PSYC 3320/5597: Psycholinguistics

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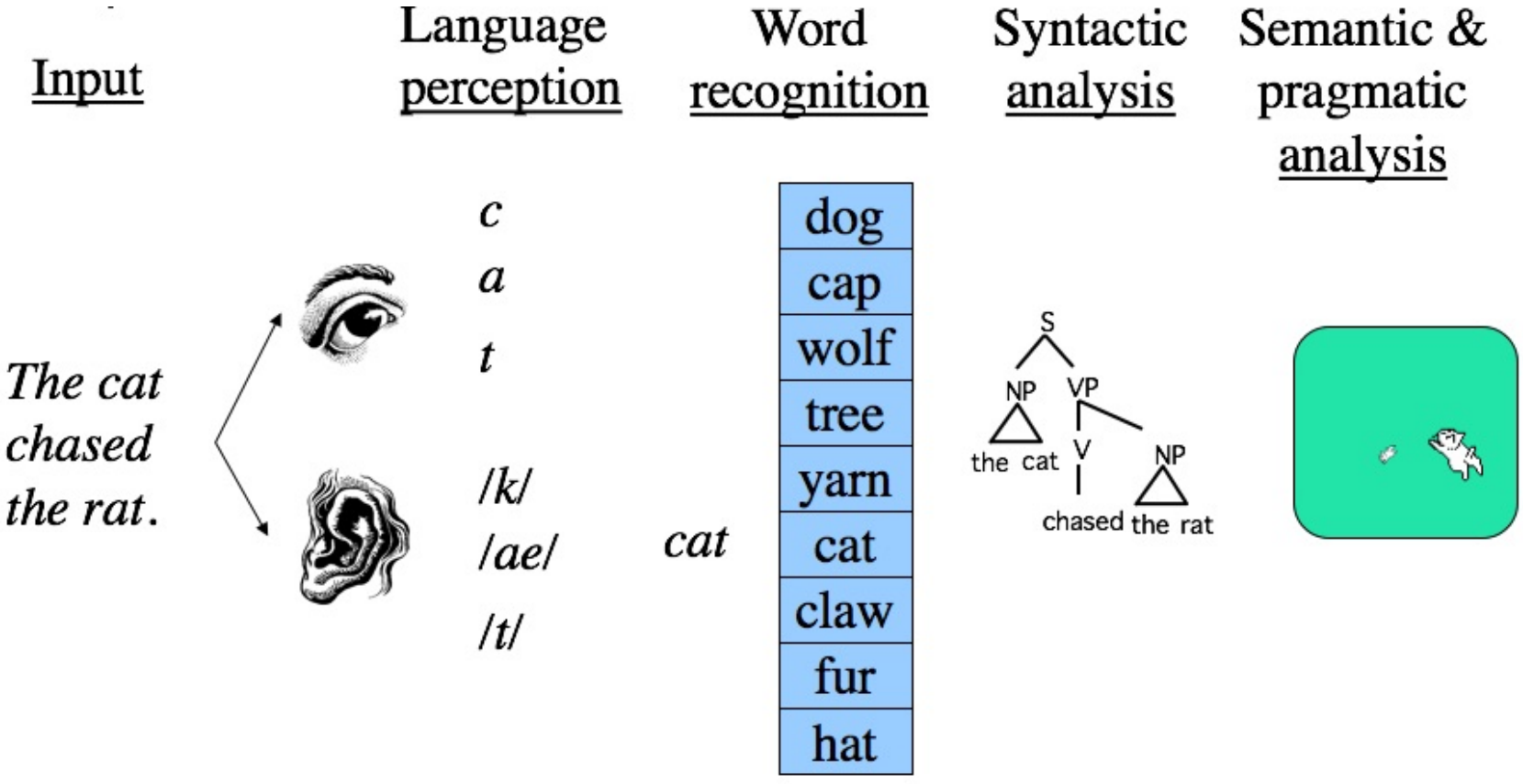
Unit 4 – Word recognition

Overview of comprehension



The comprehender's problem

Ambiguity – must take a potentially ambiguous acoustic (or visual) input and recover the intended meaning

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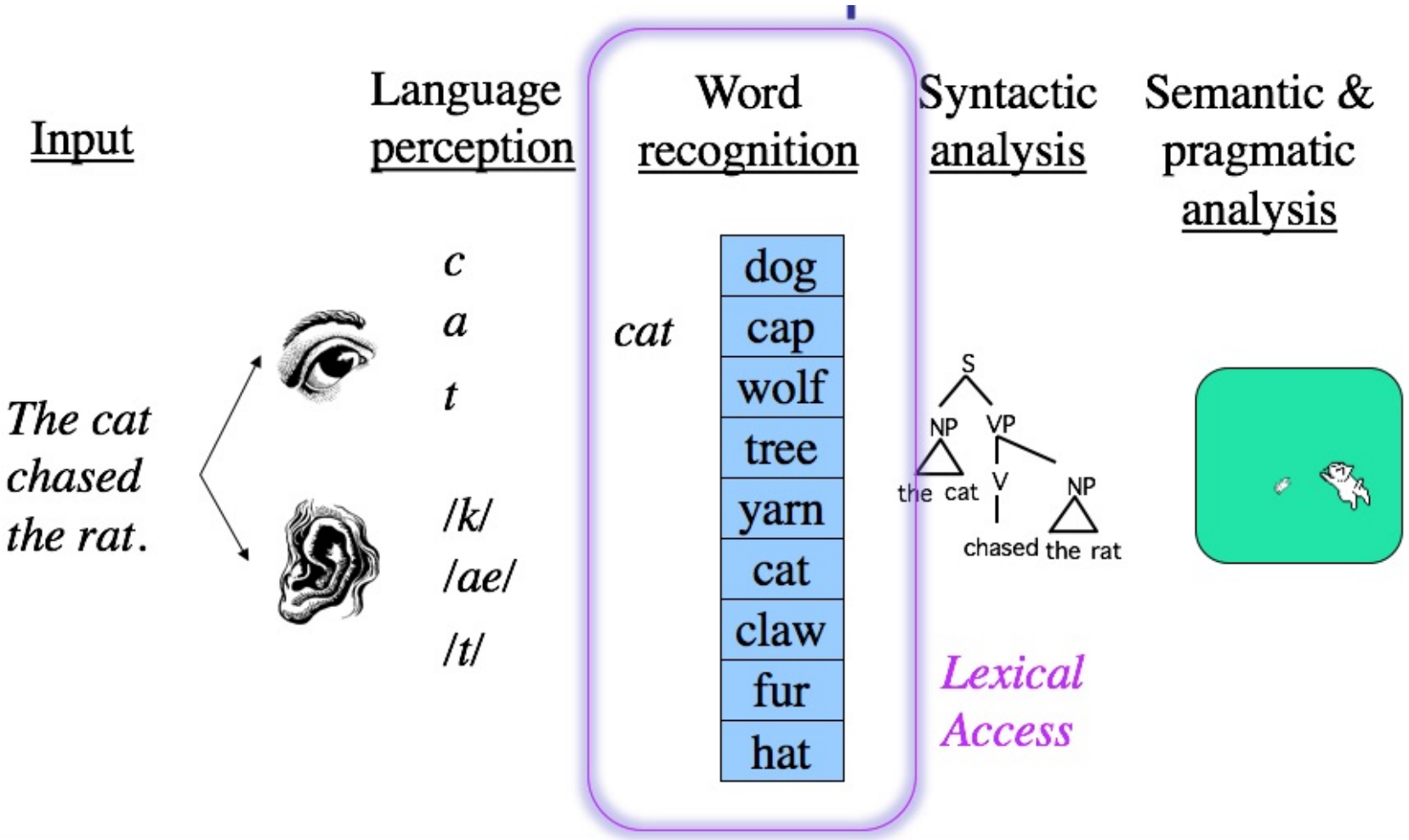
- The stuffy nose can lead to problems
- The stuff he knows can lead to problems

