# Psychology of Language

## 7 Spoken word recognition

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

Emma Wing
Drop-in hours:
By appointment

# Road map

- Review from Exam 1
- **Unit 2: The Mature System**
  Spoken word recognition

# Review of Exam 1

- Issue with the wrong answer for question about errors of omission – the correct answer should be showing now
- Nativism vs. empiricism
  - Empiricism: everything we come to know about language is acquired via general learning mechanisms and general cognitive abilities (e.g., statistical learning)
  - Nativism: we have an innate (not learned) ability that helps us to acquire language that is genetically specified; some aspects of our language ability are genetically specified
  - Both views hold that learning the specific vocabulary and syntax of your language community is required (that is, nativists do not hold that all language is innate)
  - Learning about language in the womb via exposure to language is not an argument for nativism, unless we believe that the ability to learn language is innately specified
- *Pat* vs. *Tap*

# Unit 2:
# The Mature System

## Spoken word recognition

*Altmann, Lexical Access chapter*

*Accessing lexical items (vocabulary words)*

# Key concepts

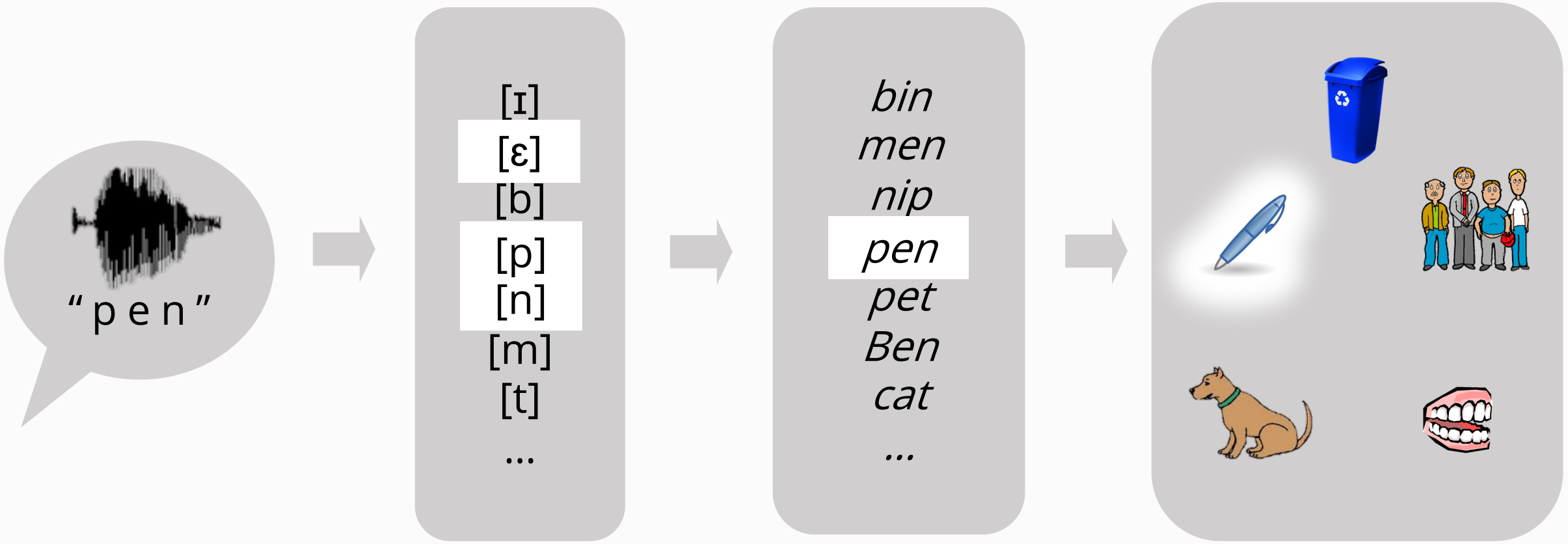
Learning objectives

- Name 2+ challenges in recognizing words
- Describe the Cohort Model
- Describe 2+ experimental methods for studying spoken word recognition
- Name 2+ strategies for fast (incremental) word recognition
- Define the uniqueness point of a word
- Give examples of context effects on spoken word recognition

# Challenges in recognizing words

- **Speech recognition:** how we recognize and access words and their meanings
- What are the challenges adults face in recognizing words and accessing their meanings?
  - *Example: Speech is variable. It varies by instance, speaker, etc.*
  - It is continuous (i.e., we need to segment it into words)
  - Words are temporarily ambiguous
  - Words are globally ambiguous (homophones)
- What are the steps of spoken word recognition?
  - In other words, what has to happen between the moment the sound hits your ears and understanding the message?

# Simplified model of word recognition




acoustic signal

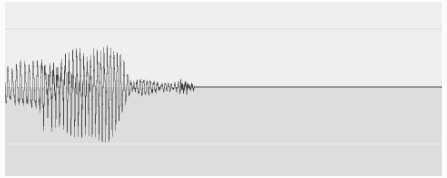
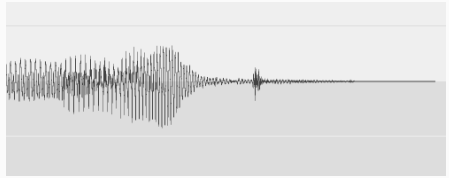
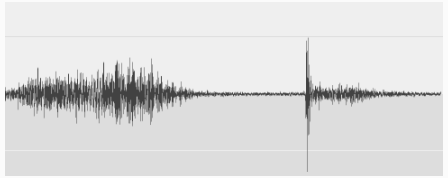
phonemic representations

word forms

semantics

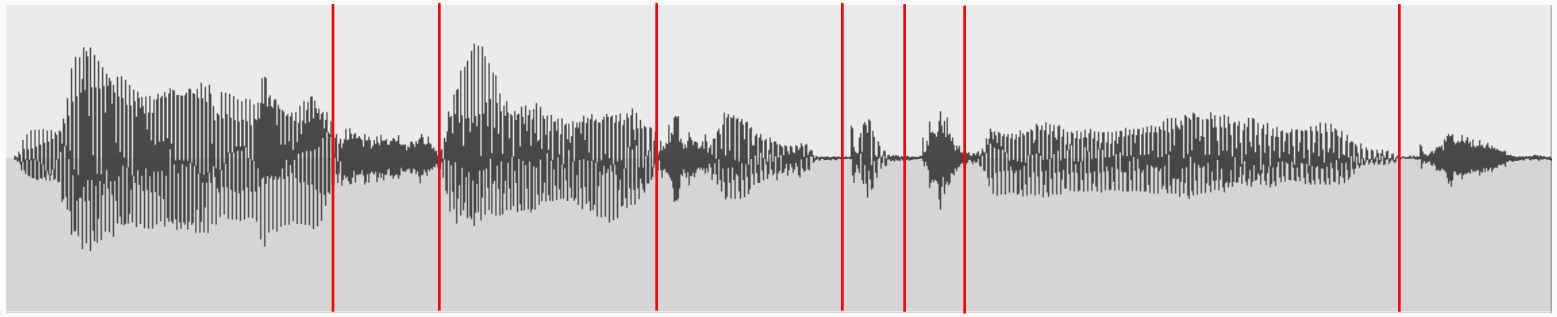
# Challenges in recognizing words

- **Challenge #1** (review)
  - Variability in the speech signal
    - Speaker characteristics
    - Articulation rate (how fast)
    - Prosody
    - Mode (e.g., whispered, creaky)

# Challenges in recognizing words

- **Challenge #2** (review)
  - Speech is continuous



A continuous utterance has to become discrete words

# Challenges in recognizing words

- **Challenge #3** (new!)
  - Speech is temporarily ambiguous
  - What do we mean by this?
    - Activity: name all the words you can think of that begin with “can”
    - Menti: **6610 0564**
  - This didn’t even include the words with “can” in the middle or at the end, or even across word boundaries!
  - We must have to wait until the end of the word to figure out…or even the end of a phrase!

# Experimental tests

Experiment: Shadowing

- response times of 250-275 ms after the onset of the word
  - subtract 50-75 msec for response execution
  - = ~200 ms delay in responding
- We figure out what the word is before the end of the word!
  - Yet we can still recognize words really easily. How?

