

Please pay attention to the comments added in some slides for clarifications.

# Theories of Language Comprehension: India and Beyond

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# Word Processing

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- Introduction

- Early views on Word Processing:

(1) Passive Secretary Approach

(2) Fingerprint Approach

- Word Recognition/ Identifying Words:

1. Cohort Model of Spoken Word recognition
2. Spreading Activation or Interactive Activation
3. Connectionism
4. Shortlist Model

- Experimental Proof of Multiple Lexical Hypothesis:

1. Phoneme Monitoring Task
2. Lexical Decision Task PAWN
3. Veiled Controlled Process

# Word Processing: Simply Put!

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Sell

Tell

Well

Sail

Sale

Nail

# Word Processing: Simply Put!

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Sell

Tell

Well

Sail

Sale

Nail

## **Step 1:**

A hearer has a mental representation of a word.

1. How does a word sound? = Phonetic / Phonological representation
2. How does a word look?= Orthographic representation

## **Step 2:**

Then, he has a semantic representation of the word. (= meaning)

# Understanding Speech:

## Early Views (Beginning of the 20<sup>th</sup> Century):

### 'Passive Secretary' Approach:

A hearer is like a secretary taking down a dictation.

She mentally writes down the sounds she heard, one-by-one. Then, reads off the words formed.

### 'Fingerprint' Approach:

A hearer is like a detective solving a crime by matching fingerprints to known criminals enlisted in his files.

She matches each sound with the specific word. Each sound is different as no fingerprints of two persons are same.

Both approaches are proven **invalid** after series of experiments.

1. Humans cannot process that fast in real-time.
2. Direct matching of sounds is impossible. Speakers have different tones.
3. There is no definite borderline between sounds. Earlier letter merges into the next.

**Deciphering the sounds of speech is an active process, not a passive process.**

# Understanding Speech:

## Identifying Words:

*'Sentence comprehension is like riding a bicycle... far easier performed than described.'*

- Cutler, 1976

While processing any sentence, listeners first try to **identify words** in it.

They are constrained by two things:

1. The sounds in that particular language,
2. Desire to make sense of what they hear.

Proven fact with considerable evidence: '**Multiple Lexical Hypothesis**:

As soon as a hearer comes across the beginning of a word, he starts making preliminary guesses for what a word may be.

He considers **numerous words** starting with that particular sound.

Ex:

*Mia went to the hospital....*

M... 1 w...1

M... 2 w...2

M... 3 w...3

# Identifying Words:

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How does a '**Multiple Lexical Hypothesis**' work?

There are disputes regarding how does a hearer processes innumerable words at a given time. Some of the ideas are as follows:



1. Cohort Model of Spoken Word recognition
2. Spreading Activation or Interactive Activation
3. Connectionism
4. Shortlist Model
5. And other (e.g., Probable Word Strategy, etc.)

## Experimental Proof of Multiple Lexical Hypothesis:

- Phoneme Monitoring Task
- Lexical Decision Task
- Veiled Controlled Process



## Identifying Words:

How does a '**Multiple Lexical Hypothesis**' work?

