Psychology of Language

8 Meaning & semantic memory

Fall 2023
Tues/Thur 5:00-6:15pm

Emma Wing
Drop-in hours:
By appointment

Road map

- **End of 7 Spoken word recognition**

- **Unit 2: The Mature System**

  8 Meaning & semantic memory

Experimental tests

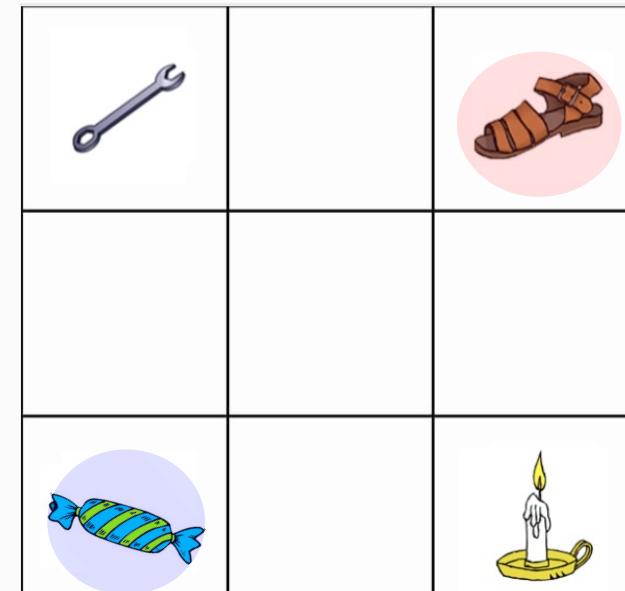Experiment: Eye-tracking in the Visual World Paradigm

Target: *candle*

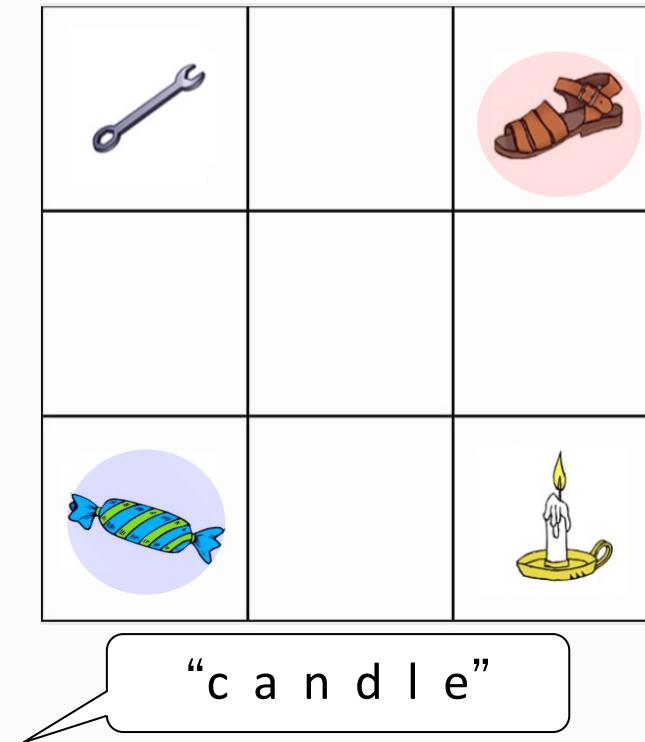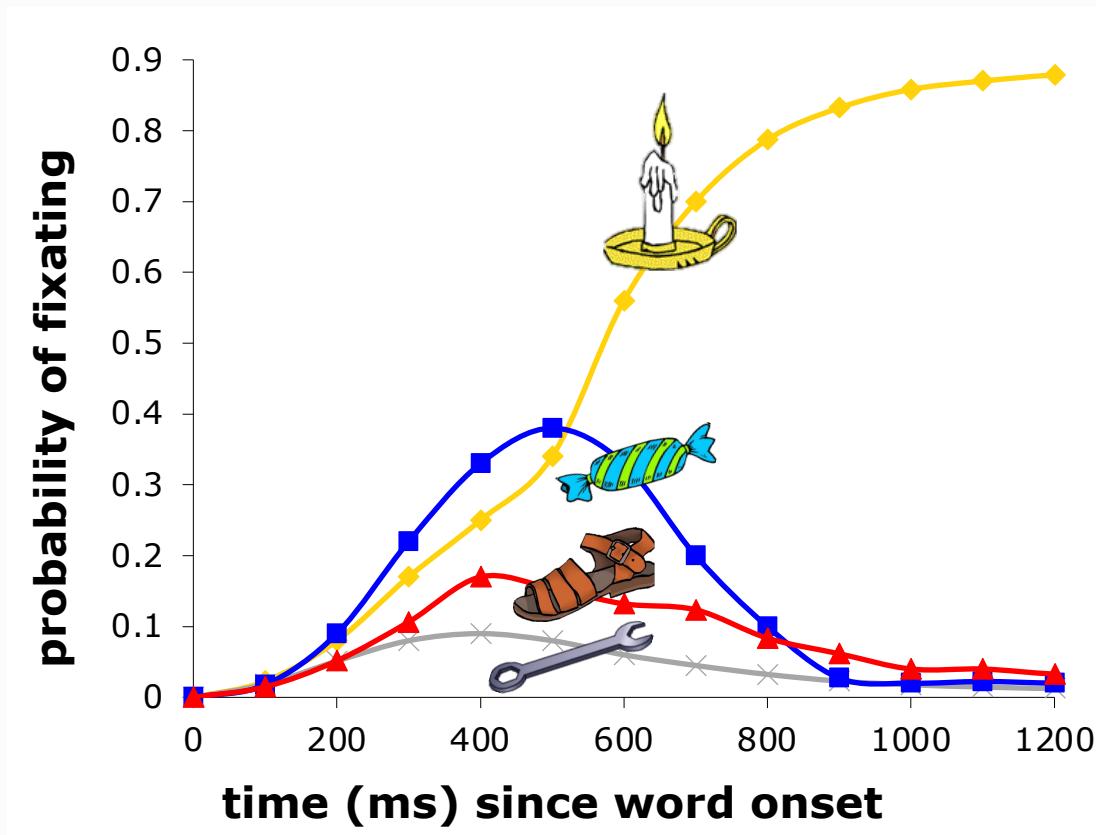Rhyme: *sandal*
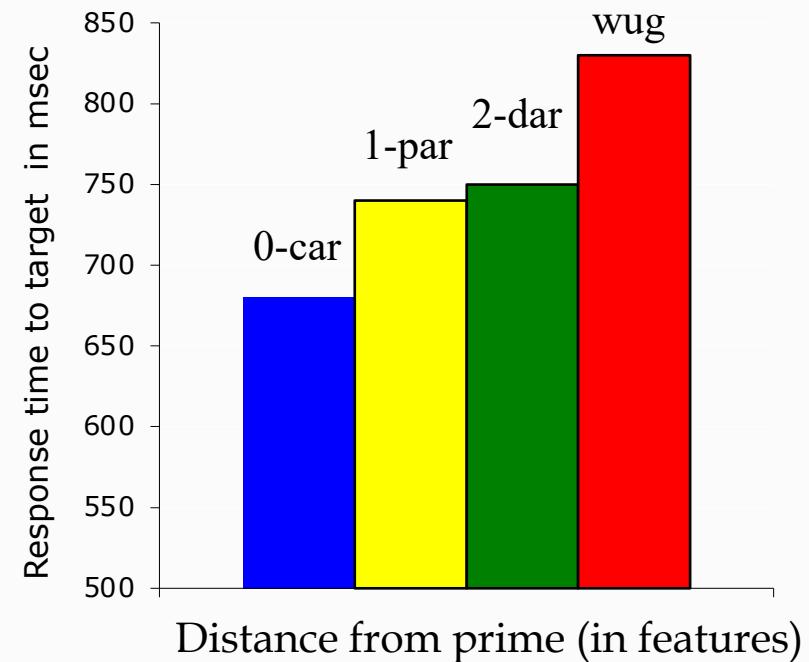
Same beginning: *candy*