Marslen-Wilson (1975)

# Experimental tests

Strategy #1: Semantic relatedness

- Read the following words. Write down all of the other words that it makes you think of. (1 minute)
  - *pen*
- Menti: **4592 3509**

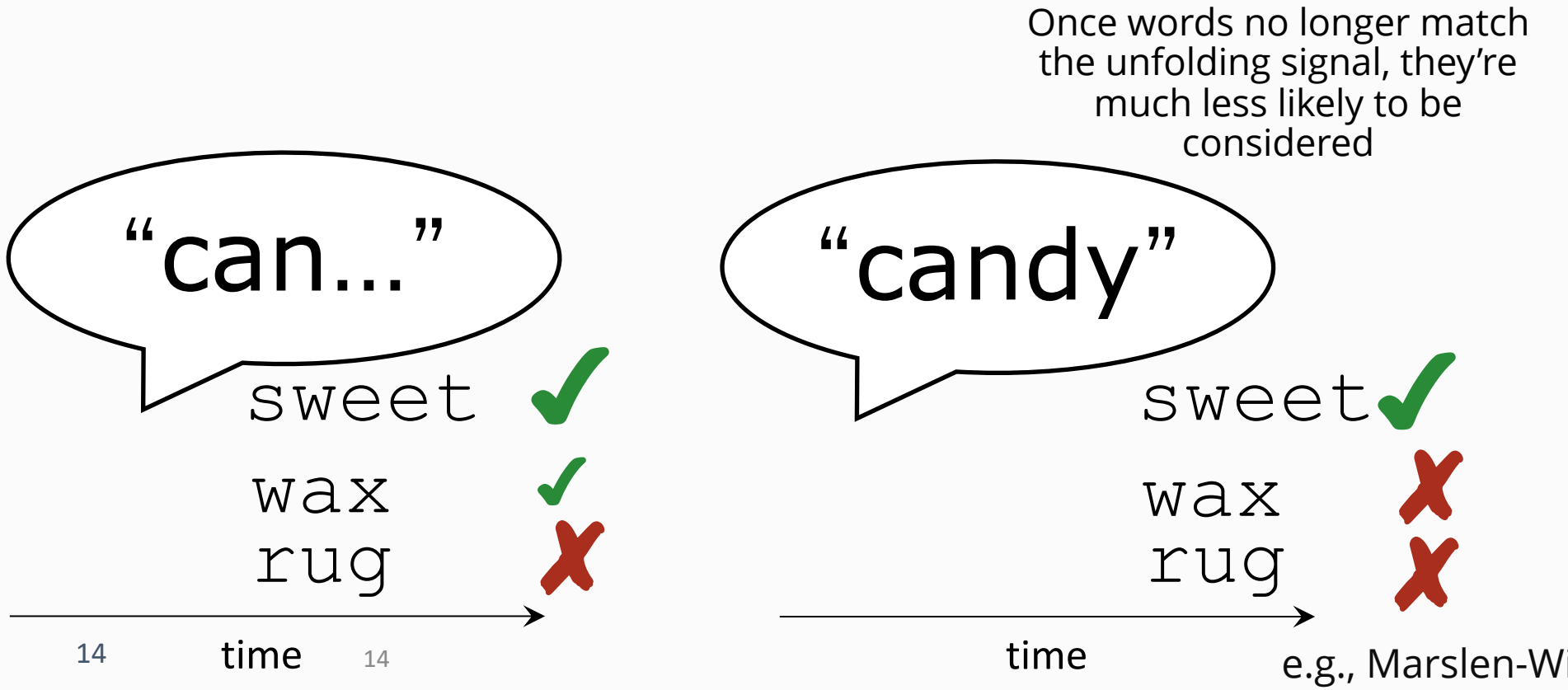
# Experimental tests

## Strategy #1: Semantic relatedness

- Experiment: Lexical decision task (say whether it is a word or not)
  - plub
  - door
  - spling
  - pen (PRIME)
  - ink (TARGET)
- People are faster to respond to a target word if the preceding prime word was semantically related
  - When we hear (or read) a word, we partially activate words that are related in meaning

# Experimental tests

Experiment: Cross-modal semantic priming



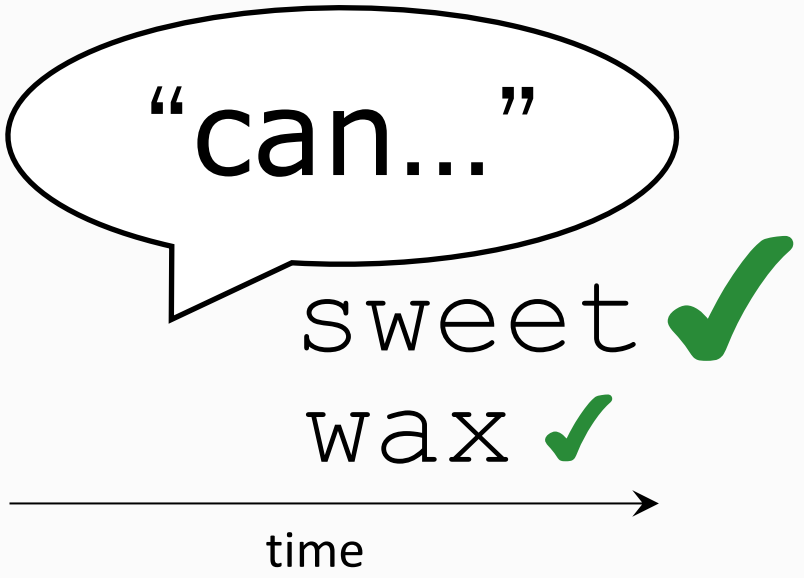

e.g., Marslen-Wilson, 1984

# Experimental tests

Experiment: Cross-modal semantic priming

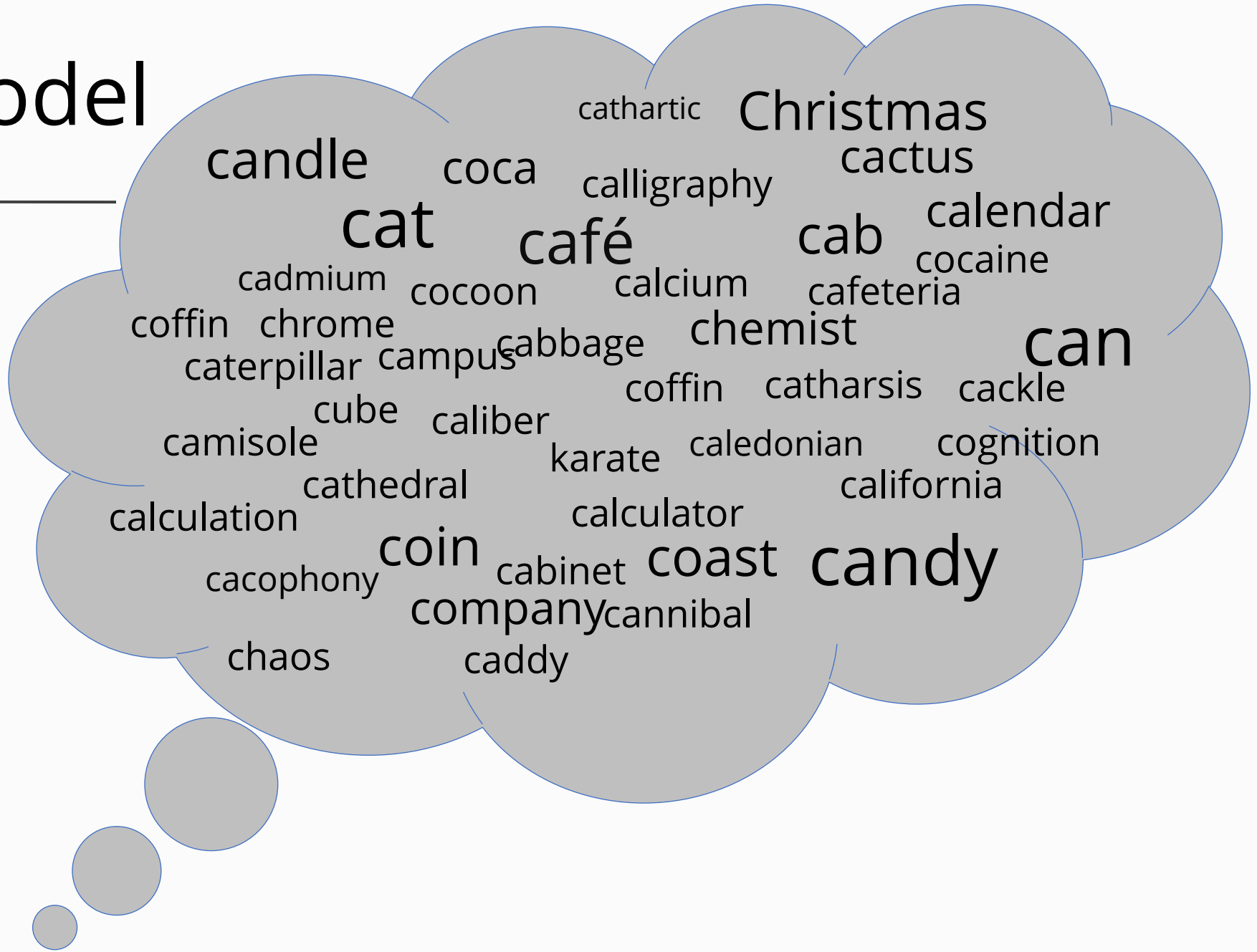
Strategy #2: Frequency

- Because *candy* is more frequent than *candle*, there is more priming for *sweet* than for *wax*



