

Lexicon, Syntax, Semantics II:
Modeling Meaning
Lexical Semantics

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Semantics

- Semantics is the study of meaning communicated through language.
- Semantics (and pragmatics) are the glue that connect language to the real world.
- Phonology, Morphology, Syntax, etc. are meaningful only once Semantics is taken into account, at some level.

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- Let's start at the word-level: Lexical Semantics

Word Meaning

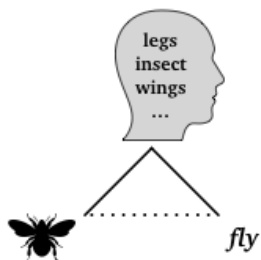
I saw my mother just now.

Word Meaning

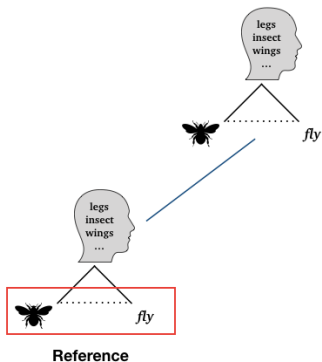
I saw my mother just now.

- We know that the speaker saw a female human, someone who is older than the speaker and is of a specific relation to the speaker
- Lexical relations (e.g. between *woman* and *mother*) are central to the way speakers and hearers construct meaning
- Links between linguistic and world knowledge also major factor in determining word meaning

Word Meaning

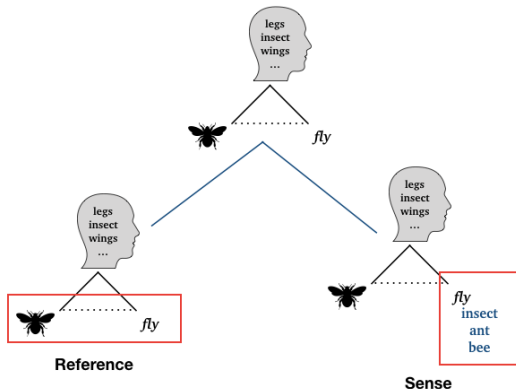


Word Meaning: Reference



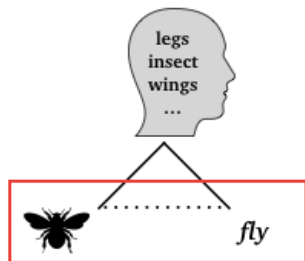
Referential Semantics: Word meaning described as a relationship between linguistic elements and the non-linguistic world and experiences (*extension*).

Word Meaning: Sense



Lexical Semantics: Word meaning described within a complex relationship between the linguistic elements themselves.

Reference as a Theory of Meaning



Reference

- To give the meaning of a word, one shows what it denotes in the real world
- FLY: animate, insect, 2 wings, 6 legs, ...
- COOKING: action

Reference as a Theory of Meaning

proper names	denote	individuals
common names	”	sets of individuals
verbs	”	actions
adjectives	”	properties of individuals
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But ...

- Real-world referents for words like *so*, *not*, *very*, *but*, *of*?
- In the painting **a unicorn** is ignoring a maiden.
- **World War III** might be about to start.
- **Father Christmas** might not visit you this year.
- I am in **love**.

- We can understand and use expressions that have no real-world referent.

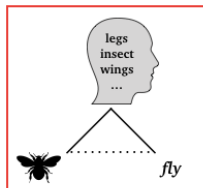
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- Meaning > Reference
- Because we understand the expression *President of Egypt*, we can use it to refer to a particular individual at any given time
→ **Sense** (aka Intension)

Concepts

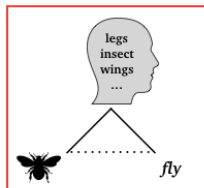


The Semiotic Triangle

Ogden/Richards (1923)

- Level needed between words and the world: *a mental representation*

Concepts

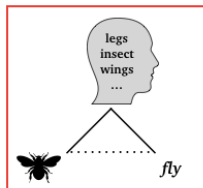


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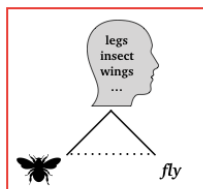


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- Question 1: What form can we assign to concepts?
- Question 2: How do children acquire them, along with their linguistic labels?

