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Cognitive Processes
Language Processing

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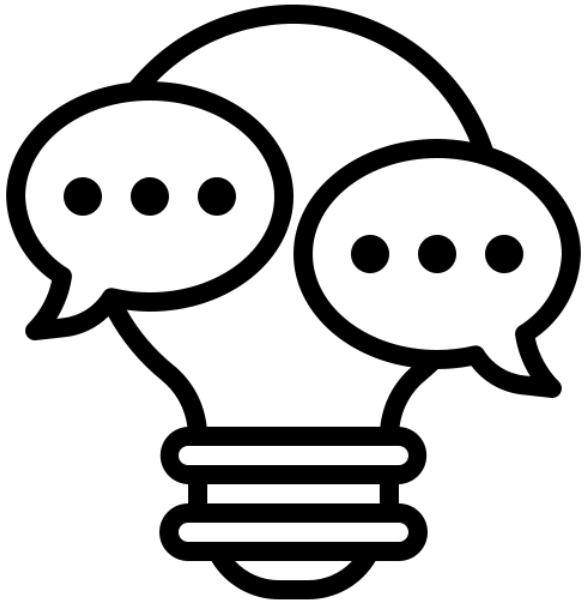


Introduction

Fundamentals of psycholoinguistics

- 4 fundamental questions:
  - How do we learn / acquire language
  - How do we process language in comprehension and production
  - How is language related to other cognitive abilities
  - How is language ability represented neurophysiologically

Language components

Phonology:
Sounds, phonemes, phonotactic rules, rythmic structure, intonation, ...

Lexicon and semantics:
Form and meaning of the words

Morphosyntax (grammar):
All mechanisms that can be used to express gramatical relationships: the order, grouping and hierarchy of words (syntax) and also all gramatical morphemes of a Language (both isolated particles and linked morhpology)

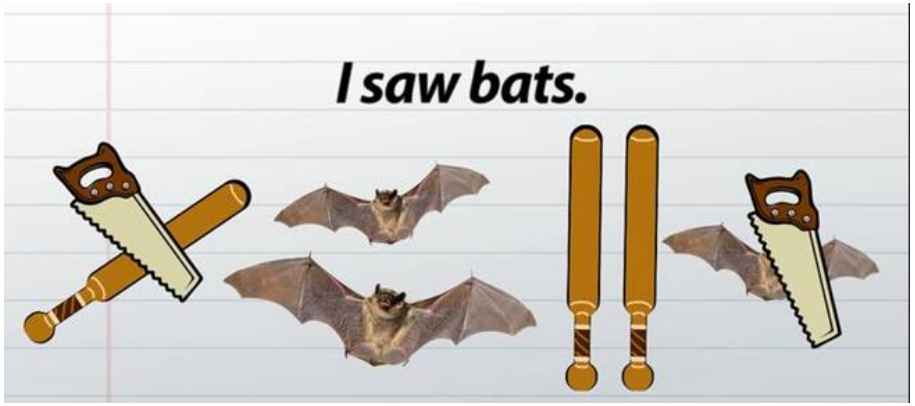
Language components

Pragmatics: language in its contexts of use. The use of language to express intentions and get things done 'in the world'.

(Discourse): Supraoracional unity that needs linguistic resources to build coherent and cohesive discourses (self-sustained); e.g., narratives.

Language components: Examples

- **Phonology**:
  - Phonemic processing mistake:
    - …check out her muscles….
    - …her mussels?
  - Segmentation mistakes:
    - I'll have a norange
    - Me costó tres mil leuros
    - Pugem amb "la sensor"?



- **Lexical ambiguity** (semantics)
  - "I saw bats"

Language components: examples

- **Syntactical ambiguity:**
  - Ambiguities:
    - I'm glad I'm a man, and so is Lola
    - Mentre l'Anna mirava el nen es va adormir
    - Mentre l'Anna passejava el nen es va adormir

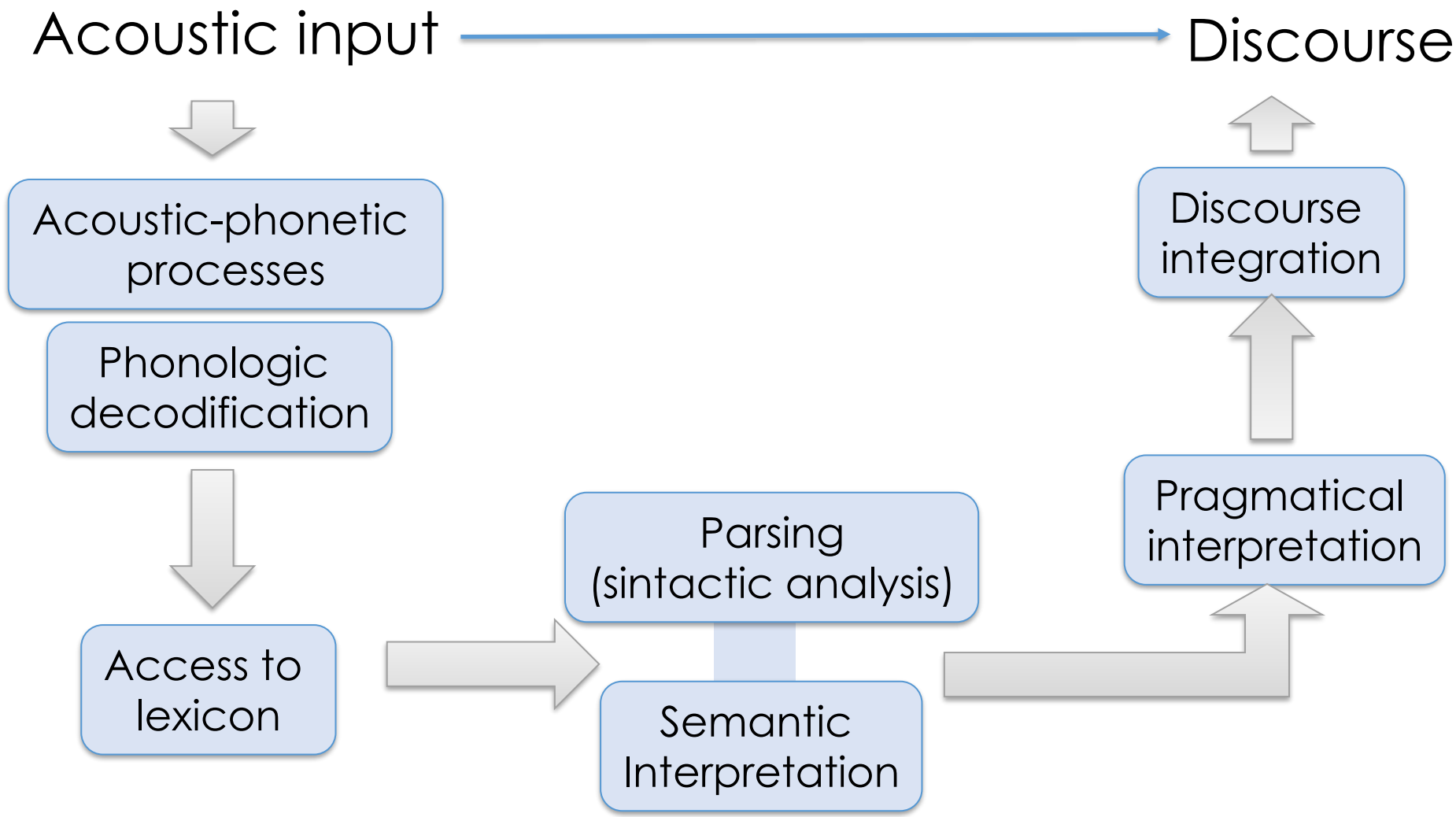
- **Pragmatics:**
  - Adult: "Is your mom home?"
    Kid: "Yes..." (silence)
    Adult: "... Aha… could you ask her to come over?"

2. Language Components (Examples)

DISCOURSE

We were good, we were gold
Kinda dream that can't be sold
We were right 'til we weren't
Built a home and watched it burn
Mm, I didn't wanna leave you
I didn't wanna lie
Started to cry but then remembered I
I can buy myself flowers
Write my name in the sand
Talk to myself for hours
Say things you don't understand
I can take myself dancing
And I can hold my own hand
Yeah, I can love me better than you can
Can love me better
I can love me better, baby
Can love me better
I can love me better, baby

Language Processing



2. Language Processing

- **Do we program (think) before saying?**

"¿Y después de venirte los chismes, tú no coges a Rubén y lo pones de vuelta y media y no dejas de hablarte con él nada más que por los chismes que puedan salir, tía?"

