

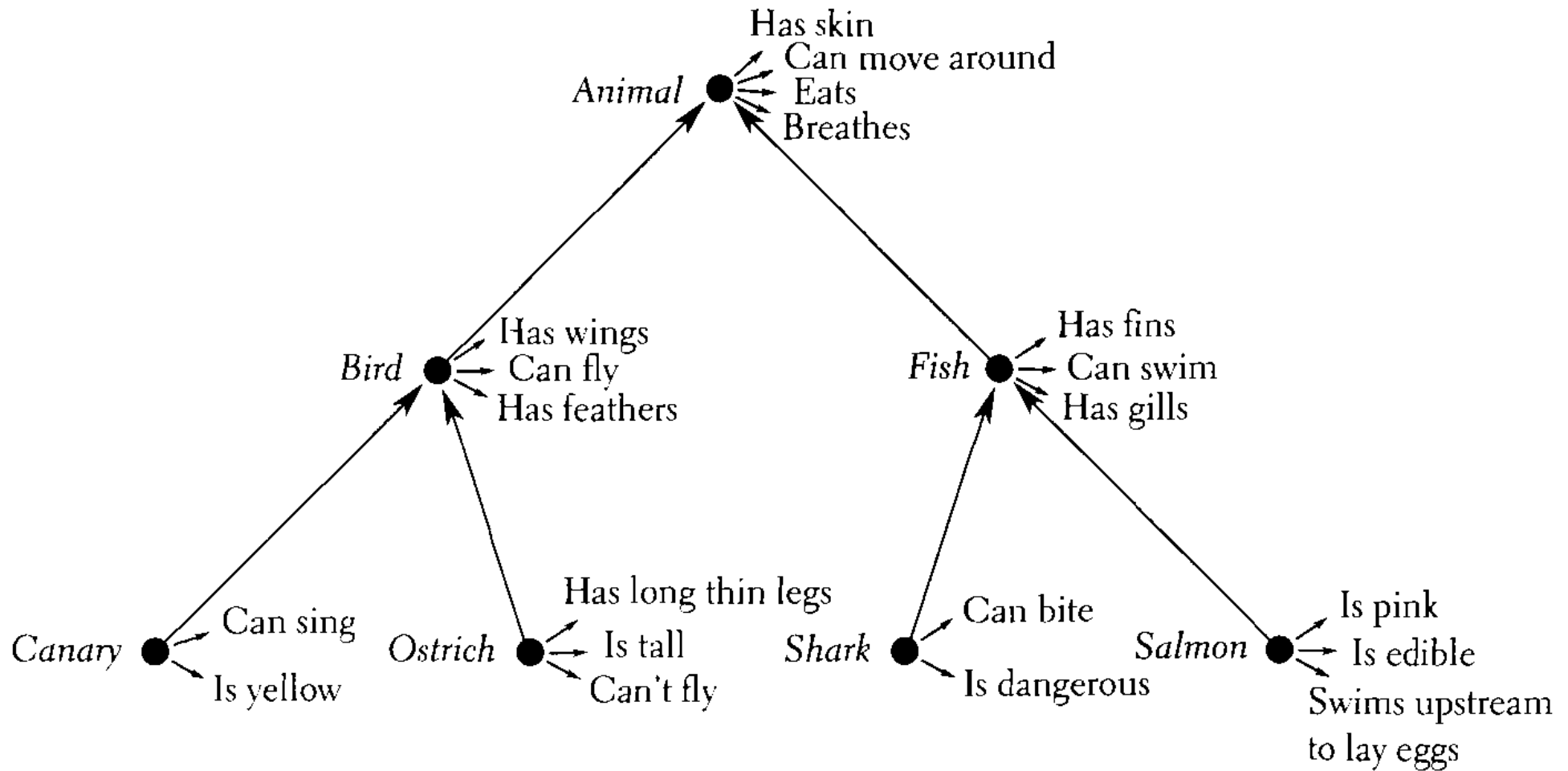
(Towards) cognitive semantics
and networks

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The organization of the lexicon 1: hierarchical network models

