Next lectures
- Word sense disambiguation
  » Background from linguistics
    ◆ Lexical semantics
  » On-line resources
  » Computational approaches

Semantic analysis
- Assigning meanings to utterances/sentences
- **Compositional semantics**: we can derive the meaning of the whole sentence from the meanings of the parts.
  - Marseille ate a green apple.
- Relies on knowing:
  - the meaning of individual words
  - how the meanings of individual words combine to form the meaning of groups of words
  - how it all fits in with syntactic analysis

Caveats
- Problems with a compositional approach
  - a former congressman
  - a toy elephant
  - kicked the bucket

Introduction to lexical semantics
- Lexical semantics is the study of
  - the systematic meaning-related connections among words and
  - the internal meaning-related structure of each word
- Lexeme
  - an individual entry in the lexicon
  - a pairing of a particular orthographic and phonological form with some form of symbolic meaning representation
- Sense: the lexeme’s meaning component
- Lexicon: a finite list of lexemes
Dictionary entries

- **right**: adj. located nearer the right hand esp. being on the right when facing the same direction as the observer.
- **left**: adj. located nearer to this side of the body than the right.

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- **red**: n. the color of blood or a ruby.
- **blood**: n. the red liquid that circulates in the heart, arteries and veins of animals.

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Lexical semantic relations: homonymy

- **Homonyms**: words that have the same orthographic and phonological form and unrelated meanings
  - Instead, a bank\(^1\) can hold the investments in a custodial account in the client’s name.
  - But as agriculture burgeons on the east bank\(^2\), the river will shrink even more.
- **Homophones**: distinct lexemes with a shared pronunciation
  - E.g. would and wood, see and sea.
- **Homographs**: identical orthographic forms, different pronunciations, and unrelated meanings
  - The expert angler from Dora, Mo., was fly-casting for bass rather than the traditional trout.
  - The curtain rises to the sound of angry dogs baying and ominous bass chords sounding.

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Lexical semantic relations: polysemy

- **Polysemy**: the phenomenon of multiple related meanings within a single lexeme
  - Example: While some banks furnish blood only to hospitals, others are much less restrictive.
  - New sense, e.g. bank\(^3\)?
  - Polysemy allows us to associate a lexeme with a set of related senses.
- **Distinguishing homonymy from polysemy is not always easy. Decision is based on:**
  - Etymology: history of the lexemes in question
  - Intuition of native speakers

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Word sense disambiguation

- **Given a fixed** set of senses associated with a lexical item, determine which of them applies to a particular instance of the lexical item
- **Two fundamental approaches**
  - WSD occurs during semantic analysis as a side-effect of the elimination of ill-formed semantic representations
  - Stand-alone approach
    - WSD is performed independent of, and prior to, compositional semantic analysis
    - Makes minimal assumptions about what information will be available from other NLP processes
    - Applicable in large-scale practical applications
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Lexemes with the same meaning
- Invoke the notion of **substitutability**
  » Two lexemes will be considered synonyms if they can be substituted for one another in a sentence without changing the meaning or acceptability of the sentence
    » How big is that plane?
    » Would I be flying on a large or small plane?
    » Miss Nelson, for instance, became a kind of big sister to Mrs. Van Tassel’s son, Benjamin.
    » We frustrate ’em and frustrate ’em, and pretty soon they make a big mistake.
    » Also issues of **register**
      ◆ Social factors that surround the use of possible synonyms, e.g. politeness, group status.

WordNet
- Handcrafted database of lexical relations
- Three separate databases: nouns; verbs; adjectives and adverbs
- Each database is a set of lexical entries (according to unique orthographic forms)
  » Set of senses associated with each entry

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<thead>
<tr>
<th>Category</th>
<th>Unique Forms</th>
<th>Number of Senses</th>
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<td>Verb</td>
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<td>29881</td>
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<tr>
<td>Adverb</td>
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<td>5677</td>
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</table>

Sample entry

- The noun “bass” has 8 senses in WordNet.
  1. bass - (the lowest part of the musical range)
  2. bass, bass part - (the lowest part in polyphonic music)
  3. bass, basso - (an adult male singer with the lowest voice)
  4. sea bass, bass - (flesh of lean-fleshed saltwater fish of the family Serranidae)
  5. freshwater bass, bass - (any of various North American lean-fleshed freshwater fishes especially of the genus Micropterus)
  6. bass, bass voice, basso - (the lowest adult male singing voice)
  7. bass - (the member with the lowest range of a family of musical instruments)
  8. bass - (nontechnical name for any of numerous edible marine and freshwater spiny-finned fishes)
More WordNet Statistics

<table>
<thead>
<tr>
<th>Part-of-speech</th>
<th>Avg Polysemy</th>
<th>Avg Polysemy w/o monosemous words</th>
</tr>
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<tbody>
<tr>
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<tr>
<td>Verb</td>
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<tr>
<td>Adjective</td>
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<td>2.71</td>
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<tr>
<td>Adverb</td>
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<td>2.50</td>
</tr>
</tbody>
</table>

WordNet relations

- **Nouns**
  - Hyponym: From concepts to superordinates
    - Breakfast → Meal
  - Hyponym: From concepts to subtypes
    - Faculty → Professor
  - Member-Of: From groups to their members
    - Capitole → Crew
  - Has-Part: From parts to wholes
    - Table → Leg
  - Part-Of: From wholes to parts
    - Course → Meal
  - Antonym: Opposites
    - Leader → Follower

- **Verbs**
  - Hyponym: From events to superordinate events
    - Fly → Travel
  - Hyponym: From events to their subtypes
    - Walk → Stroll
  - Entails: From events to the events they entail
    - Snore → Sleep
  - Antonym: Opposites
    - Increase ↔ Decrease

- **Adjectives/adverbs**
  - Antonym: Opposite
    - Heavy ↔ Light
  - Adverb: Opposite
    - Quickly ↔ Slowly

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