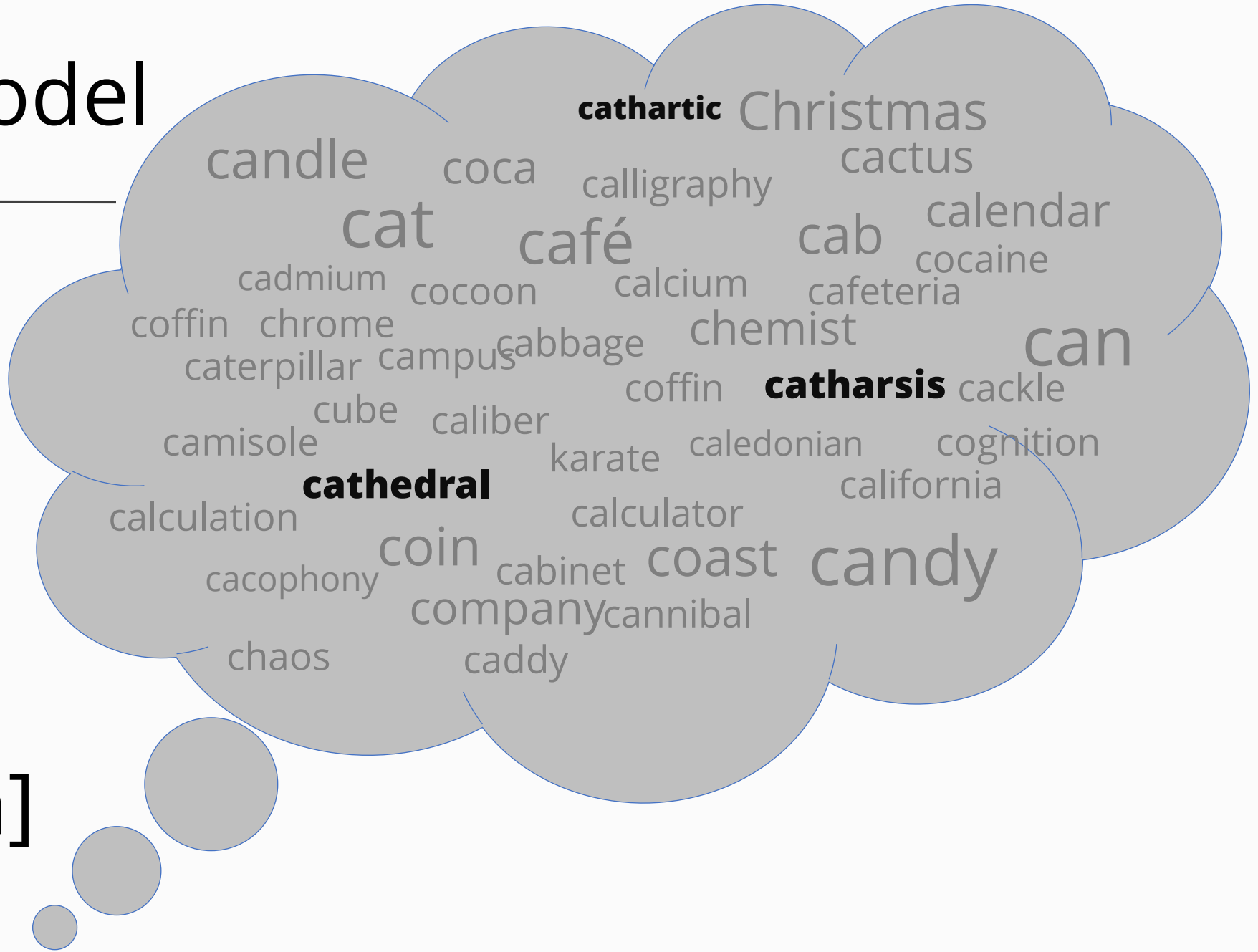

Zwitserlood, 1989

# Cohort Model




[c]

# Cohort Model

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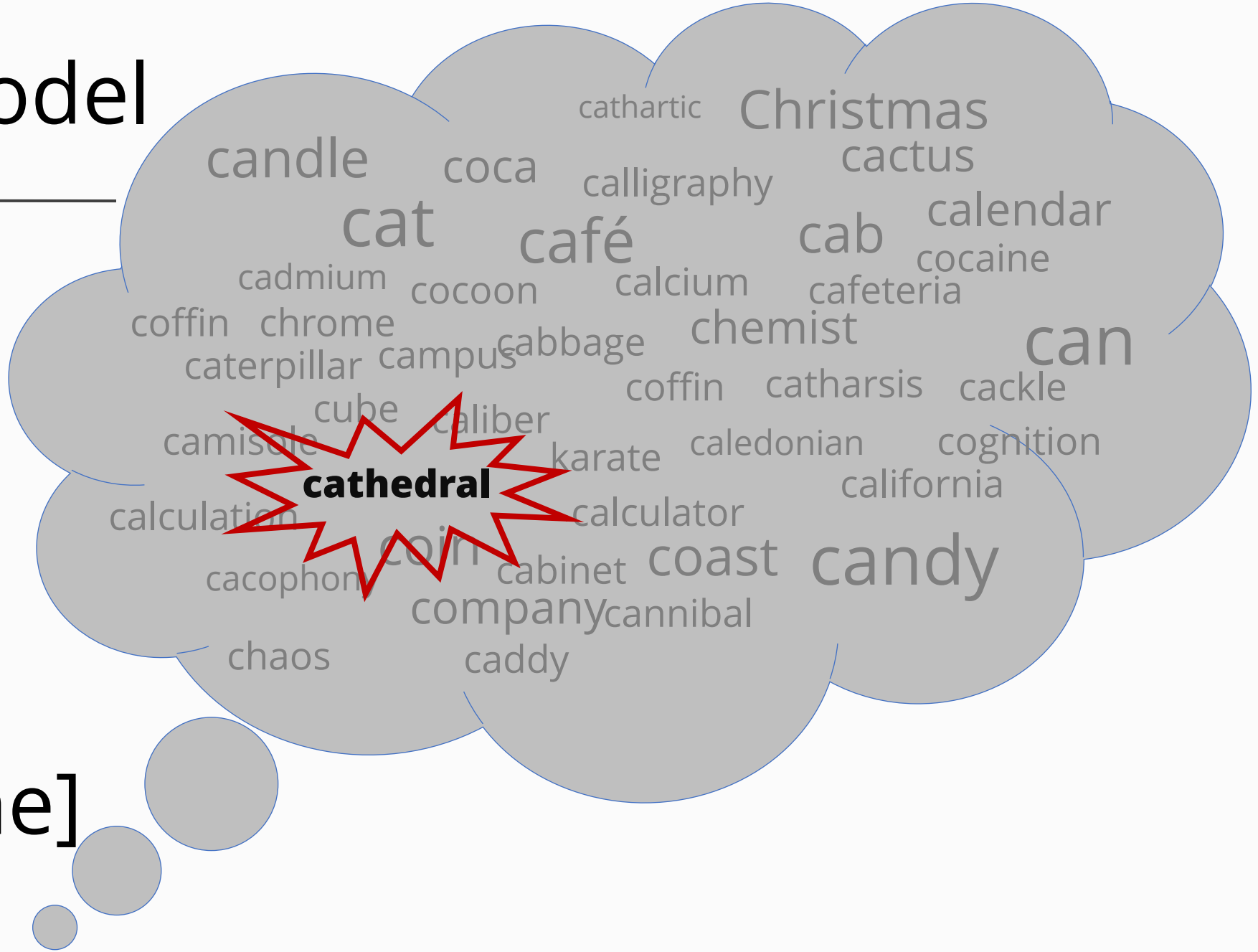
# Cohort Model

