The mental lexicon

LING 200: Introduction to the Study of Language

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February 2016

Outline

1. The nature of words
2. The mental lexicon
3. Psycholinguistics
   - Introducing psycholinguistics
   - The psychological reality of lexical categories
   - How is the lexicon organized?
   - The McGurk effect

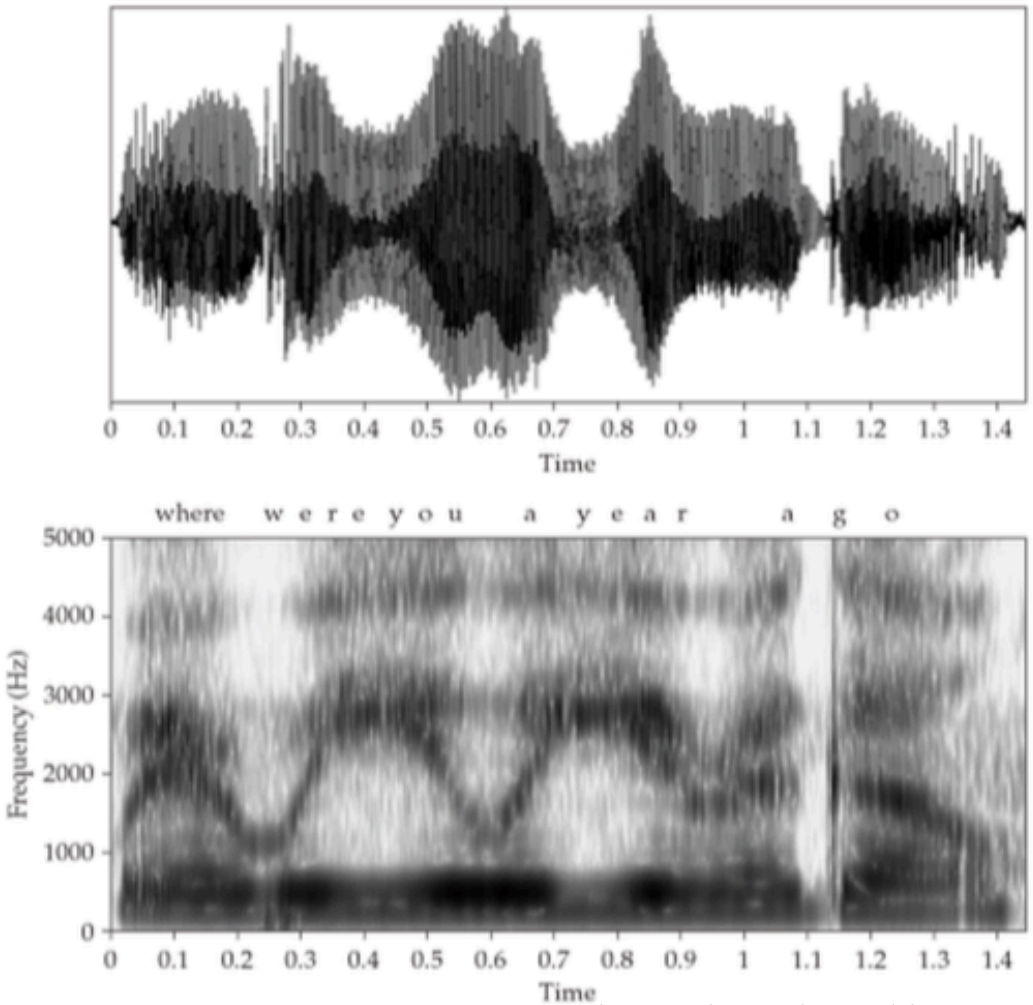
Slides credit: Stavroula Kousta, David Pesetsky, Rebecca Starr

The nature of words

Previously in LING 200...

- We have learned about several subfields of linguistics:
  - **phonetics**: the study of speech sounds.
  - **phonology**: the study of patterns in speech.
  - **morphology**: the study of the structure of words and their parts.
- We introduced several types of linguistic units:
  - phones, syllables, morphemes, words.

The speech stream



Source: *Discovering Speech, Words, and Mind by Dani Byrd, Toben H. Mintz*

The nature of words

Three questions

If words are not marked in the physical speech stream:

1. Why did our brains in childhood (infancy) go to the trouble of segmenting the speech stream into words?
2. Why do our adult brains continue to do this?