### 1. Cohort Model



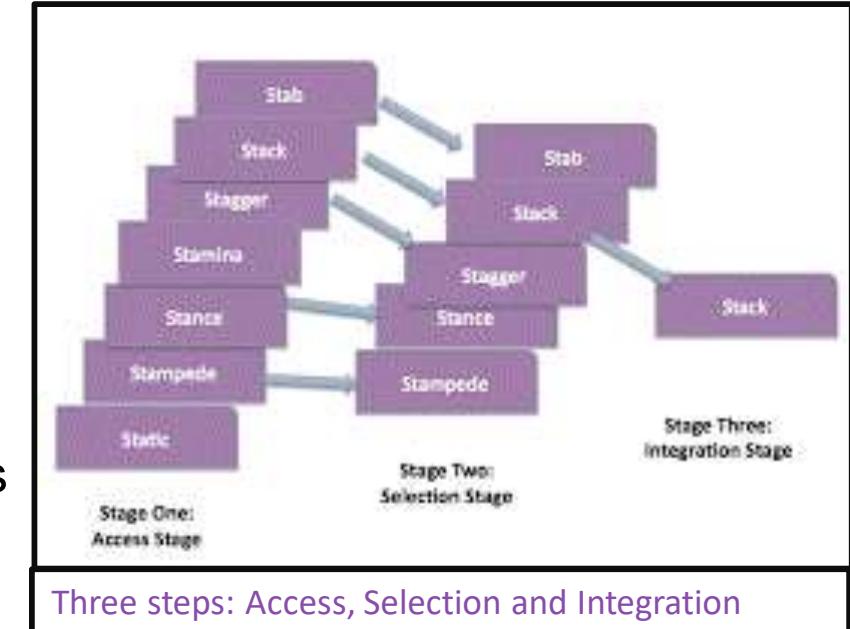
Cohort= a division of the Roman army

As soon as the beginning of a word is detected, the hearer immediately flashes up onto his or her mental screen a whole **army of words with a similar beginning**. This is a rapid and unconscious retrieval. This idea is known as the '*cohort model*'.

Words beginning with the same sounds were envisaged as **lining up** like soldiers. The hearer then **eliminates** those that do not fit in with the sound or meaning of the rest of the sentence.

Initial sounds, if heard properly, are very important for word recognition. Model is given by **Marslen-Wilson and Tyler 1980**.

A word's cohort= consists of all the lexical items that share an initial sequence of phonemes.



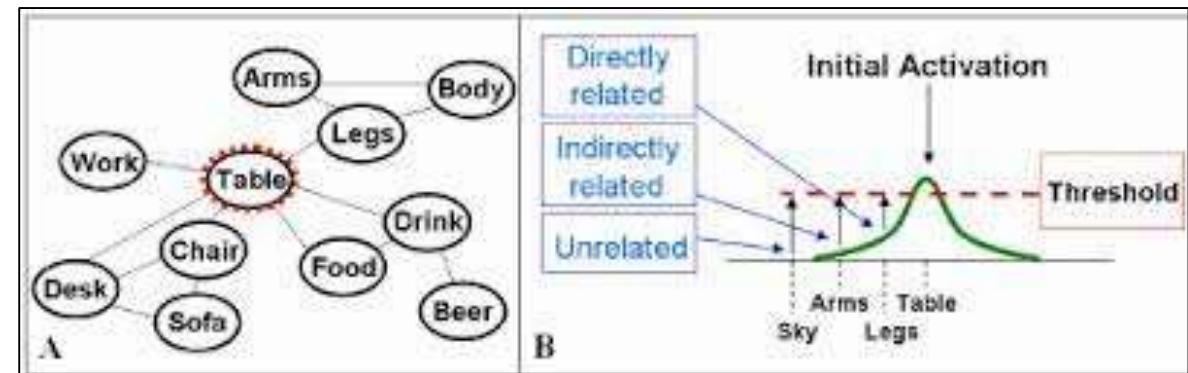
## Identifying Words:

How does a '**Multiple Lexical Hypothesis**' work?

### 2. Spreading Activation or Interactive Activation

- ✓ The sounds of a word activate multiple meanings in the mind. Then, the other meanings triggered will arouse further sounds.
- ✓ Those words that fit syntactically and semantically in the sentence, get more and more activated. The other words fade away.

- More powerful type of framework.
- Similar to the working of an electric circuit- in which the current flows backwards and forwards.
- Thus, a hearer rushes between two levels: between the already heard initial sounds and the words that are aroused.



# Identifying Words: How does a '**Multiple Lexical Hypothesis**' work? **2. Spreading Activation or Interactive Activation**

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Spreading Activation = A method for searching associative networks.

