



# Language acquisition, perception and production

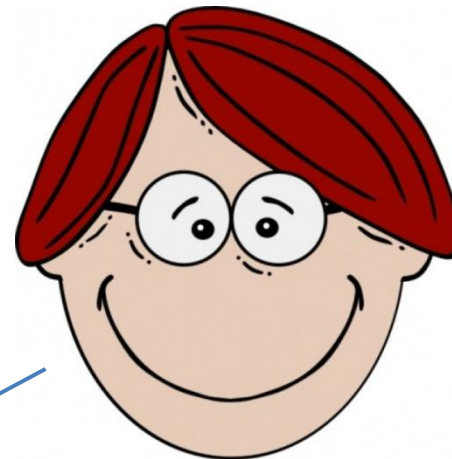
## *Lecture 1 – Production*

# Language modalities

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- **Comprehension**

- Visual (reading)
- Auditory



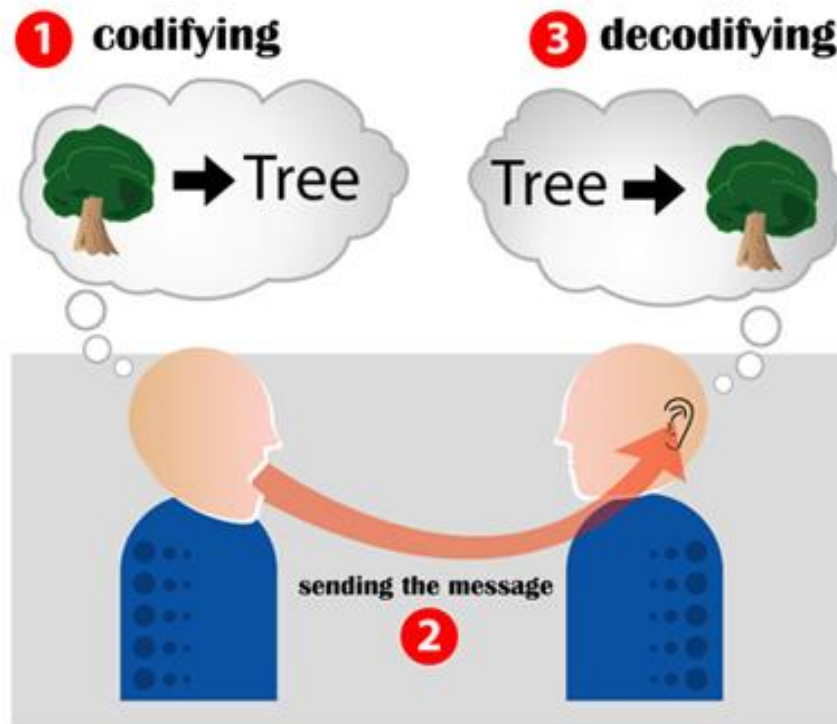
- **Production**

- Speaking
- Writing
- Sign language

# Speaking

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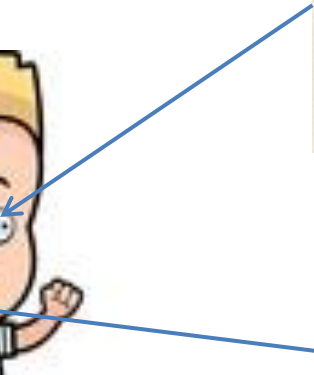
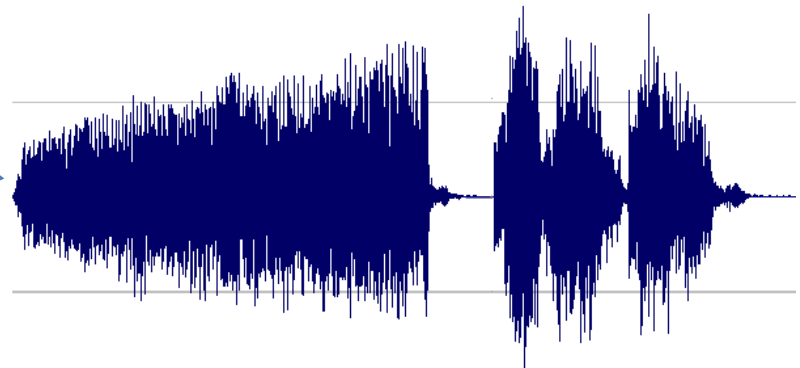
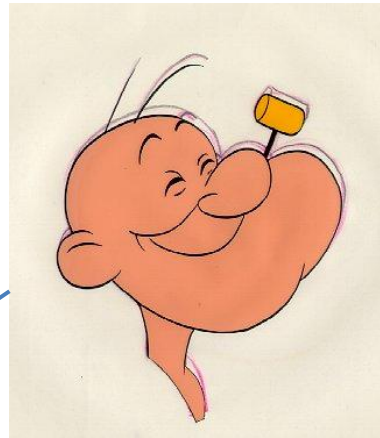
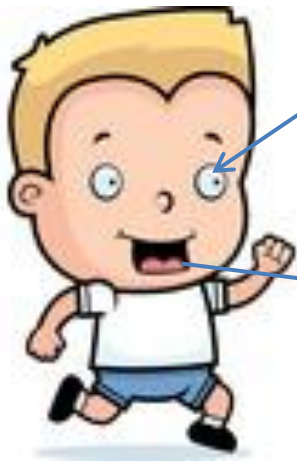
- What is speaking?



# Speaking

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- Speaking versus speech



# Speaking

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- **Speaking versus comprehending**
  - Speaking more difficult?
  - Developmental lag
  - Learning a second language

# Speaking

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- **Speaking vs comprehending**
  - **Comprehension: goal is to understand**



← **TREE**

# Speaking

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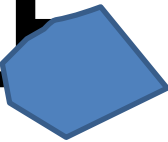
- **Speaking versus comprehending**
  - **Speaking: goal is to articulate**



# Speaking

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- Getting the form right

TREE 

"TRE" ?



# Speaking

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- **Getting the form right**
- **What is right?**
- **There are many conventions**
  - Discourse
  - Syntax
  - Phonology

# Speaking

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- Getting the form right
- Discourse

"ayer me compré *un* coche nuevo"

"ayer me compré *e/*coche nuevo"

# Speaking

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- Getting the form right
- Syntax

"nuevo ayer un compré coche me"

"ayer me compré un *a* coche nueva*a*"

# Speaking

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- Getting the form right
- Phonology

"ayer me <silencio> coooooooooompré un coche nuevo"

# Speaking

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- **Speaking =**
  - **Expressing non-ordered idea in ordered way**
  - **Take into account**
    - **Choosing right words, syntax, phonology**
  - **Have to do this fluently, on-line**

# Speaking

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- **Speed of speaking facts**
- **Know about 50,000 words**
- **2 or 3 words / second**
- **1 / 1000 words is an error**

# Speaking

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- **How to study language production?**
  - Historically: Observational methods
  - Recently: Experimental methods

# Speaking

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- **Why complicated?**
  - **Comprehension**
    - Control input
    - Moving from language to meaning
  - **Production**
    - Do not control input!
    - Moving from meaning to language
- **But, can observe end product!**



# Speaking

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- **Dependent measures used in studies**
- **What they say**
  - Intended speech vs errors
  - Patterns of hesitation
- **Time course**
  - Time it takes to produce language
- **Neurophysiology**
  - How is language represented in brain

# Speaking

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- **Methodologies: observational**
- **Disfluent speech**
  - Hesitations, planning of utterances (Ford & Holmes, 1978)
  - Error detection & monitoring (Levelt, 1983)

# Speaking

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- **Methodologies: Observational**
- **Speech errors**

"The law I sign today directs new funds and new focus to the task of collecting vital intelligence on terrorist threats and on weapons of mass **production**." George W. Bush

# Speaking

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- **Why speech errors?**
- **Logic = error tell us something about how system works**
- **Observational and Experimental approaches**

# Speaking

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- Speech errors – observational
- "Spoonerisms"
  - Archibald Spooner (1844-1930)



"you've *h*issed my *m*ystery lectures"

"you've *m*issed my *h*istory lectures"

# Speaking

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- **Speech errors**
  - Shifts = one element disappears from one location and appears in another. The element attaches to the appropriate type.