   Innate bias to perform some sort of analysis of speech (explains 1 & 2).

3. Why is the nature of the analysis so nearly identical across languages?

   Innate knowledge of what the product of this analysis will look like.

The nature of words

How kids learn words

- First words appear around age 1. (One-word stage.)
- Kids already know more than they say:
  - At 11-month old: preference for pauses that coincide with word boundaries over pauses inserted between syllables of words.
  - At 9-month old: no preference.
- So what happens between 9 and 11 months?
  How do you segment speech into words if you don't know the words?
  - Part of the story must involve **statistical analysis** of the input data carried out by the child (there are explicit proposals about this).
  - *But why does the child perform this statistical analysis*, and why are the results saved in memory (ultimately, in the lexicon)?
  - An approach to an answer: **an instinct for language acquisition.**
    Innate knowledge coupled with environment-dependent learning.

➽ More on language acquisition later in the course!

The nature of words

The arbitrariness of words

- The words themselves are not innately specified, or they wouldn't differ across speech communities.
- Words are **arbitrary**...
  - English *rooster*, Hebrew *tarnegol*, Dutch *haan*
- Even in onomatopoeia:
  - cock-a-doodle-do (English)
  - kukuriki (Hebrew)
  - kukeleku (Dutch)
  - wo-wo-wo (Mandarin)
  - ake-e-ake-ake (Thai)
  - kokekokkō (Japanese)
  - gaggala gaggala gú (Icelandic)

The nature of words

Innateness

- **What is innate** (in this domain):
  - Drive to analyze speech into words.
- **What is learned** (in this domain):
  - What the words actually are.

The mental lexicon

What is listed in the mental lexicon?

- **The morpheme**: the smallest meaningful unit in a language.

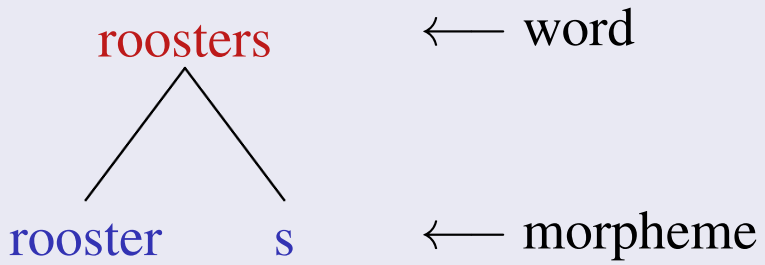
➽ Morphemes are listed in the lexicon.

- *roosters* = *rooster* 'the animal that says cock-a-doodle-do' + *s* 'plural'.
- *walked* = *walk* 'to proceed by steps' + *ed* 'past tense'.

- *kick the bucket*
- *let the cat out of the bag*
- *spill the beans*

The mental lexicon

Reminder: morphemes are put together using **Merge** to form words



The mental lexicon

What has to be specified for each morpheme in the lexicon?

1. its sound
2. its meaning
3. its part-of-speech (category): N, V, A...
   - Let's define the part of speech of an affix as the part of speech it 'produces'
4. if it is an affix, the part of speech it merges with
5. if it is an affix, its place of attachment: prefix, suffix, ...

The mental lexicon

possible

1. its sound /pasəbəl/
2. its meaning "able to be done; within the power or capacity of someone or something."
3. its part-of-speech (category) ADJ
4. ~~if it is an affix, the part of speech it merges with~~
5. ~~if it is an affix, its place of attachment~~

The mental lexicon

_im-_ (as in _impossible_)

1. its sound /in-/
   predictable phonological changes don't need to be recorded in the lexicon! (but they do need to be learn and stored somewhere.)
2. its meaning "not"
3. its part-of-speech (category) ADJ
4. if it is an affix, the part of speech it merges with ADJ
5. if it is an affix, its place of attachment prefix

Psycholinguistics

- First, let's do a test!
- Call out the font color of the words
  (=the color that you see, not what you read!)

Psycholinguistics

Blue

Psycholinguistics

Red

Psycholinguistics

Green

Psycholinguistics

Purple

Psycholinguistics

Yellow

Psycholinguistics

Did it work?