Distractor: *wrench*

Allopenna, Magnuson, & Tanenhaus (1998)

Experimental tests

Experiment: Eye-tracking in the Visual World Paradigm

Allopenna, Magnuson, & Tanenhaus (1998)
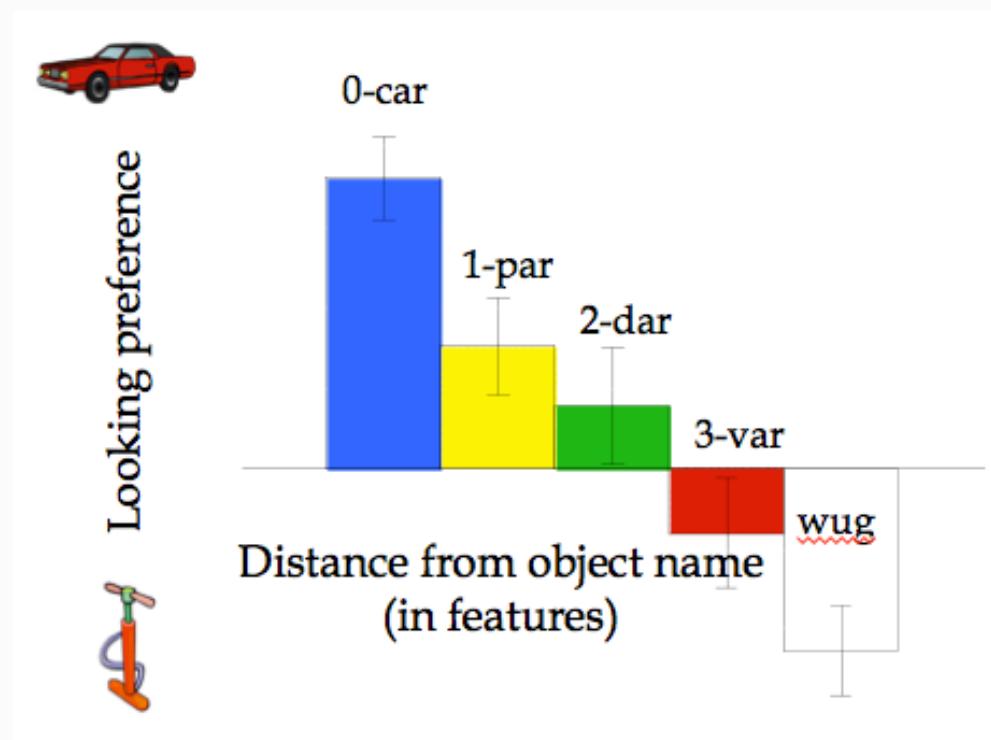
Experimental tests