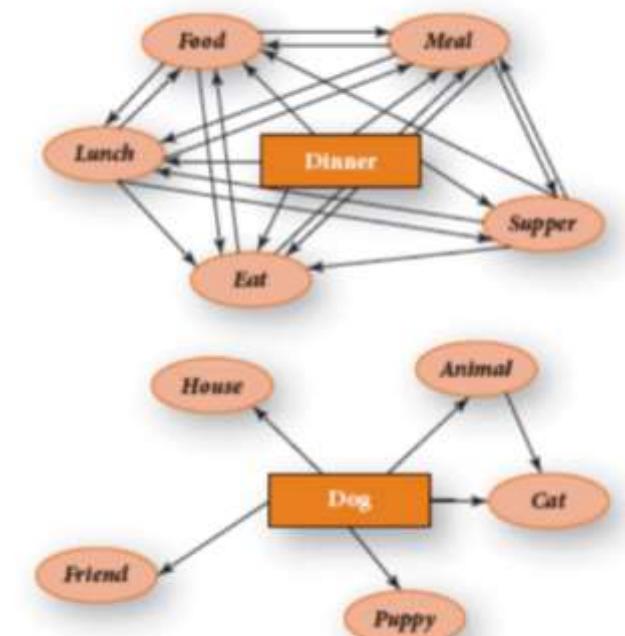
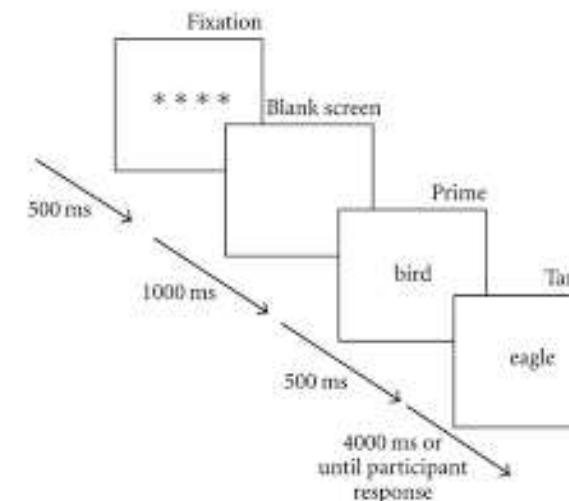
Also known as 'Semantic Network'.

- Participants respond faster and perform better when the target word is preceded by an associated word. An associated word is known as a *prime*. (i.e., If a word is semantically primed with an other word, it is recognized faster.)

Ex:

'Doctor..... Nurse' (faster cognition)

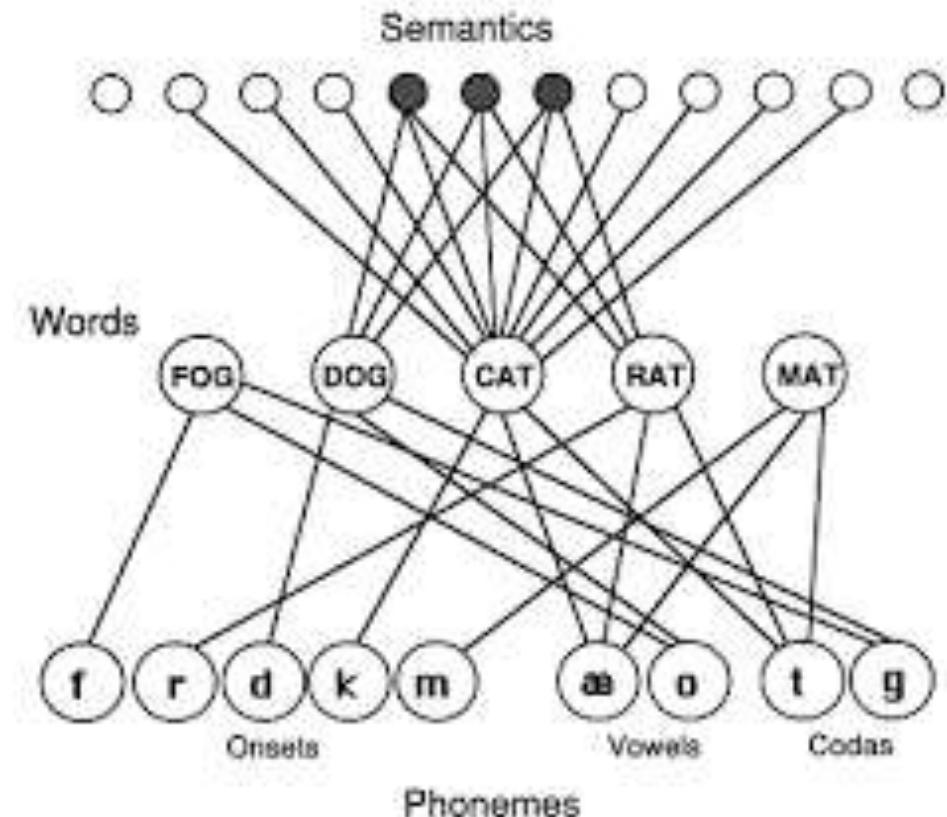
'Doctor..... Carrot' (slower cognition)