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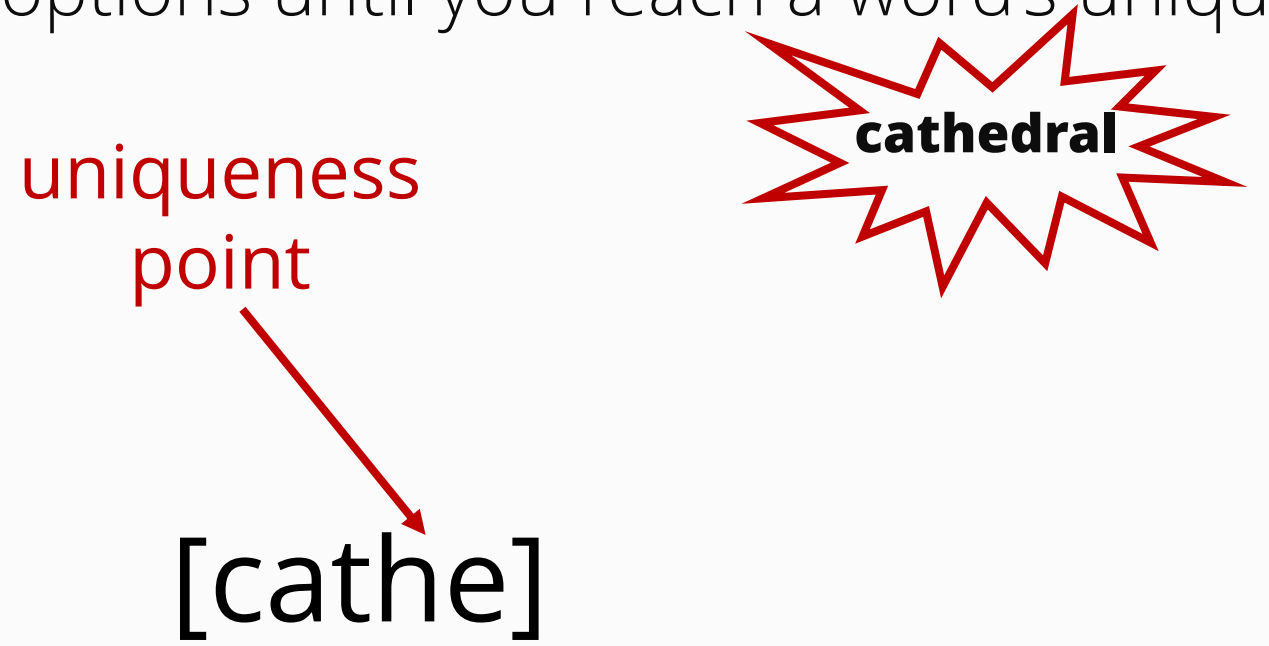
# Cohort Model

Strategy #3: Uniqueness point

- Activate the most likely candidates and narrow down the options until you reach a word's uniqueness point

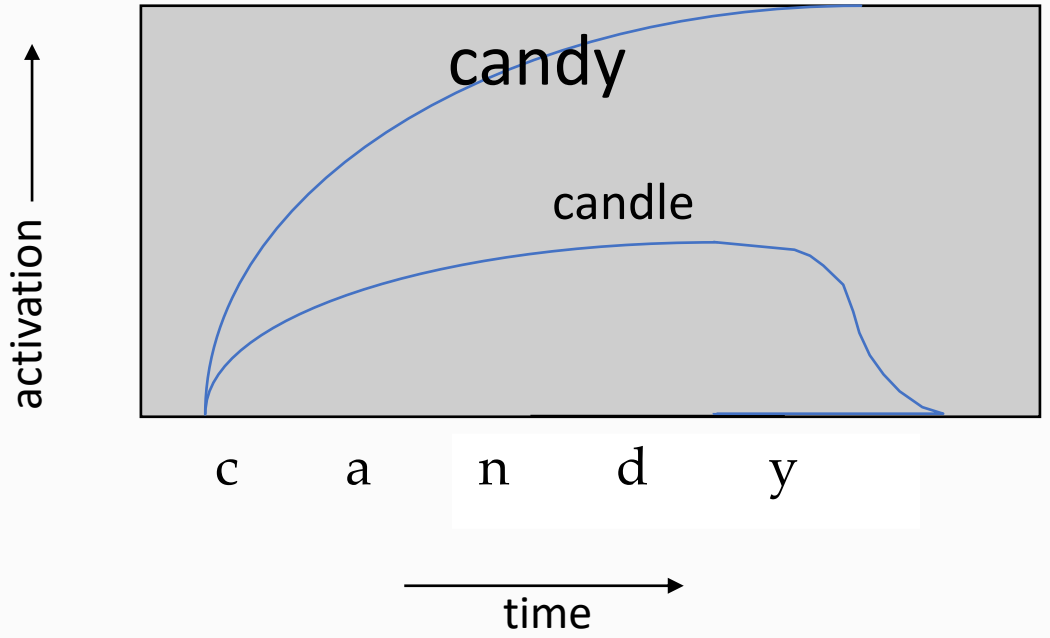


# Cohort Model

Write out what we know so far. What does it predict we would see if we tested all strategies at once?

1. Initial sounds of a word activate all words that begin with those sounds
2. Higher frequency words and words that are more semantically related have steeper activation functions
3. Amount of match/mismatch between acoustic input and a word's stored representation is reflected in degree of activation
4. Options are narrowed down until the uniqueness point of a word

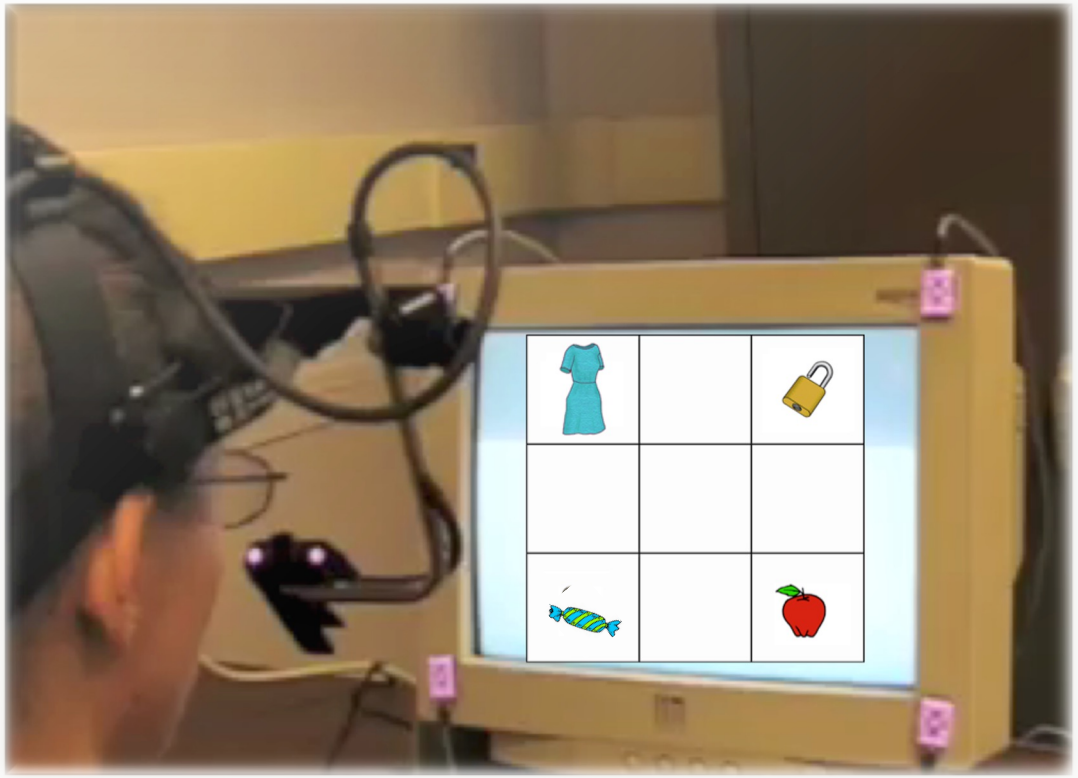
Cohort Model:
Hypothesized activation function