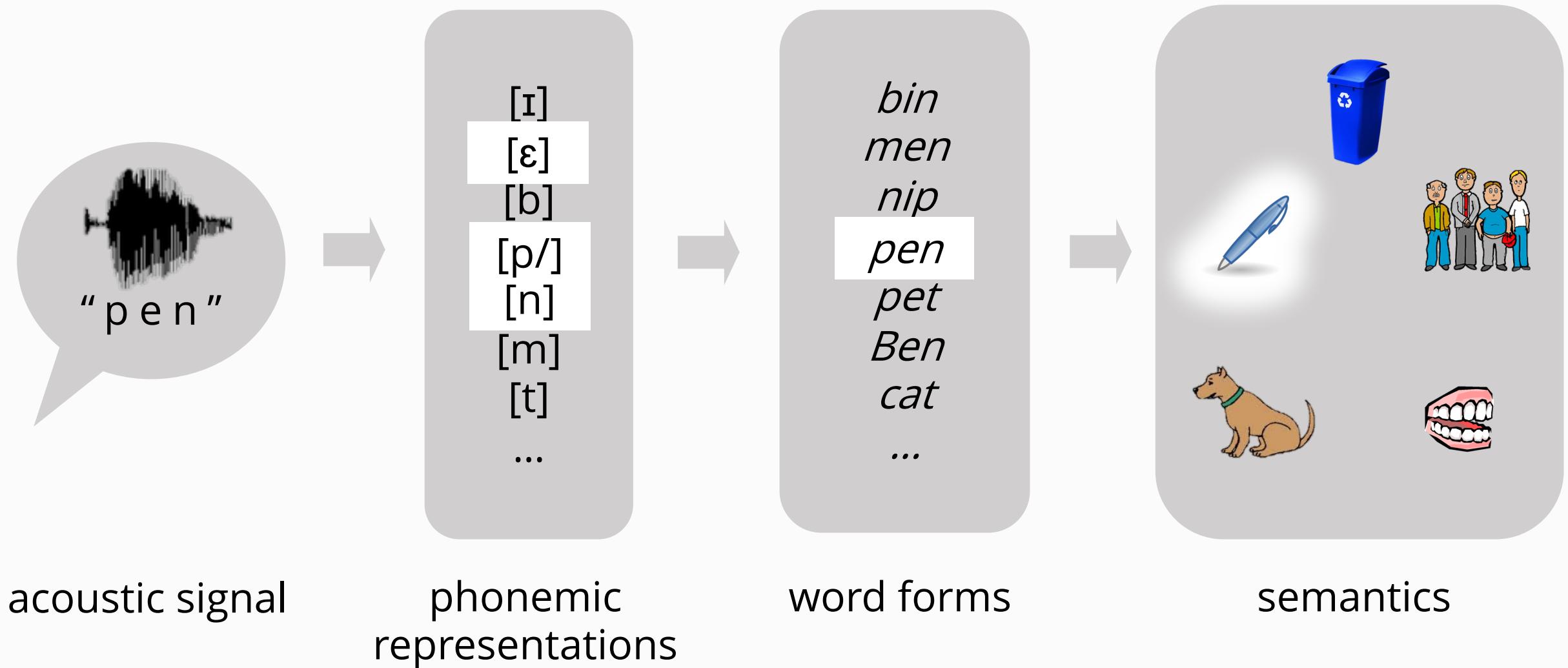Activation of competitors differs based on similarity:
It happens based on articulatory features, too! Both infants (left) and adults (right) are sensitive to featural similarity.
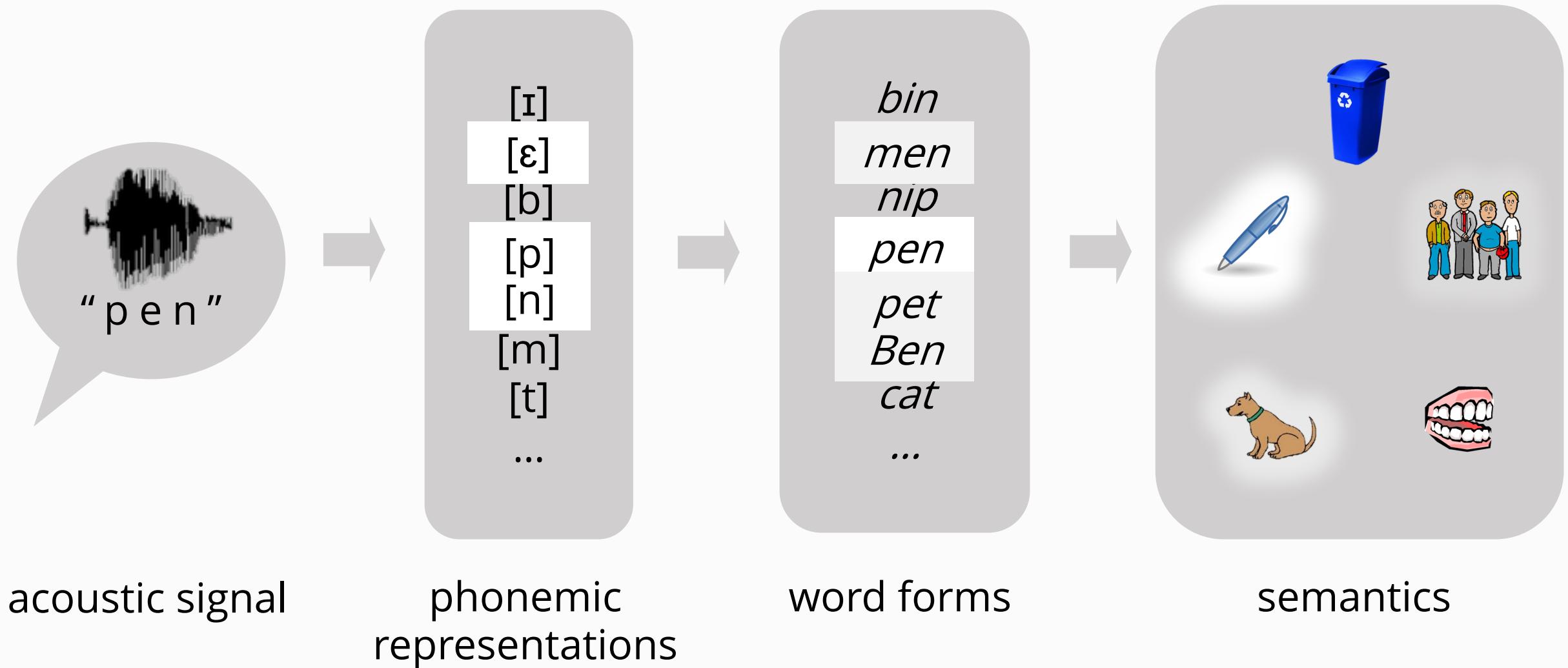
White & Morgan (2008); Milberg, Blumstein & Dworesky (1988)