"she decide to hitsit" →

"she decides to hit it"

# Speaking

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- Speech errors
  - Exchanges = two shifts backward and forward

"Put the *briefcase* in the *cigar*" →

"Put the cigar in the briefcase"

# Speaking

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- **Speech errors**
  - Anticipation = replace upcoming element in an too early location in the utterance

"I *bake* my *bike*" →

"I take my bike"



# Speaking

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- **Speech errors**
  - Perserveration = replace element with an element that appeared earlier in the utterance

"I *give* my *goy*" →

"I give my boy"

# Speaking

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- **Speech errors**
  - Addition = New elements are added to the utterance

"You need to be clareful" →

"You need to be careful"

# Speaking

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- **Speech errors**
  - Deletion = some element is deleted

"you talk ... intelligently" →

"you talk unintelligently"

# Speaking

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- **Speech errors**
  - Blends = Two elements blend into a single utterance

"You dont bother me in the sleast" →

"you dont bother me the least / in the slightest"

# Speaking

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- **Speech errors**
  - Malapropism = Blending of two elements when one element is not present in utterance

"I'm *stuttering* psycholinguistics" →

"I'm *studying* psycholinguistics"

# Speaking

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- **Overview of speech errors:**
  - Spoonerism
  - Shifts
  - Exchanges
  - Anticipations
  - Perserverations
  - Additions
  - Deletions
  - Blends
  - Malapropisms

# Speaking

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- What do these errors tell us?
- Look at ANTICIPATION error

"I *bake* my *bike*" → "I take my bike"

– Speech is planned in advance

# Speaking

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- What do these errors tell us?
- Look at EXCHANGE errors

"put the *briefcase* in the *cigar*" – word exchange

"*heft* *hemisphere*" – sound exchange

- Word exchange
  - Same grammatical class, long distance
- Sound exchange
  - Different grammatical class, short distance



# Speaking

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- **Other observations**

- Consonant - vowel rule = consonants never exchange with vowels or viceversa)
- Errors respect phonotactic rules = you never say "qrwept"
- Lexical bias = errors are more likely to result in words than non-words
- Grammaticality effect = words are exchanged for other words of the same grammatical class

# Speaking

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- **Implications**

- Speech is planned ahead

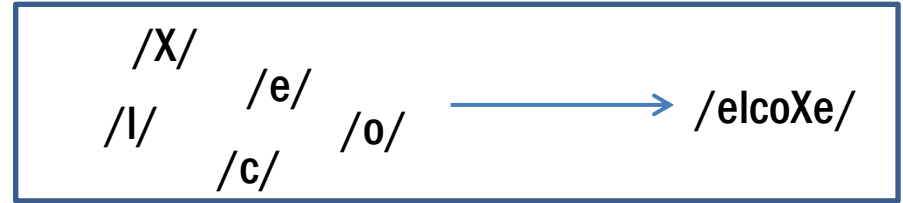
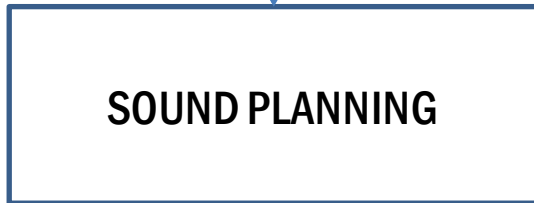
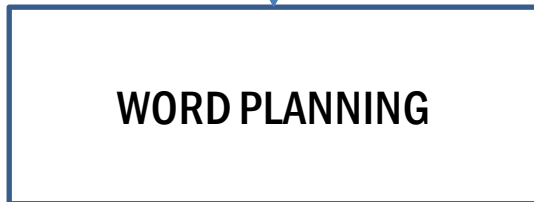
- Speech is planned at different stages

- Word planning stage where word exchanges occur

- Sound planning stage where sound exchanges occur

# Speaking

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# Speaking

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- **Experimental methods**
- **Pros**
  - Less chance of observer bias
  - More targeted study of question
  - More chance of systematic study of question
- **Cons**
  - Input/output problem
  - How to control input? Ecological validity
  - Output: Controlling responses, artificiality

# Speaking

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- Methodologies: Experimental
- Picture naming



bottle



frog

# Introduction Language Production

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- Object naming latencies

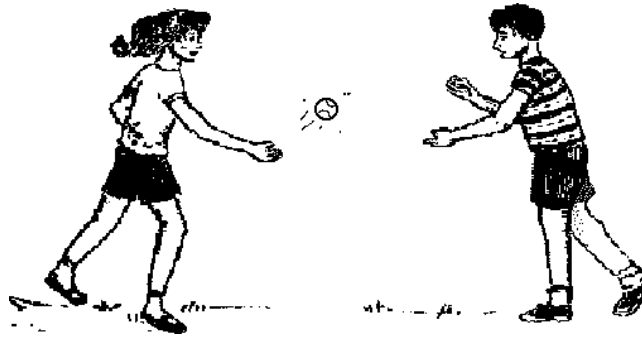


- RT determined by "Voicekey"

# Speaking

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- Methodologies: Experimental
- Picture naming



“The girl is  
throwing a ball  
to the boy”

“The girl is  
throwing the  
boy a ball”

# Speaking

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- Methodologies: Experimental
- Picture-word interference naming





# Speaking

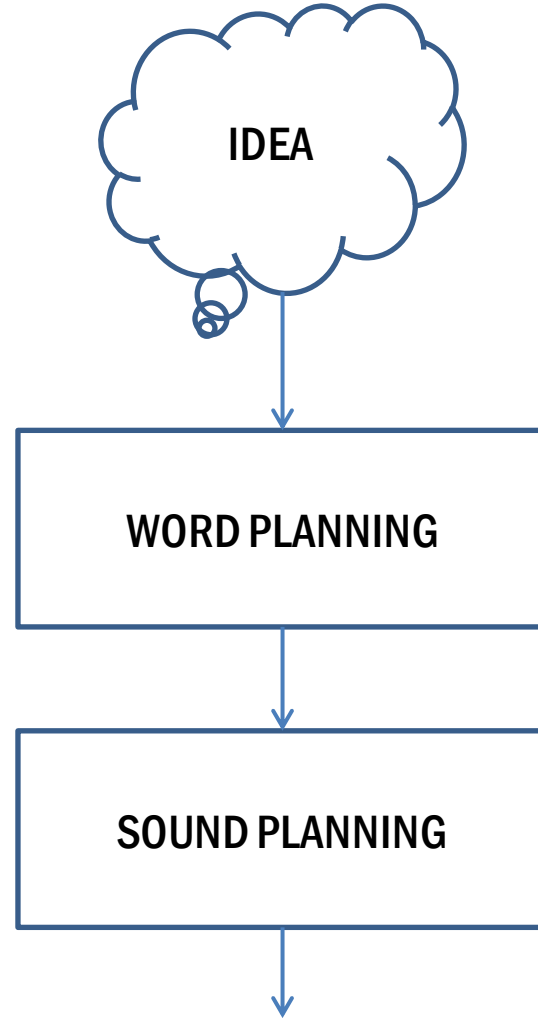
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- **Picture-word interference task**
  - Language production system is top-down or interactive?

# Speaking

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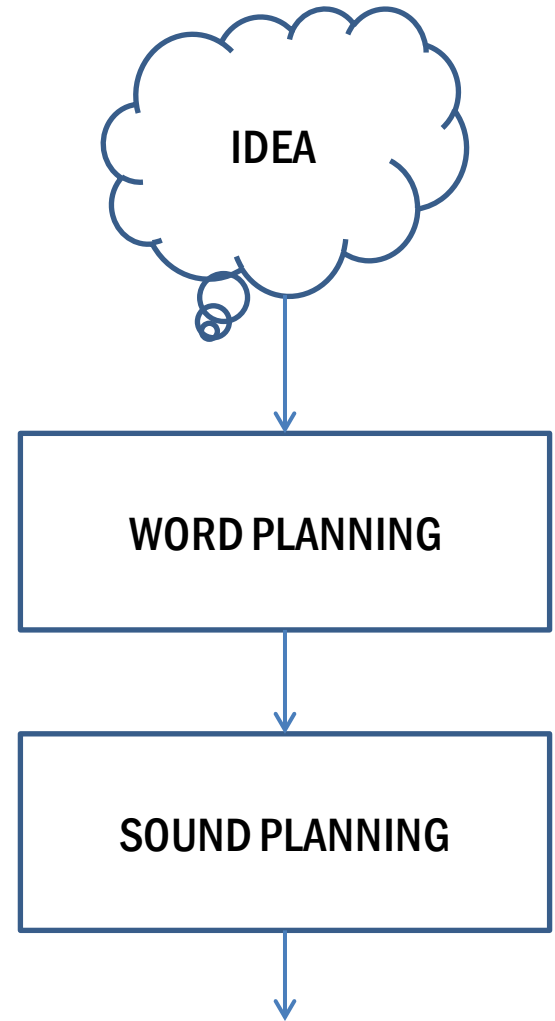
- **Three stages**
  1. **Meaning**
  2. **Syntax**
  3. **Phonology**
- **Top-down vs interactive**



# Speaking

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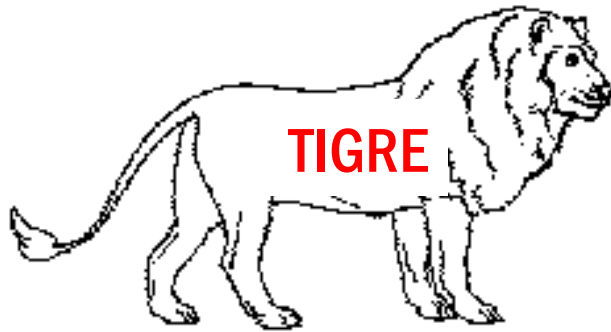
- **Prediction about time course**
  - If top-down, word planning should come before sound planning
  - If interactive, word planning and sound planning should overlap