Marslen-Wilson & Welsh 1978; Marslen-Wilson 1987

# Experimental tests

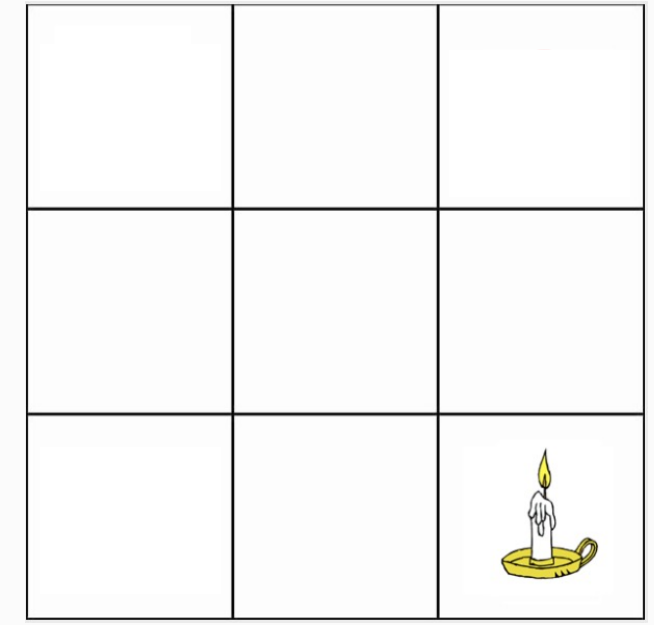
Experiment: Eye-tracking in the Visual World Paradigm



# Experimental tests

Experiment: Eye-tracking in the Visual World Paradigm

Target: *candle*



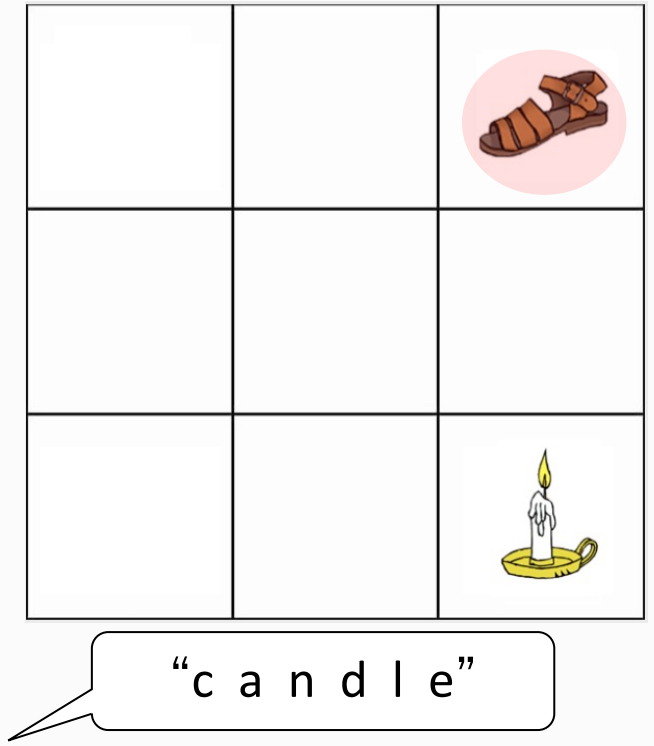

Allopenna, Magnuson, & Tanenhaus (1998)

# Experimental tests

Experiment: Eye-tracking in the Visual World Paradigm

Target: *candle*

Rhyme: *sandal*




Allopenna, Magnuson, & Tanenhaus (1998)

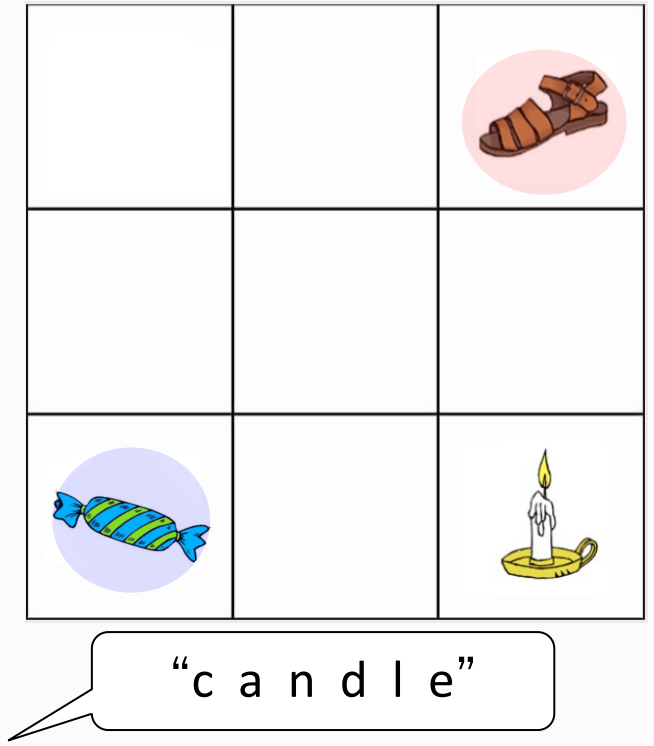
# Experimental tests

Experiment: Eye-tracking in the Visual World Paradigm

Target: *candle*

Rhyme: *sandal*

Same beginning: *candy*




Allopenna, Magnuson, & Tanenhaus (1998)

# Experimental tests

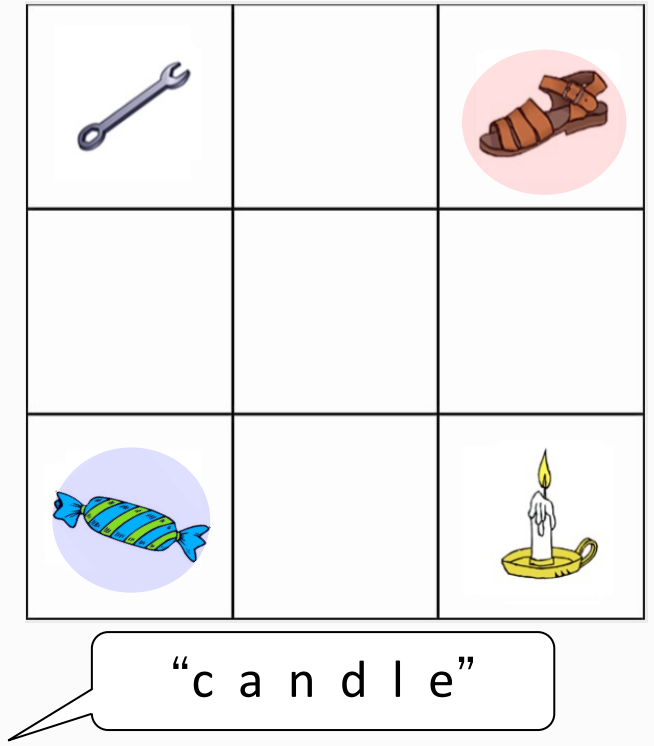
## Experiment: Eye-tracking in the Visual World Paradigm