# Identifying Words: How does a '**Multiple Lexical Hypothesis**' work? **3. 'Connectionism'**

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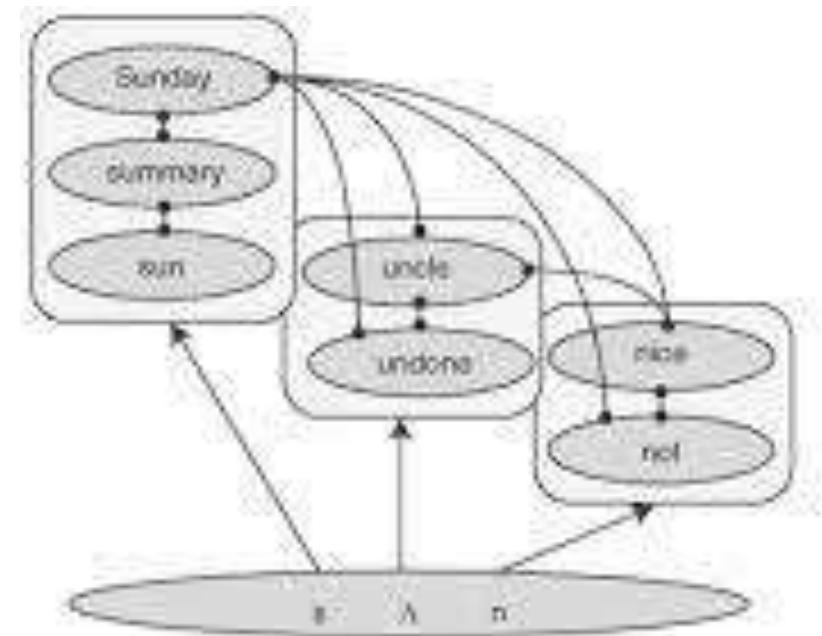
- ❑ A certain group of words is aroused on hearing upon phonemes in the words.
- ❑ There is a network of such words (heard and aroused), where ultimately everything connects to everything else. = 'Connectionism'.
- ❑ The model of 'Spreading Activation' can also fall under this category.
  
- ❑ Model given by **McClelland and Elman, 1986**.
- ❑ Connectionism is also known as **Associationism**.



Identifying Words:  
How does a '**Multiple Lexical Hypothesis**' work?

#### 4. Shortlist Model

- ❖ A hearer first has a **phoneme string** as an input.
- ❖ He performs a **Lexical Lookup Process** to identify all the words that correspond to the sequence of phonemes in the input.
- ❖ Based on the input, a **shortlist** of all word candidates is selected.
- ❖ The selected words **compete** with each other to fit in the sentence.
- ❖ The hearer continuously shortlists as the **updates** information on phonemes start coming in.
- ❖ Some candidates are **eliminated** as a result of competition.
- ❖ Model given by **Norris, 1994 and 2005**.



Identifying Words:  
**‘Multiple Lexical Hypothesis’:**

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**‘Multiple Lexical Hypothesis’: Experimental  
Evidences**

## Identifying Words:

### ‘Multiple Lexical Hypothesis’: Experimental Evidence

#### 1. Phoneme Monitoring Task

##### Experiment:

Participants are asked to detect the target words based on the beginning of the words.

“Press a button if you see a word starting with ‘B’.”