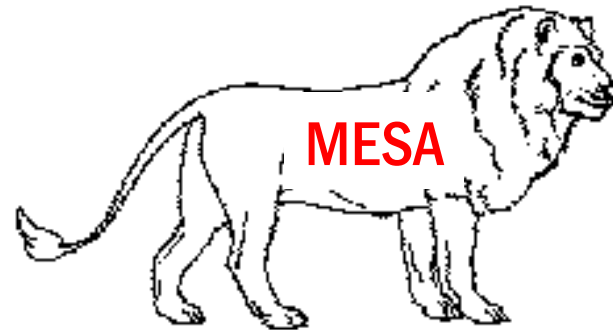
# Speaking

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- **Picture-word interference task**
  - **Semantic Interference Effect (Lupker, 1979)**



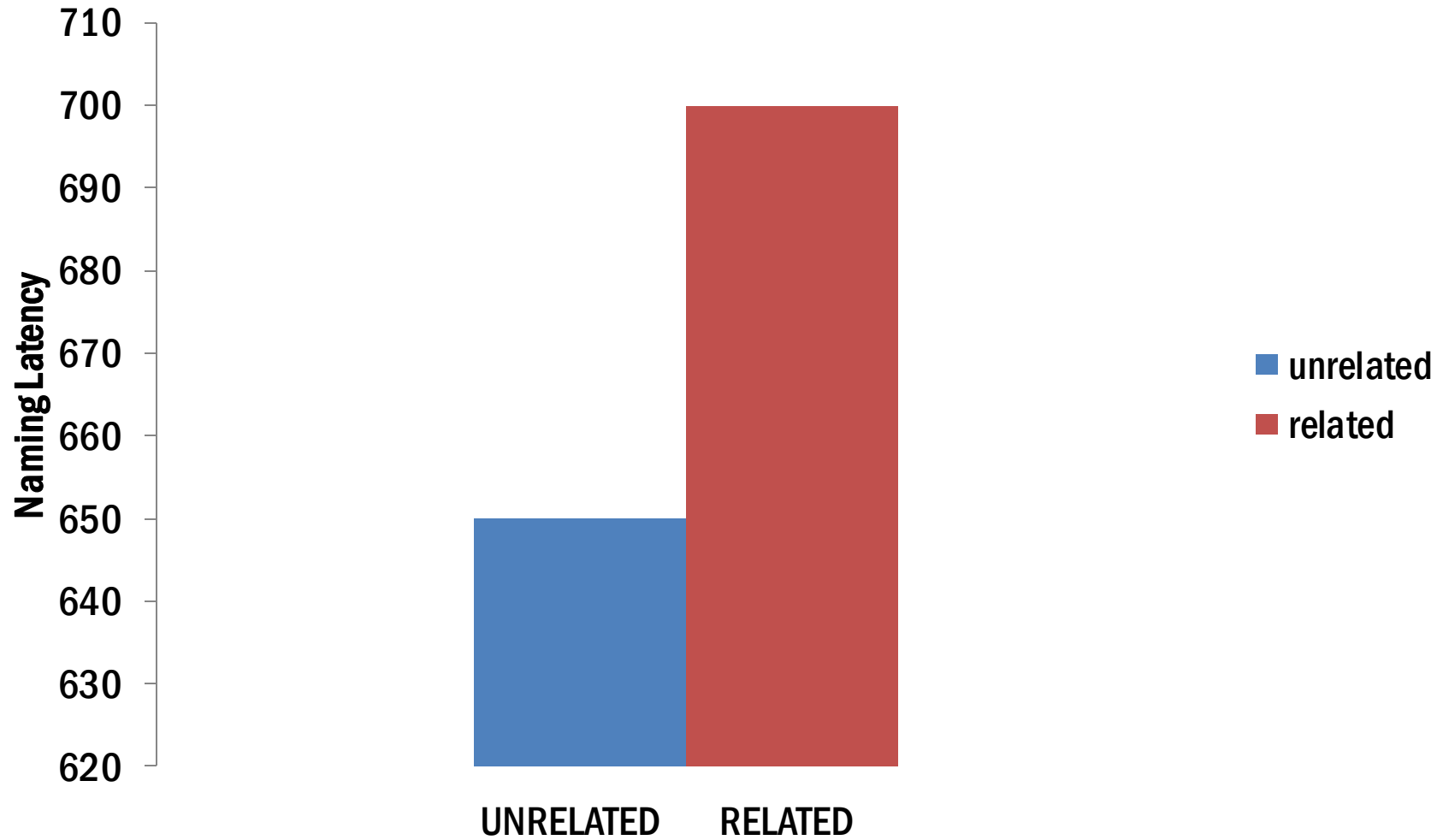
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UNRELATED

# Speaking

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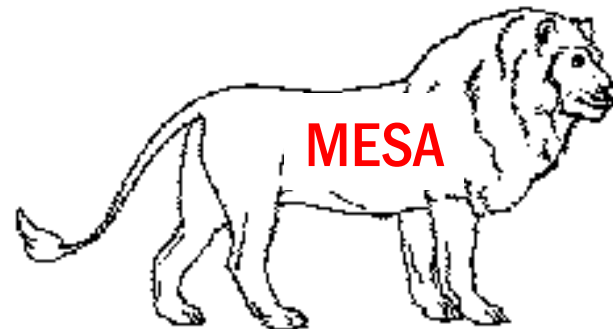
# Speaking

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- **Picture-word interference task**
  - Phonological facilitation Effect (Lupker, 1981)



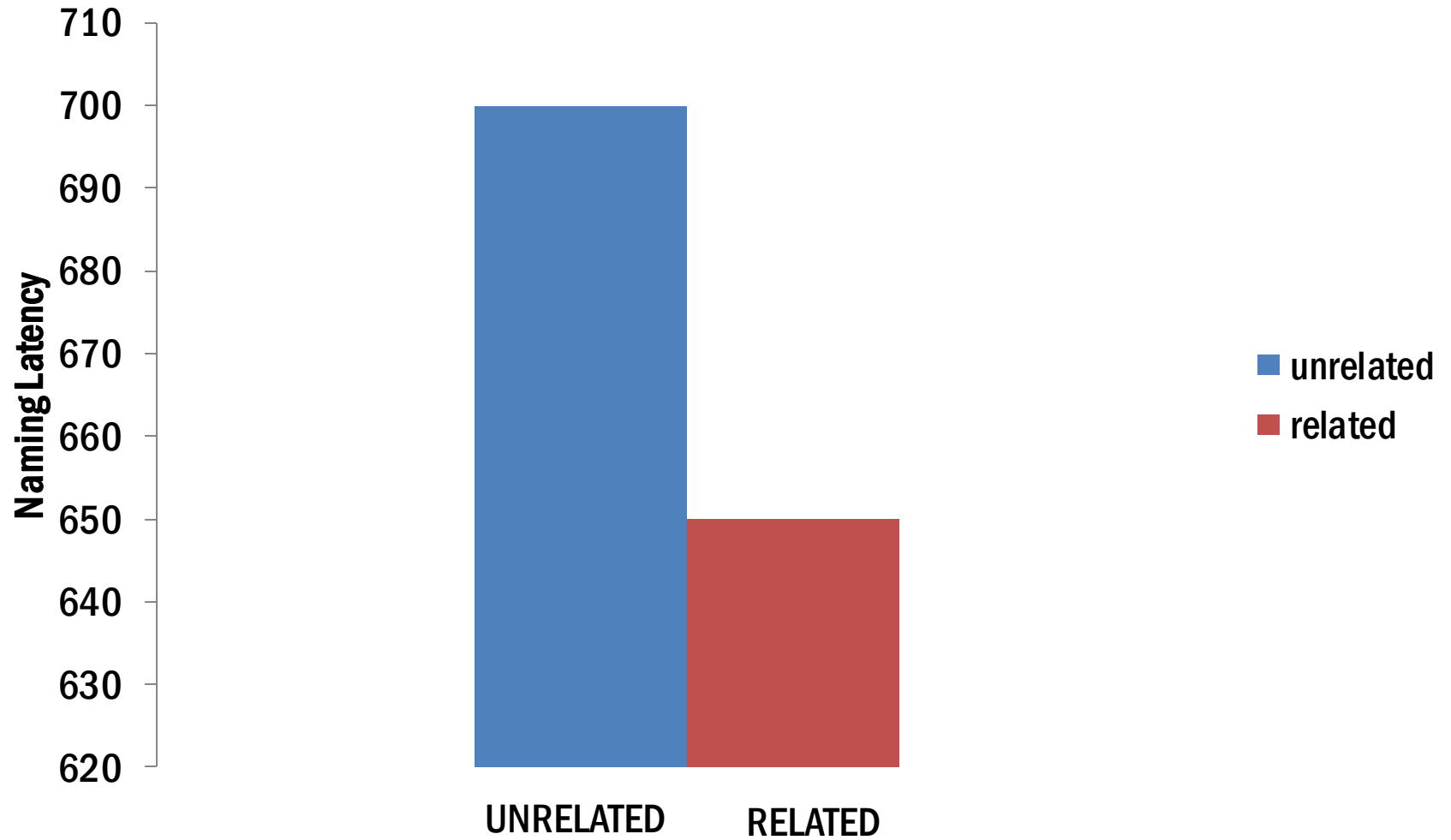
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# Speaking

