- **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*.*

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

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.

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

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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Synonymy

- 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

Category	Unique Forms	Number of Senses
Noun	94474	116317
Verb	10319	22066
Adjective	20170	29881
Adverb	4546	5677

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

Part-of-speech	Avg Polysemy	Avg Polysemy w/o monosemous words
Noun	1.24	2.79
Verb	2.17	3.57
Adjective	1.40	2.71
Adverb	1.25	2.50

WordNet relations

- Nouns

Relation	Definition	Example
Hypernym	From concepts to superordinates	breakfast → meal
Hyponym	From concepts to subtypes	meal → lunch
Has-Member	From groups to their members	faculty → professor
Member-Of	From members to their groups	copilot → crew
Has-Part	From wholes to parts	table → leg
Part-Of	From parts to wholes	course → meal
Antonym	Opposites	leader → follower

- Verbs

Relation	Definition	Example
Hypernym	From events to superordinate events	fly → travel
Troponym	From events to their subtypes	walk → stroll
Entails	From events to the events they entail	snore → sleep
Antonym	Opposites	increase ⟺ decrease

- Adjectives/adverbs

Relation	Definition	Example
Antonym	Opposite	heavy ⟺ light
Adverb	Opposite	quickly ⟺ slowly

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