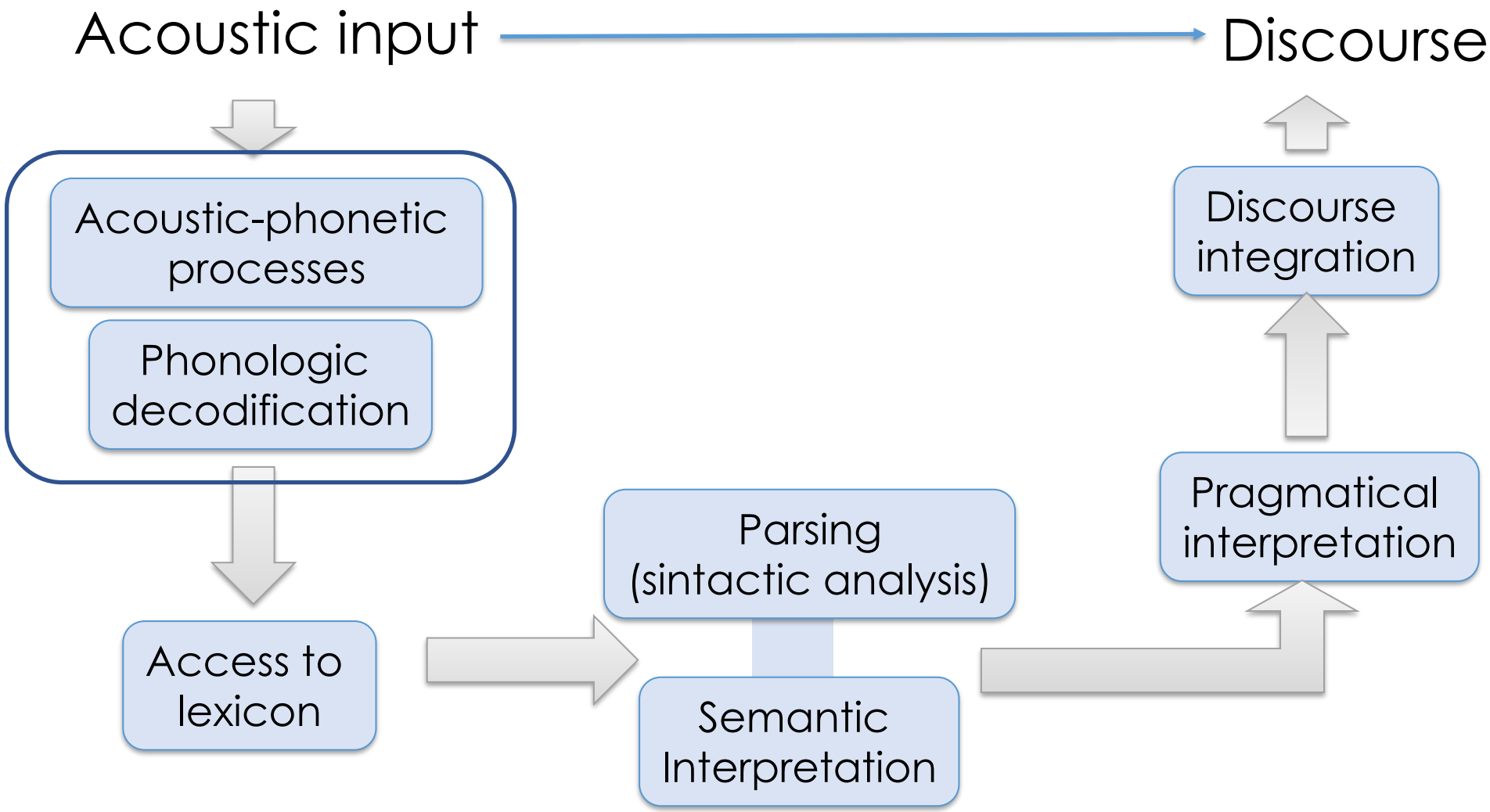
Group exercise

- Let's assume that you want to ask me to extend the delivery period of some follow-up activity
  - Explain how would you organize the information
  - Specify how many processes should be involved on this interaction

Speech perception

1.Prelexical processing

Language Processing



Speech perception

- Stages in speech perception
- The speech signal:
  - The phoneme as a unit
  - Characteristics of speech:
    - Variability (absence of invariance)
    - Linearity (segmentation problem)
- Low-level perceptual aspects: categorization
- Prelexical perceptual aspects: segmentation

Stages in speech perception

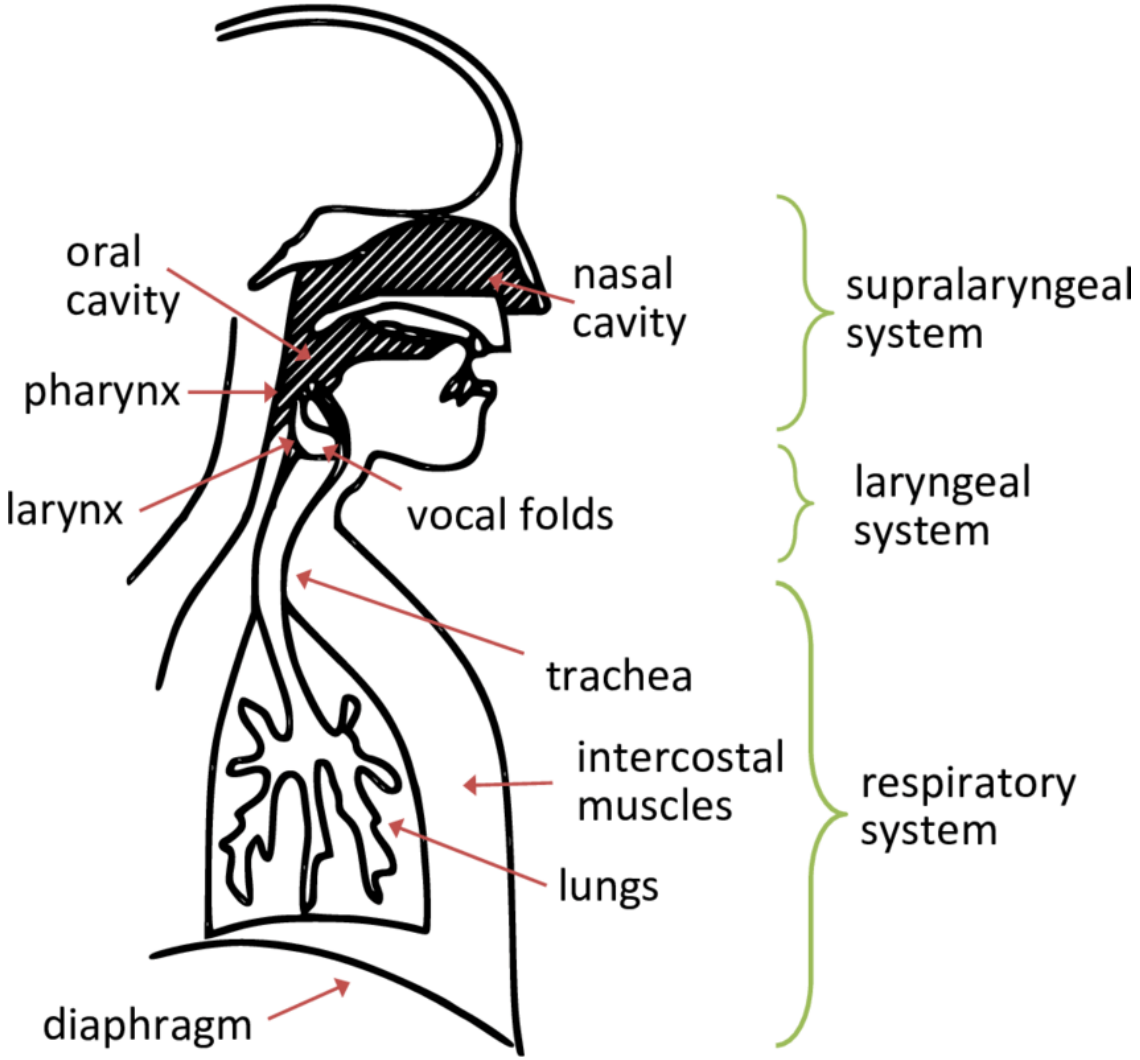
- Auditory stage- analysis of physical input. Provides the acoustic features of the signal
- Phonetic stage- first linguistic analysis. It identifies the distinctive features of speech, based on the signs obtained in the acoustic phase
- Phonological stage- evaluation of the distinctive features by means of the phonological rules of each language
- Lexical-syntactic-semàntic stage: higher levels of language processing