- In hierarchical semantic network models (Collins and Quillian 1969)
 - nodes for concepts are related within a network
 - this network is organized in terms of
 - **taxonomic relations**, in terms of hyp(er)onymy
 - **attributive relations**, in terms of characteristics of concepts
 - information is represented economically in terms of **inheritance hierarchies** at the highest possible level
 - attributions involve intersection searches traveling from node X to node Y
- experimental validation: **semantic verification task**
 - subjects get to read *An A is a B* → reaction time in ms
 - if two concepts are more closely related, reaction times should be smaller

The organization of the lexicon 1: hierarchical network models



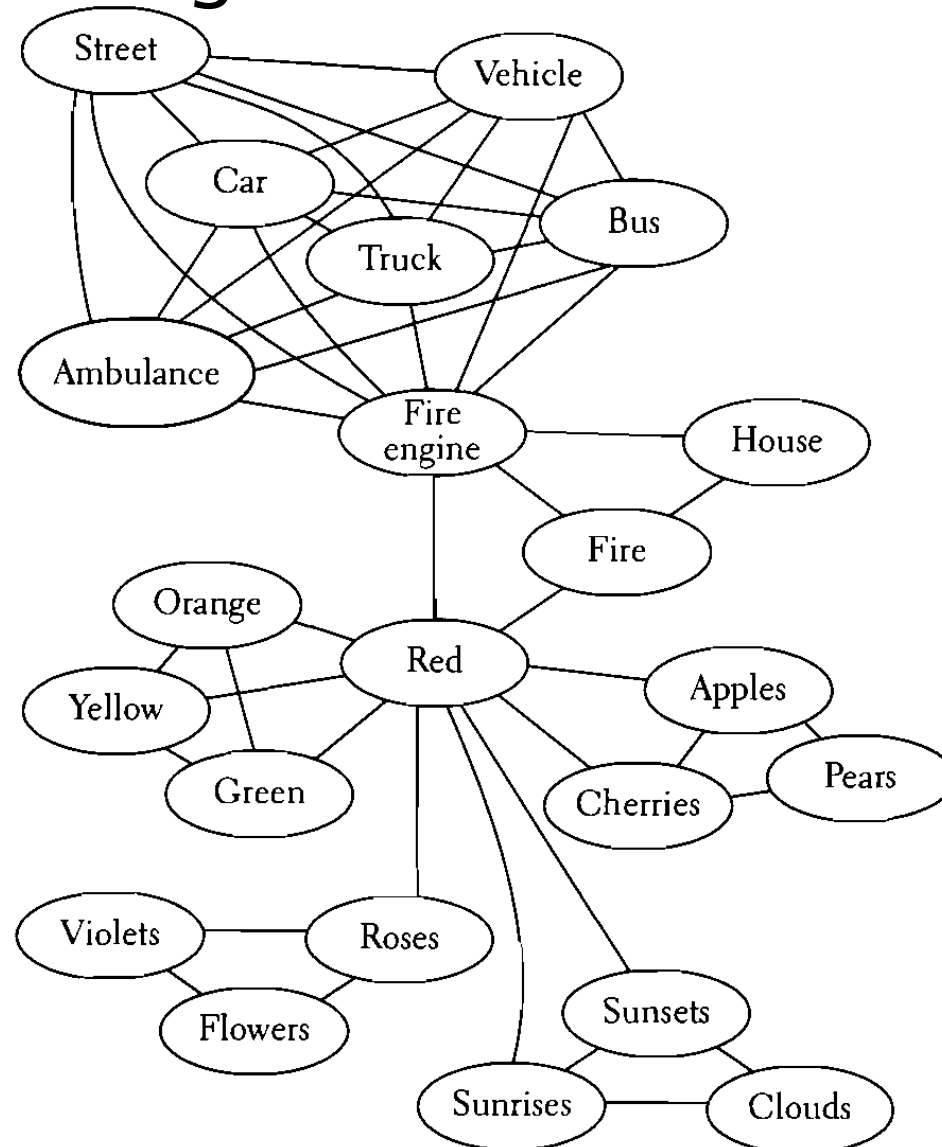
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 - attributions involve intersection searches traveling from node X to node Y
- experimental validation: **semantic verification task**
 - subjects get to read *An A is a B* → reaction time in ms
 - if two concepts are more closely related, reaction times should be smaller
 - however, the following effects are also found
 - **category-size effect** (RTs to small categories = short)
 - **typicality effect** (RTs to typical items = short)
 - **basic-level effects**: (RTs to basic-level = short)