- For most people, it is much harder to call out the color of the text when the words are spelling out a different color.

Why does this happen?

- This is called the **Stroop effect**.
- Even when we are trying to focus on something else, our brain automatically processes the words we see.
- And this seems to interfere with our ability to produce the correct word.
- This tells us something about how our brain organizes and processes language.

Psycholinguistics

What is psycholinguistics?

- **Psycholinguistics** is the discipline that explores...
  - language processing mechanisms and operations
  - the relation between theories of language and human linguistic performance
  - the acquisition of language
  - the evolution of linguistic ability
- Through...
  - observational studies
  - experiments
  - computational modeling

The psychological reality of lexical categories

Innateness

- We learned a lot about linguistic categories in previous lectures:
  - phonetic features,
  - phonemes,
  - morphemes,
  - words,
  - phrases (coming soon!)
- Are these real?
  - are they just a convention linguists use in order to describe language,
  - or does the mind also use these categories to store and process language?
- The study of **slips of the tongue** (speech errors) has been used to provide answers to this question.

The psychological reality of lexical categories

Slips of the tongue

- **Spoonerisms** (Reverend Dr. William Archibald Spooner):
  The exchange of initial consonants between words in a sentence.
  - "The weight of rages will press hard upon the employer"
    (Oxford Dictionary of Quotations, 1979)
    "The rate of wages will press hard upon the employer"
  - "You have hissed all my mystery lectures" (attributed)
    "You have missed all my history lectures"
  - ⇨ Can you guess what Spooner intended to say?
- **Malapropisms** (mal à propos = inappropriate):
  The inappropriate substitution of words in a sentence.
  - "Sure, if I reprehend any thing in this world it is the use of my oracular tongue, and a nice derangement of epitaphs!"
    [Mrs Malaprop, *The Rivals* by Richard Brinsley Sheridan (1775)]
    "Sure, if I apprehend any thing in this world it is the use of my vernacular tongue, and a nice arrangement of epithets!"

The psychological reality of lexical categories

Slips of the tongue

- Speech errors can be categorized on the basis of the linguistic units involved in the error
  - phonological feature, phoneme, syllable, morpheme, word, phrase, sentence.
- And the mechanism involved
  - blend, substitution, addition, deletion, anticipation, perseveration, exchange of units.

The psychological reality of lexical categories

Slips of the tongue

Type	**Example**	**Intended**
Feature anticipation	a spicky point	*a sticky point*
Feature perseveration	He pulled a pantrum	*tantrum*
Phoneme exchange	piss and stretch	*pitch and stress*
Syllable exchange	buterpillar and catterfly	*caterpillar and butterfly*
Morpheme exchange	I randomed some samply	*I sampled some randomly*
Morpheme deletion	The chimney catch_ fire	*The chimney catches fire*
Word substitution	Get me a fork	*Get me a spoon*
Word blend	That child is looking to be spaddled	*spanked/paddled*
Phrase blend	Miss you a very much	*very much + a great deal*

Carroll, D.W. (2008) Psychology of Language, 5th edn, Thomson Learning
Fromkin, V. (1971) The non-anomalous nature of anomalous utterances. Language 57, 27-52
Harley, T. (2001) The Psychology of Language, 2nd edn, Psychology Press

The psychological reality of lexical categories

Slips of the tongue

- **The segments that change and move in speech errors are precisely those postulated by linguistic theory**.
- Linguistic units such as phonetic features, phonemes, and morphemes constitute planning units during the production of an utterance.

➽ Phrases and clauses are planned in advance.

The psychological reality of lexical categories

Speech production processes

- **Conceptualization**: forming an intention to speak.
- **Formulation**: selecting individual words (lexicalization), turning them into sounds (phonological encoding), putting them together to form phrases and sentences (syntactic planning).
- **Articulation**: specifying how the muscles of the articulatory system should be moved to produce the intended sounds.

The psychological reality of lexical categories

Speech production models

- The simplest model: a **serial model**.
  - First, we conceptualize what we want to say;
  - then we formulate it into words;
  - then we send instructions to the motor system to produce our utterance.
- Can the following speech errors be accounted for by this model?
  - It's difficult to valify (validate+verify)
  - I'm making the kettle on (I'm making some tea+I'm putting the kettle on)
- Not quite.
  - 'It's difficult to valify' indicate that two words are simultaneously retrieved from the lexicon.
  - Phrases tend to blend where they sound most alike.
  - This suggests that two alternative utterances are processed in parallel from the conceptualization to the phonological levels.