- Why don't you take a nice cold shower?
- Why don't you take an ice cold shower?

- Groucho Marx – "One morning I shot an elephant in my pajamas. How he got into my pajamas I'll never know."

Our focus today



Lexical access

How do we retrieve the linguistic information from long-term memory?

- How is the information organized/stored?
- What factors are involved in retrieving information from the lexicon?
- Models of lexical access

Storing linguistic information

- High capacity: 40,000-60,000 words
- Fast: recognition in as little as 200 ms!
- Question: how do we search that many, that fast?
  - must be a large amount of organization

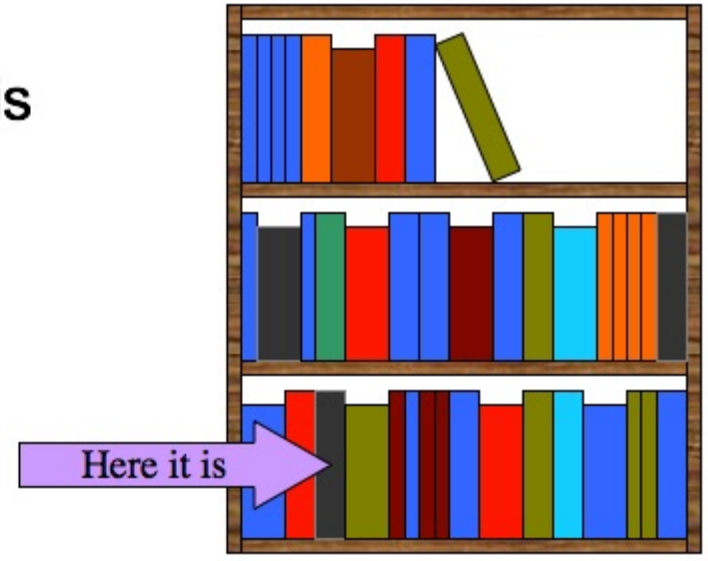
Storing linguistic information

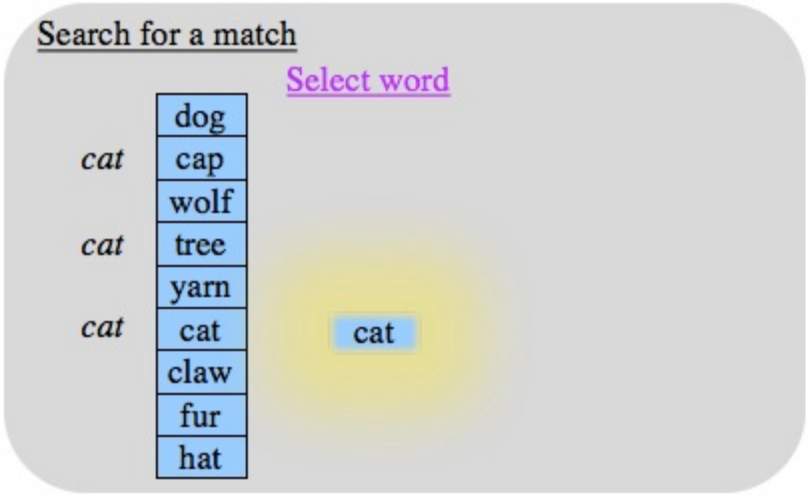
Some vocabulary:

- Mental lexicon – the representation of words in long term memory
- Lexical access – how do we access words and their meanings (and other properties)?

Access versus Recognition

- Often used interchangeably, but sometimes a distinction is made
  - Recognition - finding the representation





Access versus Recognition

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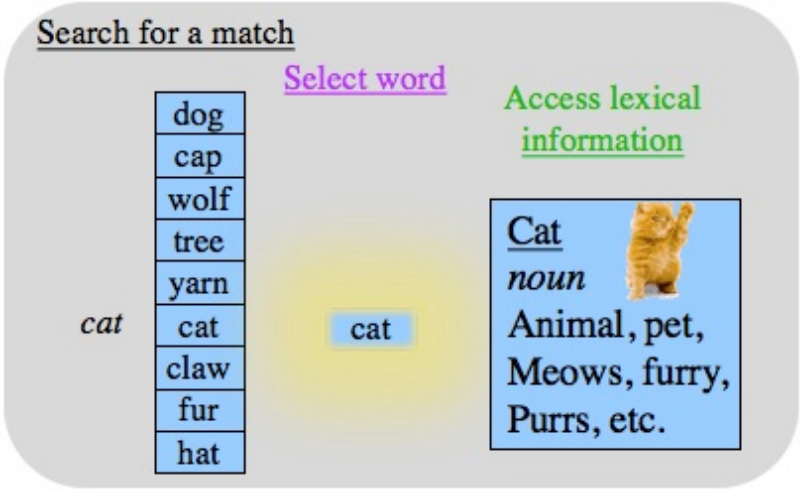
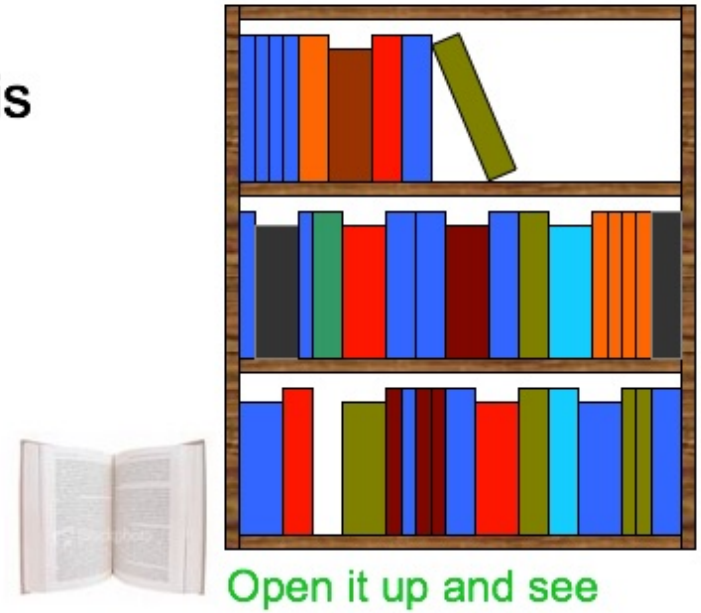
  - Access - getting information from the representation