The organization of the lexicon 2: spreading activation models

- In spreading activation models (Collins & Loftus 1975)
 - the organization of nodes is **not strictly hierarchical**
 - strengths of, and distances between, connections are determined by
 - taxonomic relations
 - accessibility as determined by
 - frequency of usage
 - typicality
 - degree of association between concepts
 - retrieval is not based on intersection searches but on **spreading activation** that
 - starts at one node
 - spreads throughout the network in parallel
 - decreases over distance and time
- problem: this model includes only conceptual information

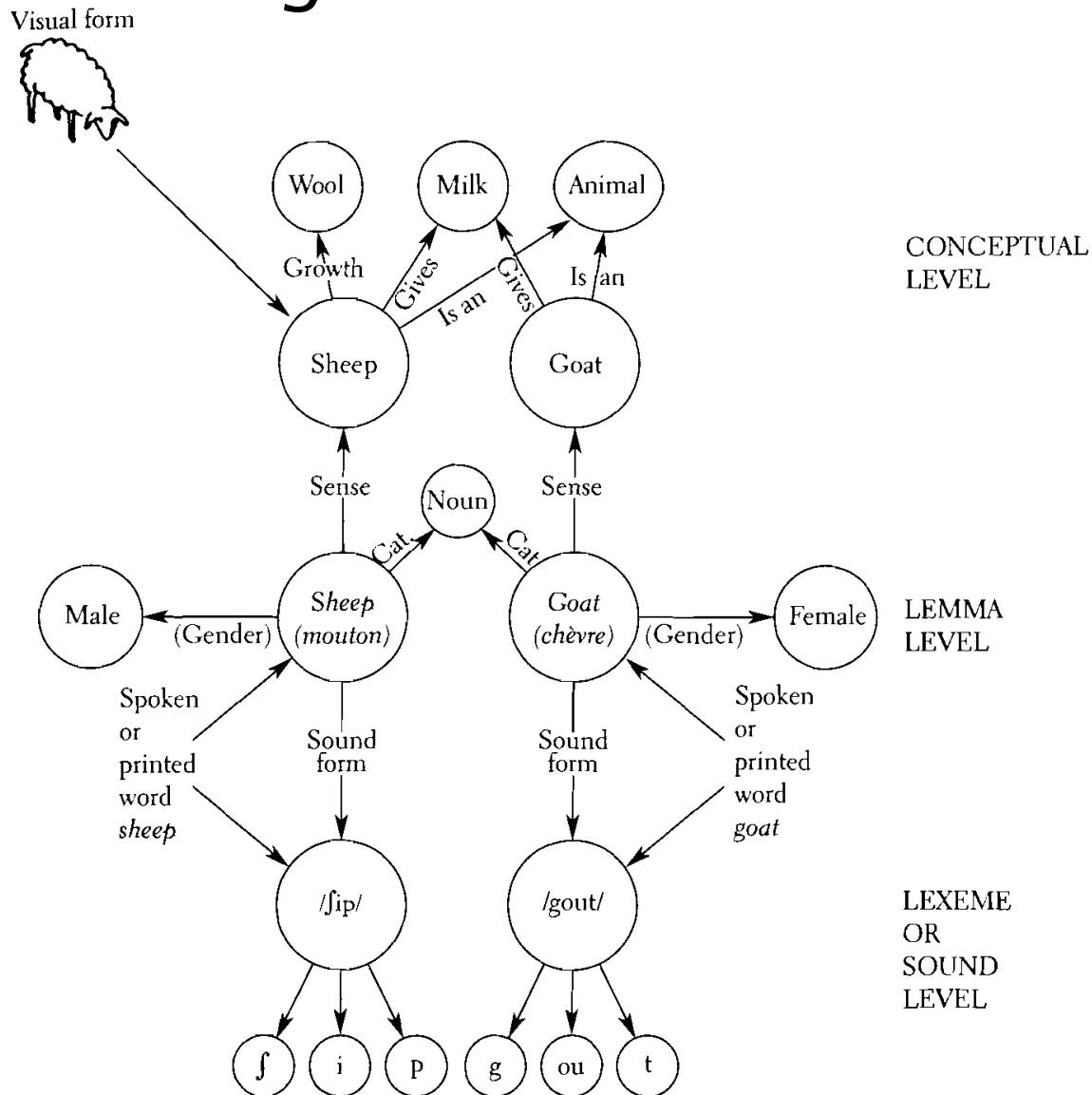
The organization of the lexicon 2: spreading activation models