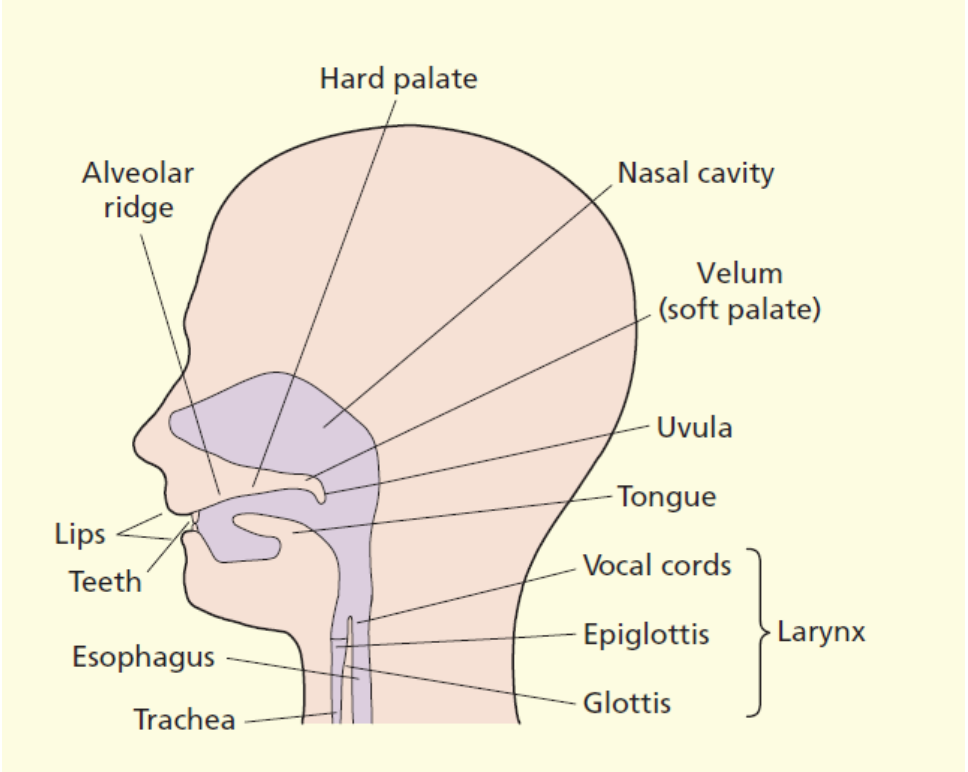
The speech signal

Phoneme as a unit

- Definitions:
  - Minimum sound unit that allows meaning distinction (phoneme vs. allophone)
  - Set of distinctive features that occur simultaneously
- Descriptions:
  - Based on articulation
  - Based on distinctive features

The speech signal





El senyal de la parla

- Based on articulation

International Phonetic Alphabet (IPA) ˌɪntəˈnæʃn·l fəˈnɛtɪk ˈælfəˌbɛt

Consonants (pulmonic)

	Bilabial	Labio-dental	Dental	Alveolar	Post-alveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k g	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	ɴ		
Trill	ʙ			r					ʀ		
Tap or flap		ⱱ		ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant		ʋ		ɹ		ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	ʟ			

The speech signal: Distinctive features

/t/

- Consonant
- Oral
- Plosive
- Dental / alveolar
- **Unvoiced**

/d/

- Consonant
- Oral
- Plosive
- Dental / alveolar
- **Voiced**

Speech characteristics

Variability (absence of invariance)

- Sources of variation:
  - **Individual**: anatomical characteristics of subglotic cavities, larynx and vocal tract (age, sex, psychological state...)
  - **Related to the process of speech production:** speed of locution, tone (*voice quality*), phonation mde and articulatory habits
  - **Contextual factors**: the immediate phonetic environment, the accentuation, the position of a sound in the syllable, the word and the statement
  - **Factors sociolingüístics i culturals**

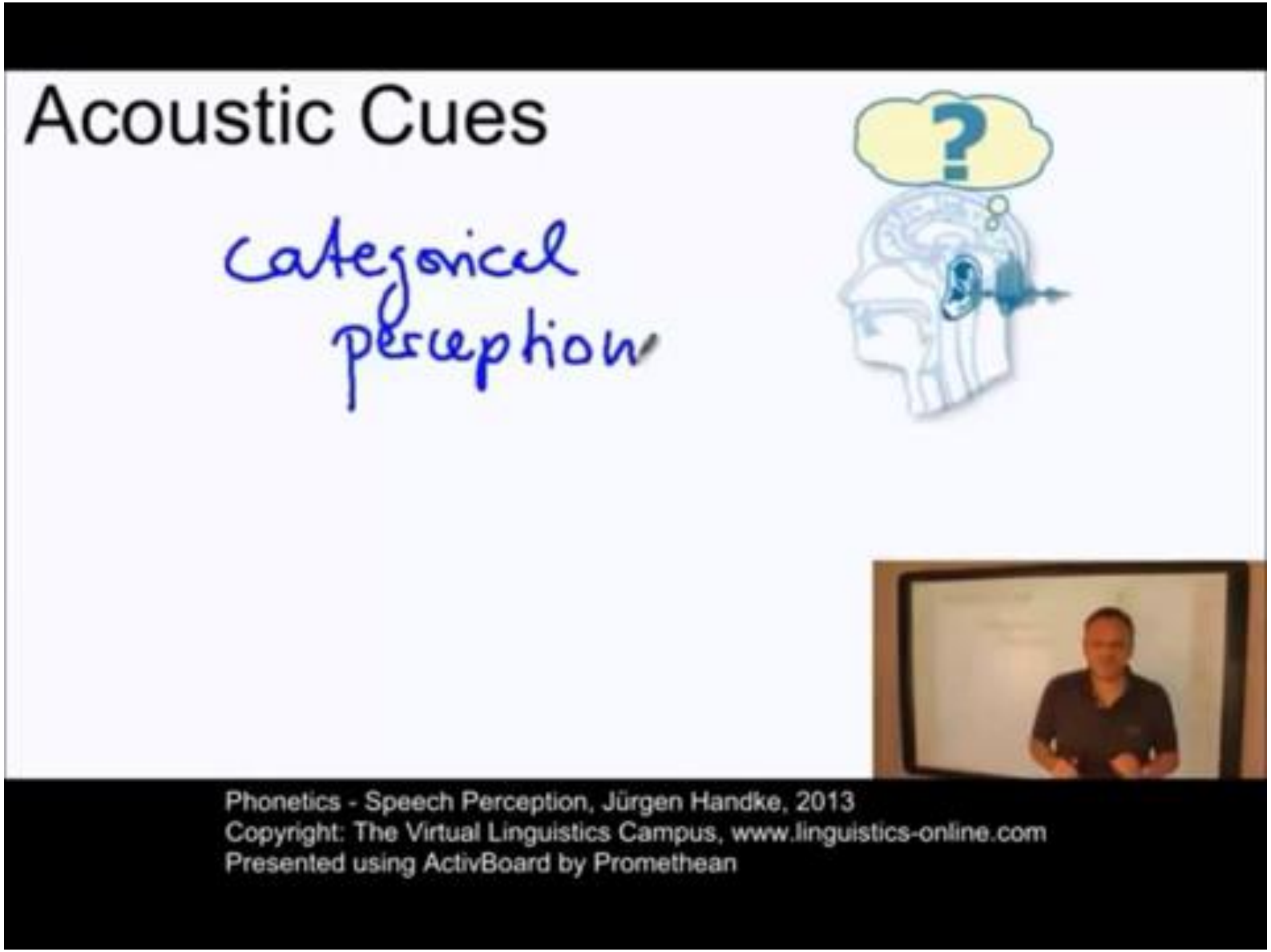
Low-level perceptual aspects: categorization

How to solve variability (phonetic stage)