Necessary and sufficient conditions



- x is a lion if and only if L .
- where L is a list of attributes
 - x is an animal,
 - x has four legs,
 - x is a carnivore,
 - x is a feline,
 - x has a mane, ...

Class Activity

Say words are labels for concepts, and a concept can be defined by a set of necessary and sufficient conditions (attributes). For each word, establish sets of attributes that would distinguish it from its companions in the group:

1. cake biscuit/cookie bread roll cracker
2. boil fry bake simmer grill roast

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Prototype Theory

Prototype Theory (Eleanor Rosch, 1970's): Theory to represent idea of family resemblances (Wittgenstein)



- **Prototype:** an “ideal” or “typical” example of a category
- A test case is compared with prototype, and if similar, will be considered a member of the category, otherwise it will not.
- Notion of **fuzzy boundaries:** some members are “better” members than others.
- Other approaches to typicality include Frames (Fillmore, 1982) and Idealized Cognitive Models (Lakoff, 1987).

Conceptual Theories

- word-fields
- componential analysis
- semantic networks: computational approach
- prototype theory: cognitive approach
- meaning postulates: logic-based

Approach 1: Decompositional Semantics

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boy

	+ human	
	- female	
	- adult	

girl

	+ human	
	+ female	
	- adult	

man

	+ human	
	- female	
	+ adult	

woman

	+ human	
	+ female	
	+ adult	

Word Meaning?



He scored with his left **foot**¹.



They made camp at the **foot**² of the mountain.



I ate a **foot**³-long hot dog.

Lexical Relations and Meaning

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- 1 a. My bank manager has just been murdered.
 - b. My bank manager is dead
 - c. My bank will be getting a new manager

- 2 a. This bicycle belongs to Sinead.
 - b. Sinead owns this bicycle.
 - c. Sinead rides a bicycle.

- 3 a. Rob has failed his statistics exam.
 - b. Rob hasn't passed his statistics exam.
 - c. Rob can't bank on a glittering career as a statistician.

Lexical Semantics

1. Represent the meaning of each word in the language; and
2. Show to the meanings of words in a language are interrelated

What can we do with Lexical Semantics?

- Recognize word senses in text (manually and automatically)
- Define similarities between words
- Determine how strongly a verb “goes with” its subject (selectional preferences)
- Recognize and interpret figurative uses of words
- Describe relations between words (or better, between word senses)

Lexical Relations

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 - couch/sofa boy/lad lawyer/attorney large/big

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2. **Antonymy**: Words which are opposite in meaning

- dead/alive pass/fail hit/miss (complementary)
- hot (warm tepid cool) cold (gradable)
- (go) up/down (turn) right/left (reverses)
- own/belong to employer/employee (converses)

Lexical Relations

3. **Hyponymy:** Relation of (taxonomic) inclusion, aka subset
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5. **Meronymy:** *Part-whole* relationship between lexical items
 - *cover* and *page* are meronyms of *book*
 - *engine* and *door* are meronyms of *car*

Lexical Relations

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7. **Polysemy**: Like homonymy, but senses are judged to be related
 - **hook** (n): **1.** a piece of curved material. **2.** a trap or snare.
3. short for fish-hook. **4.** something that attracts. ...

Problem with pinning down word meaning

1. Collocations: e.g. *strong* vs. *powerful*
 - *strong argument* and *powerful argument*
 - *strong tea* vs. *powerful tea*
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 - I go for a run every morning.
 - He hit a home run.
 - There's been a run on the dollar.
 - The bears are here for the salmon run.

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4. Ambiguity and vagueness: Do the uses of *run* above have different senses (ambiguous), or share the same sense (vague)?

Class activity: Word senses of “SHOWER”

- Handout: corpora (BNC) examples of uses of *shower*



- How many senses does *shower* have?
- Note: disregard *shower* if it occurs in a compound noun (e.g. *shower curtain*)

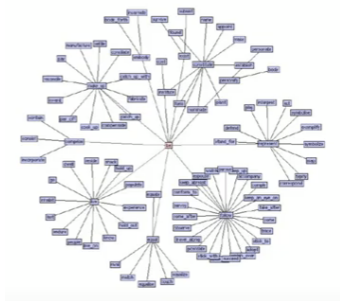
Noun

- **S: (n) shower#1** (a plumbing fixture that sprays water over you) *"they installed a shower in the bathroom"*
- **S: (n) shower#2, shower bath#2** (washing yourself by standing upright under water sprayed from a nozzle) *"he took a shower after the game"*
- **S: (n) shower#3, rain shower#1** (a brief period of precipitation) *"the game was interrupted by a brief shower"*
- **S: (n) shower#4, cascade#3** (a sudden downpour (as of tears or sparks etc) likened to a rain shower) *"a little shower of rose petals"; "a sudden cascade of sparks"*
- **S: (n) exhibitor#1, exhibitioner#1, shower#5** (someone who organizes an exhibit for others to see)
- **S: (n) shower#6** (a party of friends assembled to present gifts (usually of a specified kind) to a person) *"her friends organized a baby shower for her when she was expecting"*

Verb

- **S: (v) lavish#1, shower#1** (expend profusely; also used with abstract nouns) *"He was showered with praise"*
- **S: (v) shower#2** (spray or sprinkle with) *"The guests showered rice on the couple"*
- **S: (v) shower#3** (take a shower; wash one's body in the shower) *"You should shower after vigorous exercise"*
- **S: (v) shower#4, shower down#1** (rain abundantly) *"Meteors showered down over half of Australia"*
- **S: (v) shower#5** (provide abundantly with) *"He showered her with presents"*

Approach 2: Semantic Ontologies and WordNet



- WordNet is a lexical resource that organizes words according to their semantic relations
- Words have different senses
- Each sense is associated with a synset (set of words that are roughly synonymous for a particular sense)
- These synsets are associated with one another using semantic relations (note synonymy is treated differently)

Word meaning in WordNet

fish#1 (any of various mostly cold-blooded aquatic vertebrates usually having scales and breathing through gills)

- aquatic vertebrate (animal living wholly or chiefly in or on water)
- vertebrate, craniate (animals having a bony or cartilaginous skeleton with a segmented spinal column and a large brain enclosed in a skull or cranium)
- chordate (any animal of the phylum Chordata having a notochord or spinal column)
- animal, animate being, beast, brute, creature, fauna (a living organism characterized by voluntary movement)
- organism, being (a living thing that has (or can develop) the ability to act or function independently)
- living thing, animate thing (a living (or once living) entity)
- whole, unit (an assemblage of parts that is regarded as a single entity)
- ...

Limitations of WordNet and Semantic Ontologies

- WordNet is a glorified thesaurus
- Requires many years and depends on skilled lexicographers, inconsistencies throughout the resource
- Ontology is only as good as ontologist(s) - it is not only data

Approach 3: Distributional semantics

Landauer and Dumais 1997, Turney and Pantel 2010, ...

he curtains open and the **shining** in on the barely
 ars and the **cold** , close **"** . And neither of the w
 rough the **night** with the **shining** so **brightly** , it
 made in the **light** of the **.** It all boils down , wr
 surely under a **crescent** , thrilled by ice-white
 sun , the **seasons** of the **? Home** , alone , Jay pla
 m is dazzling snow , the **has risen full and cold**
 un and the **temple** of the **, driving out of the hug**
 in the **dark** and now the **rises , full and amber a**
 bird on the **shape** of the **over the trees** in front
 But I could n't see the **or the stars** , only the
 rning , with a **sliver** of **hanging among the stars**
 they love the **sun** , the **and the stars** . None of
 the **light** of an **enormous** . The plash of flowing w
 man 's first **step** on the **; various exhibits , aer**
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 oud **obscured part** of the **.** The Allied guns behind

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Thanks, see you next week!

<https://www.vecchi.com/eva/teaching/modelingmeaning.html>

