlemiel, soft touch, mug}

Important: It is this exact synset that makes up one of the sense for each of the entries listed in the synset.

Theoretically, each synset can be viewed as a concept in a taxonomy—like the concepts described in Chapter 14.

Internal Structure of Words

What are the meaning components underlying word senses?
Thematic Roles ($\theta$-roles)

What is a thematic role?

- $\exists w, x, y, z \, \text{Giving}(x) \land \text{Giver}(w, x) \land \text{Giver}(z, x) \land \text{Given}(y, x)$
- $\exists w, x, z \, \text{Breaking}(x) \land \text{Breaker}(w, x) \land \text{BrokenThing}(z, x)$

Examples of Thematic Roles

[Figure 16.9]

Generic Thematic Roles

[Figure 16.8]

Early Theories of Thematic Roles


Two fundamentally different approaches to linguistics:

- **Gruber/Jackendoff**: Account for semantics and use grammar derived to say something about syntax

- **Fillmore**: Account for syntax and use that to describe semantics
### Comparison of β-Role Paradigms

<table>
<thead>
<tr>
<th>Role</th>
<th>Description</th>
<th>F</th>
<th>O/J</th>
<th>Example</th>
</tr>
</thead>
</table>
| Themat (Patient) | undergoing effect of some action      | D, F, O | Theme | Mary reported
| Agent (Actor)    | instigator of some action              | A  | Agent | John killed Harry
| Experiencer     | entity experiencing some psychic state | D  | Name | John was happy
| Benefactive     | entity benefiting from some action     | B  | Goal | John bought some flowers for Mary
| Instrument      | means by which something comes about  | I  | Name | John wounded Harry with a knife
| Locative        | place where event is situated or takes place | L  | Location | John hid the letter under the bed
| Goal            | entity towards which something moves   | G  | Goal | John passed the book to Mary
| Source          | entity from which something moves      | S  | Source | John returned from Paris
| Temporal        | time of action                         | T  | Time | The meeting was at 9:00

D=dative(affectum), F=factive(affectum), O=objective(neutrat)