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# Speaking

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- **Semantic interference effect:**
  - Reflects word planning stage





# Speaking

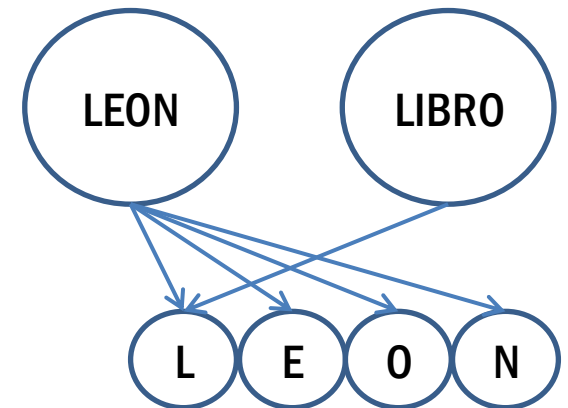
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- Phonological facilitation effect:
  - Reflects sound planning stage



WORD PLANNING

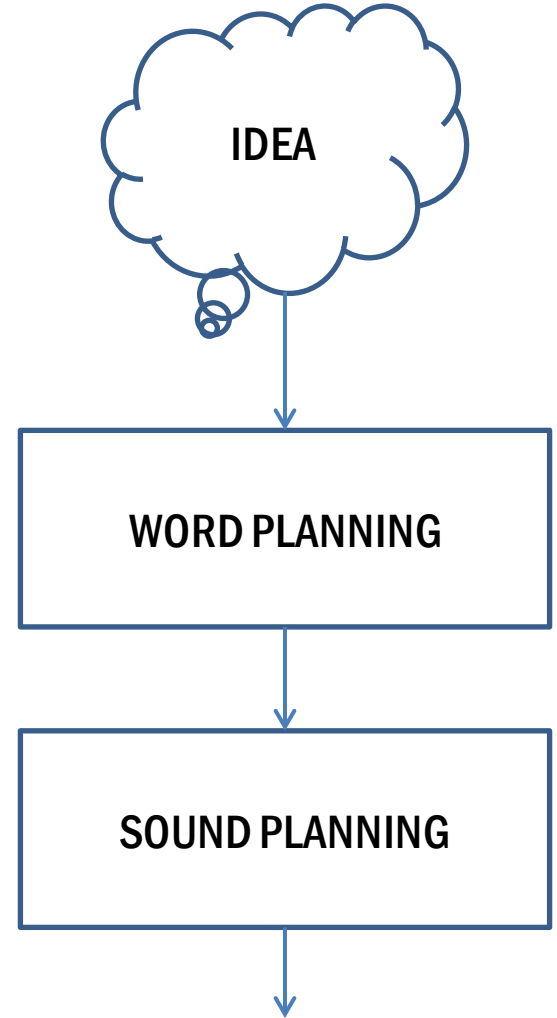
SOUND PLANNING



# Speaking

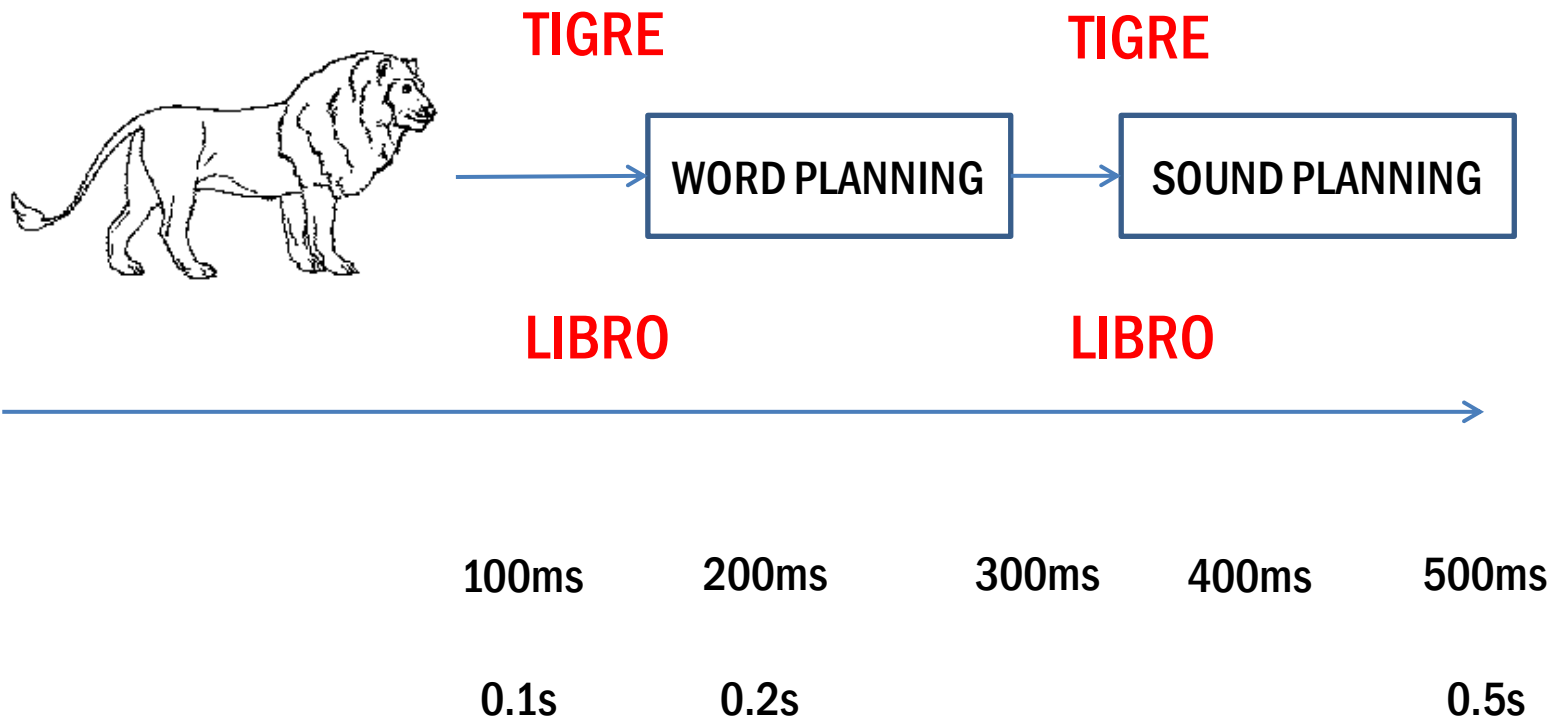
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- **Top-down vs interactive?**
  - Change timing of word!
- **Lets walk through logic:**
  - Word planning stages are early
  - Sound planning stages are late



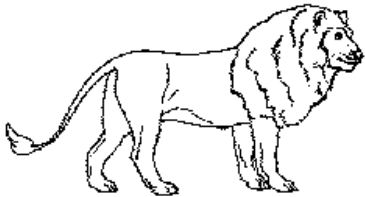
# Speaking

- Stages (Schriefers, Meyer, & Levelt, 1990)