- We don't perceive phonemes individually, but as falling into categories

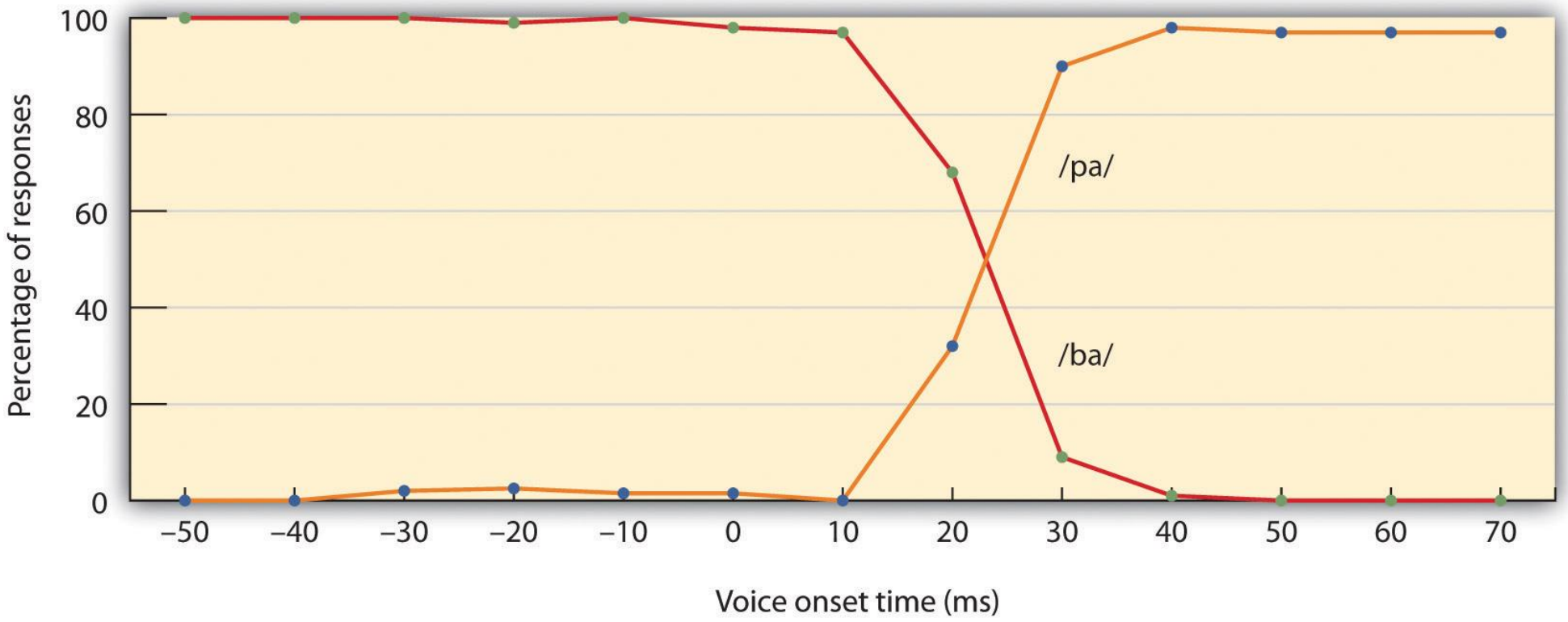
  Example: Voiced and unvoiced consonants.

  - The voice of a consonant is not perceived as continuous.
  - However... it depends of a continuous variable: VOT (*Voice Onset Time*).



Low-level perceptual aspects: categorization

- Wood (1976)- Discriminability, response bias, and phoneme categories in discrimination of voice onset time. Journal of the Acoustical Society of America, 60(6), 1381–1389.



13 Estímuls ba pa

Speech characteristics

- Linearity: Segmentation problem

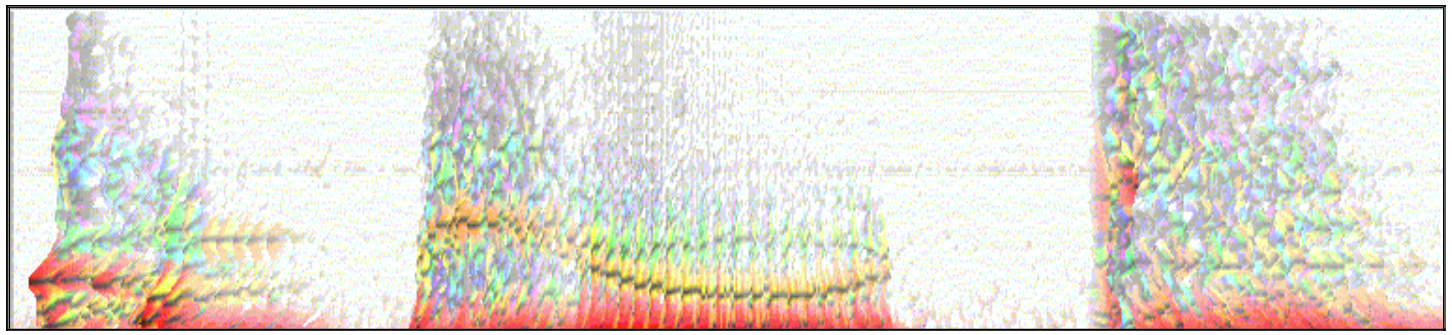
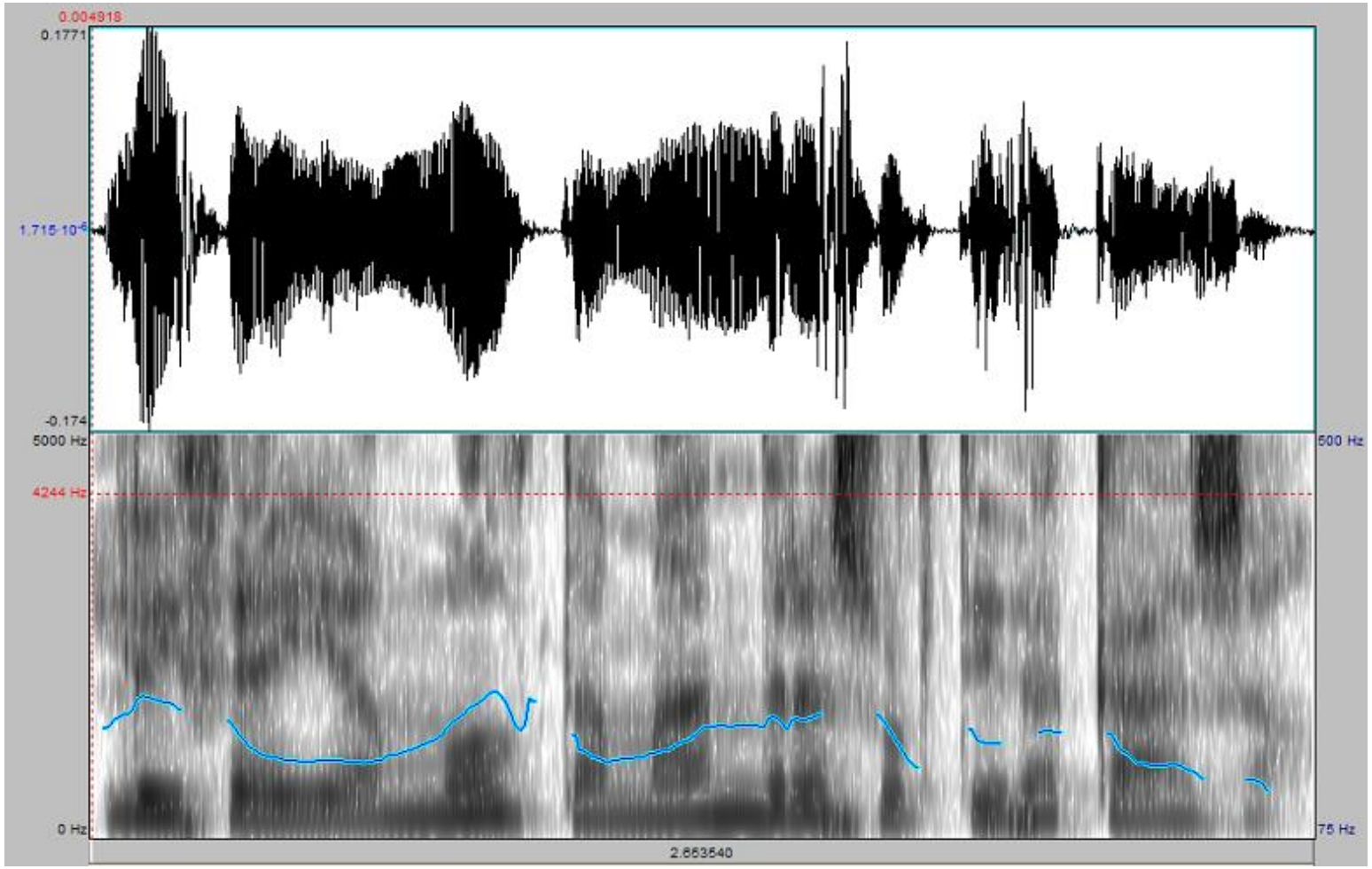


Gráfico 1. Espectrograma de la palabra “compute” (en Inglés)

- 10 phonemes per second (coarticulation)

Linearity

- Li feia molta mandra sortir de casa



Resolution of segmentation

- Spanish is Flamenco / El inglés es Rock'n'roll

Prelexical perceptual aspects: segmentation

- How to solve the problem of linearity (phonological stage)

  Which indicators are used in syllabic languages?