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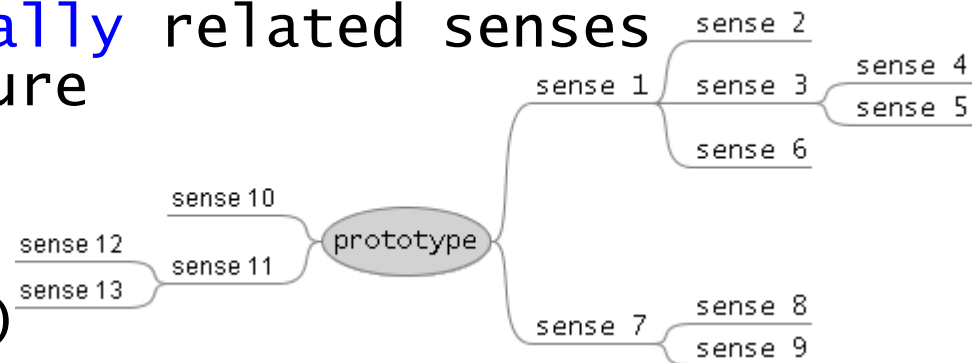
- A more refined model by Levelt and Bock is probably one of the most widely accepted ones
- it involves three different levels
 - a **conceptual level** (cf. the previous model)
 - a **lemma level** (syntactic aspects of word knowledge)
 - nouns: e.g., grammatical gender
 - verbs: subcategorization properties
 - a **lexeme level** (phonological aspects of word knowledge)
- this model can account for TOT states