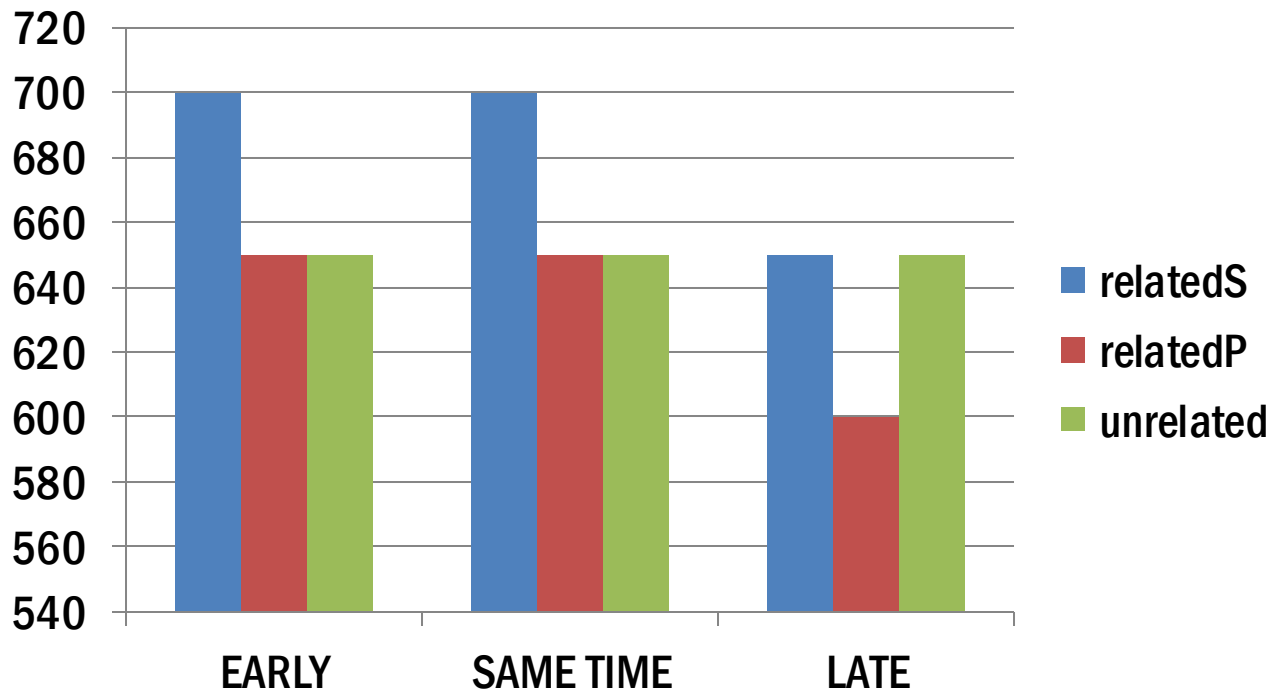
# Speaking

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**TIGRE LIBRO MESA**

1. AT THE SAME TIME
2. EARLY
3. LATE



# Speaking

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- **Evidence for top-down, against interaction**
  - Early semantic effect
  - Late phonological effect
  - No overlap
    - No early phonological effect
    - No late semantic effect

# Speaking

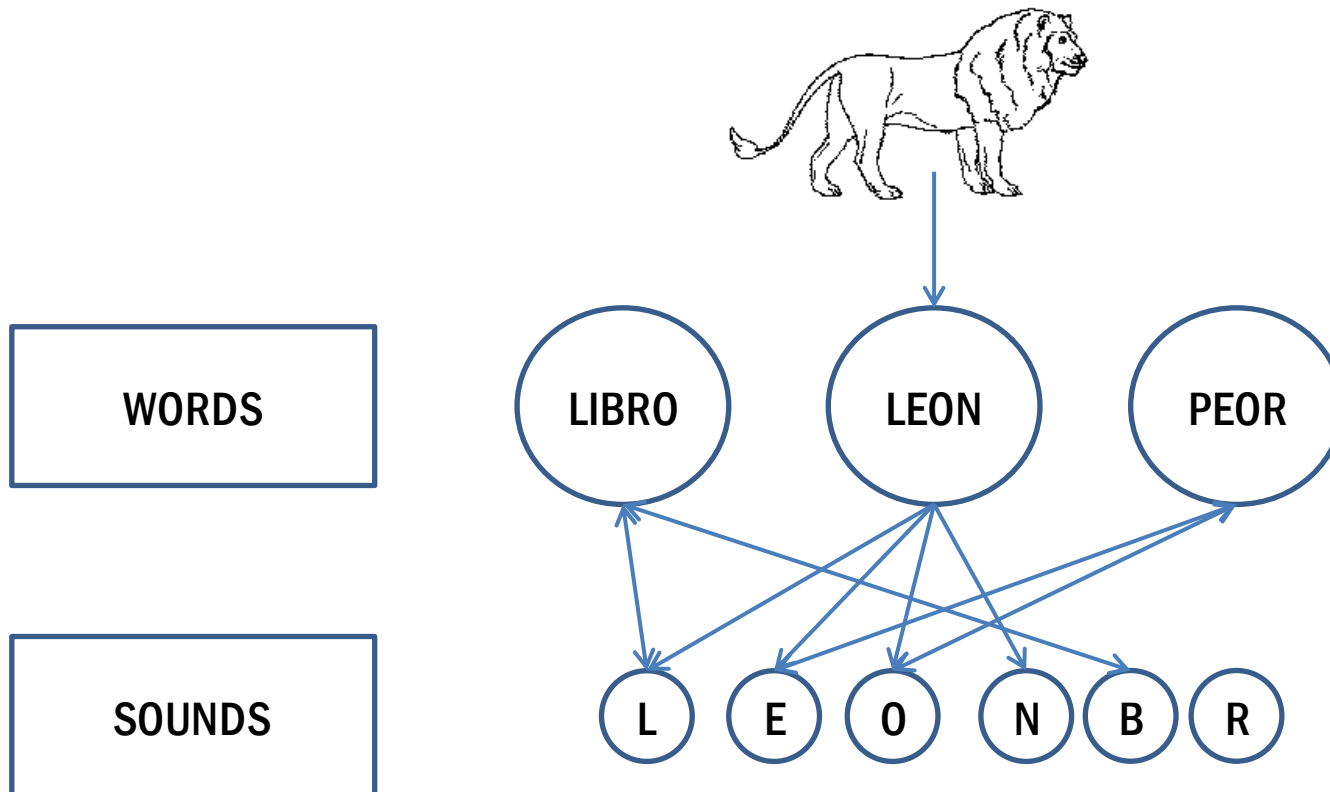
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- **End of story?**
- **No, also evidence for interactive models**

# Speaking

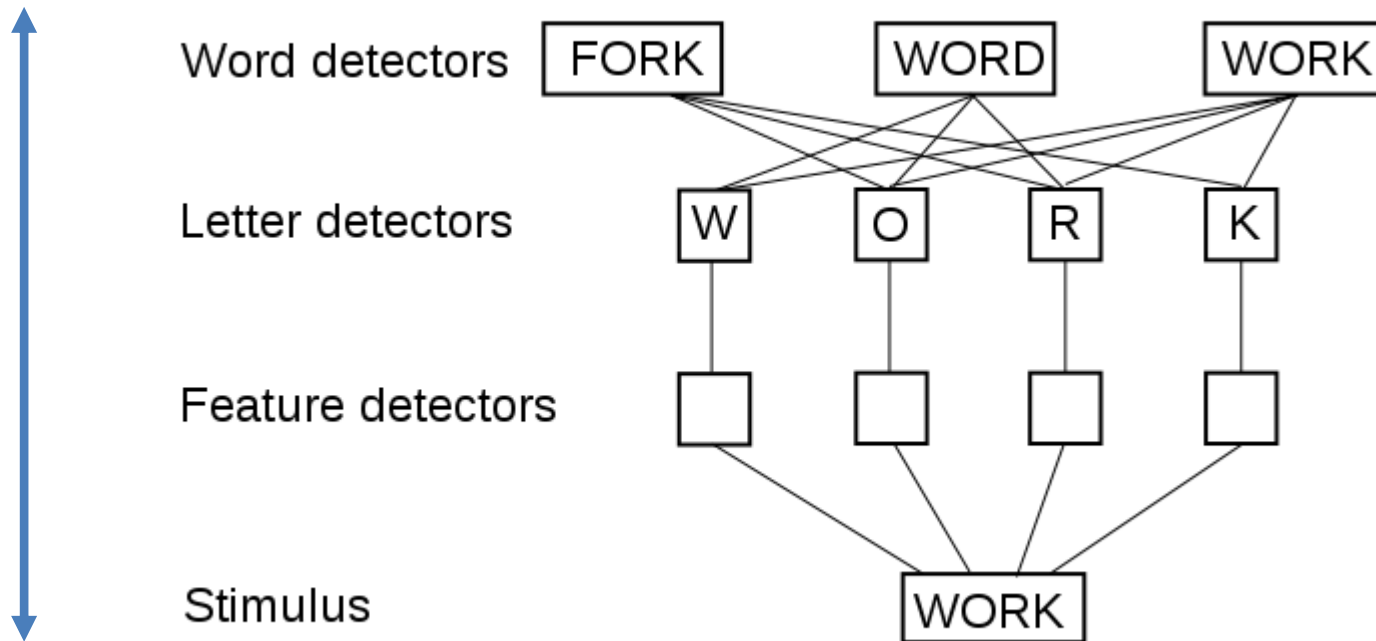
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- Interactive models



# Reading

- **Interactive models of reading**
  - Bottom up & top-down





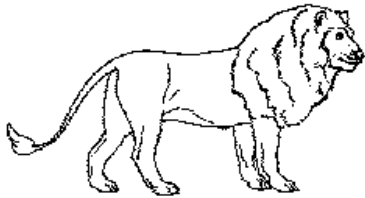
# Speaking

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- **From speech errors**
  - **Predicts mixed errors**
    - **Errors that are both semantically AND phonologically related to target**
- **Errors like "rat" for "cat" are more likely than expected by chance**

# Speaking

- From picture-word interference task (Damian & Martin, 1999)