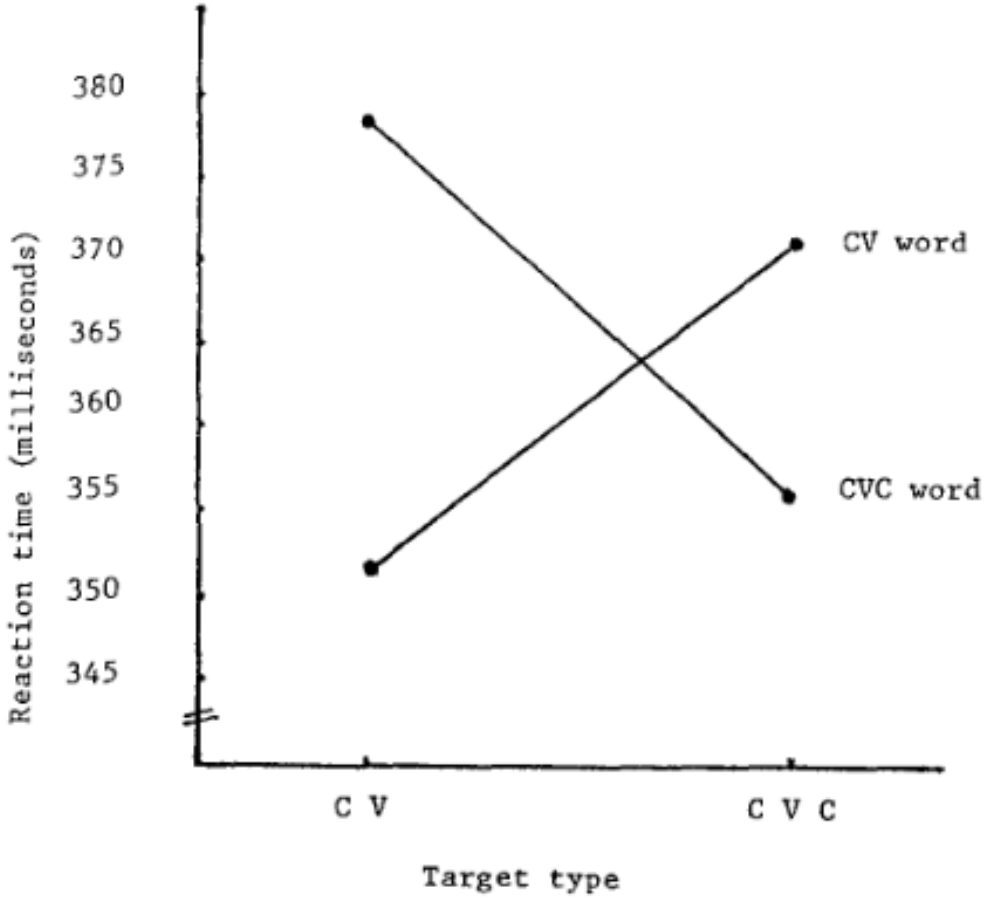
  - MEHLER, DOMMERGUES, FRAUENFELDER, SEGUÍ (1981)
    - Look for segments : PA CV — PAL CVC
    - In words such as: PALAIS CV — PALMIER CVC

Prelexical processes: Segmentation

- French speakers (syllabic language) with French words

TABLE 1
DESCRIPTION OF EXPERIMENTAL SEQUENCES AND TARGETS

Number of experimental sequence	The position of the stimulus words in the experimental sequences				Target for subjects in Group 1	Target for subjects in Group 2
	1	2	3	4		
Block A						
6	MORCEAU	*BALANCE*			BAL	BA
8	JEUDI	MUSEE	*CAROTTE*		CA	CAR
17	FICHIER	*BALLON*			BA	BAL
25	SERVICE	CHEVEUX	*CARTON*		CAR	CA
Block B						
19	MONSIEUR	*BALANCE*			BA	BAL
33	EPOQUE	MAISON	*CAROTTE*		CAR	CA
40	PROBLEME	CHEVAL	*CARTON*		CA	CAR
42	JOURNEE	*BALCON*			BAL	BA



Mehler, Dommergues, Frauenfelder, Seguí (1981)

Prelexical processes: Segmentation

- Resolution of segmentation (estadi fonològic)

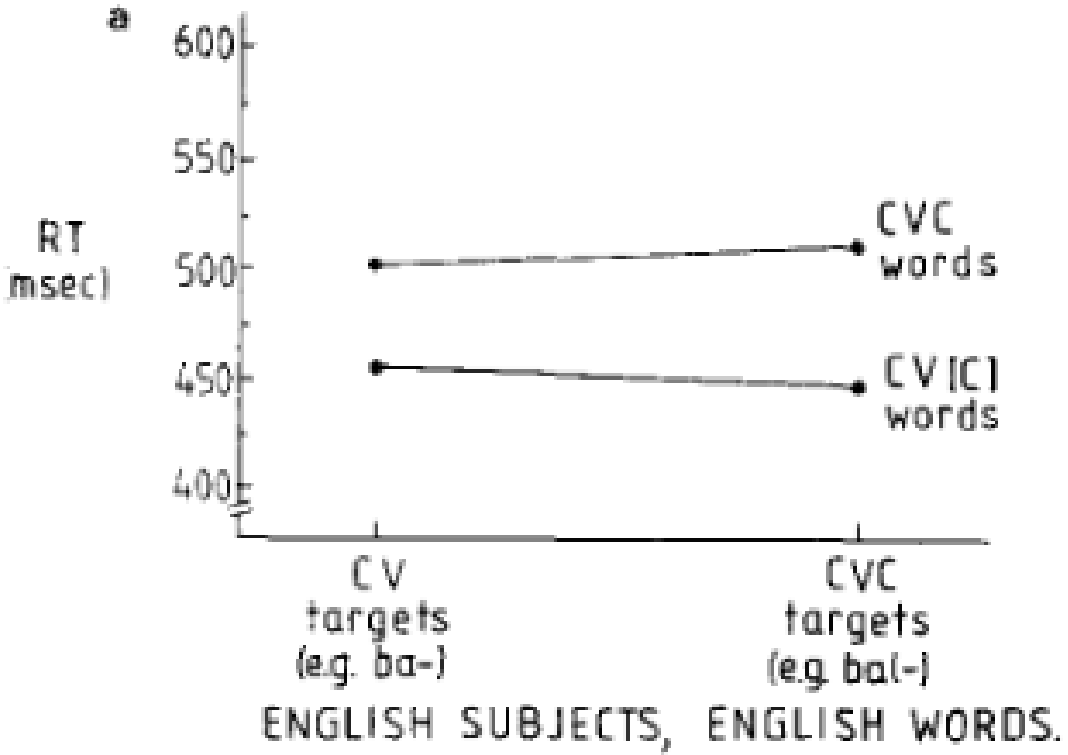
  what indicators are used in NON-syllabic languages?

  - CUTLER, MEHLER, NORRIS Y SEGUÍ (1986)
    - Look for segments : BA BAL
      - CV CVC
    - En paraules de tipus : BALANCE BALCONY
      - CV CVC

Prelexical processes: Segmentation

- English speakers (non-syllabi

pairs were: *balance–balcony*, *calorie–calculate*, *galaxy–galvanize*, *malady–malcontent*, *palace–palpitate*, *salad–salvage*, *talon–talcum*.