Open it up and see what's inside

Studying lexical access

- General research question – what makes word identification easy or difficult?
- General method – measure response time (RT)

Some common experimental tasks

Measure how long people take to...

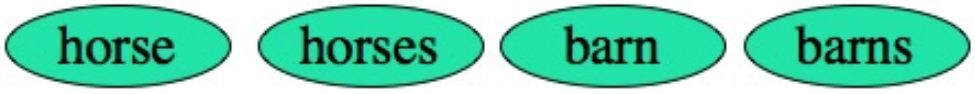
- decide whether a string of letters is (or is not) a word (*lexical decision*)
- *categorize* a word ("apple" is a fruit)
- say a word (*naming* time)

Factors affecting lexical access

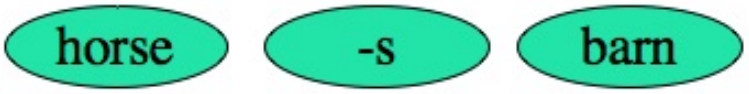
- Morphological structure
- Concreteness/abstractness
- Imageability
- Frequency
- Semantic priming
- Role of prior context
- Lexical ambiguity

- Some of these may reflect the structure of the lexicon
- Some may reflect the processes of access from the lexicon

What is stored: words or morphemes?

- Word primitives 

  - Need a lot of representations
  - Fast retrieval

- Morpheme primitives 

  - Economical - fewer representations
  - Slow retrieval - some assembly required
    - Decomposition during comprehension
    - Composition during production

What is stored: words or morphemes?

Lexical decision task (e.g., Taft, 1981)

- see a string of letters
- as fast as you can, determine if it is a real English word or not
  - "yes" if it is a word
  - "no" if it is nonsense
- Dependent measures: speed (RT) and accuracy

What is stored: words or morphemes?

- Lexical Decision task

table	Yes
vanue	No
daughter	Yes
tasp	No
cofef	No
hunter	Yes

What is stored: words or morphemes?

- Lexical Decision task

daughter

hunter

What is stored: words or morphemes?

- Lexical Decision task
  - This evidence supports the morphemes as primitives view

daughter Pseudo-suffixed

daught -er

Takes longer hunter Multimorphemic

hunt -er

What is stored: words or morphemes?

Other factors associated with morphology:

- What kind of morpheme?
  - Inflectional (e.g., singular/plural, past/present tense)
  - Derivational (e.g., drink $\rightarrow$ drinkable)
- Frequency of usage
  - High frequency multimorphemic may get represented as single unit (especially if derivational morphology)
  - e.g., impossible versus imperceptible
- Compound words
  - Semantically transparent (e.g., buttonhole)
  - Semantically opaque (e.g, butterfly)

Imageability

Imageability, concreteness, abstractness

Umbrella

Lantern

Freedom

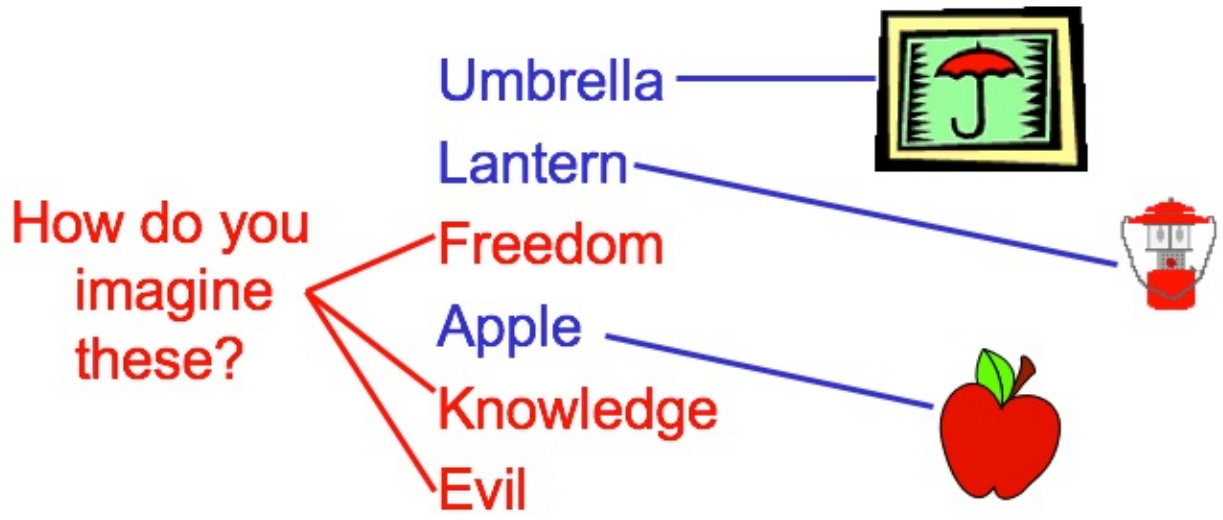
Apple

Knowledge

Evil

Imageability

Imageability, concreteness, abstractness



Imageability

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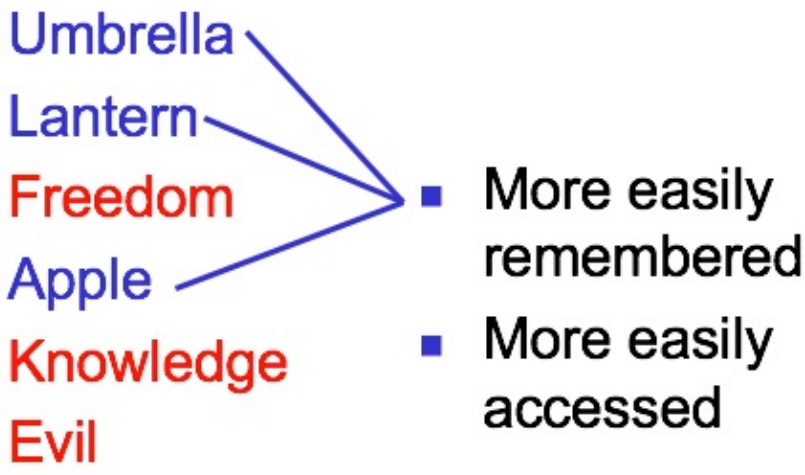