Target: *candle*

Rhyme: *sandal*

Same beginning: *candy*

Distractor: *wrench*

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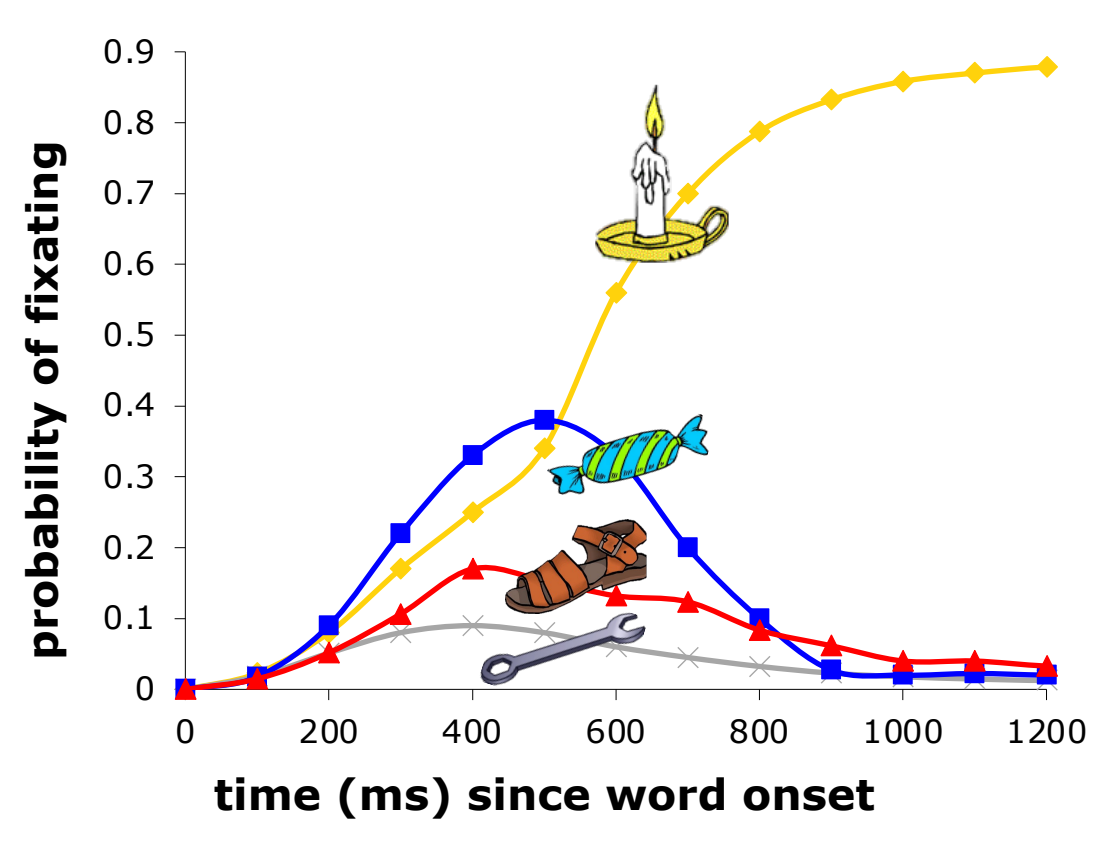
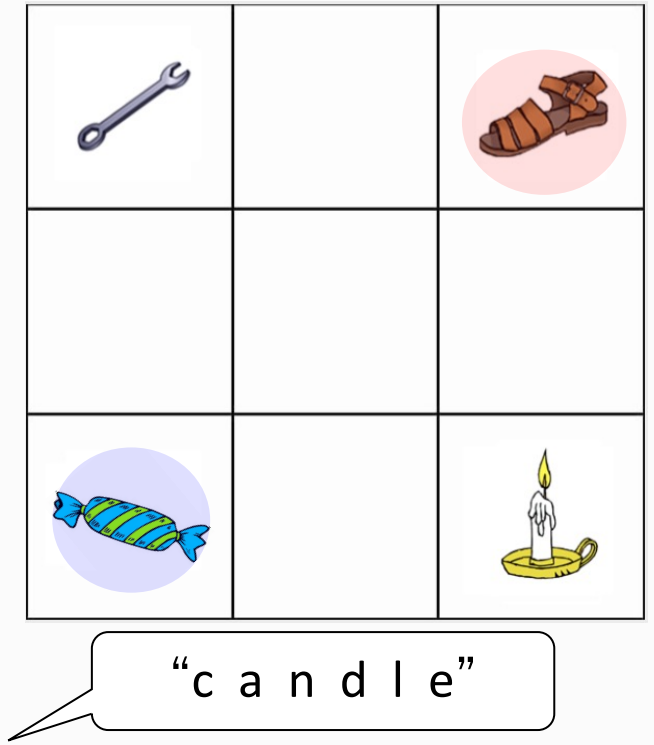
# Experimental tests

## Experiment: Eye-tracking in the Visual World Paradigm

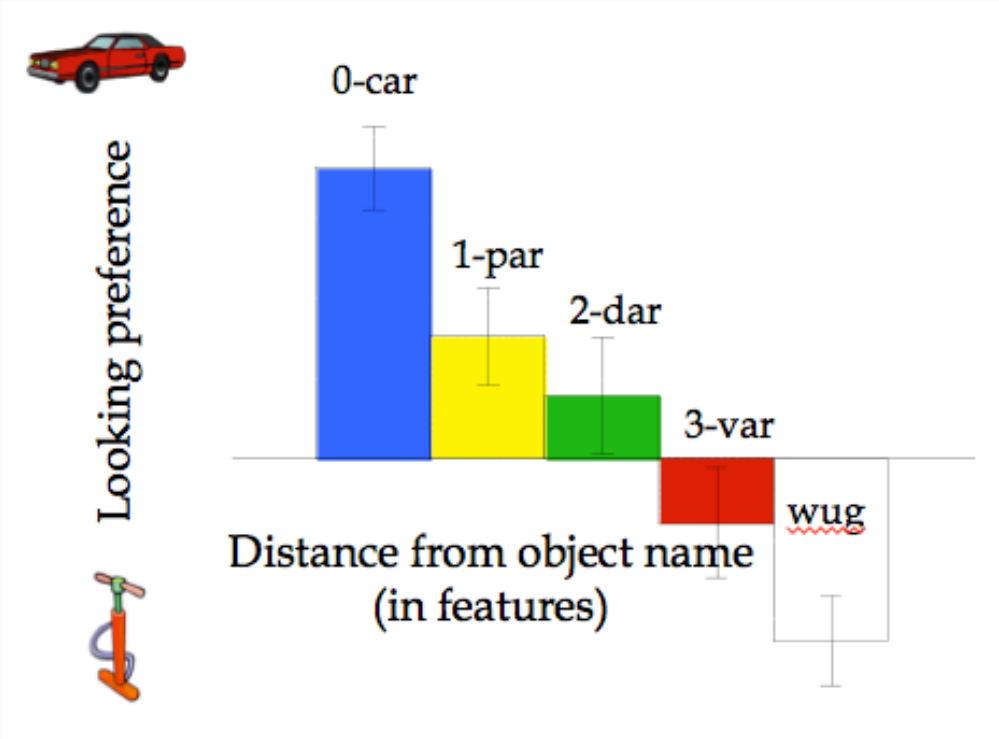


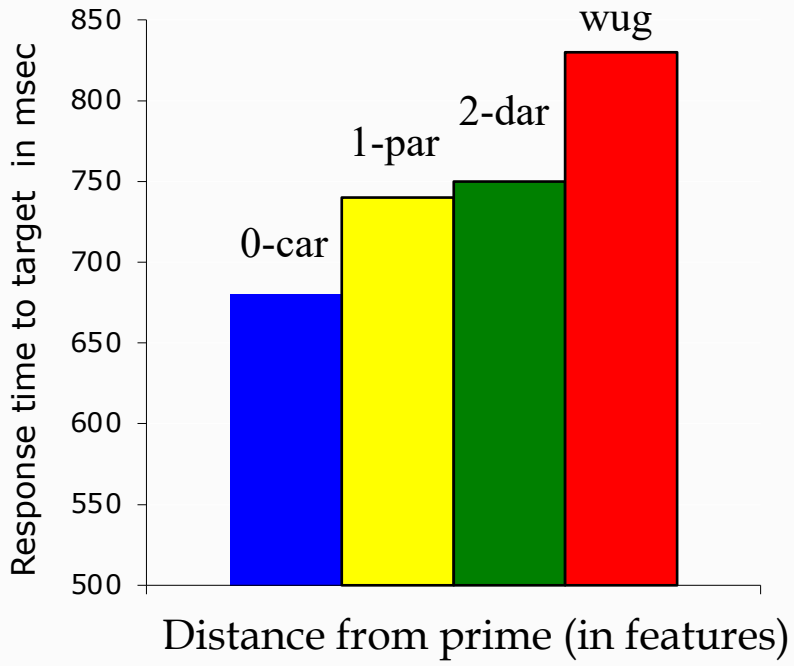




Allopenna, Magnuson, & Tanenhaus (1998)

# Experimental tests

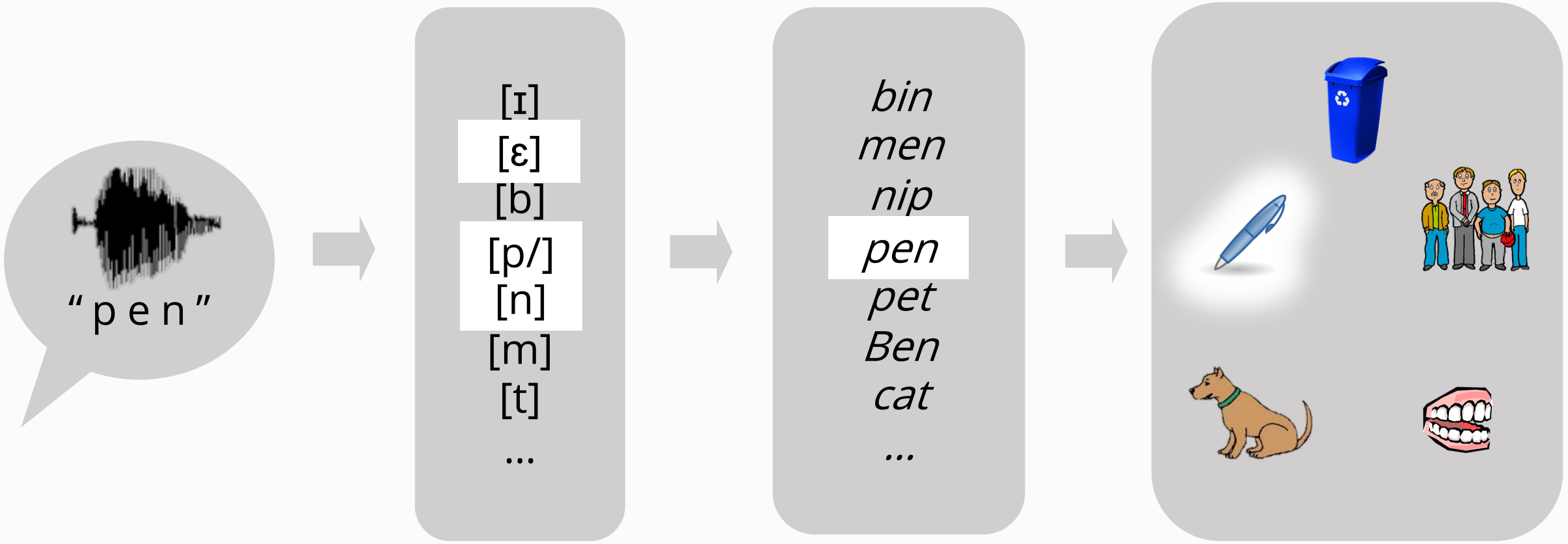
Activation of competitors differs based on similarity:
It happens based on articulatory features, too! Both infants (left) and adults (right) are sensitive to featural similarity.




White & Morgan (2008); Milberg, Blumstein & Dworesky (1988)

# Simplified model of word recognition




acoustic signal

phonemic representations

word forms

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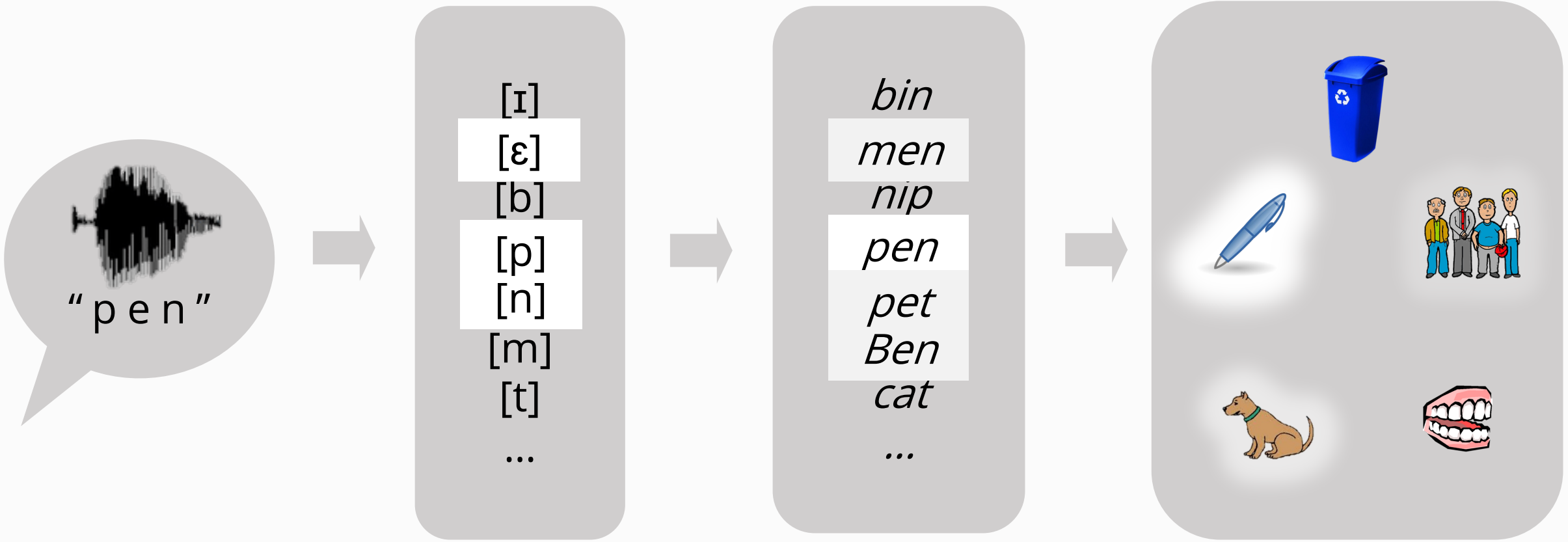
# Simplified model of word recognition

UPDATE #1

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# 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 bank.
      - I opened a checking account at the bank.