Simplified model of word recognition

Simplified model of word recognition

UPDATE #1

| acoustic signal | phonemic representations | word forms | semantics |

Challenges in recognizing words

- **Challenge #4** (new!)
  - Lexical items are globally ambiguous (not just temporarily ambiguous!)
    - bank
    - jam
    - star
    - bulb
    - toast
  - These are called **homophones**
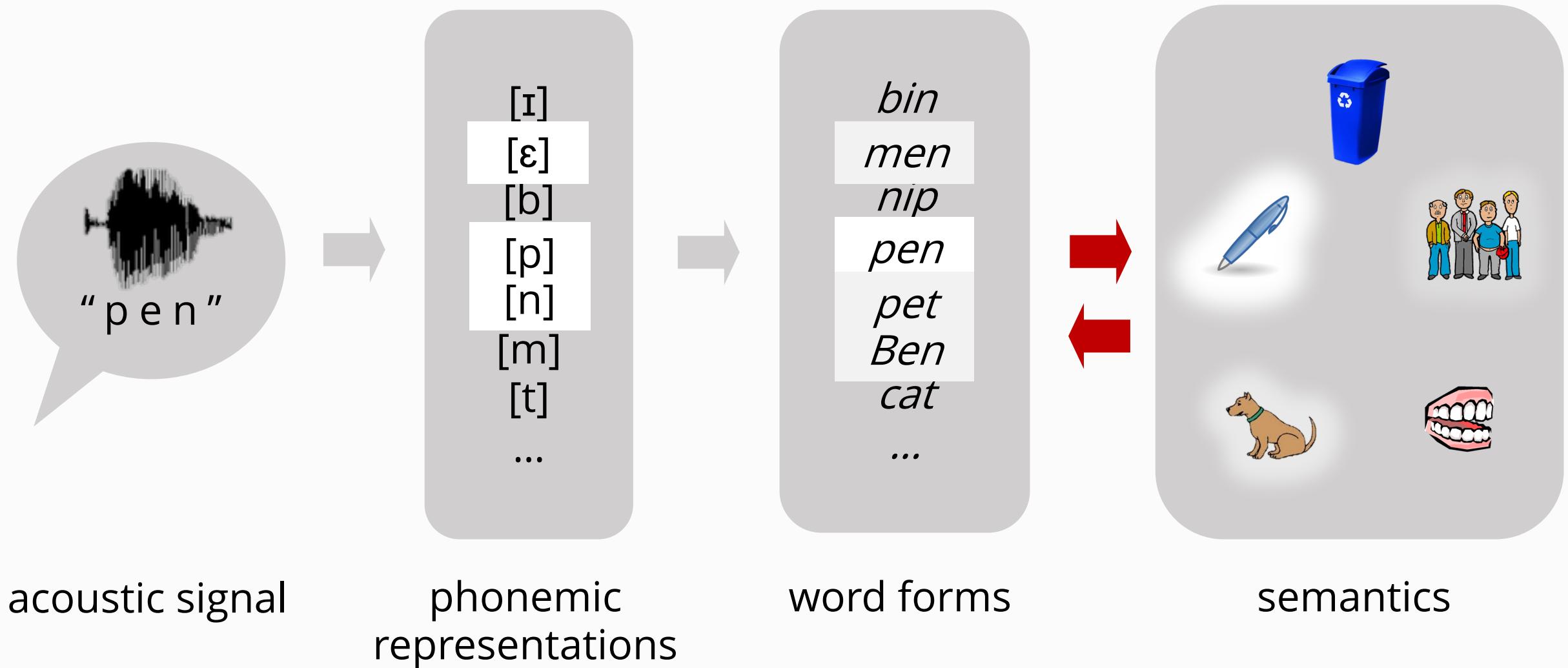
Challenges in recognizing words

- **Challenge #4** (new!)
  - Lexical items are often globally ambiguous (not just temporarily ambiguous!)
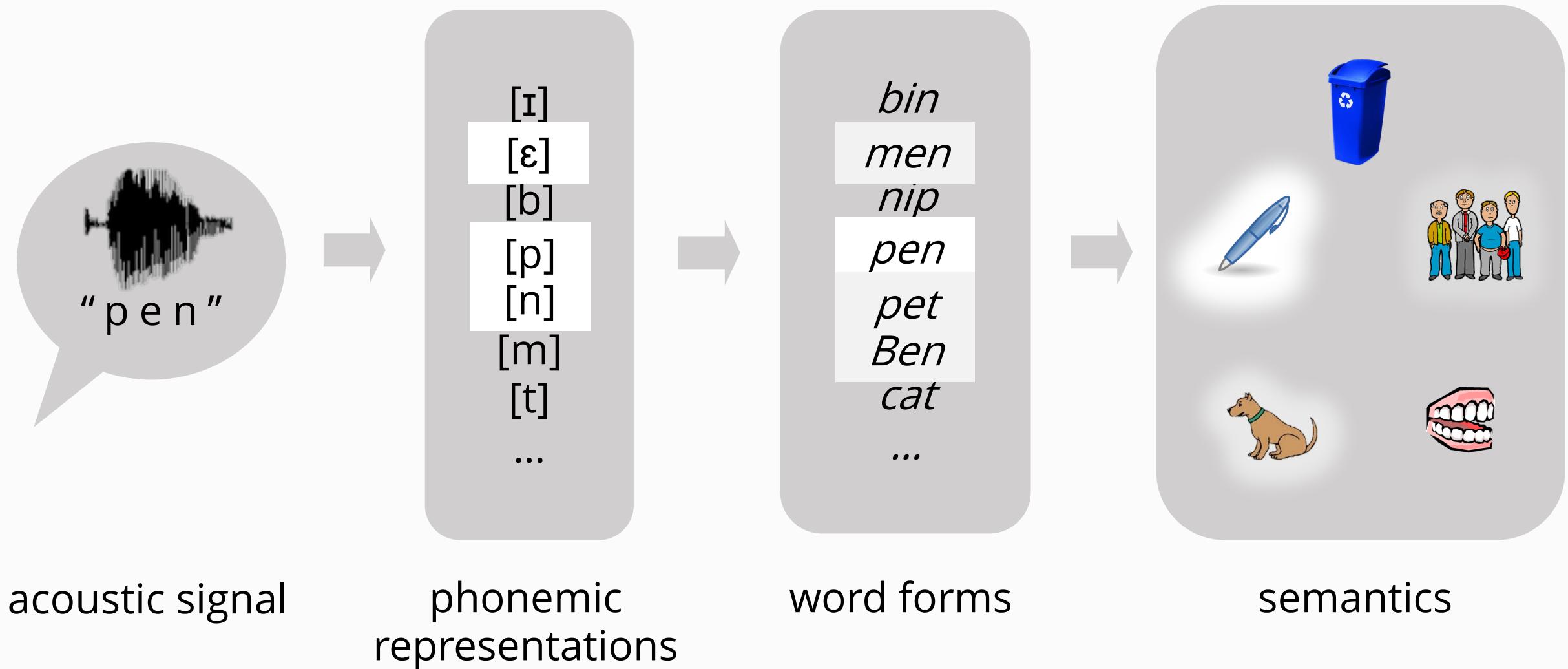 - We typically activate **more frequent words** more strongly, but sentential context helps tip the scale
    - **Bank**: more frequent meaning is the finance meaning, not the river meaning
      - I bumped into Kaya at the <u>bank</u>.   NEUTRAL: apple / money / river
      - I opened a checking account at the <u>bank</u>.   BIASED: apple / money / river
  - When context is constraining, *and* it biases the most frequent meaning, it appears to immediately constrain which meaning is accessed