Frequency

- Lexical Decision Task:

Gambastya	Oriole	Mulvow	Develop
Revery	Vuluble	Governor	Gardot
Voitle	Chalt	Bless	Busy
Chard	Awry	Tuglety	Effort
Wefe	Signet	Gare	Garvola
Cratily	Trave	Relief	Match
Decoy	Crock	Ruftily	Sard
Puldow	Cryptic	History	Pleasant
Raflot	Ewe	Pindle	Coin

Frequency

- Typically the more common a word, the faster (and more accurately) it is named and recognized
  - Typical interpretation: easier to access (or recognize)
- Lexical Decision Task:

Low frequency		High(er) frequency	
Gambastya	Oriole	Mulvow	Develop
Revery	Vuluble	Governor	Gardot
Voitle	Chalt	Bless	Busy
Chard	Awry	Tuglety	Effort
Wefe	Signet	Gare	Garvola
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Semantics

- Free association task – we find that most free associates (e.g, "What is the first word you think of?) are semantically related (rather than phonologically related)
- Semantic priming task (Meyer & Schvaneveldt, 1971)
  - For the following letter strings, decide whether it is an English word
  - TASP
  - NURSE
  - DOCTOR
  - FRACT
  - SLITHEST
  - SHOES
  - DOCTOR

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  - DOCTOR $\rightarrow$ 855 msec
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  - TASP
  - NURSE (semantically related)
  - DOCTOR $\rightarrow$ 855 msec
  - FRACT
  - SLITHEST
  - SHOES (semantically unrelated)
  - DOCTOR $\rightarrow$ 940 msec

This is a priming effect – evidence that associative relations can influence lexical access

Role of prior context

Cross-modal priming task:

> *Listen to short paragraph. At some point during the paragraph, a string of letters will appear on the screen. Decide if it an English word or not. Say "yes" or "no" as quickly as you can.*

Role of prior context

"Rumor had it that, for years, the government building has been plagued with problems. The man was not surprised when he found several spiders, roaches and other bugs in the corner of his room."

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ant

Role of prior context

- Swinney (1979)

  "Rumor had it that, for years, the government building has been plagued with problems. The man was not surprised when he found several spiders, roaches and other bugs in the corner of his room."

  - Lexical Decision task

    Context related: *ant*

    Context inappropriate: *spy*

    Context unrelated: *sew*

  - Results and conclusions
    - Within 400 msecs of hearing "bugs", both *ant* and *spy* are primed
    - After 700 msecs, only *ant* is primed

Lexical ambiguity

Hogaboam & Pefetti (1975) – asked participants to listen to sentences and decide if the last word was ambiguous (i.e., has multiple meanings)

- "The jealous husband read the letter"
- "The antique typewriter was missing a letter"

Results – participants are faster on the second sentence!

Why?

- First sentence, meaning is dominant, so context strongly biases toward that meaning
- ..which means, the second meaning is harder to access (making the ambiguity judgment more difficult)

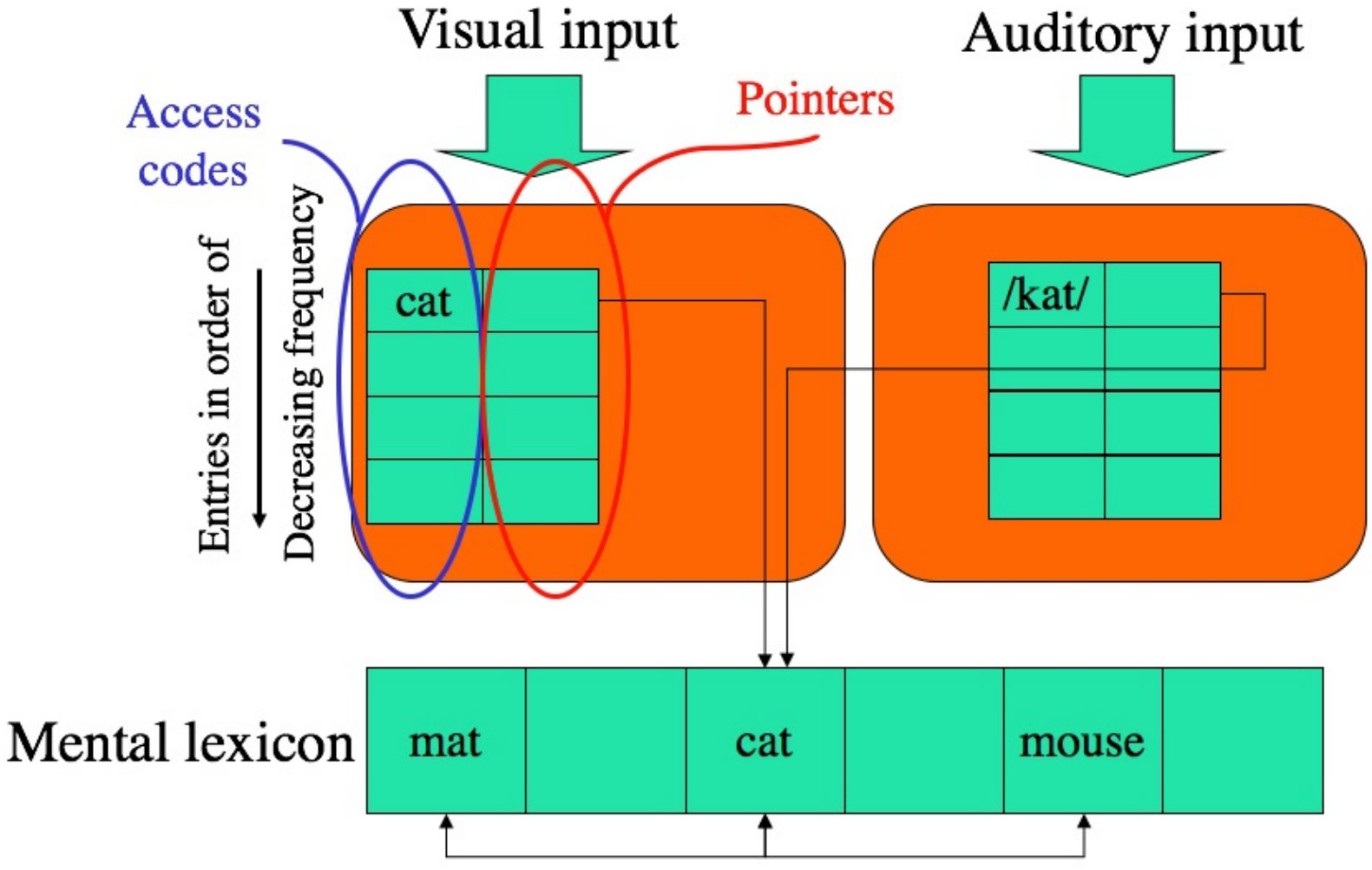
Models of lexical access

Computational models must account for previous empirical findings!

- Serial comparison models
  - Search model (Forster, 1976, 1979, 1987, 1989)
- Parallel comparison models
  - Logogen model (Morton, 1969)
- Connectionist models
  - Interactive activation model (McClelland & Rumelhart, 1981)

Serial search model

Forster (1976, 1979)



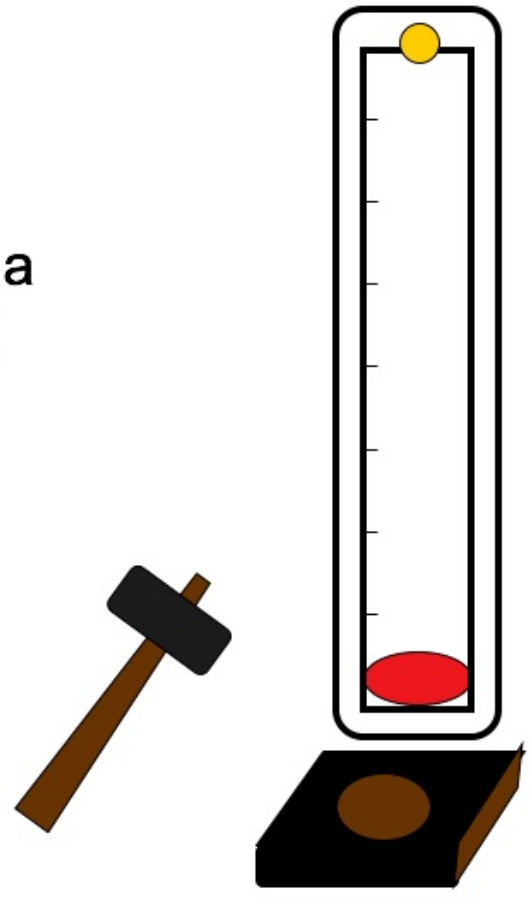
Logogen model

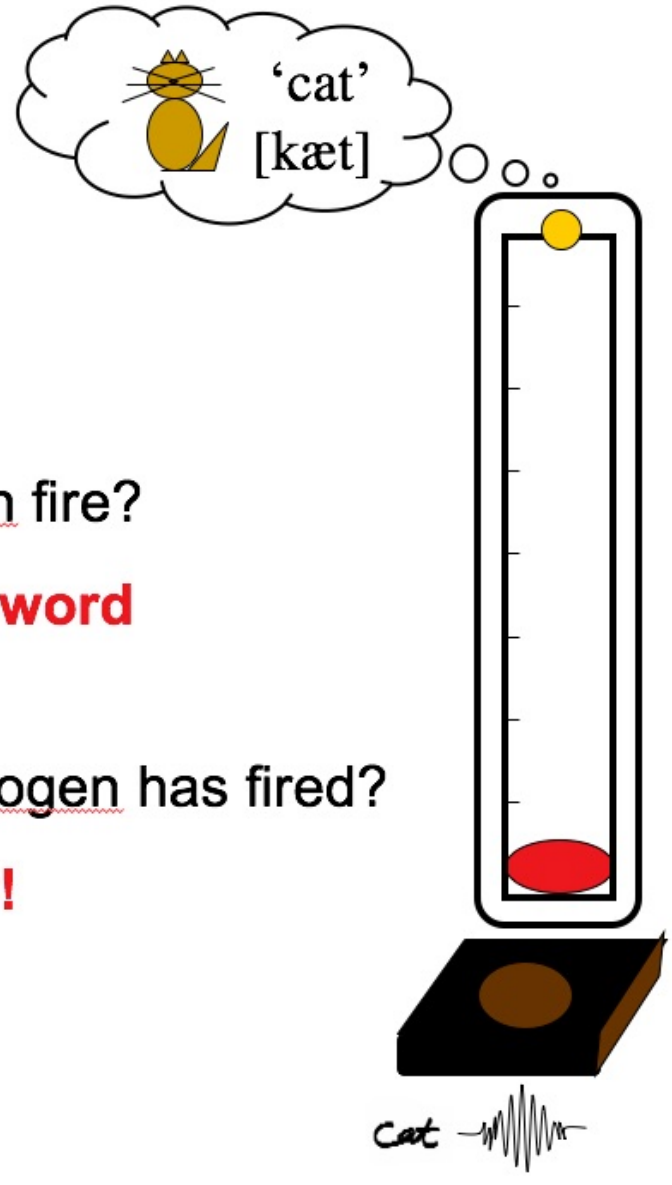
Morton (1969)

- The lexical entry for each word comes with a logogen
- The lexical entry only becomes available once the logogen "fires"
  - When does logogen fire? When you read/hear the word

Think of a **logogen** as being like a ‘strength-o-meter’ at a fairground

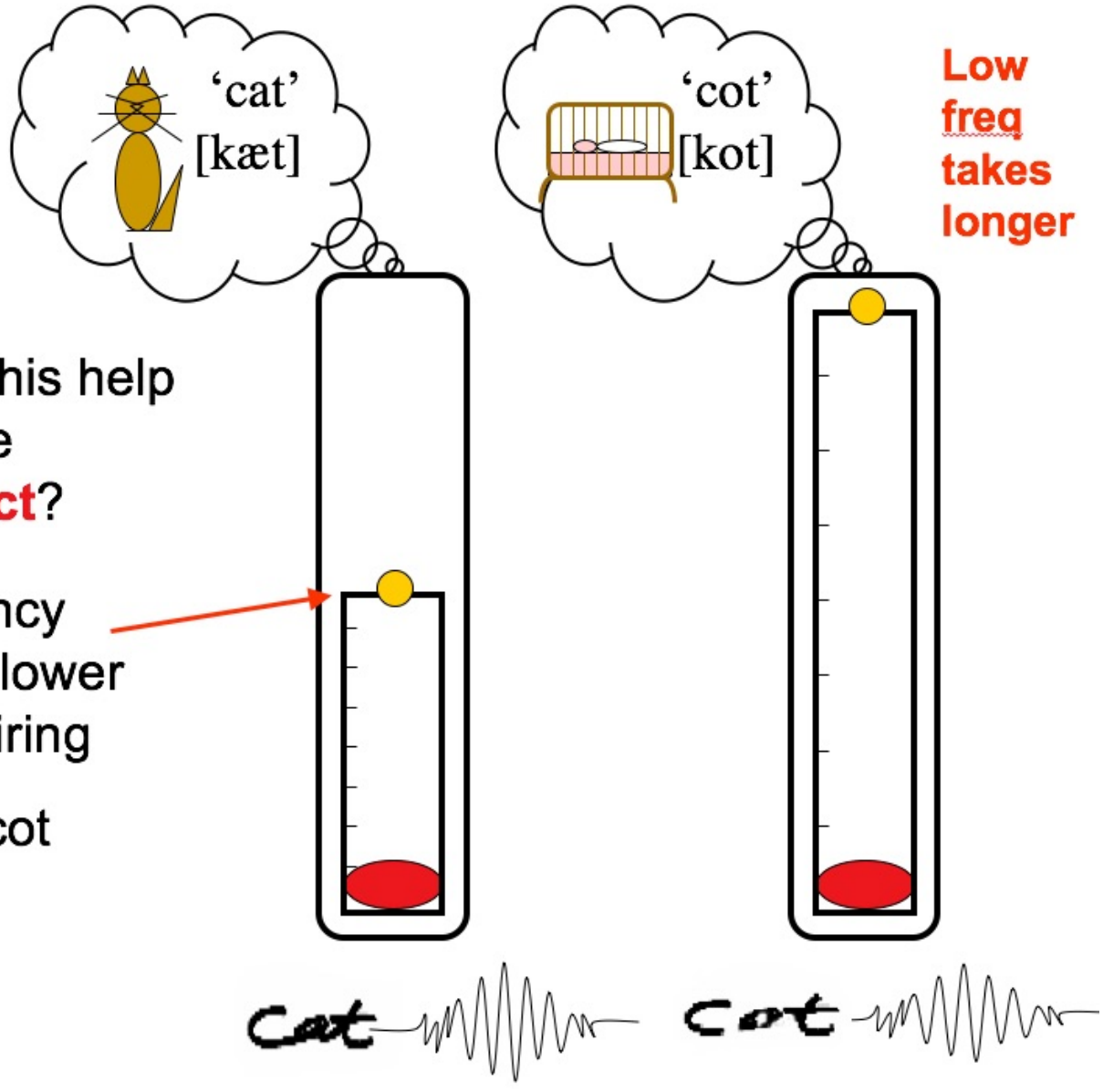
When the bell rings, the logogen has ‘**fired**’



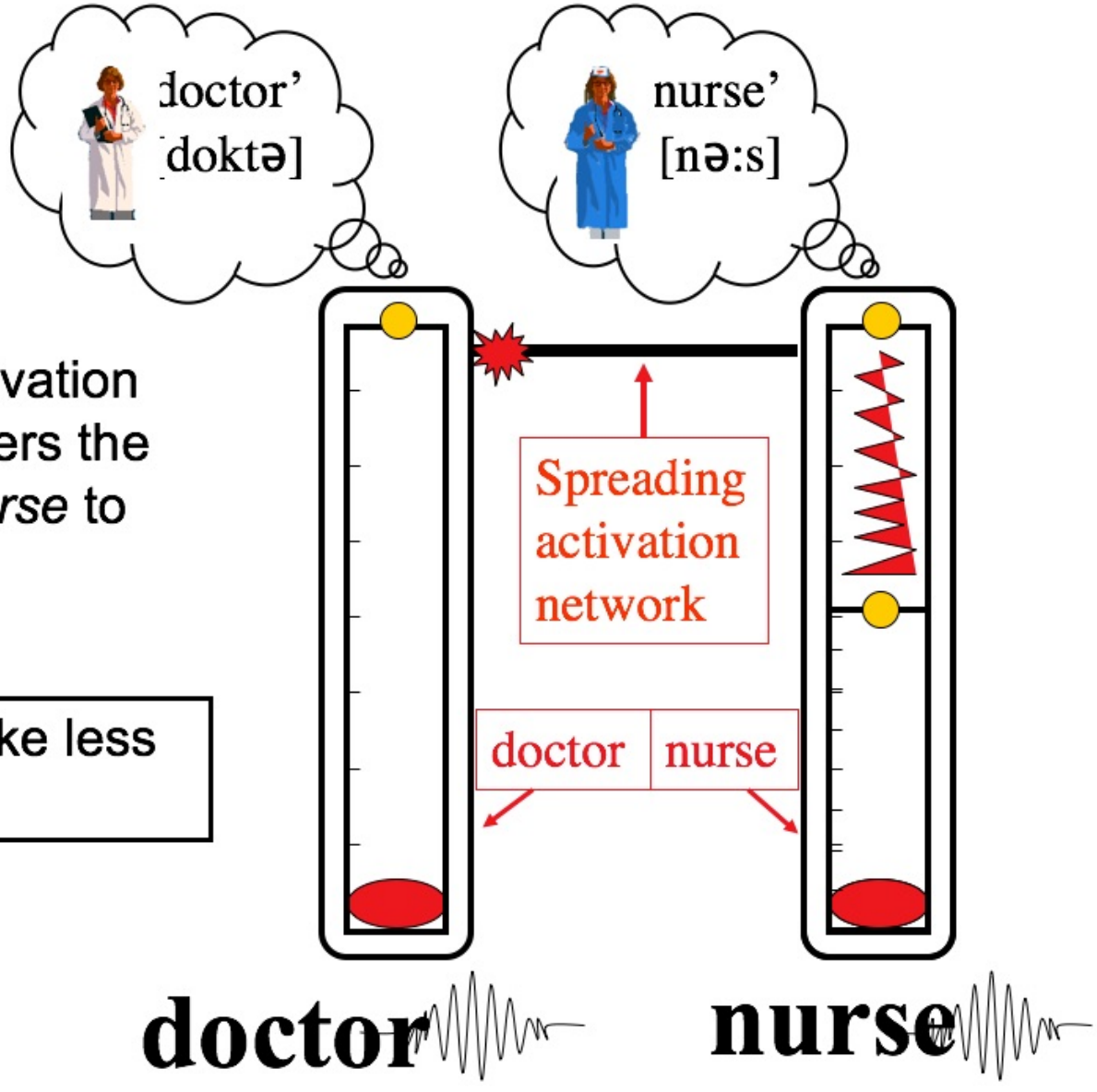


- What makes the logogen fire?
  - **seeing/hearing the word**

- What happens once the logogen has fired?
  - **access to lexical entry!**



- So how does this help us to explain the **frequency effect**?
  - – High frequency words have a lower threshold for firing
  - –e.g., cat vs. cot



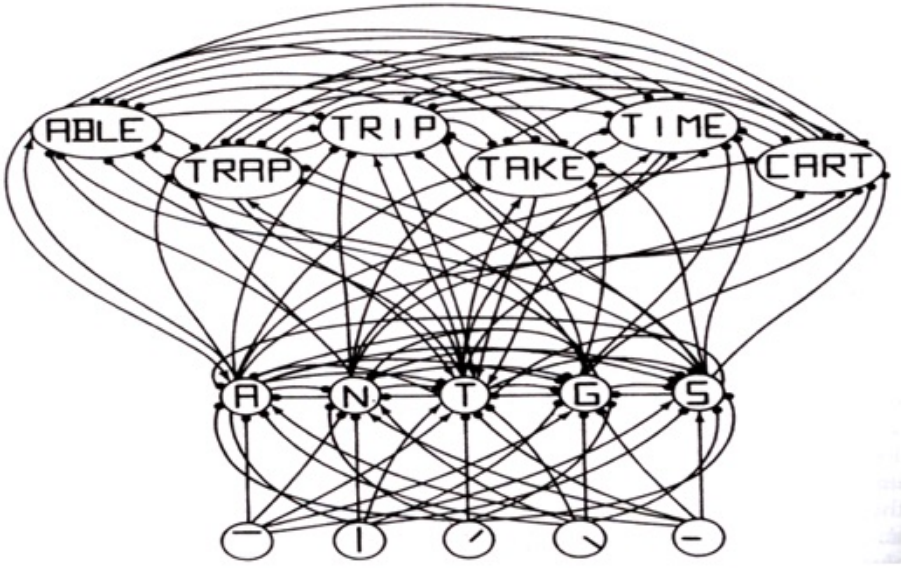
- Spreading activation from *doctor* lowers the threshold for *nurse* to fire

  – So *nurse* take less time to fire

Interactive Activation Model

Previous models posed a ***bottom-up*** flow of information (from features to letters to words).

IAM also poses a *top-down* flows of information



McClelland and Rumelhart, (1981)

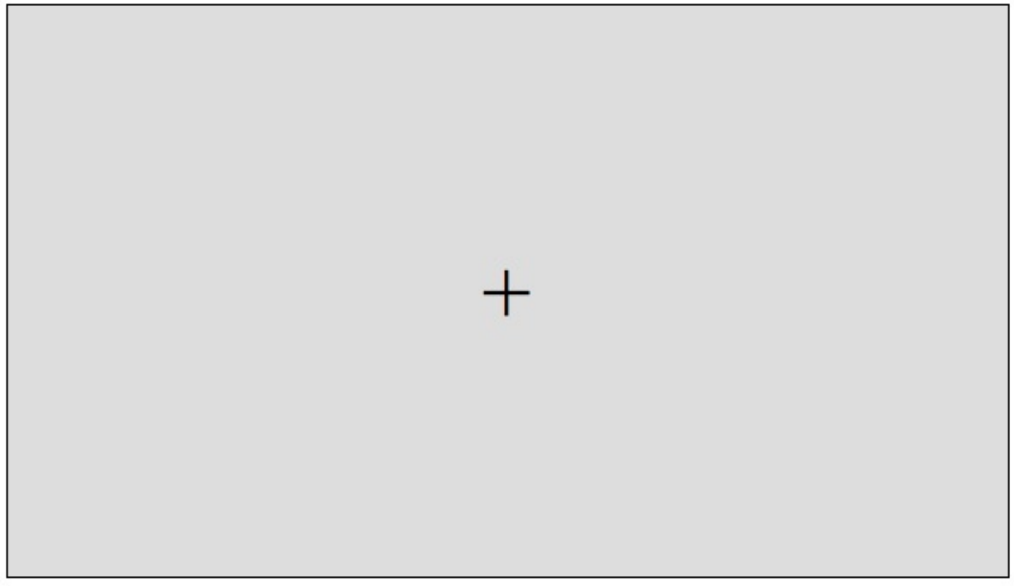
Nodes:

- (visual) feature
- (positional) letter
- word detectors
  - **Inhibitory** and **excitatory** connections between them.

Interactive Activation Model

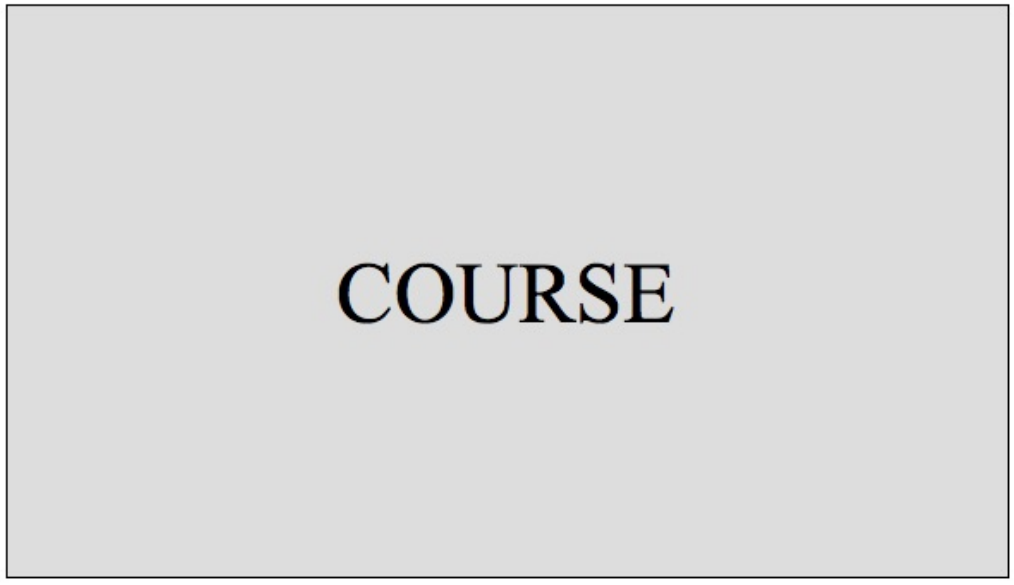
- Inhibitory connections within levels
  - If first letter is A, then it isn't B or C or...
- Inhibitory and excitatory connections between levels
  - Bottom up processing – if first letter is A, the word could be APPLE or ANT, but not BOOK or CHURCH
  - Top down processing – if word is APPLE, the first letter has to be A, not B

Word superiority effect (Reicher, 1969)



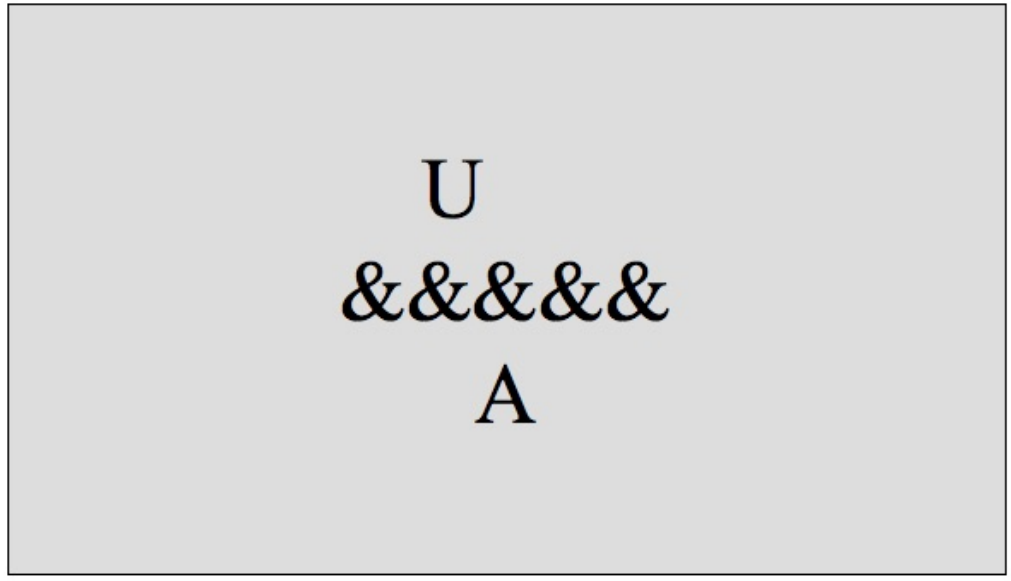
Until the participant hits some start key

Word superiority effect (Reicher, 1969)



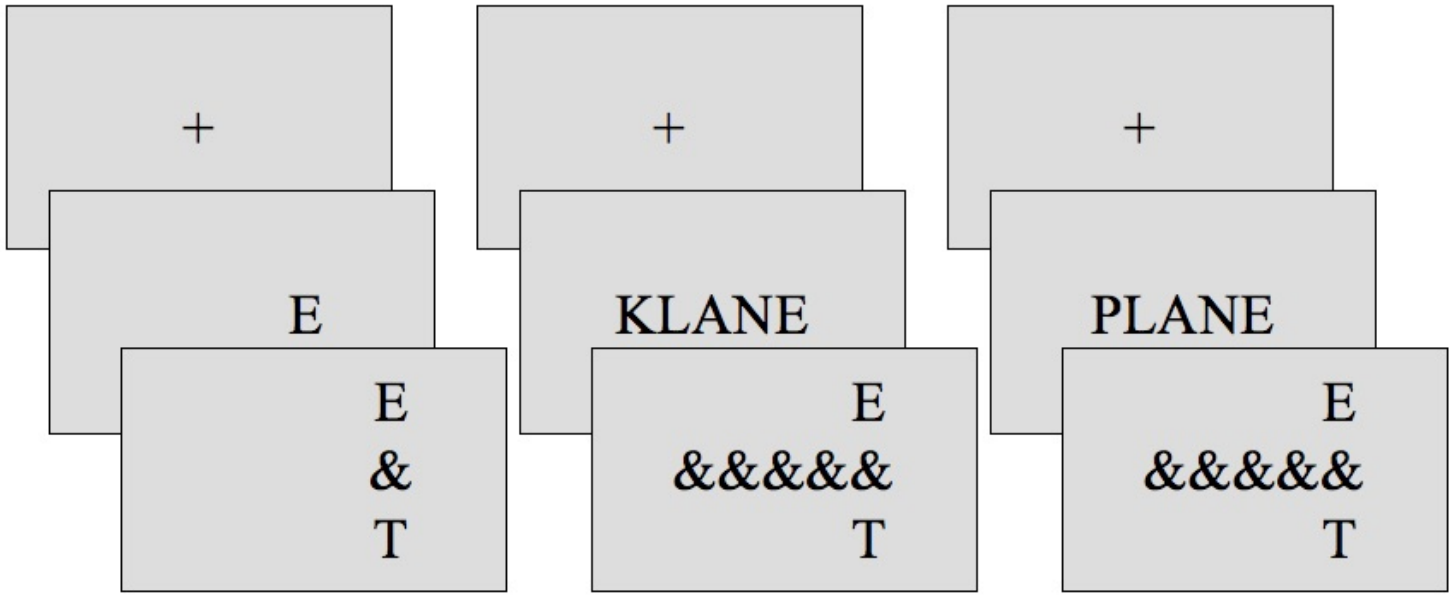
Presented briefly … say 25 ms

Word superiority effect (Reicher, 1969)



Mask presented with alternatives above and below the target letter … participants must pick one as the letter they believe was presented in that position.

Word superiority effect (Reicher, 1969)



Letter only
Say 60%

Letter in Nonword
Say 65%

Letter in Word
Say 80%

Why is identification better when a letter is presented in a word?

Word superiority effect (Reicher, 1969)

Why is identification better when a letter is presented in a word?

- Interactive activation model – we are processing at the word and letter levels simultaneously
- Letters in words receive BOTH bottom-up and top-down activation
- Letters alone receive ONLY bottom-up activation

Model comparison

Each model can account for the major empirical results (e.g., frequency effects, semantic priming), but they do so in different ways:

- Search model is serial and bottom-up
- Logogen model is parallel and interactive
- Interactive activation model is both bottom-up and top-down, uses facilitation and inhibition