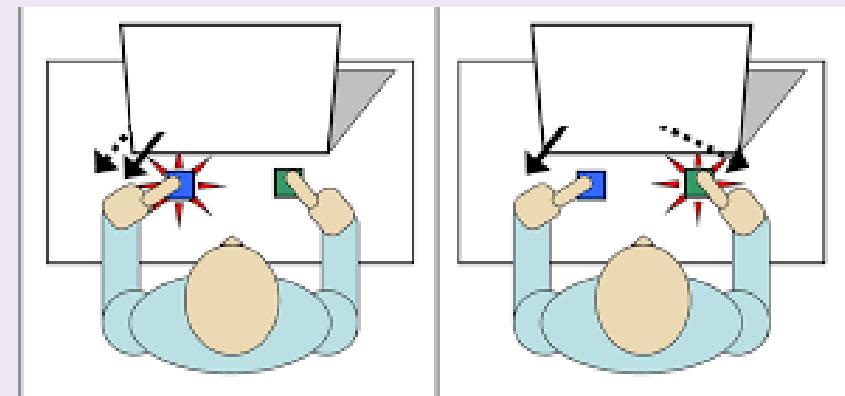
- Unambiguous words are processed fast.
- Ambiguous words slowed down the performance.
- Which suggests that readers process multiple words at the same time. Thus, ambiguity takes longer to press the button than unambiguous words.

EASY

Beautiful, Bill, Bank,  
Bored, Below, bold,  
blue...

DIFFICULT

Brusque, Bank,  
Beatitude, boorish,  
blatant...



Experiment conducted by Foss, 1970.

## Identifying Words:

### ‘Multiple Lexical Hypothesis’: Experimental Evidence

#### 2. Lexical Decision Task

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Used to investigate lexical access.

A word flashes on the computer and a participant indicates whether the word is real or non-sensical.

**Impossible Non-words** are rejected very rapidly. (Ex: TLAT, ZNER, MROCK...) 

**Possible Non-words** take longer to reject. (Ex: SKERN, FLOOP, PLIM...)

- Ambiguous words with related senses are retrieved faster than ambiguous words with unrelated senses.

Ex ‘EYE’ (noun and verb- related senses) versus PUNCH (noun and verb, unrelated senses)



This suggests that, a reader processes multiple lexemes at a single time. Then, based on the semantic fitness, they perform the lexical decision task to narrow down its meaning.

Experimented by **Swinney, 1979, Tatenhaus, 1979, Seidenberg, 1982**, and **Kinoshita, 1986**.

**Peterson, 1990** conducted a PET study: Same areas of the brain are activated in response to real words and possible non-words. For the impossible non-words, the other part of the brain is activated.

Identifying Words:

**'Multiple Lexical Hypothesis': Experimental Evidence**

## 2. Lexical Decision Task

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Factors that affect Lexical Decision Task:

- **Word Frequency:** Most frequent words are retrieved faster than the less frequent words. (Ex: happy-ecstatic- jovial- rapturous)
- **Neighborhood Density:** Word's Neighborhood= All the lexical items that are phonologically similar to the word. Larger or denser neighborhoods take longer to retrieve. (Ex: tell, tail, tale...)
- **Priming** = A general property of human cognition.  
A stimulus we just experienced will affect how we would respond to a later stimulus.  
A residual activation from previously experienced stimuli.  
Form Priming- words are connected in phonological form, not semantically. (Ex: table, fable, able...)  
Semantic Priming- words are connected by meaning (Ex: doctor, hospital, nurse...)
- **Ambiguity:** Most ambiguous words are retrieved slower than the less ambiguous words. (fall vs. spring) (fall vs. rise)