The organization of the lexicon 2: spreading activation models



Some central issues in cognitive semantics

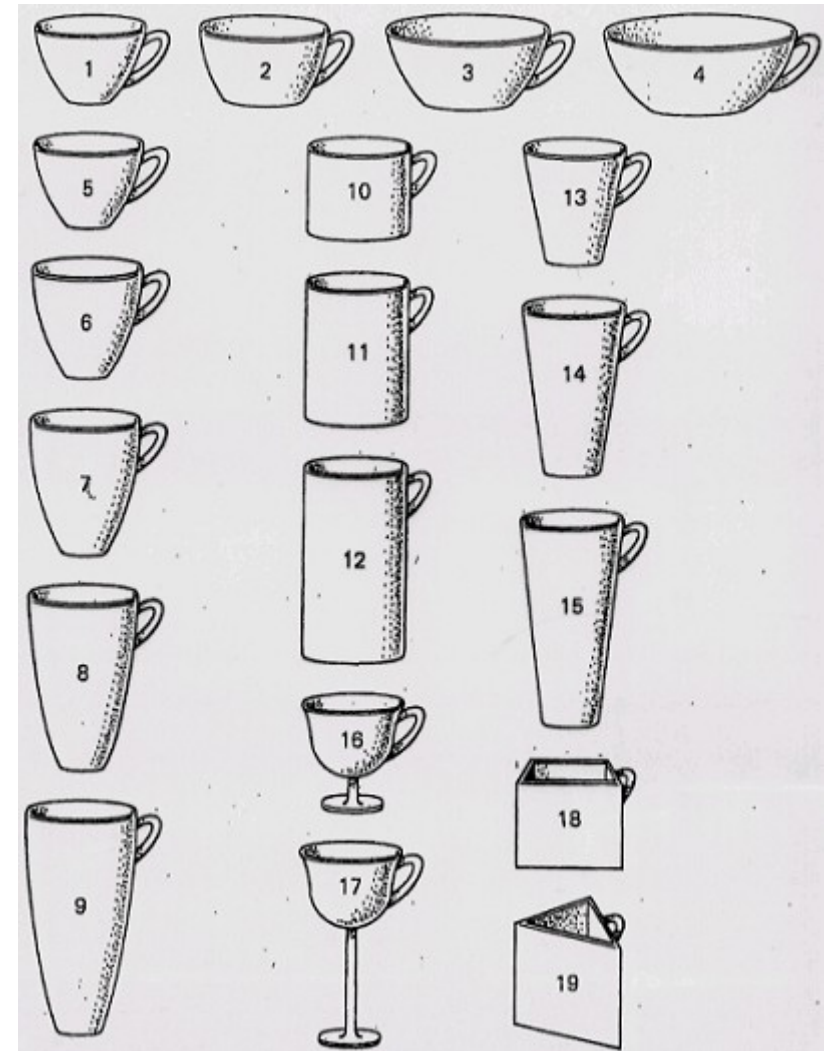
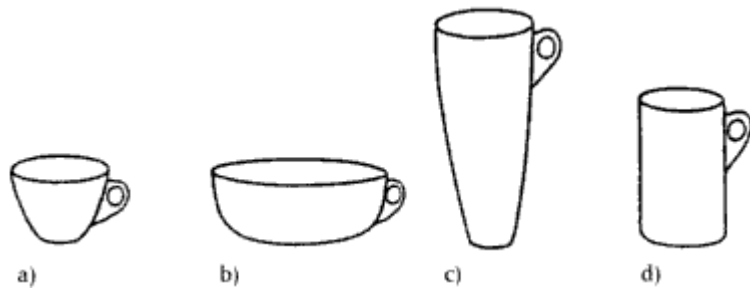
- In order to understand the cognitive semantics approach, we first need to understand a few things
- **categorization**, because signs usually do not refer to unique elements, but to classes of elements
 - *cat* does not mean 'furry, quadruped, domesticated animal with sharp retractable claws, black/white/grey/tortoise-shell/marmalade in color and whose adult specimens measure ca. 25 inches from nose to tip of tail'
- also, words usually have more than one 'meaning'
- words are thus conceived of as **lexical categories**
 - with a **prototypical** sense
 - with distinct but **metaphorically** related senses
 - without necessarily one feature that is shared by all elements of the category (**radial category** or **family resemblance category**)



Categorization

- What do categories do?
 - they maximize within-category commonalities
 - they minimize within-category differences
 - they minimize between-category commonalities
 - they maximize between-category differences
- this entails that it is a more flexible approach than the necessary-*cum*-sufficient conditions approach (e.g., three-legged zebra)

Cups and mugs



Categorization: basic-levels and prototypes

- The historical development of prototype theory
 - phase 1: late 1960s - early 1970s
 - objects of study: basic color terms, shapes, emotions
 - prototypes were defined in terms of perceptual salience and memorability
 - phase 2: early - mid 1970s
 - effects = structure fallacy
 - goodness-of-membership ratings → category membership
 - goodness-of-membership ratings → fuzzy cat. boundaries
 - prototype/structure = representation fallacy
 - categories are represented on the basis of prototypes
 - degrees of membership are based on similarity to the prototype
 - phase 3: late 1970s
 - the above fallacies were abandoned (cf. experiments on even vs. odd numbers)

Categorization: basic-levels and prototypes

- Prototype theory differs radically from objective necessary-and-sufficient condition models
- categories are organized
 - horizontally around a **prototype** which is
 - the best exemplar of a category vs.
 - the most frequently named exemplar of a category vs.
 - the most familiar member of a category vs.
 - a schema (generalization) with all average values vs.
 - an abstract entity which consists of **the combination of the most salient attributes of the category**
 - salient attributes for a category are those with a high **cue validity** for the category

Categorization: basic-levels and prototypes

- What is the cue validity of the attribute 'has feathers' for the category 'birds'?
- cue validity = cue availability x cue reliability
 (in later work on the Competition Model!)