**LOBO**

**TIGRE**

**LIBRO**

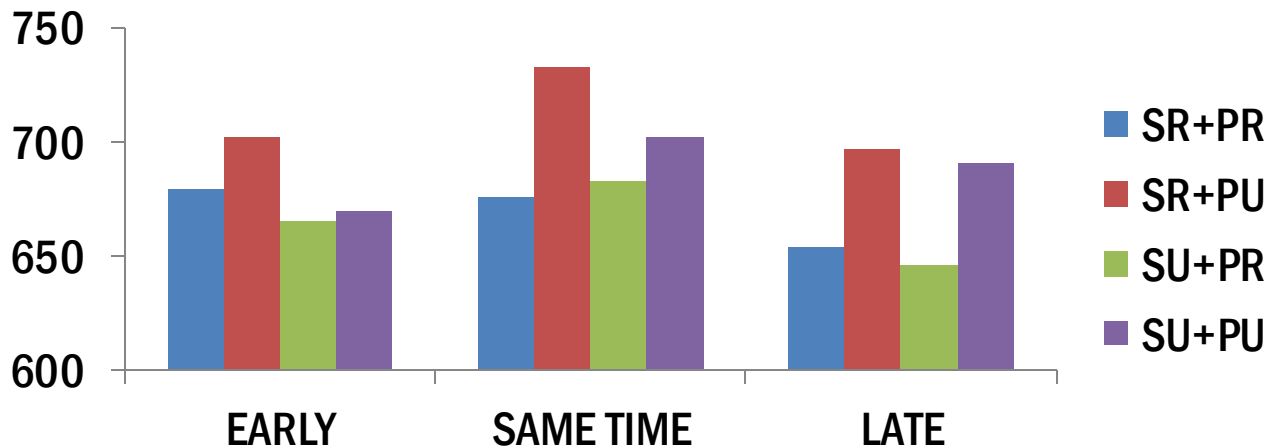
**MESA**

SR+PR,

SR+PU,

SU+PR,

SU+PU



# Speaking

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- **Summary**
  - **Language production versus comprehension**
  - **Observation methods**
    - Speech errors
  - **Experimental methods**
    - Picture word interference paradigm
  - **Conclusions**
    - Speech is planned at different stages
    - Bottom up versus top-down

# Language production and the brain

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- **Much of traditional brain research focused production**
  - Broca's area
- **Conclusion was that Broca's is involved in grammatical processing**

# Language and brain

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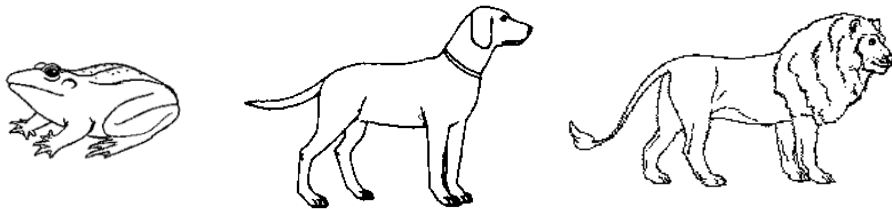
- More recent ideas about the role of Broca's area
- Conflict resolution (Thompson-Schill et al., 1997)



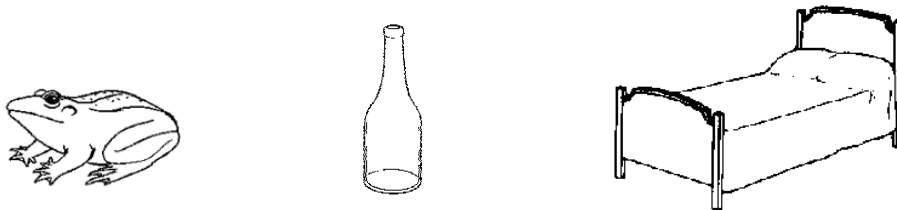
# Language and brain

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- **Semantic blocking task (Schnur et al., 2008)**
  - Picture naming
  - Groups of related pictures
  - Groups of unrelated pictures



RELATED

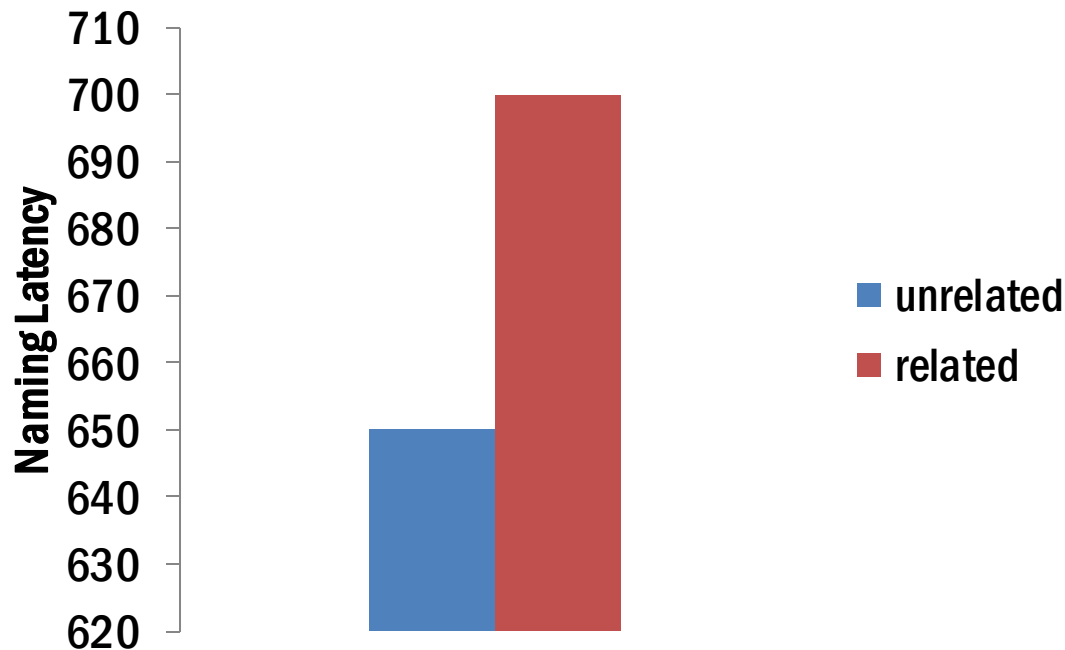


UNRELATED

# Language and brain

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- **Semantic blocking task (Schnur et al., 2008)**
  - **Conflict resolution**

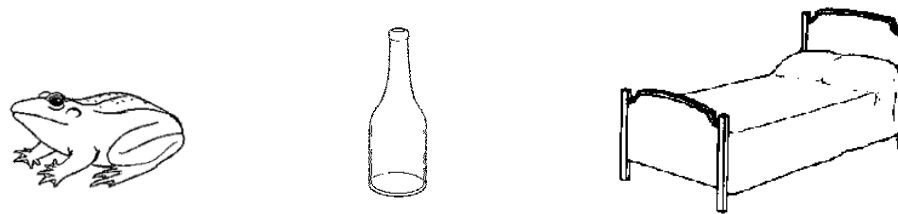
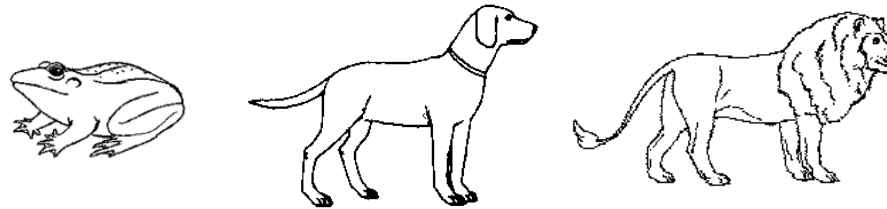


# Language and brain

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- fMRI – Schnur et al. (2008)

RELATED



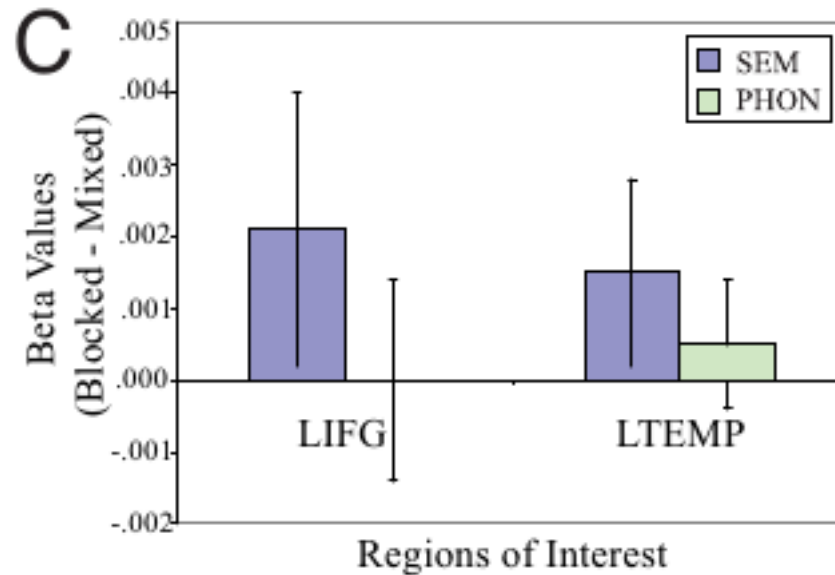
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# Language and brain