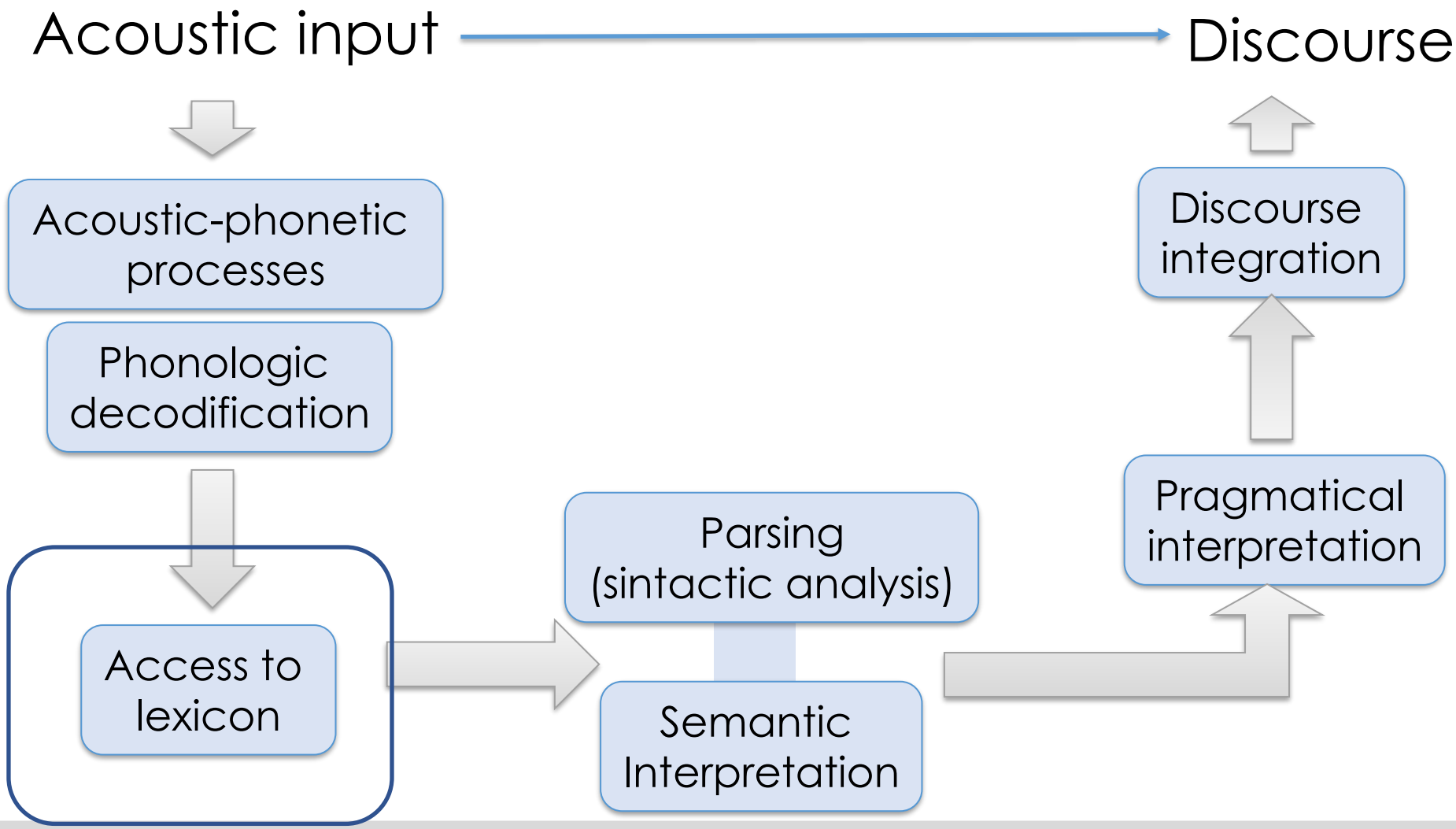


Cutler, Mehler, Norris, Seguí, 1986

Speech perception

2.Word Recognition

Language Processing



Word recognition (Guide)

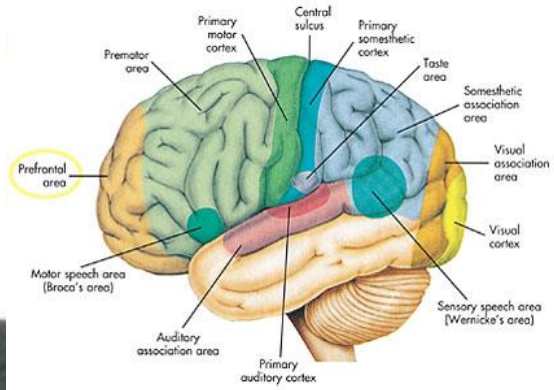
- The mental lexicon
- Information represented in the lexicon
- Lexicon designs:
  - Lexical representations
  - Access to representations
- How are words organized?
  - Experimental study – lexical decision task
  - Important variables for recognition

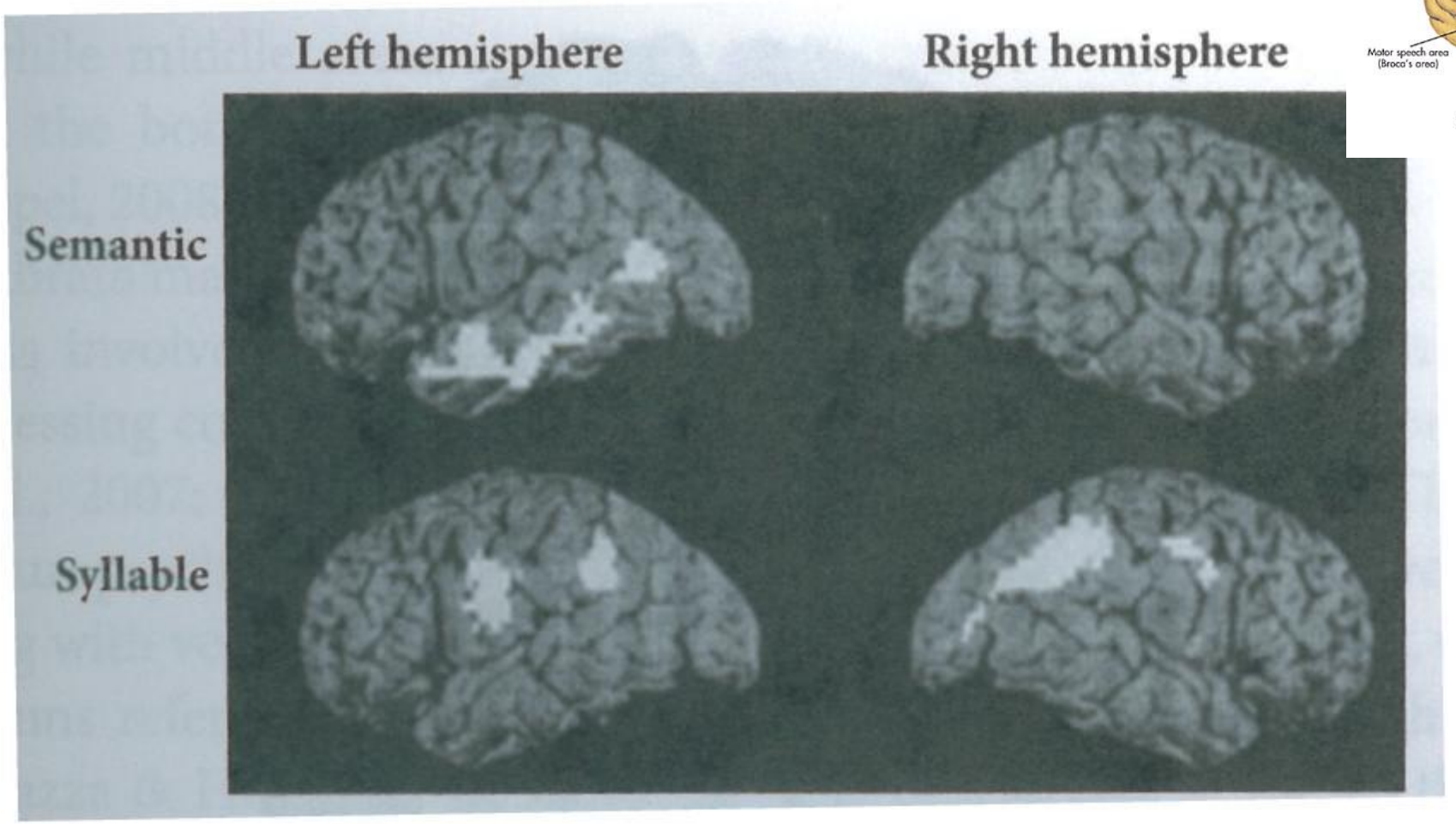
The mental lexicon

- Mental lexicon is:
  1. The repository of all our knowledge regarding words.
  2. The set of mental representations about words.
- Information associated to each word:

Information about the FORM of the words:	Information about the CONTENT of the words:
•phonological •orthographic •...	•morphological •syntactical •semantical