	Category/Entity		Totals
	+bird	-bird	
+feathers	99	2	101
-feathers	1	98	99
Totals	100	100	200

- cue availability = % the cue is present: $101/200=0.505$
- cue reliability = % the cue is the right clue: $99/101=0.98$
- cue validity = $101/200 \times 99/101 = 99/200 = 0.495$
- prototypes are special
 - they are acquired earlier
 - they are remembered earlier (in free recall tasks)
 - they share more attributes with other category members
 - they share fewer attributes with non-category members

Categorization: basic-levels and prototypes

- Prototype theory differs radically from objective necessary-and-sufficient condition models
- categories are organized
 - horizontally around a prototype [...]
 - vertically around a psychologically particularly salient **basic-level category**
 - superordinate level (hyperonyms): *vehicle*
 - basic-level category: *car*
 - subordinate level (hyponyms): *sedan*
- each of these vertical levels may exhibit prototype effects

Categorization: basic-levels and prototypes

- What are the (typical) characteristics of the (words referring to the) basic-level category?
 - they are **acquired earlier**
 - the words are **shorter** than their hyperonyms / hyponyms
 - basic-level category members are identified as category members **fastest**
 - much of our **knowledge and memory of events** is organized around, and conceptualized with, basic-level category members
 - the basic-level category is the highest level
 - at which we can conjure up a **mental image** of the category
 - for which **common interactional motor knowledge** is available
 - for which **conceptual priming** can be obtained
 - why's that
 - they maximize the number of shared attributes: much distinctiveness is gained by moving from hyperonym to basic-level category
 - they minimize the number of non-shared attributes

A comparison: necessary/sufficient conditions vs. basic levels/prototypes

- Status of membership in category
 - nec/suff: all members have equal status
 - bl/pt: all members need not have equal status
- category boundaries
 - nec/suff: categories have clear boundaries
 - bl/pt: categories need not have clear boundaries
- taxonomic relations
 - nec/suff: taxonomic relations are absolute
 - bl/pt: taxonomic relations need not be absolute
- nature of features
 - nec/suff: features are abstract and usually binary
 - bl/pt: features can be abstract, but also experiential, and can be gradable
- relevance of features
 - nec/suff: all features are equally important
 - bl/pt: some features may be more important
- prototype effects are found on all linguistic levels

Lie again: something is a lie ...

- ... when a speaker S asserts a **proposition P that is false** to an addressee A
 - but that's not good enough
 - people often say things that are false (e.g., when they don't know any better)
- ... when **S believes P is false**
 - but that's not good enough
 - people often say things they know not to be literally true (hyperbole, irony/sarcasm) and that they do not try to convince A of
- ... when **S intends to deceive A**
 - now these the seem to be jointly sufficient – although other situational characteristics can also be important
- ... when **A's acceptance of P has "non-trivial human consequences"**
- thus, social lies ("Nice to see you") or evasions ("To the store") are no prototypical lies

Scenarios of Lying

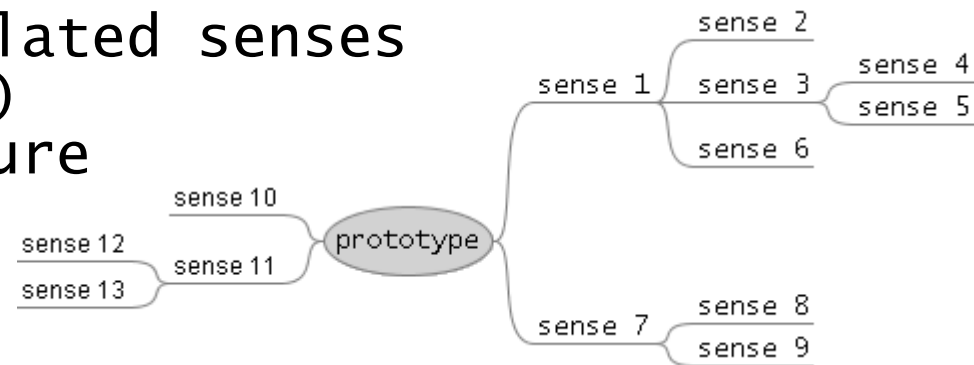
- | | | P=F | S:P=F | Dec |
|-----------------------------------|-----|-----|-------|-----|
| • Moe has eaten Juliet's cake: | 7 | + | + | + |
| • John steps on Dick's gold ball: | 1.1 | - | - | - |
| • Pigfat and the pool hall: | 3.7 | + | - | + |
| • Kate. is sick before the test: | 5.2 | - | + | + |
| • Schmall. liked the dinner: | 4.7 | + | + | - |
| • Mary's ex boyfriend: | 3.5 | - | - | + |
| • Nurse Braine's patients: | 3 | + | - | - |
- the more prototype elements the story contains, the higher it scores on the lie scale
 - but there are additional tricky issues
 - typicality vs. prototypicality
 - S's exact motive: egoistic vs. altruistic
 - the severity of the consequences