Simplified model of word recognition

acoustic signal

phonemic representations
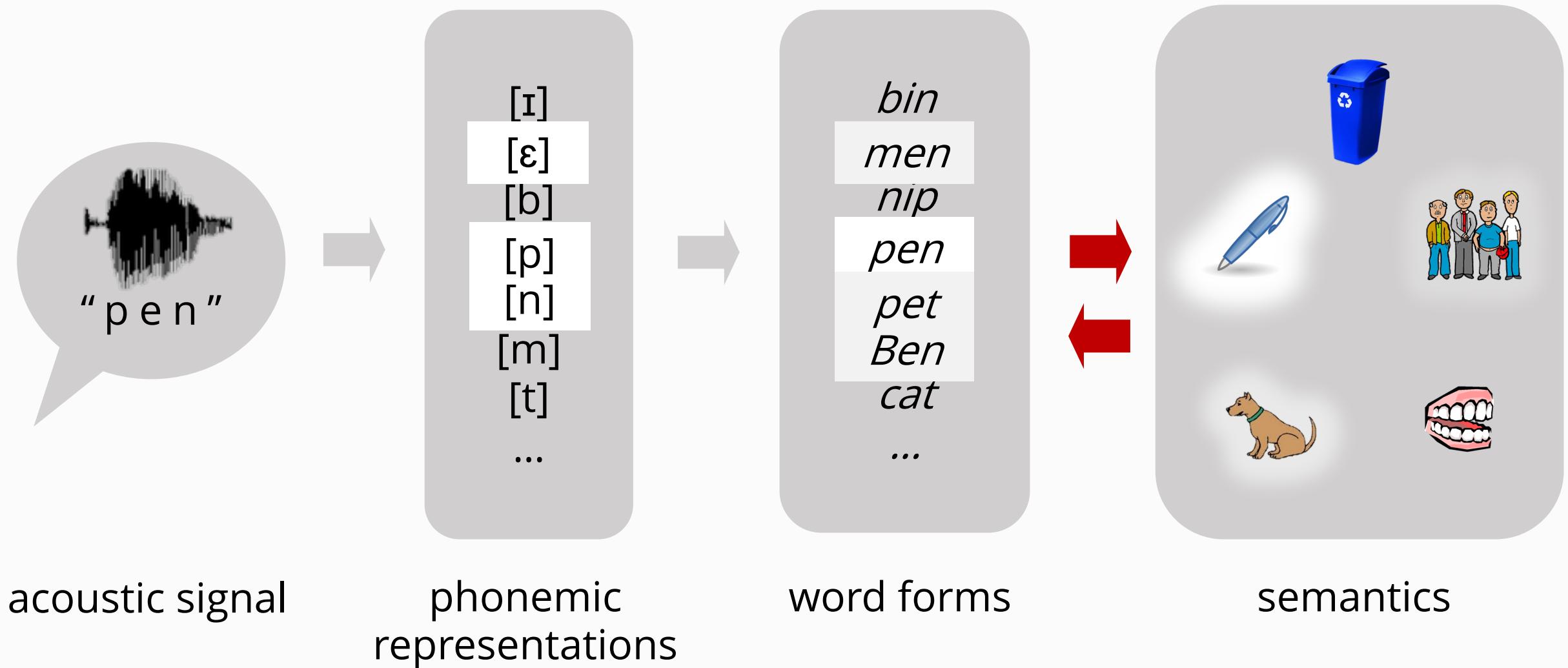
word forms

semantics

Simplified model of word recognition

UPDATE #2

acoustic signal

phonemic representations

word forms

semantics

Challenges in recognizing words

- **Challenge #5** (new!)
  - Context also affects sub-lexical (phonemic) recognition
    1. **Coarticulation** constrains the number of possible words (and may contribute to the uniqueness point)

    2. **Kuhl-McGurk effect:** visual context affects phoneme recognition ([Kuhl-McGurk effect](#))

    3. **Ganong effect**: perception of an ambiguous phoneme is affected by the rest of the word it is embedded in ([Ganong effect](#))

    4. **Phoneme restoration effect**: knowledge of words helps when the auditory signal is unclear ([Phoneme restoration effect](#))

Ganong (1980); Warren (1970); Kuhl (1985)

Simplified model of word recognition

UPDATE #2

acoustic signal

phonemic representations

word forms

semantics

Key concepts

- ✓ Challenges in recognizing words
  - ✓ Speech is variable (review), continuous (review), temporarily ambiguous (new!), and globally ambiguous (new!)
- ✓ Cohort Model
- ✓ Experimental methods for studying spoken word recognition
- ✓ Strategies for fast (incremental) word recognition
- ✓ Uniqueness point
- ✓ Context effects on spoken word recognition
  - ✓ sentential context, lexical context (Ganong effect; Phoneme restoration effect), phonological context (coarticulation); visual context (Kuhl-McGurk effect)

Learning objectives

- Identify different kinds of meanings
- Describe what semantic memory is and how it is acquired
- Give an example of different kinds of semantic associations
- Describe two perspectives on studying meaning in language
- Give a theoretical reason to believe that words and sentences have a core meaning
- Define compositionality

Different kinds of meaning

- Semantics (linguistics)
  - Literal meaning
    - *Give me a hand.*
    - e.g., you're decorating for Halloween

  - Idiomatic meaning
    - *Give me a hand.*
    - help me

  - Presupposition
    - *President Biden's twin wrote a very famous poem.*
    - this presupposes that President Biden has a twin

  - Entailment
    - *A cat is an animal.*
    - In any case where A (being a cat) is true, then B (being an animal) is true too

Different kinds of meaning

- Semantic associations (semantic memory)
  - Associations between concepts: pen-ink; candy-candle

- Pragmatics
  - Speaker: *Sandra knows English, Spanish, and French.*
  - Implication: Sandra does not know Italian, otherwise the speaker would have said that.
    - These implications can easily be cancelled (that is, the sentence remains true even if we find out that Sandra actually knows a fourth language)

- Discourse meaning
  - E.g., themes of books/discussions; question under discussion

Semantic memory

- World knowledge (e.g., Paris is in France)
- Object knowledge (e.g., cups are used for drinking)
- Language knowledge (e.g., [kʌp] refers to)

- What are some hints about how semantic memory is organized?
  - Priming! (from last time)
  - But why are pen and ink, for example, even related?!