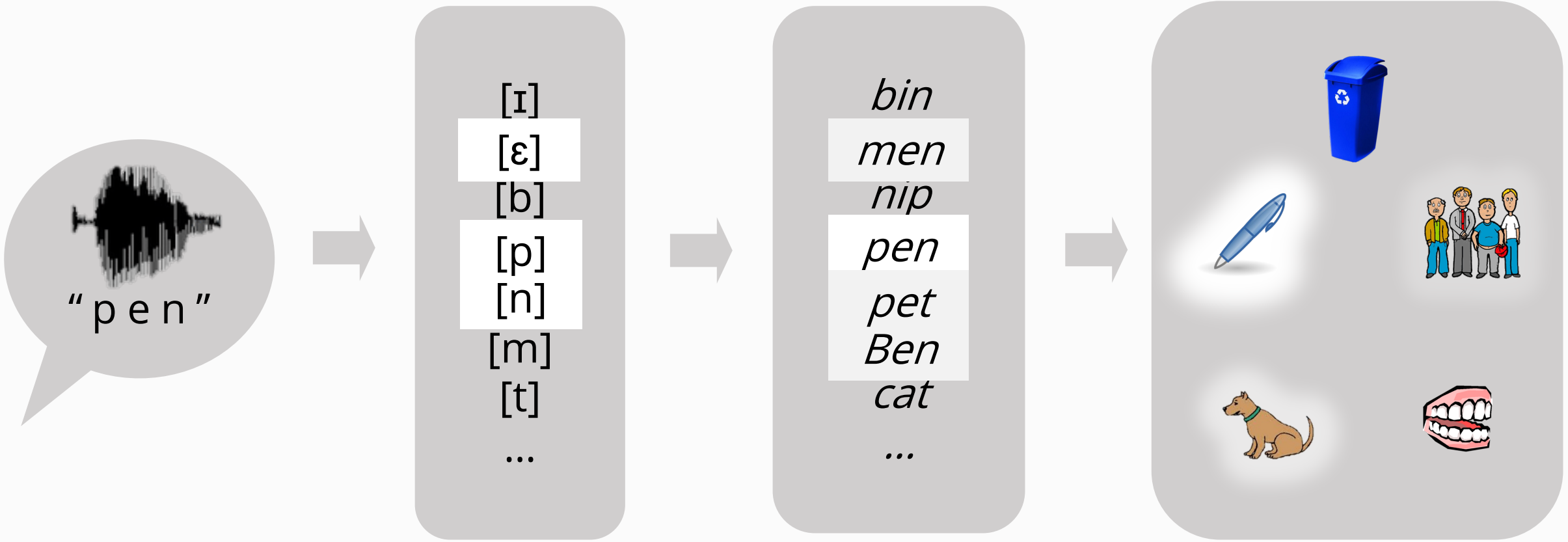
NEUTRAL: apple / money / river

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

UPDATE #1

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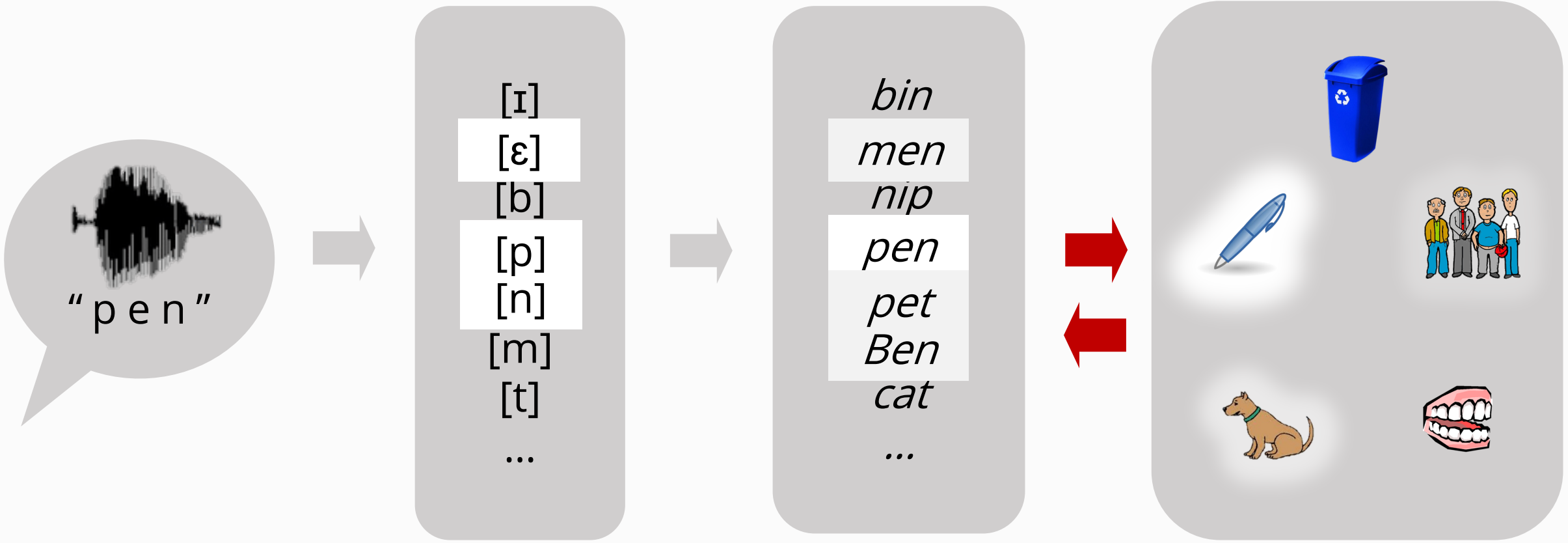
# Simplified model of word recognition

UPDATE #2

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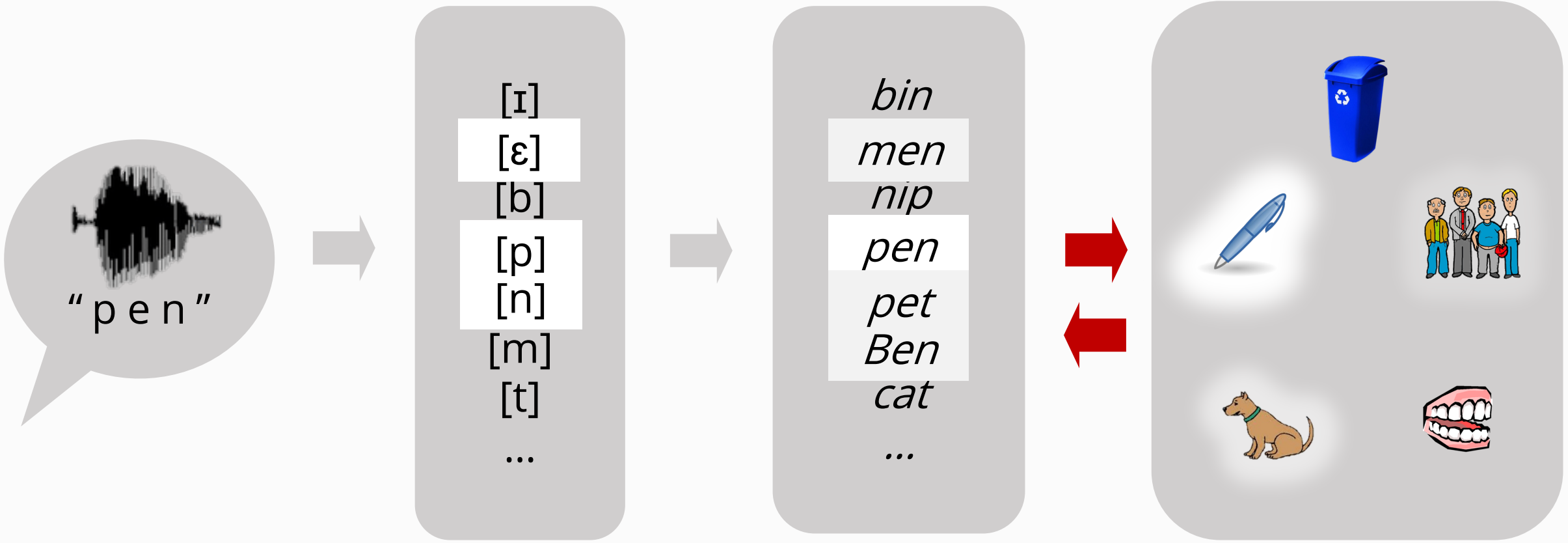
# Challenges in recognizing words

- **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

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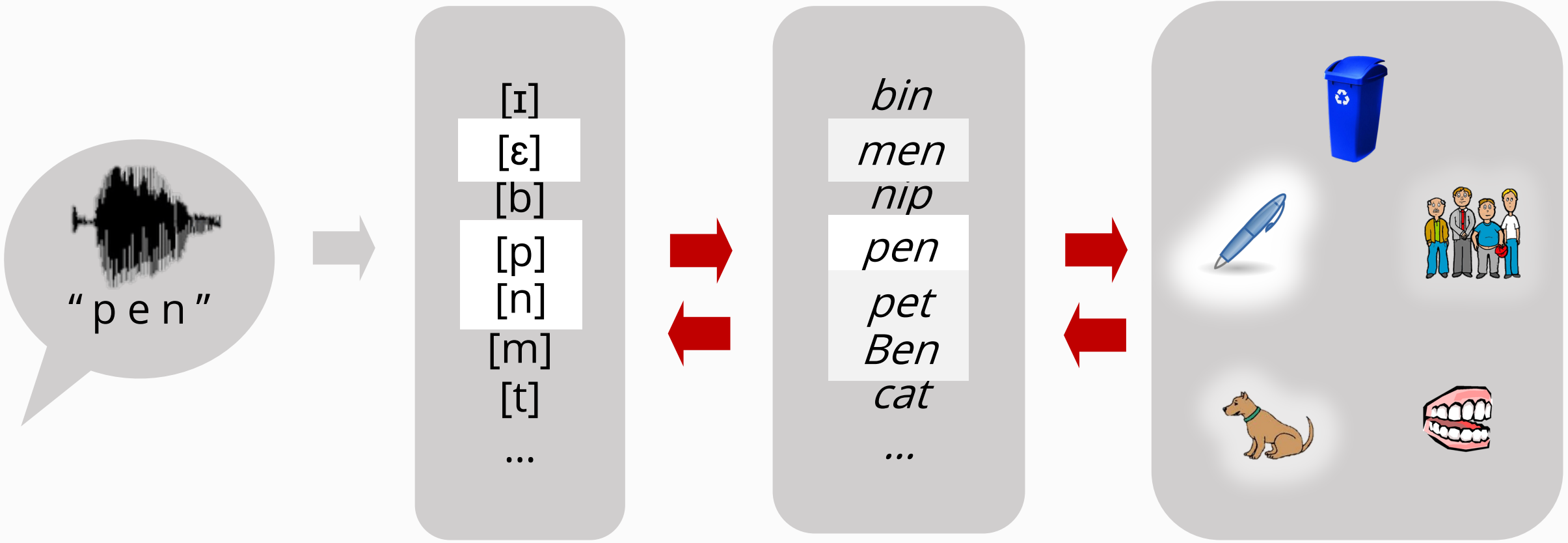
# Simplified model of word recognition

UPDATE #3

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# 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)