Problems of the basic-level / prototype approach

- what is the prototype for *truth*?
- what is the prototype of Dyirbal *balan*, a category denoting 'women, fire, and dangerous things'?
- isn't the whole approach circular?
 - items are in the same category because they are similar
 - items are similar because they are in the same category
- why is the basic level even privileged among experts who know many details about the subordinate level?

Categorization and polysemy

- Recall, in cognitive semantics, words are conceived of as **lexical categories**
 - with distinct but usually related senses
 - with 1+ prototypical sense(s)
 - without necessarily one feature that is shared by all elements of the category (**radial category** or **family resemblance category**)
- the most famous example: the preposition *over*
- Brugman and Lakoff (and many others) claim that *over* is stored as a category of distinct but related senses, not as a single abstract monosemous meaning
- from this it follows that polysemy
 - reflects conceptual organization!
 - exists at the level of mental representation!
- but let's look at a simpler example first ...



Polysemy in cognitive semantics: the example of *climb*

- Consider *climb* (v.)
 - *the boy climbed the tree* self-prop, ascend, contact, clamber
 - *the train climbed the hill* self-prop, ascend, contact
 - *the plane climbed to 30,000 ft* self-prop, ascend
 - *the temper. climbed into the 90s* ascend, numerical scale
 - *the boy climbed down the tree* clamber, descend
 - *the boy climbed over the wall* clamber, a-/descend
 - *we climbed along the cliff* clamber
 - *he's a real social climber* ascend, social scale
- many of these share a meaning component ...
- ... but unlike in a definition-based approach, that component
 - does not exhaust the semantic description
 - does not distinguish *climb* from other such verbs
- → **radial family-resemblance category**

Polysemy in cognitive semantics: the example of *over*

- Central sense 'above/across': *the plane flew over*
 - trajector (TR) moves over unspecified landmark (LM) and across its boundaries
- extension: *the bird flew over the yard*
 - LM = specified and horizontally extended; no contact
- extension: *the bird flew over the wall*
 - LM = specified and vertically extended, no contact
- extension: *the plane flew over the hill*
 - LM = specified and horizontally as well as vertically extended; no contact
- extension: *John walked over the bridge*
 - LM = specified, horizontally extended, contact
- extension: *John climbed over the wall*
 - LM = specified, vertically extended, contact
- ...

Polysemy in cognitive semantics: the example of *over*

- Extension: *the cathedral is over the bridge*
 - end-point focus on *John walked over the bridge*, only possible with extended landmark
- extension: *John lives over the hill*
 - end-point focus on *John walked over the hill*, only possible with extended landmark
- extension: *the helicopter is hovering over the city*
 - TR **above** LM, no across path, movement does not extend beyond LM, no contact (hence not prototypical)
- extension: *the board is over the hole*
 - TR **covers** LM (from an understood viewpoint)
- extension: *he has freckles over most of his body*
 - TR covers LM, TR=multiplex TR (cf. count/mass)
- extension: *he walked all over the hill*
 - TR across LM, multiplex locations combined to form a path along which the TR travels
- ...

Polysemy in cognitive semantics: the example of *over*

- Extension: *the fence fell over*
 - **reflexive**: TR=LM, final location of TR is understood with respect to its starting position
- extension: *she has a strange power over him*
 - **control** (CONTROL IS UP: *I am on **top** of things, he is **under** my control, he **fell** from power, ...)*
- extension: *the bathtub overflowed*
 - **excess** of TR over LM (cf. perceptual similarity)
 - perceptual similarity of a liquid flowing over the edge of the container with *he climbed over the wall*
- extension: *the student started the assignment over*
 - **repetition**
 - A PURPOSEFUL ACTIVITY IS A JOURNEY
 - EVENTS ARE OBJECTS
 - thus, repetition of an activity is movement across an earlier performance of that activity