- Via semantic memory, you can know something you didn't learn because of the interrelatedness of concepts

Semantic memory

- Some people use language as a tool to look into the mind
- What are the first words that come to mind?
    - SOUP

Semantic memory

- Some people use language as a tool to look into the mind
  - How are concepts related in the mind?
- Are there certain kinds of semantic relationships that you see coming up with some regularity in the word association test?
  - Part–whole relationships
  - Category membership
  - Object-action relationships
  - Situational co-occurrence
  - Linguistic co-occurrence
  - Physical resemblance
  - Antonyms
  - Synonyms

Semantic memory

- Part–whole relationships   e.g., paper-book, bicycle-wheel
- Category membership   e.g., shirt-pants, apple-banana
- Object-action relationships   e.g., balloon-pop, beach-swim
- Situational co-occurrence   e.g., menu-waiter, register-grocery store
- Linguistic co-occurrence   e.g., cat-fluffy, eat-hungry
- Physical resemblance   e.g., football-lemon, donut-tube
- Antonyms   e.g., hot-cold, high-low
- Synonyms   e.g., couch-sofa, soda-pop

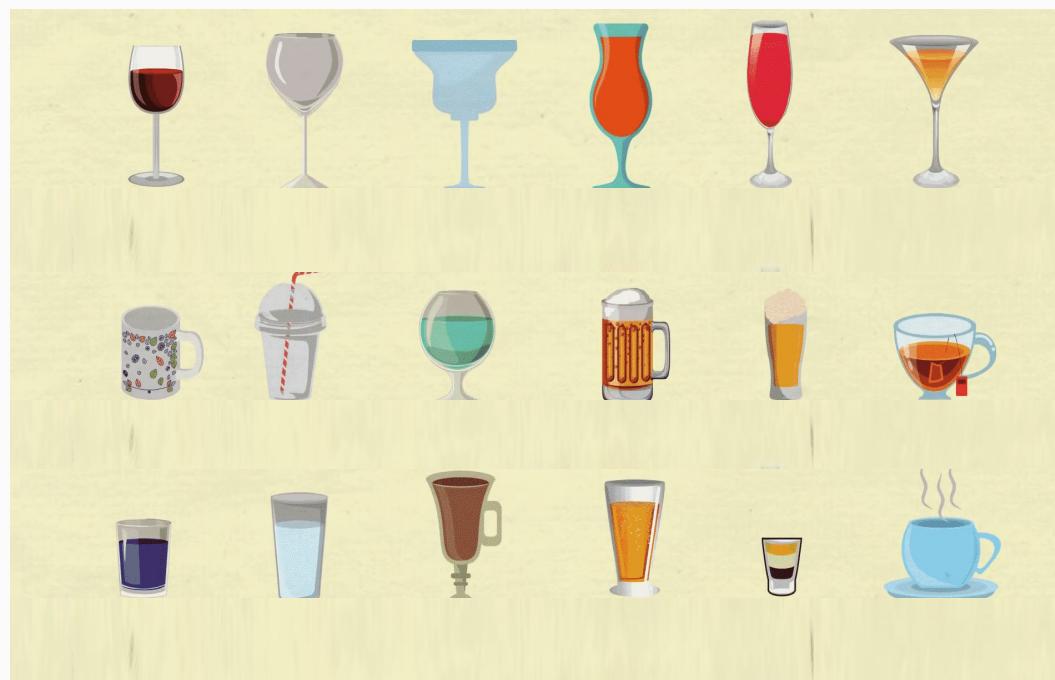For inspiration: cat, hot, blouse, window, hammer, apple

Acquiring semantic memory

- What is a cup?
  - How do you know that?
  - Cups can be made of different materials and hold different contents

Acquiring semantic memory

- What is a cup?
  - How do you know that?
  - Cups can be made of different materials and hold different contents
  - And they come in lots of different shapes and sizes

Acquiring semantic memory

- What is a cup?
  - How do you know that?
  - Cups can be made of different materials and hold different contents
  - And they come in lots of different shapes and sizes
    - …even when they are used for the same contents!

- **Episodic memory:** memory of specific instances at particular times in particular places
- **Semantic memory**: categories of things and events abstracted over many instances
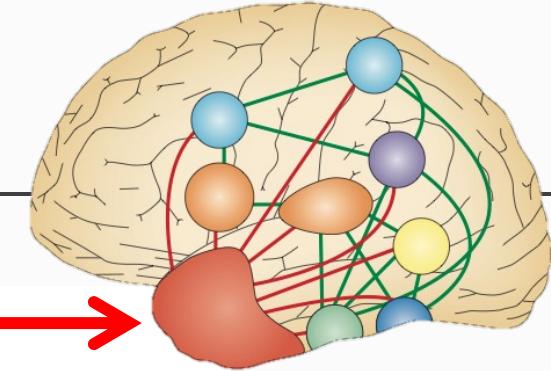
Categorical relationships

- Supported by anterior temporal lobe

- "Semantic Dementia" is associated with damage here
  - Gradual atrophy of anterior temporal lobe (L > R)
  - Knowledge about object properties is lost
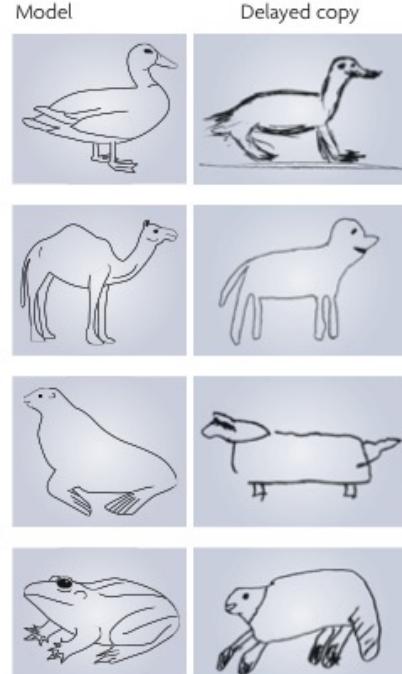 - Specific knowledge is lost before general

b Picture naming

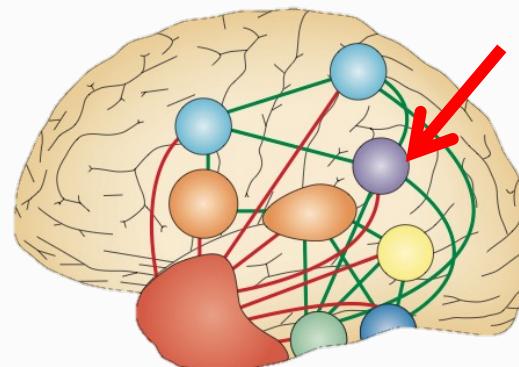| Item	Sept 1991	Mar 1992	Sept 1992	Mar 1993
Bird	+	+	+	Animal
Chicken	+	+	Bird	Animal
Duck	+	Bird	Bird	Dog
Swan	+	Bird	Bird	Animal
Eagle	Duck	Bird	Bird	Horse
Ostrich	Swan	Bird	Cat	Animal
Peacock	Duck	Bird	Cat	Vehicle
Penguin	Duck	Bird	Cat	Part of animal
Rooster	Chicken	Chicken	Bird	Dog