## Identifying Words:

### ‘Multiple Lexical Hypothesis’: Experimental Evidence

#### 3. Veiled Controlled Process

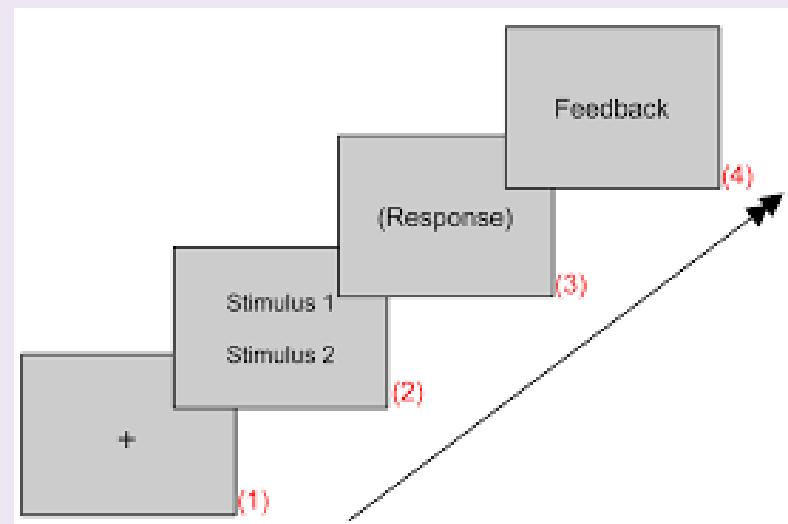


The process of thinking about multiple words is **neither automatic**, nor conscious. Hence, known as ‘**veiled controlled**’.

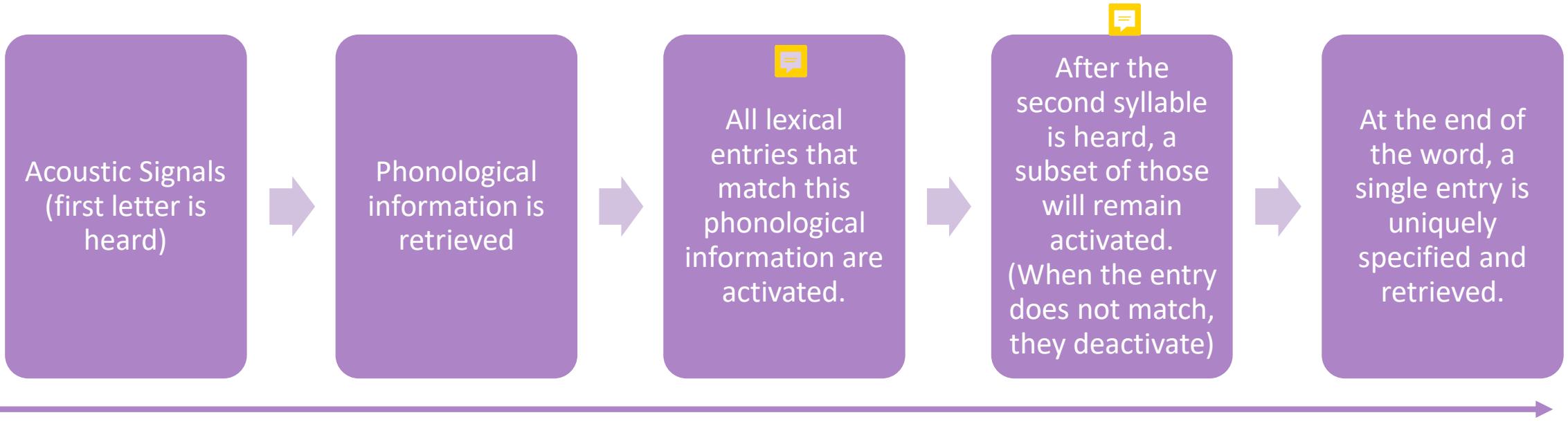
- Participants respond faster to the word FLOWER- both as a noun and as a verb, when followed by ROSE.

Veiled Controlled processes are:

- Opaque to consciousness,
- Faster than conscious controlled processes, and
- They make fewer demands on limited processing resources. (**Tatenhaus, 1985**)
- Given by **Seidenberg, 1982**



# Summary: Word Processing



**Timeline:**

0 Milliseconds

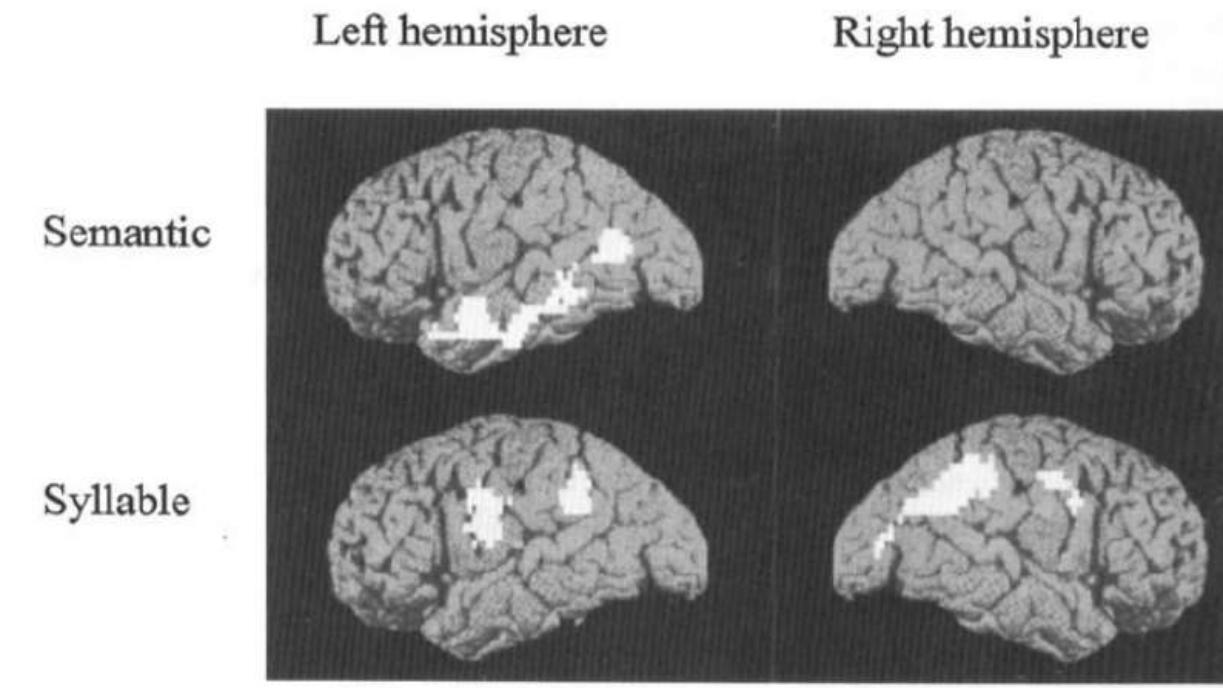
200-250 Milliseconds

## SOME MORE FACTS:

- Fluent readers use a '**whole-word strategy**' in identifying words. The prediction of meaning is the major strategy used in the identification of words, not the decoding of letter or sound correspondences.
- Some aphasic patients have greater difficulty in retrieving verbs than nouns, and others have the opposite problem.
- Verbs are processed at the frontal lobe, while nouns (concrete objects) are processed at the temporal lobe.

## Some Neuropsychological Research:

- Knowledge of concepts (semantics) and knowledge of word forms (phonetics) are handled by different systems in the brain.



## Key Takeaways:

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- Introduction
- Early views on Word Processing:
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- Experimental Proof of Multiple Lexical Hypothesis:
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  2. Lexical Decision Task
  3. Veiled Controlled Process

## Reading Material: Same as Module 1

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### **Extra:**

1. For Word Recognition: <https://milnepublishing.geneseo.edu/steps-to-success/chapter/3-word-recognition-skills-one-of-two-essential-components-of-reading-comprehension/>
2. The Neurobiology of Lexical Access: [https://ssl2.cms.fu-berlin.de/geisteswissenschaften/v/brainlang/PM\\_Intranet/Neurobiology-of-Language/Word-Processing.pdf](https://ssl2.cms.fu-berlin.de/geisteswissenschaften/v/brainlang/PM_Intranet/Neurobiology-of-Language/Word-Processing.pdf)
3. Word Processing: Advanced level: [https://www.linguisticsociety.org/sites/default/files/e-learning/Lecture\\_3\\_Word\\_Processing\\_0.pdf](https://www.linguisticsociety.org/sites/default/files/e-learning/Lecture_3_Word_Processing_0.pdf)
4. For Basics: <https://www.studocu.com/en-gb/document/university-of-southampton/language-and-memory/word-processing/12025567>