



Lexical Semantics



SLP3 Ch 18; INLP Ch 4.2

Semantics

荃者所以在鱼，得鱼而忘荃

蹄者所以在兔，得兔而忘蹄

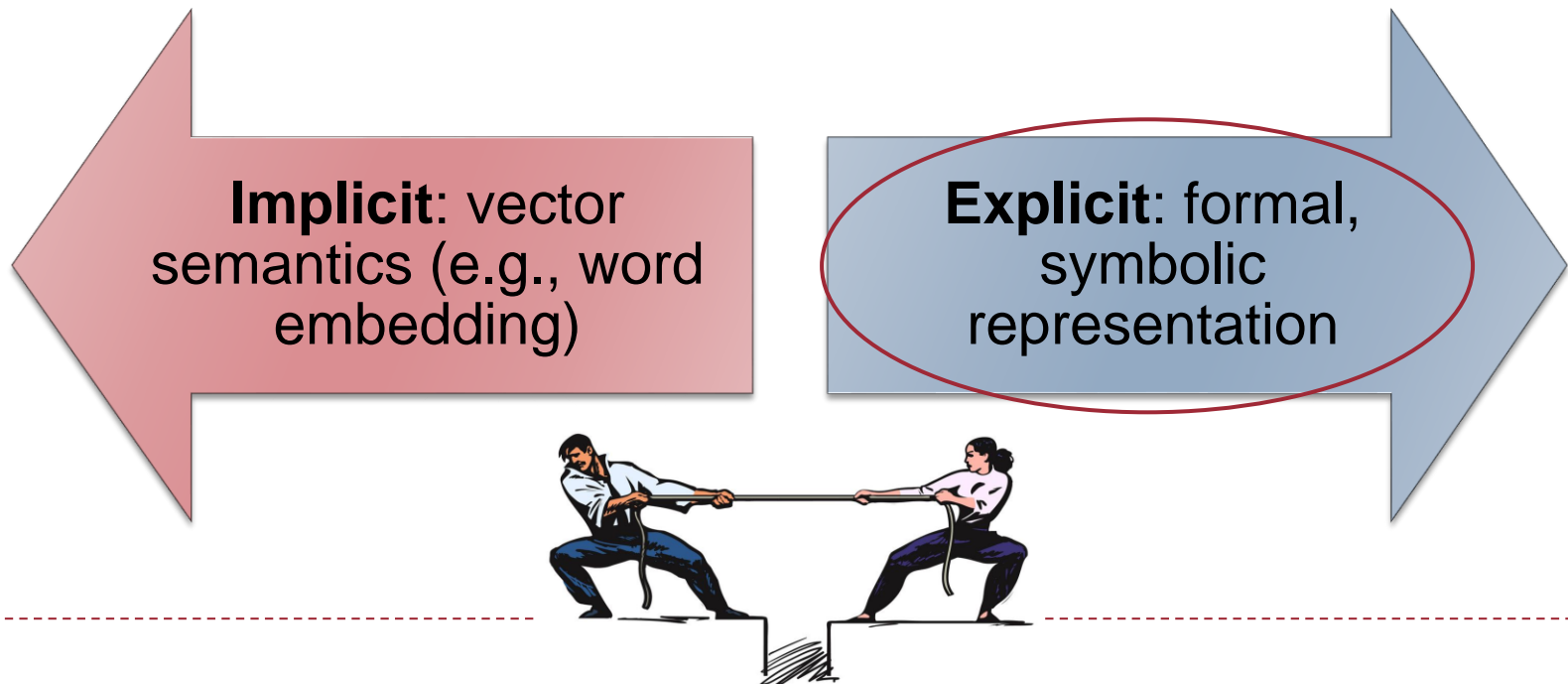
言者所以在意，得意而忘言

——庄子



Semantics

- ▶ Semantics studies meaning, connecting language to the real world
 - ▶ Lexical semantics: the meanings of words
 - ▶ Sentence semantics (next chapter)
- ▶ Implicit vs. explicit meaning representation



Word Sense

- ▶ A lemma is the dictionary headword form of one or more words
 - ▶ mouse, mice → mouse
 - ▶ sing, sang, sung → sing
- ▶ A lemma can have multiple meanings (polysemous)
 - ▶ mouse (N)
 1. any of numerous small rodents...
 2. a hand-operated device that controls a cursor...
 - ▶ Each of these is call a word sense



Word Sense

- ▶ How to decide different uses of a word should be treated as different senses
 - ▶ independent truth conditions
 - ▶ Ex:
 - ▶ They rarely **serve** red meat, preferring to prepare seafood.
 - ▶ “Help to some food; help with food or drink”
 - ▶ He might have **served** his time, come out and led an upstanding life.
 - ▶ “Spend time in prison or in a labor camp”
 - ▶ Quite different situations in which the sentences would be true



Word Sense

- ▶ How to decide different uses of a word should be treated as different senses
 - ▶ independent truth conditions
 - ▶ different syntactic behaviors
 - ▶ Ex:
 - ▶ He might have **served** his time, come out and led an upstanding life.
 - ▶ serve + noun phrase
 - ▶ He **served** as U.S. ambassador to Norway in 1976 and 1977.
 - ▶ serve as + noun phrase



Word Sense

- ▶ How to decide different uses of a word should be treated as different senses
 - ▶ independent truth conditions
 - ▶ different syntactic behaviors
 - ▶ exhibit antagonistic meanings
 - ▶ Ex:
 - ▶ Which of those flights **serve** breakfast?
 - ▶ Does Air France **serve** Philadelphia?
 - ▶ Does Air France **serve** breakfast and Philadelphia?
 - ▶ The last sentence is ill-formed.



Word Sense

- ▶ How to decide different uses of a word should be treated as different senses
 - ▶ independent truth conditions
 - ▶ different syntactic behaviors
 - ▶ exhibit antagonistic meanings
 - ▶ independent sense relations
 - ▶ Ex:
 - ▶ They rarely **serve** red meat, preferring to prepare seafood.
 - ▶ Hypernym: provide, supply
 - ▶ He might have **served** his time, come out and led an upstanding life.
 - ▶ Hypernym: spend



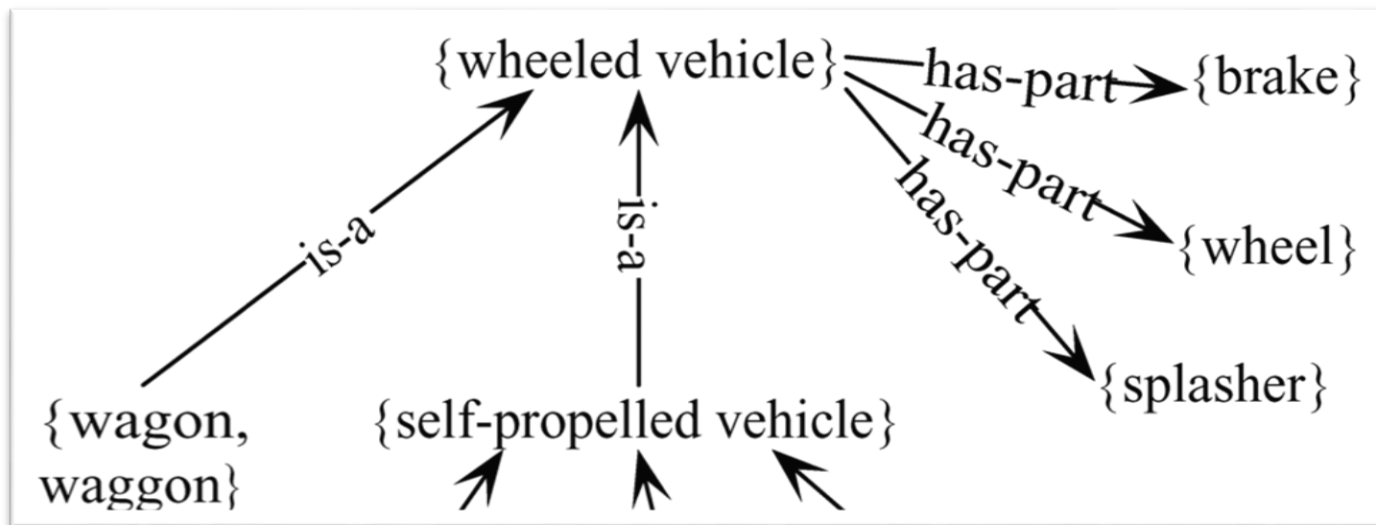
Some Semantic Relations

- ▶ **Synonymy** – equivalence
 - ▶ <small, little>
- ▶ **Antonymy** – opposition
 - ▶ <small, large>
- ▶ **Hyponymy** – subset; is-a relation
 - ▶ < dog, mammal>
- ▶ **Hypernymy** – superset
 - ▶ <mammal, dog>
- ▶ **Meronymy** – part-of relation
 - ▶ <liver, body>
- ▶ **Holonymy** – has-a relation
 - ▶ <body, liver>



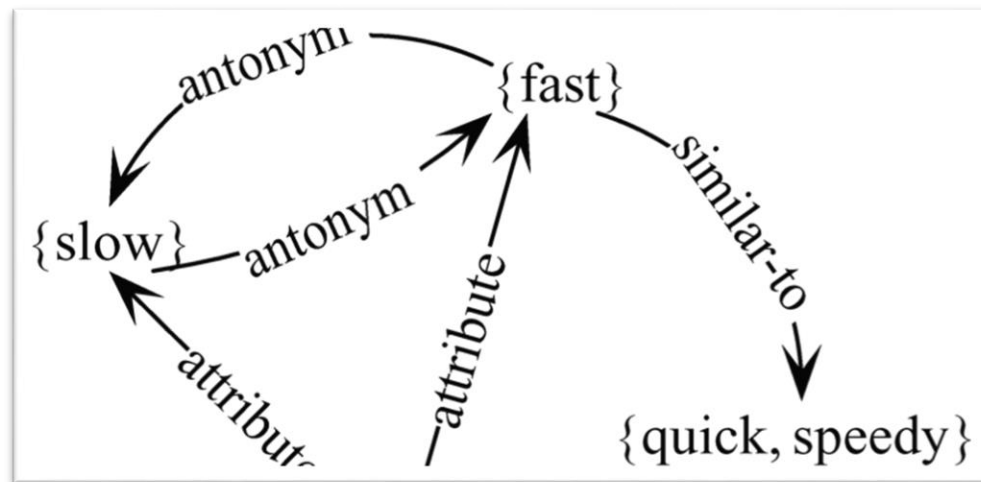
WordNet <http://wordnetweb.princeton.edu/perl/webwn>