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- fMRI results



- Broca's area does conflict resolution

# Language and brain

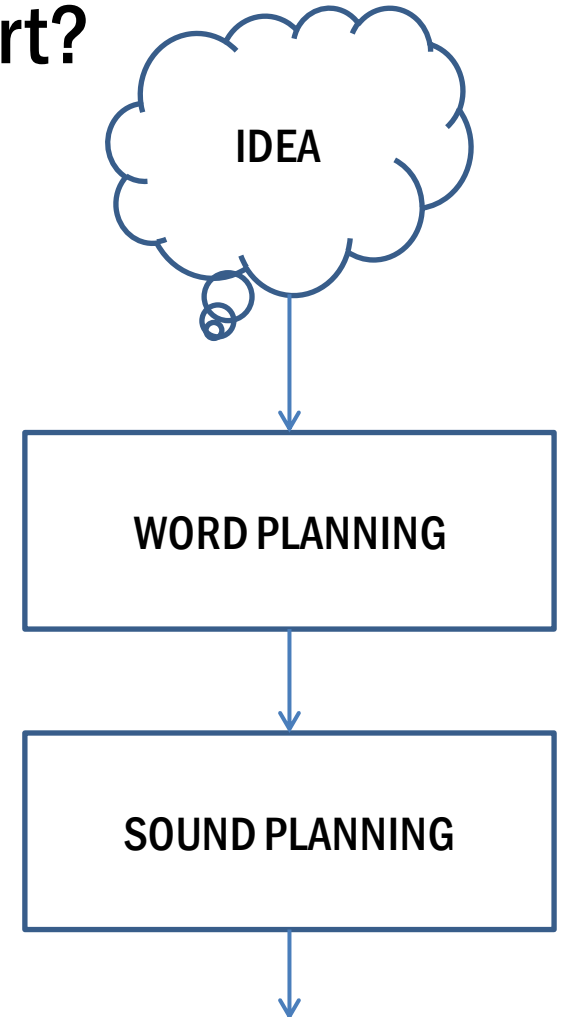
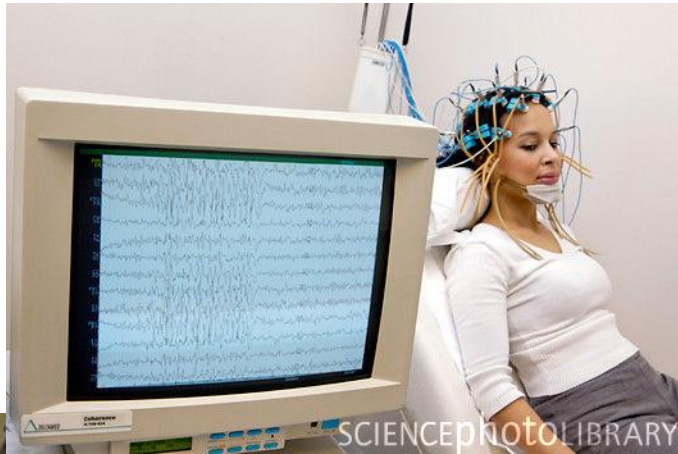
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- **Summary**
- **Aphasia**
  - **Classic model**
- **Role of Broca's area**
  - **Speech production**
  - **Grammatical function**
  - **Conflict resolution**

# Language and the brain

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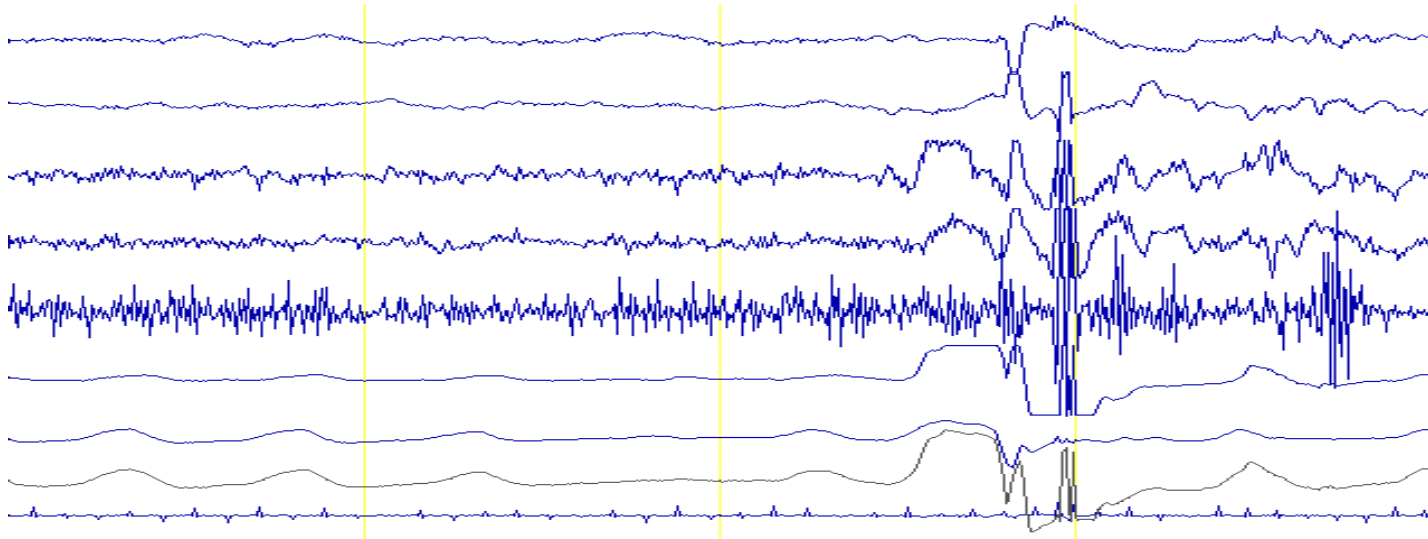
- When does word planning stage start?



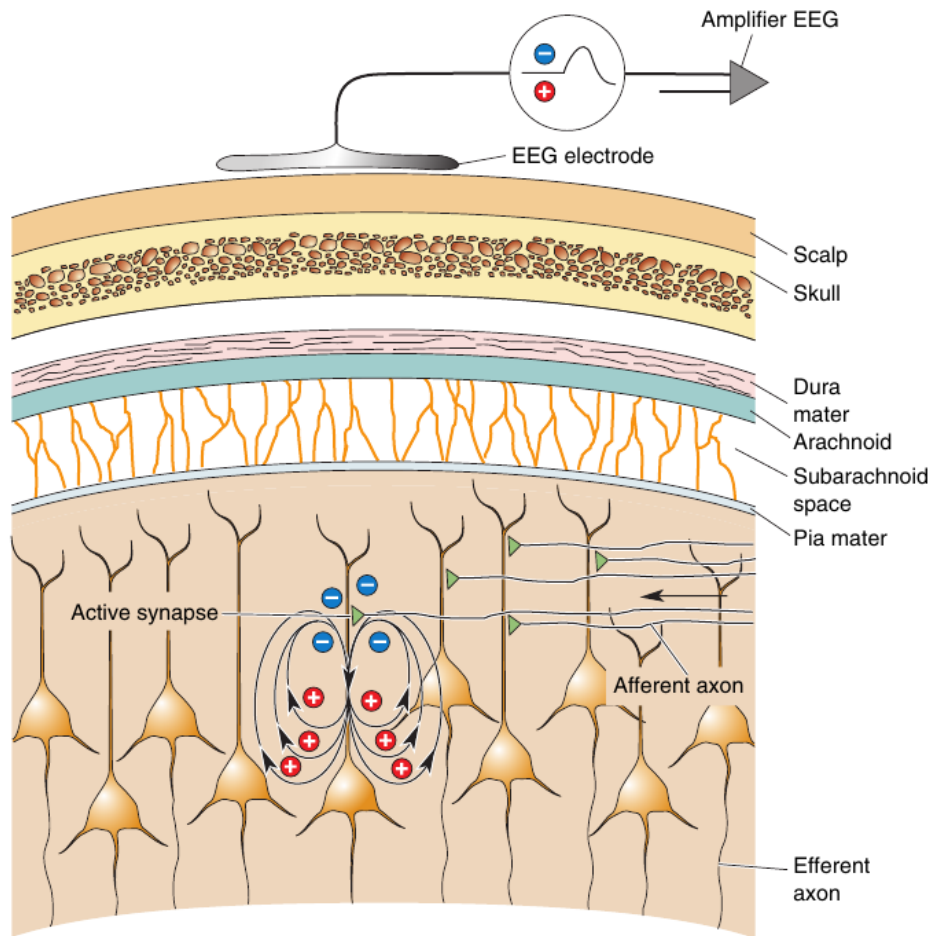
# Language and brain

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- EEG (Electro Encephalo Graphy)
- Measure electric activity in the brain



# Language and brain



**FIGURE 19.3**

**The generation of very small electrical fields by synaptic currents in pyramidal cells.** In this case, the synapse is on the upper part of the dendrite. When the afferent axon fires, the presynaptic terminal releases glutamate, which opens cation channels. Positive current flows into the dendrite, leaving a slight negativity in the extracellular fluid. Current spreads down the dendrite and escapes from its deeper parts, leaving the fluid slightly positive at those sites. The EEG electrode (referred to a second electrode some distance away) measures this pattern through thick tissue layers. Only if thousands of cells contribute their small voltage is the signal large enough to see the scalp surface. (Notice the EEG convention of plotting the signals with negativity upward.)