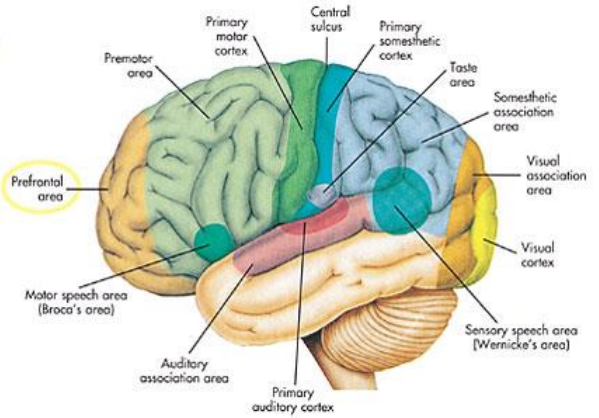
The mental lexicon

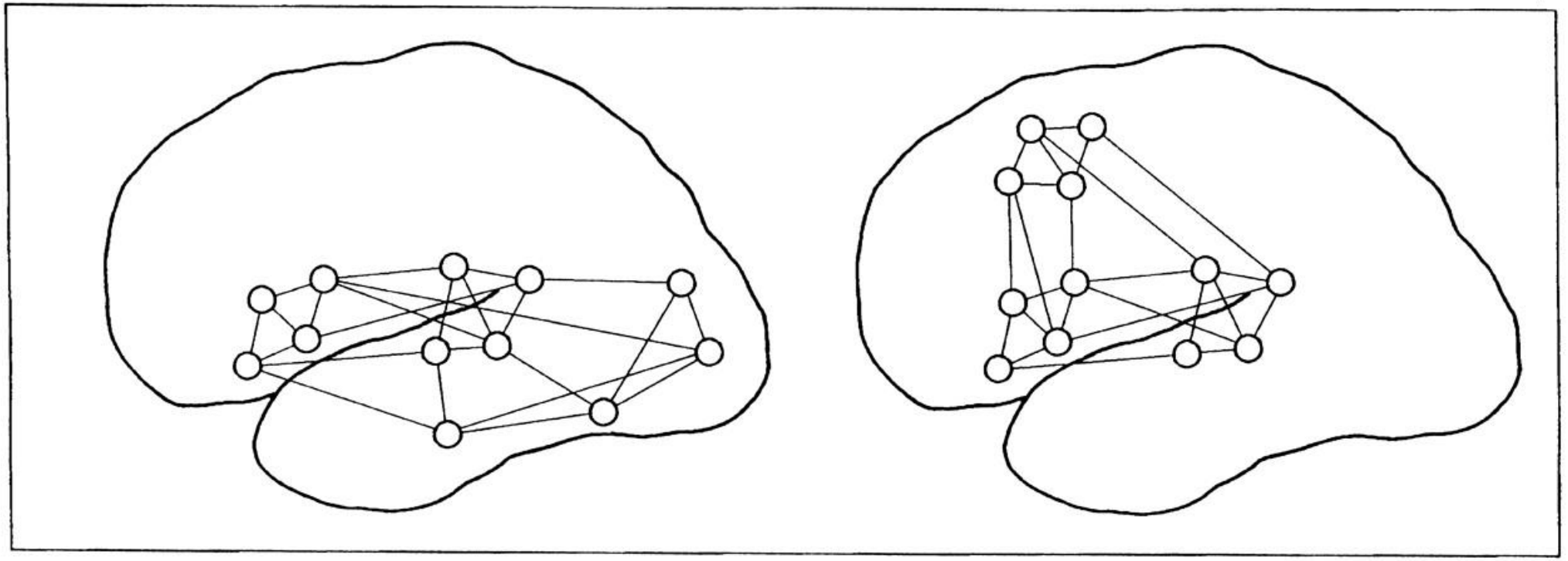




PET Scan (Positron Emission Tomography) where different areas are activated in the brain on a task where participants had to judge the similarity between words (top images) or syllabic similarity (bottom images)

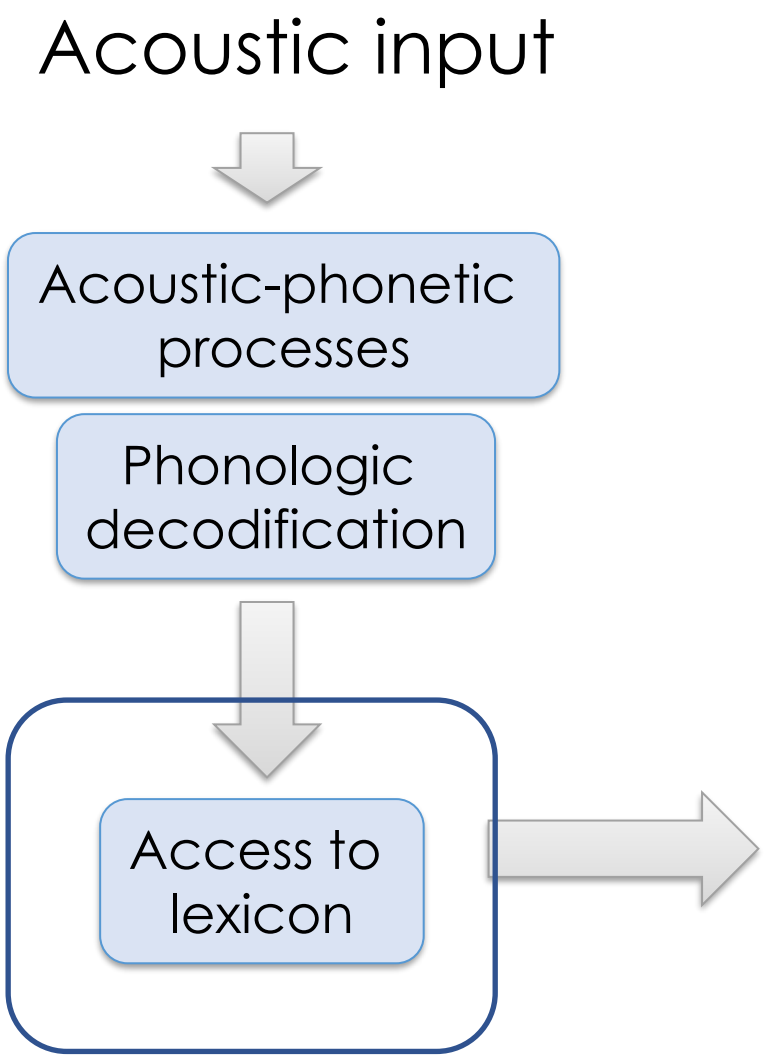
Sketch of possible cortical representations of nouns eliciting visual associations and verbs leading to association of body movements.





Pulvermüller F et al. Cereb. Cortex 1999;9:497-506

Cerebral CORTEX



How is our lexicon organized and how can we access to associated information

Stages in word recognition

1. **Initial contact**: Sensory input reaches the lexicon we compare it with the stored entries
2. **Activation**: Entries that best fit the input become more accessible for the output representation
3. **Lexical selection**: Selection of the stored entry that best suits the representation-stimulus. It involves the inhibition of inappropriate words
4. **Word recognition**: The selection is completed and we only leave one candidate to be the word stimulus

How are words organized?

Experimental study – lexical decision task

Lexical decision task

The participants has to decide wether a letter-chain conforms a word or not

Measures: Response time and mistakes

Lexical decision task

ABRIL

Lexical decision task

ARBIL

How are words organized?

The manipulation of the stimulus words (independent variables) allow to study how the properties of words intervene in the access to the lexicon, allowing therefore to hypothesize about how the mental lexicon is organized

Variables associated with lexical access

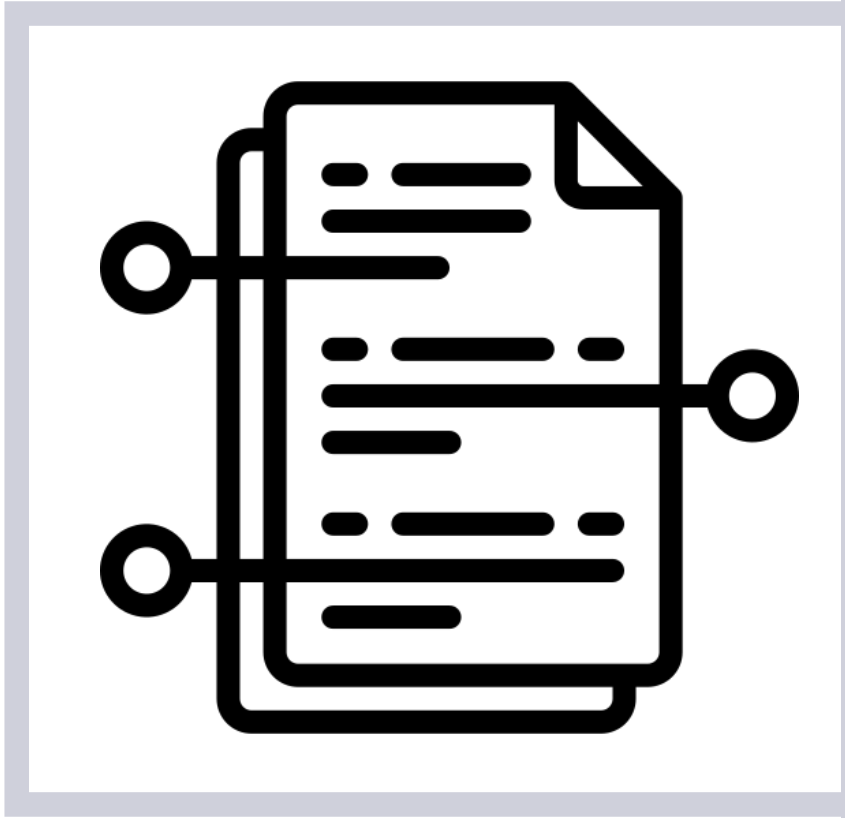
- Frequency-related variables
  - Frequency
  - Familiarity
  - Age of acquisition
  - Cumulative frequency