- ▶ WordNet is a lexical resource that organizes words according to their semantic relations.
- ▶ Synset: group of word senses that are synonymous
- ▶ Synsets are associated to one another by semantic relations



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Synsets for *dog* (n)

- ▶ (n) **dog, domestic dog, Canis familiaris** (a member of the genus *Canis* that has been domesticated by man since prehistoric times; occurs in many breeds) "the dog barked all night"
▷ dog.n.1
- ▶ (n) **frump, dog** (a dull unattractive unpleasant girl or woman) "she got a reputation as a frump"; "she's a real dog"
- ▶ (n) **dog** (informal term for a man) "you lucky dog"
- ▶ (n) **cad, bounder, blackguard, dog, hound, heel** (someone who is morally reprehensible) "you dirty dog"
- ▶ (n) **frank, frankfurter, hotdog, hot dog, dog, wiener, wienerwurst, weenie** (a smooth-textured sausage of minced beef or pork usually smoked; often served on a bread roll)
- ▶ ...



Direct Hyponyms (subset) for *dog.n.1*

- ▶ (n) **puppy** (a young dog)
- ▶ (n) **pooch, doggie, doggy, barker, bow-wow** (informal terms for dogs)
- ▶ (n) **cur, mongrel, mutt** (an inferior dog or one of mixed breed)
- ▶ (n) **lapdog** (a dog small and tame enough to be held in the lap)
- ▶ (n) **toy dog, toy** (any of several breeds of very small dogs kept purely as pets)
- ▶ (n) **hunting dog** (a dog used in hunting game)
- ▶ ...



Direct Hypernym (superset) for *dog.n.1*

- ▶ (n) **canine, canid** (any of various fissiped mammals with nonretractile claws and typically long muzzles)
- ▶ (n) **domestic animal, domesticated animal** (any of various animals that have been tamed and made fit for a human environment)



Part Meronym (part-of) for *dog.n.1*

- ▶ (n) **flag** (a conspicuously marked or shaped tail)



Member Holonym (has-a) for *dog.n.1*

- ▶ (n) **Canis, genus Canis** (type genus of the Canidae: domestic and wild dogs; wolves; jackals)
- ▶ (n) **pack** (a group of hunting animals)



Word Sense Disambiguation (WSD)

- ▶ Selecting the correct sense for a word in context
 - ▶ The set of senses of each word is given (e.g., WordNet)
- ▶ Ex: He **cash**ed a check at the bank.
 - ✓ ▶ (v) cash, cash in (exchange for cash)
 - ▶ (adj) cashed (for which money has been paid)



Word Sense Disambiguation (WSD)

- ▶ Selecting the correct sense for a word in context
 - ▶ The set of senses of each word is given (e.g., WordNet)
- ▶ Ex: He cashed a **check** at the bank.
- ✓ ▶ (n) check, bank check, cheque (a written order directing a bank to pay money)
- ▶ (n) check mark, check, tick (a mark indicating that something has been noted or completed etc.)
- ▶ (v) check, check up on, look into, check out, suss out, check over, go over, check into (examine so as to determine accuracy, quality, or condition)
- ▶ (v) check (make an examination or investigation)
- ▶ ...



Word Sense Disambiguation (WSD)

- ▶ Selecting the correct sense for a word in context
 - ▶ The set of senses of each word is given (e.g., WordNet)
- ▶ Ex: He cashed a check at the **bank**.
 - ▶ (n) bank (sloping land (especially the slope beside a body of water))
 - ✓ ▶ (n) depository financial institution, bank, banking concern, banking company (a financial institution that accepts deposits and channels the money into lending activities)
 - ▶ (n) bank (a long ridge or pile)
 - ▶ (v) bank (tip laterally)
 - ▶ ...



Word Sense Disambiguation (WSD)

- ▶ Selecting the correct sense for a word in context
 - ▶ The set of senses of each word is given (e.g., WordNet)
- ▶ Methods
 - ▶ It's a sequence labeling problem!
 - ▶ Can use any of the methods discussed earlier.





Summary



Lexical Semantics

- ▶ Word senses
- ▶ WordNet
- ▶ Word Sense Disambiguation