Hodges et al., 1995

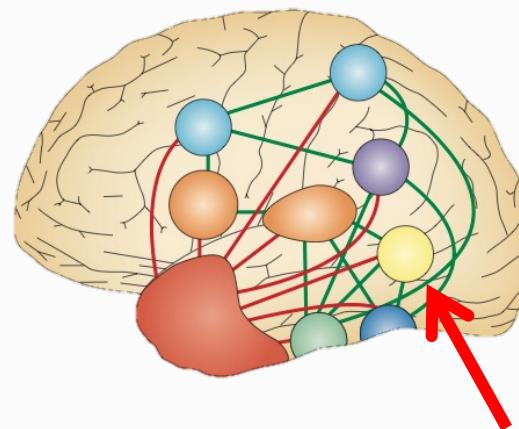**d** Delayed-copy drawing

Patterson et al., 2008

Thematic (event-based) relationships

- Supported by angular gyrus (purple circle).
  - Damage here causes problems with situational co-occurrence associations
    - ambulance-hospital
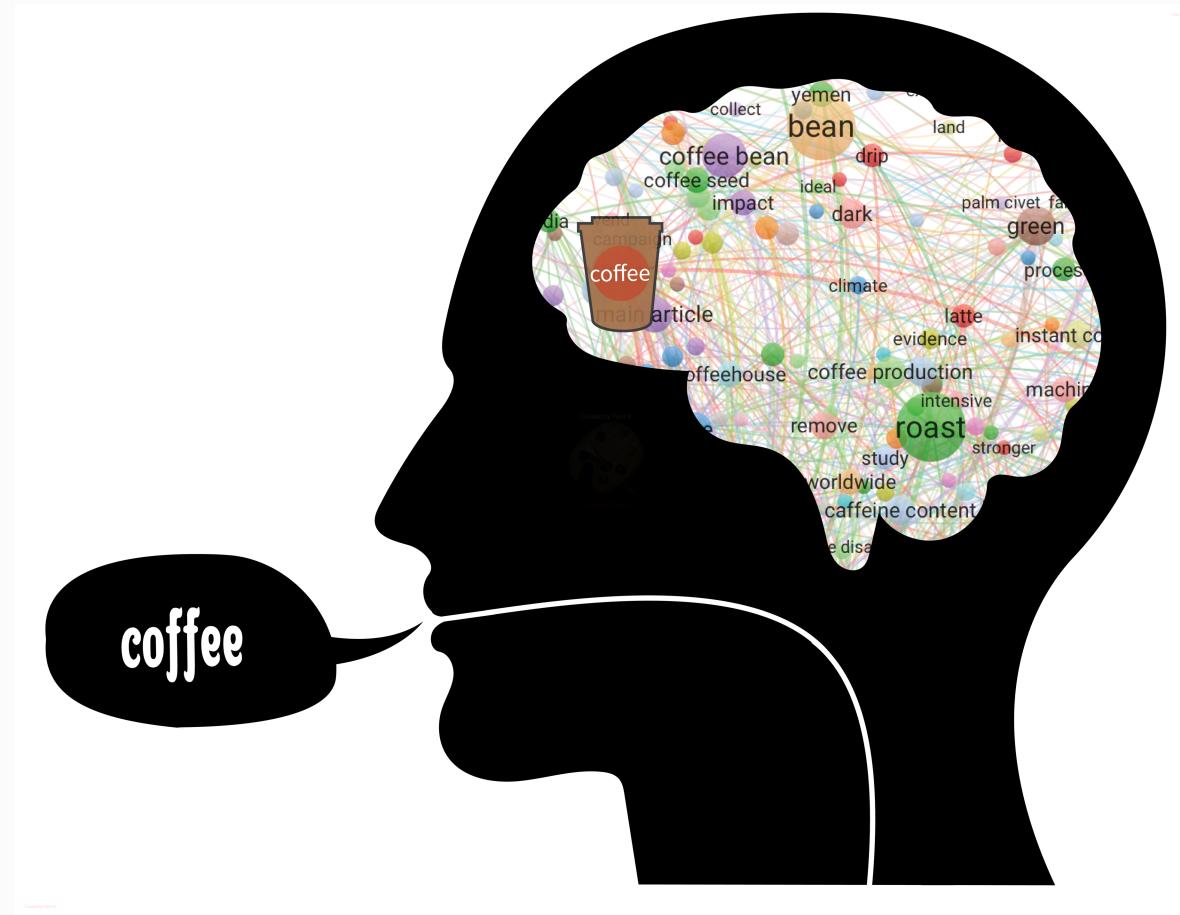   - dog-bone
    - professor-classroom

Mapping from word to meaning

- Supported by posterior middle temporal gyrus (yellow circle).
  - Damage here causes problems with mapping sounds onto meaning…
  - Is this a problem with representation or access?
    - (we will come back to this later in this unit)

So many semantic associations!

How do we arrive at the interpretation of a sentence with all of the ambiguity in speech, and with **spreading activation** to associations?

Meaning in language

There is a distinction between two subfields, mostly in terms of their respective perspectives

Psycholinguistics
how language is produced and comprehended in real time, and how these processes interact with other mental faculties such as memory and attention.

Experimental linguistics
strives to obtain empirical data that are relevant to debates framed from a linguistic viewpoint, including learning about what knowledge of language is.

Note: not all researchers make this distinction between terms, but most make the distinction between the two perspectives.