# Language and brain

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- EEG set up
  - Cap
  - Electrodes
  - Amplifier



# Language and the brain

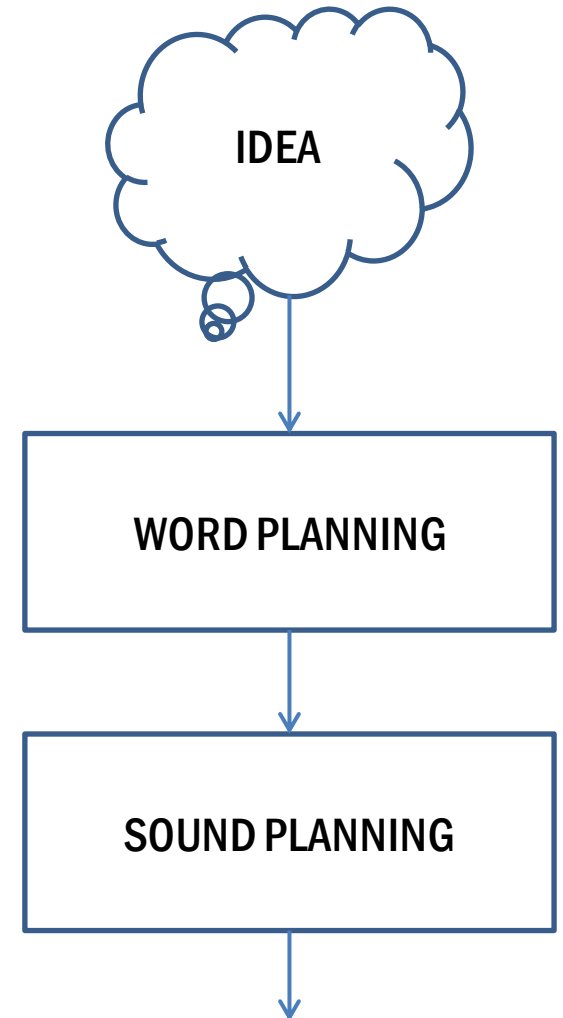
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- **Opposite of fMRI**
  - Good temporal resolution
  - Bad spatial temporal resolution
- **But, noisy and need lots of averaging**
- **Can be used to examine timing of cognitive processes**

# Language and brain

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- **When does word planning start?**
- **How to measure word planning?**
  - Semantic effect in **Picture-word interference**
  - Frequency effect in picture naming





# Language and Brain

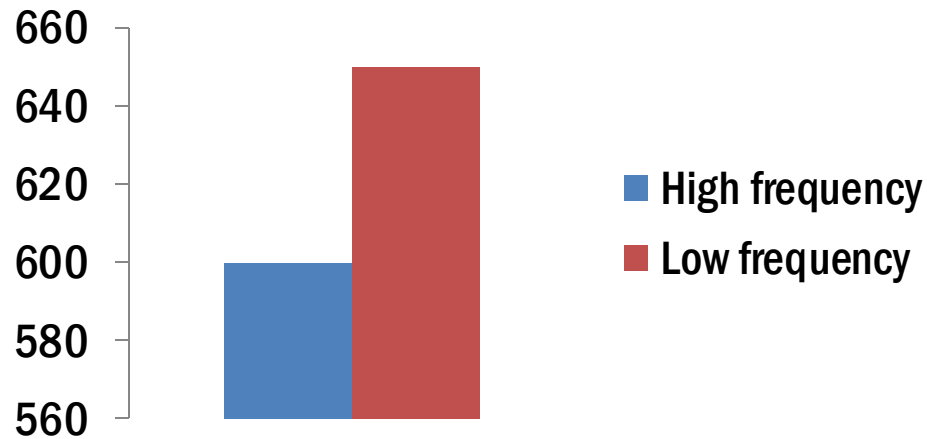
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- EEG and frequency effect (Strijkers et al., 2009)
- Word frequency
  - Number of times word appears in language
- Example:
  - "casa" frequency = 1000 = high frequency
  - "mofeta", frequency = 10 = low frequency

# Language and brain

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- Frequency effect



# Language and brain

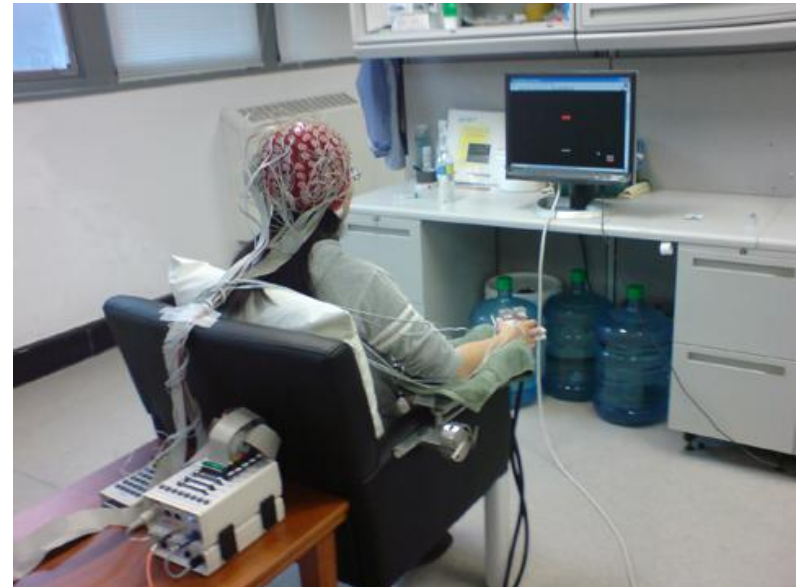
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- **Explanation of frequency effect**
  - During word planning
  - High frequency word have higher activation than low frequency word
  - Frequency effect measures word planning

# Language and brain

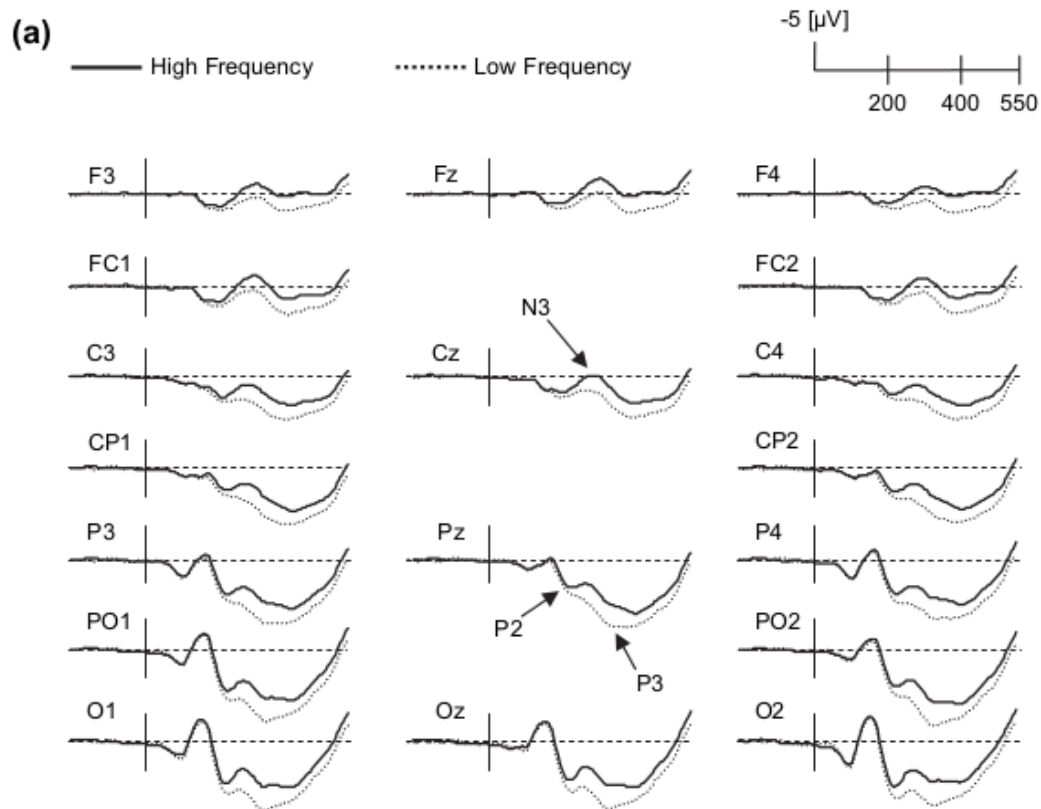
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- EEG and frequency (Strijkers et al., 2009)
- Name pictures with low and high frequency names



# Language and brain

- Results



# Language and the brain

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- **Low and high frequency waves diverge around 200 ms**
- **Word planning stage starts 200 ms (0.2s) after seeing picture**
- **Very fast!**