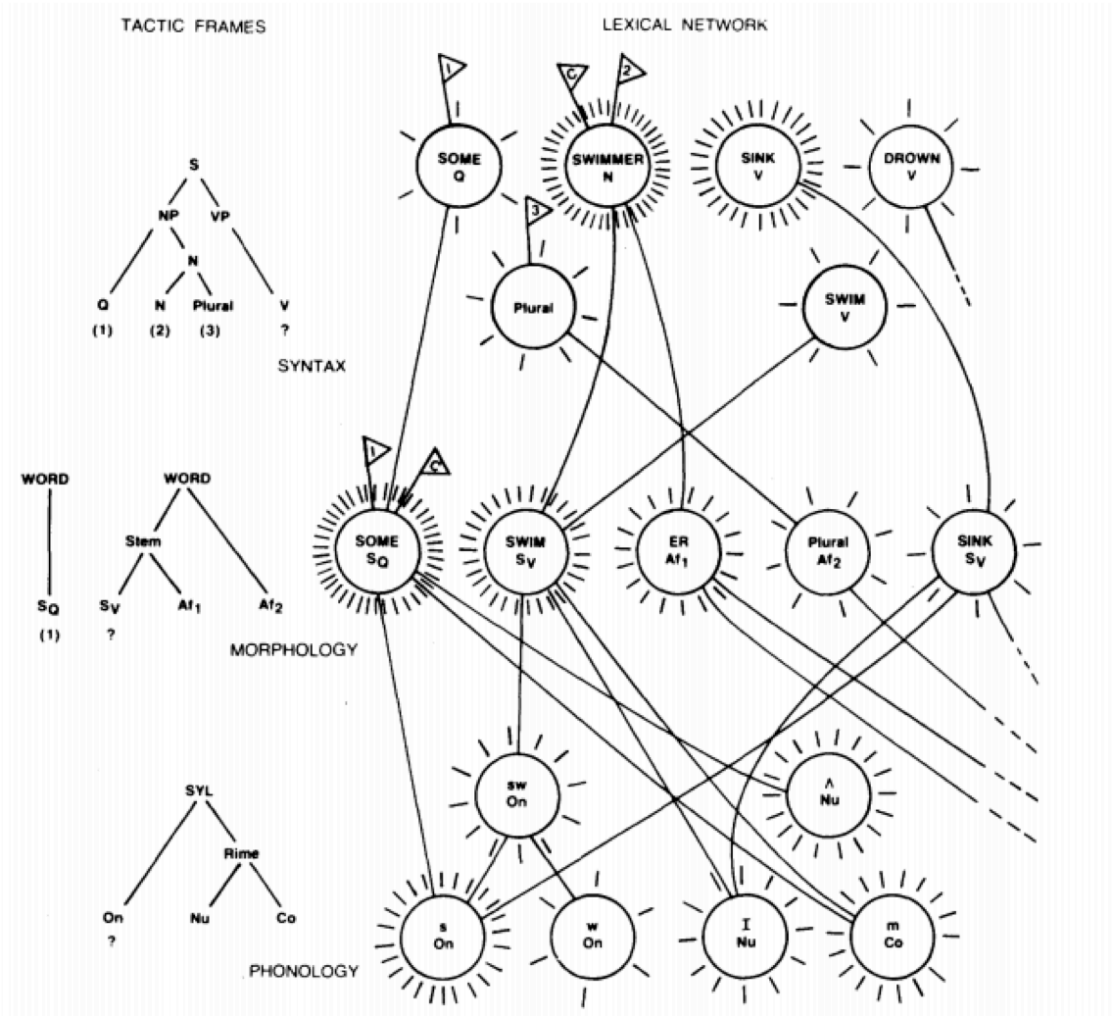
The psychological reality of lexical categories

Speech production models

- An alternative: an **interconnected model**.
- Activation spreads from one level to the other, and several units can be active at any given time.
- Allows for feedback between the levels

The psychological reality of lexical categories

Model for ‘some swimmers sink’ (Dell 1986):



The mental lexicon

The mental lexicon

- One of the most intense areas of psycholinguistic investigation involves determining how words are organized in the mind.
  - How are entries in the lexicon linked?
  - How are entries accessed?
  - What information is contained in an entry?

The mental lexicon

Lexical decision experiments

- **Lexical decision**: a very common experimental paradigm used to probe the properties of the mental lexicon.
  - participants sit in front of a computer screen
  - they read strings of letters that either form actual words or not.
  - they are asked to respond as quickly and as accurately as possible by pressing either of two response buttons on the keyboard or on a response box.
  - the software used for these experiments records the time it took to make a decision and whether the decision was correct or not.

The mental lexicon

bag

The mental lexicon

The mental lexicon

gat

The mental lexicon

The mental lexicon

xna

The mental lexicon

The mental lexicon

cat

The mental lexicon

The mental lexicon

feg

The mental lexicon

The mental lexicon

fret

The mental lexicon

The mental lexicon

dog

The mental lexicon

The mental lexicon

lpg

The mental lexicon

The mental lexicon

beng

The mental lexicon

The mental lexicon

free

The mental lexicon

The mental lexicon

Lexical decision experiments

- Words are recognized faster than non-words.
- Frequency effect: Frequent words (e.g., free) are recognized faster than less frequent words (e.g., fret).
- Pronounceable non-words (e.g., gat) are harder to reject than unpronounceable non-words (e.g., lgp)

Priming effects

- Words are processed faster when preceded by
  - a semantically related word (cat → dog) **semantic priming**
  - an orthographically related word (couch → touch) **orthographic priming**
  - a phonologically related word (might → bite) **phonological priming**
  - a morphologically related word (reuse → retry) **morphological priming**
  - the same word (cat → cat) **repetition priming**

The mental lexicon

Priming effects

- Taken together, these findings indicate that lexical entries in the mental lexicon incorporate...
  - semantic,
  - syntactic,
  - morphological,
  - phonological,
  - orthographic information
- ...and that frequency plays a major role in the organization of the lexicon.

The mental lexicon

Previously: What has to be specified for each morpheme in the lexicon?

1. its sound — phonology
2. its meaning — semantics
3. its part-of-speech (category): N, V, A... — syntax
4. if it is an affix, the part of speech it merges with — morphology
5. if it is an affix, its place of attachment: prefix, suffix, ... — morphology
6. its spelling — orthography

Spelling and the mental lexicon

- Spelling is different from the other parts of a lexical entry.
  - It's **learned** at a later date, not **acquired** as a child.
  - Some languages don't have a writing system at all, but they will have all the other components of the entry.

The mental lexicon

Review

Write lexical entries for all the morphemes in *industrialindustrial*.

1. its sound /ɪndəstri/
2. its meaning "a group of businesses that provide a particular product or service"
3. its part-of-speech (category) N
4. ~~if it is an affix, the part of speech it merges with~~
5. ~~if it is an affix, its place of attachment~~
6. its spelling Industry

The mental lexicon

Review

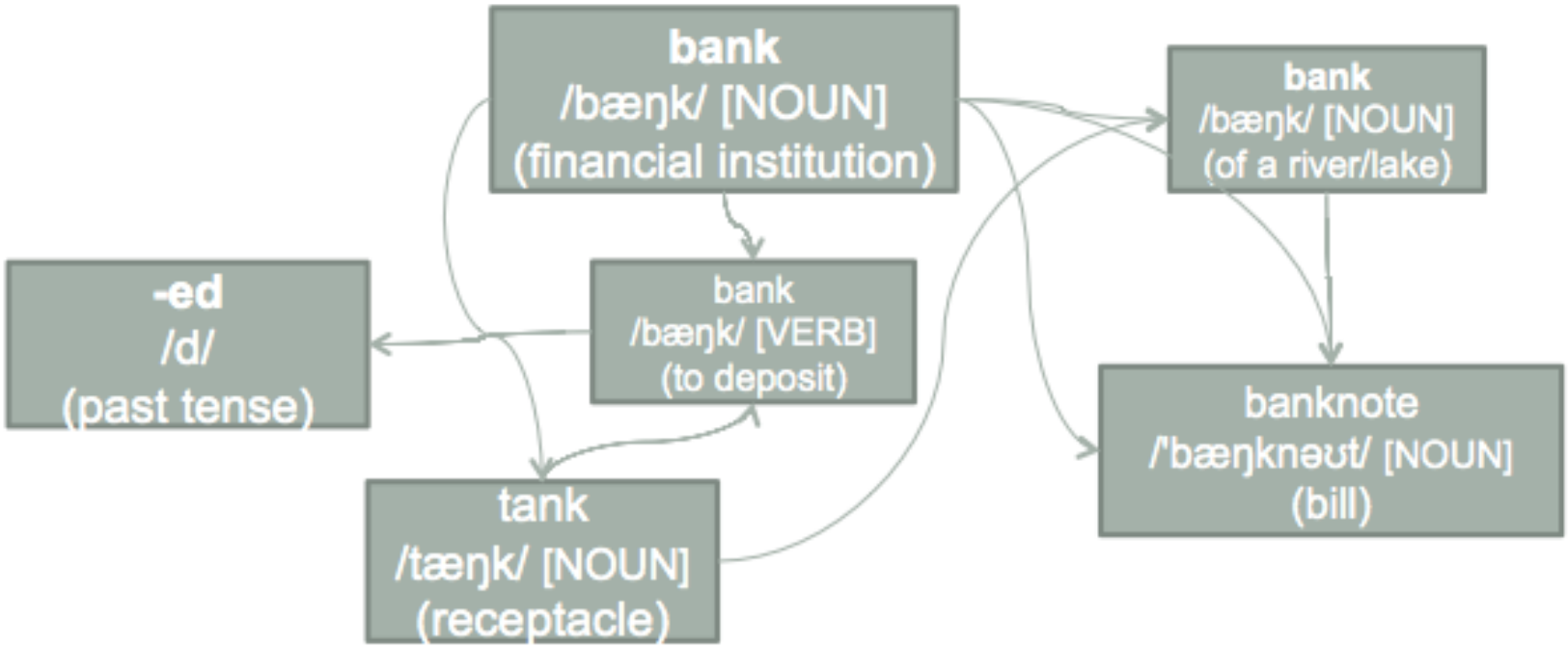
Write lexical entries for all the morphemes in *industrial*

1. its sound /-əl/
2. its meaning "of, relating to, or characterized by"
3. its part-of-speech (category) ADJ
4. if it is an affix, the part of speech it merges with N
5. if it is an affix, its place of attachment suffix
6. its spelling al

The mental lexicon

The structure of the mental lexicon

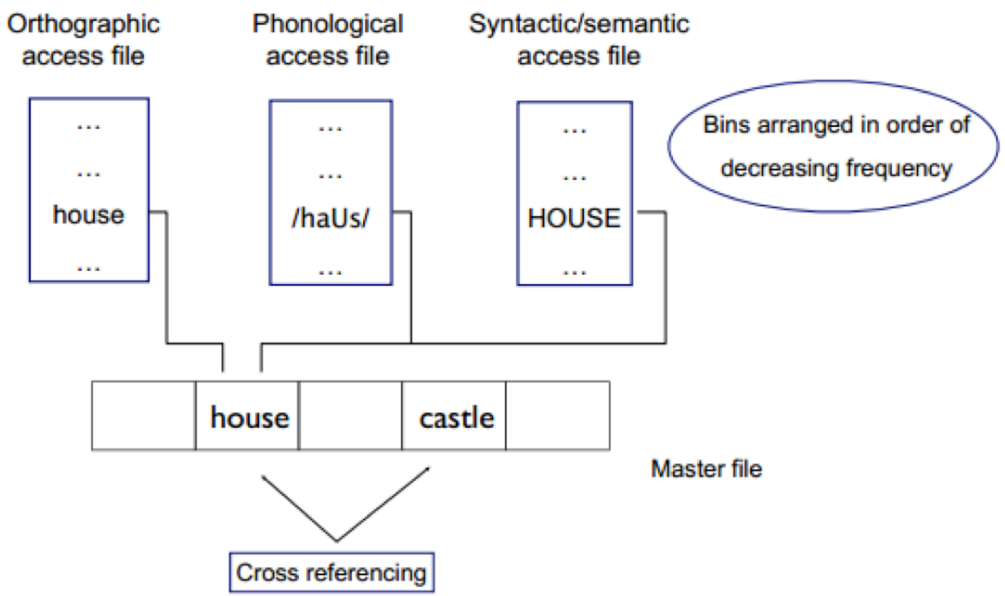
- Lexical entries in the mental lexicon are connected at the semantic, syntactic, morphological, phonological, and orthographic level.
- Frequency matters.



The mental lexicon

The serial search model of lexical access

- It is tempting to think of the mental lexicon as a sort of dictionary.
- This is how early models of lexical access conceived of it.

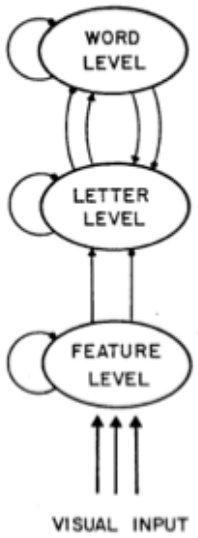


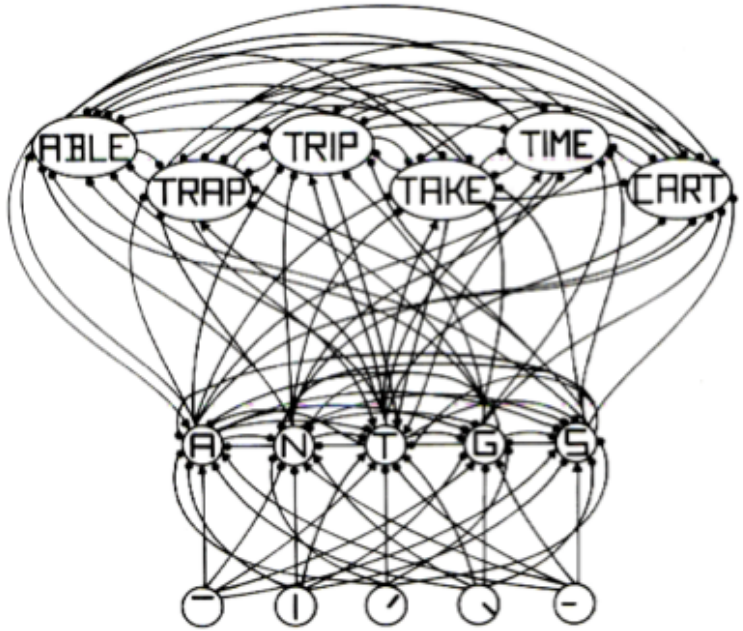
- Implausible that we search the entire lexicon every time.
- What about non-words?

The mental lexicon

An alternative: interactive activation models

- Three interconnected levels: visual input → letters → words.
- T activates words starting with "T" and suppresses other words.





- This has been highly influential in psycholinguistics.
- There is more to say: what about the meaning and sound of words?

Language processing

The McGurk effect

- Remember the **red**, **green**, **pink**, **blue** test?
  - The **Stroop Effect**
- When we see a word, we automatically process what it means.
- This meaning somehow interferes with our effort to name the color that we see.
  - This gives us a clue about how language production works.

Language processing

The McGurk effect

- Here's another interesting phenomenon in language processing called the **McGurk Effect**.
- **The left half of the class:** watch the video carefully.
- **The right half of the class:** close your eyes! listen, but don't peek.
- We'll switch roles later, don't worry!
- `https://www.youtube.com/watch?v=aFPtc8BVdJk`

Language processing

The McGurk effect

- The audio says: [ba ba ba]
- The video shows: [ga ga ga]
- Most people hear something like: [da da da]
- What does this tell us about how we process language?
  - We make use of visual articulatory information and combine it with what we hear.

The McGurk effect

- Another interesting aspect of this effect is that we cannot turn it off.
  - Even when we KNOW he is saying “ba ba ba,” we can’t hear it, if we are looking at his mouth.
- This shows us that speech processing is, to some extent, automatic.

For next time. . .

- **Assignment 3** is due today at 23:59. Submit on *MyCourses*.
- Practice questions for next week's midterm have been posted on MyCourses. Try to solve before Friday's conference.
- On Wednesday: writing systems.