Compositionality

- Though associations are activated during language, we also somehow activate a core meaning of the words and sentences we read

- **Compositionality:** The meaning of a complex expression is determined by the meanings of its constituent expressions and the rules used to combine them
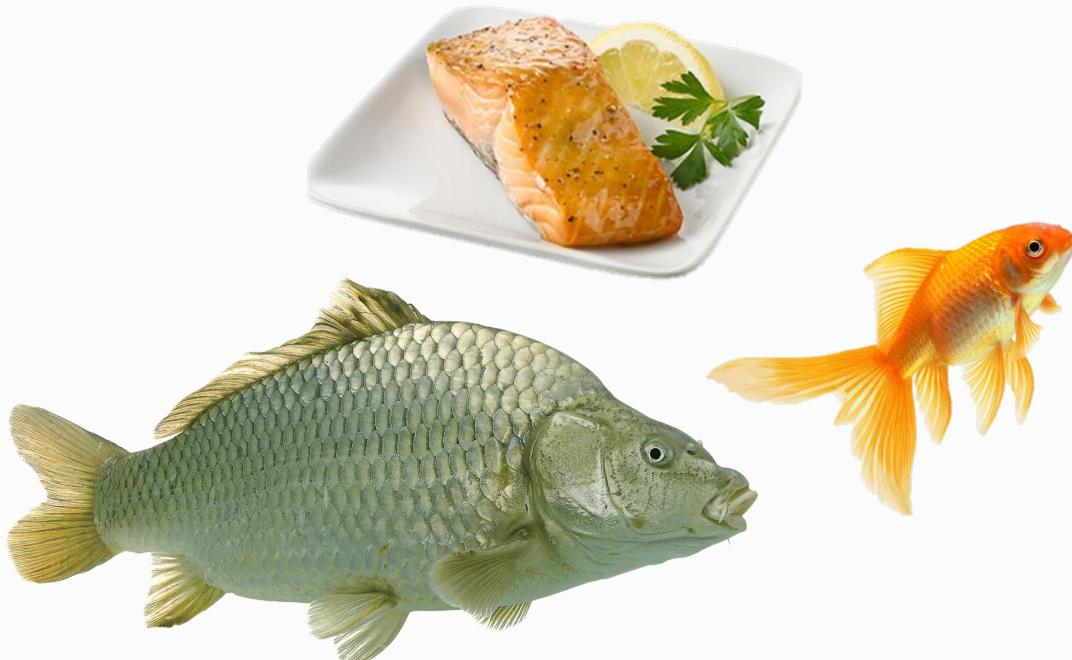
Compositionality

- In theory (because in practice in experiments it's hard!) we can separate core meanings of words from semantic association

FISH

Compositionality

- In theory (because in practice in experiments it's hard!) we can separate core meanings of words from semantic association

FISH

Compositionality

- In theory (because in practice in experiments it's hard!) we can separate core meanings of words from semantic association

FISH

Compositionality

- In theory (because in practice in experiments it's hard!) we can separate core meanings of words from semantic association

PET
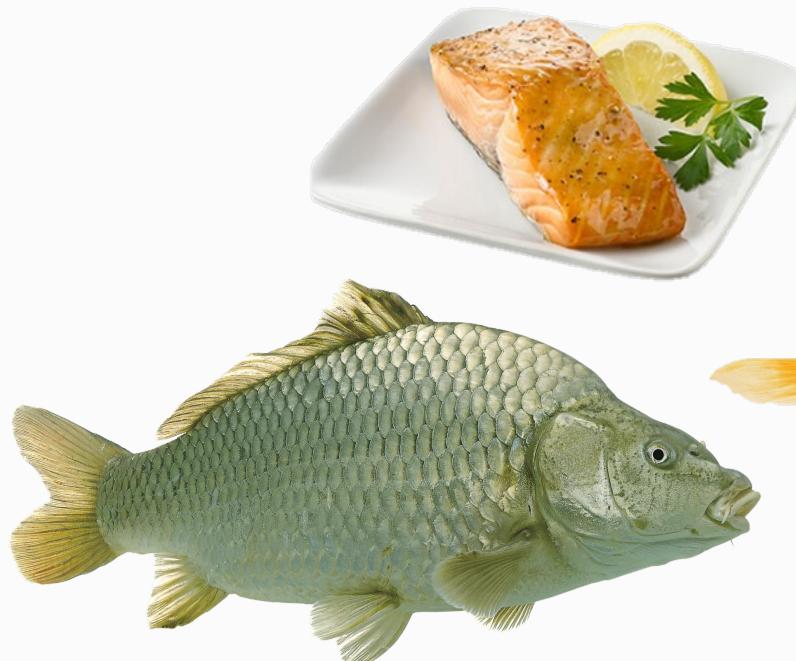
Compositionality

- In theory (because in practice in experiments it's hard!) we can separate core meanings of words from semantic association

PET

Compositionality

- In theory (because in practice in experiments it's hard!) we can separate core meanings of words from semantic association

PET

Compositionality

- In theory (because in practice in experiments it's hard!) we can separate core meanings of words from semantic association

PET FISH

Compositionality

- In theory (because in practice in experiments it's hard!) we can separate core meanings of words from semantic association

PET FISH

Evidence for compositionality

- **Background:** verbs carry information about the number and type of participants/locations/objects involved in the events those verbs convey
  - Build
    - 2: a builder; a thing being built
  - Give
    - 3: a giver, a thing being given, receiver
  - Eat
    - 1 or 2: an eater, (optional: a thing being eaten)

Evidence for compositionality

- Participants are faster to read sentences with phrases when those phrases carry participant information (a and b), rather than when they carry extra information (c and d)

a) The saleswoman tried to interest the man <u>in a wallet</u>.

b) The man expressed his interest <u>in a wallet</u>.

c) The man expressed his interest <u>in a hurry</u>.

d) The saleswoman tried to interest the man <u>in his fifties</u>.

Clifton (1991)

Semantic ambiguity

- Sentences can be semantically ambiguous: they can have more than one interpretation

A child built every sandcastle.

- Imagine there are 5 sandcastles. How many children are there?
  - One child may have built all sandcastles
  - A different child may have built each sandcastle

Wrapping up

- There are many ways to study meaning
  - Compositional meaning and associations are two of the main ways
  - Ambiguity is another main area of research
    - Semantic ambiguity is related to syntactic ambiguity—more on this next time!

Key concepts

✓Semantic memory (structure and acquisition)

✓Psycholinguistics and experimental linguistics

✓Compositionality

✓Semantic ambiguity

✓Spreading activation

✓Evidence for categorical relationships

✓Types of meaning: