

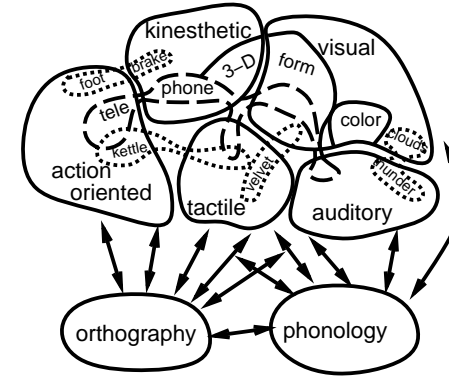
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How Do Words Come to Mean Anything?

- What Gives Words Their Meaning?
- Where Does this Meaning Come From?

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What Gives Words Their Meaning?: Distributed Semantics



Semantics is distributed across specialized processing areas.

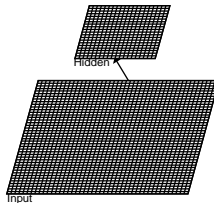
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Where Does this Meaning Come From?: Correlational Semantics

Hebbian learning encodes structure of word co-occurrence.

Same idea as:

- V1 receptive field learning: learn the strong correlations.
- Latent Semantic Analysis (LSA).



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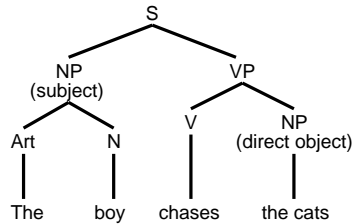
Multiple-Choice Quiz

0. neural activation function	5. attention
A spiking rate code membrane potential pt	A competition inhibition selection binding
B interactive bidirectional feedforward	B gradual feature conjunction spatial invariance
C language generalization nonwords	C spiking rate code membrane potential point
1. transformation	6. weight based priming
A emphasizing distinctions collapsing diffs	A long term changes learning
B error driven hebbian task model based	B active maintenance short term residual
C spiking rate code membrane potential pt	C fast arbitrary details conjunctive
2. bidirectional connectivity	7. hippocampus learning
A amplification pattern completion	A fast arbitrary details conjunctive
B competition inhibition selection binding	B slow integration general structure
C language generalization nonwords	C error driven hebbian task model based
3. cortex learning	8. dyslexia
A error driven task based hebbian model	A surface deep phonological reading problem
B error driven task based	B speech output hearing language nonwords
C gradual feature conjunction spatial invar	C competition inhibition selection binding
4. object recognition	9. past tense
A gradual feature conjunction spatial invar	A overregularization shaped curve
B error driven task based hebbian model	B speech output hearing language nonwords
C amplification pattern completion	C fast arbitrary details conjunctive

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Sentences

Traditional approach:



Alternative approach:

Distributed reps of sentence *meaning*: The sentence Gestalt!

Parallel to object recognition issues: 3D structural model vs. distributed reps that distinguish different objects.

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Toy World

People: *busdriver* (adult male), *teacher* (adult female), *schoolgirl*, and *pitcher* (boy).

Actions: *eat, drink, stir, spread, kiss, give, hit, throw, drive, rise.*

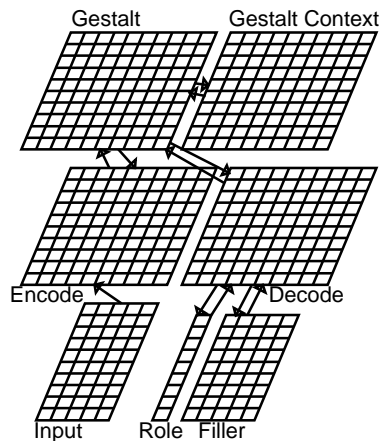
Objects: *spot* (the dog), *steak, soup, ice cream, crackers, jelly, iced tea, kool aid, spoon, knife, finger, rose, bat* (animal), *bat* (baseball), *ball, ball* (party), *bus, pitcher, and fur*

Locations: *kitchen, living room, shed, and park.*

Syntax: Active & Passive, phrases.

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Network



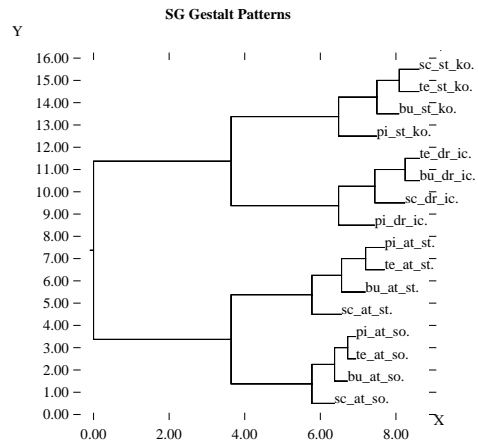
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Tests

Task	Sentence
Role assignment	
Active semantic	The schoolgirl stirred the kool-aid with a spoon.
Active syntactic	The busdriver gave the rose to the teacher.
Passive semantic	The jelly was spread by the busdriver with the knife.
Passive syntactic	The teacher was kissed by the busdriver.
(control)	The busdriver kissed the teacher.
Word ambiguity	The busdriver threw the ball in the park. The teacher threw the ball in the living room.
Concept instantiation	The teacher kissed someone (male).
Role elaboration	The schoolgirl ate crackers (with finger). The schoolgirl ate (soup).
Online update	The child ate soup with daintiness.
(control)	The pitcher ate soup with daintiness.
Conflict	The adult drank iced-tea in the kitchen (living-room).

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Gestalt Representations



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Questions

- What general processes are involved in reading, and how do these sometimes fail (e.g., in dyslexia)?
- How are we able to read “cat”, “yacht”, and “nust”?
- Why do kids say “I goed to school” *after* first saying “I went”?
- How do words come to mean anything?
- How do we go beyond words to sentences?