Variables associated with lexical access

- Meaning-related variables
  - Imaginability
  - Semantical priming

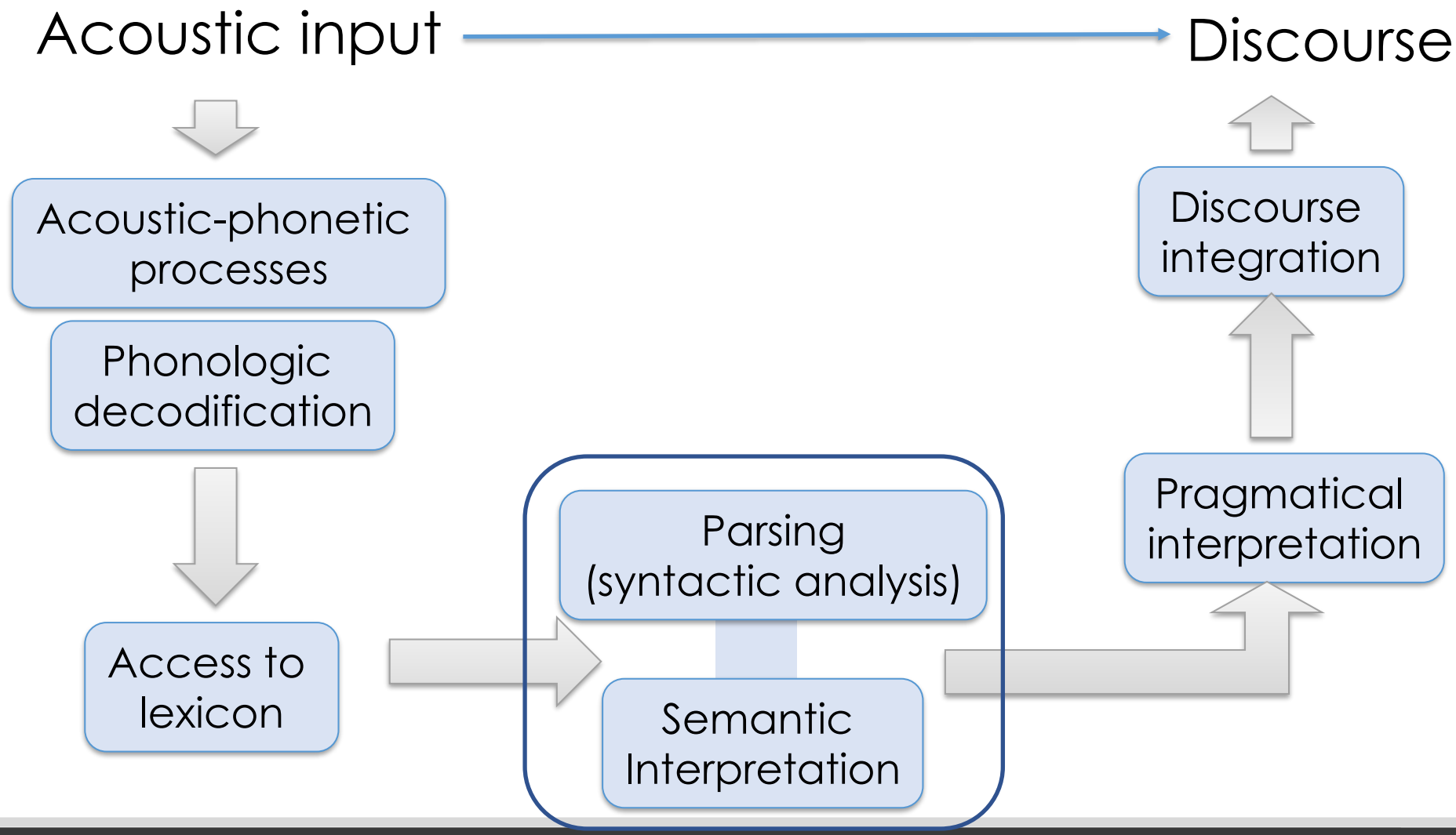
Variables associated with lexical access

- Form-related variables
  - Length
  - Neighbourhood



Parsing and Pragmatics

Language Processing



Syntax processing

- Syntax processing
  - What is syntax?
- Syntax processor
  - Syntax processor tasks
  - Syntactical ambiguity
  - Garden-path model

What is syntax?

Definitions:

• Language: discrete combinatorial system that makes use of the lexicon and a combination code.

• Grammar: formalism that uses a finite number of rules that, in combination, allow to generate all sentences of a language

What is syntax?

UNDERSTANDING

Discourse mental model

↑

PROPOSITIONAL content

Proposition: conceptual unit that expresses the semantic information contained in a linguistic statement

↑

PARSING

↑

(word recognition)

Sentence

Syntax processor

- **Basic analytical strategies**

a) Segmentation in structural units
b) Allocation of syntactic roles
c) Establishment of structural dependencies:
    Phrase marker
d) Syntactical-semantical coupling
e) Propositional construction of the sentence

Syntax processor

Basic analytical strategies

- The kid was eating beans.
- The thief hit the policeman with a hammer.

a) Segmentation in structural units

- **[<The kid> <<was eating> < beans>>]**
- **[<The thief> <<hit> <the policeman> <with a hammer>>]**

Syntax processor

Basic analytical strategies

b) Allocation of syntactic roles

1) [< The kid (NP)> <<was eating(V)> <beans(NP)>(VP)>(S)]

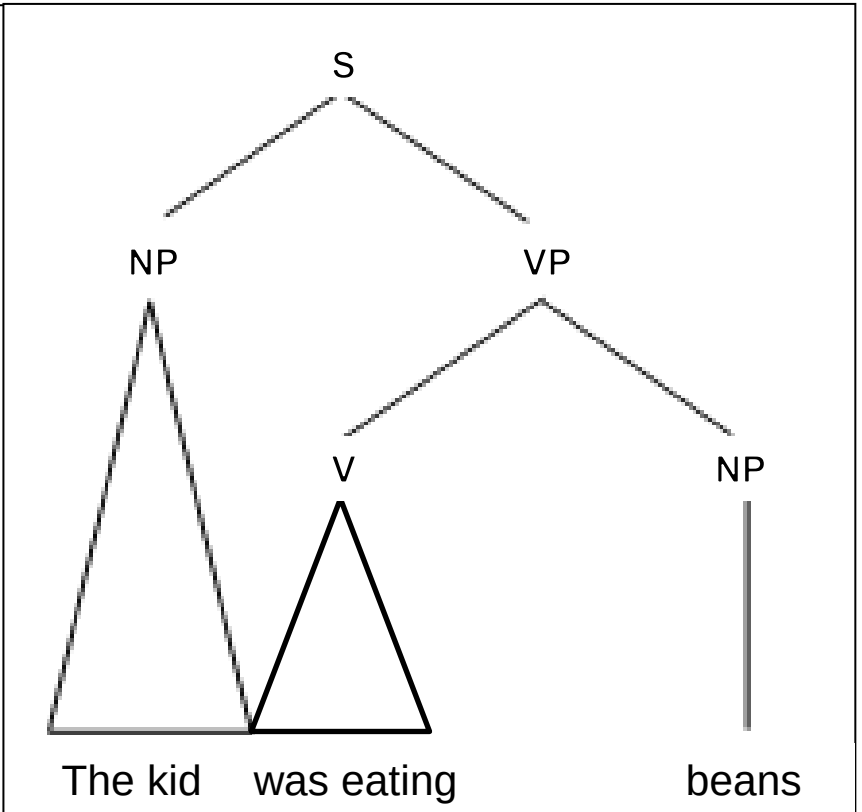
2) [< The thief (SN)> << hit (V)> <the policeman(SN)> <with a hammer (SP)>(SV)>(O)]

Syntax processor

Basic analytical strategies

c) Establishment of structural dependencies

Phrase marker



Syntax processor

Basic analytical strategies

d) Syntactical-semantical coupling

- **[< The kid (agent)> <<was eating> <beans (theme)>>]**

- **[< The thief (agent)> <<hit> < the policeman(patient)> <with a hammer (instrument)>(theme)>>]**

e) Propositional construction of the sentence

Syntax processor

- **Basic analytical strategies**

a) Segmentation in structural units
b) Allocation of syntactic roles
c) Establishment of structural dependencies:
    Phrase marker
d) Syntactical-semantical coupling
e) Propositional construction of the sentence

Syntactical ambiguity

- Sentences with **permanent ambiguity**

I saw the man with the binoculars.

El policía entrevistó a la hija del coronel que tuvo un accidente.

La Sílvia creia que l'Alba obeïa les normes contra la seva voluntat.

Syntactical ambiguity

- Sentences with **local ambiguity** or **garden-path sentences**

El amigo que bebía vino cansado.

La Marta arreglarà el cotxe que es va comprar demà.

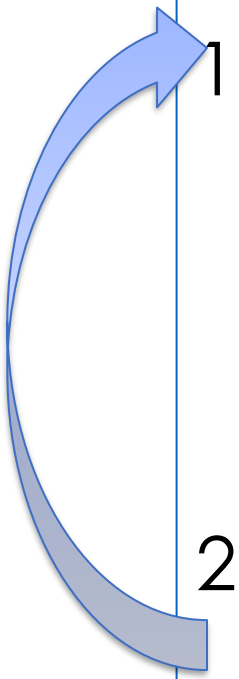
The horse raced past the barn fell.

Garden-path model

Lyn Frazier et al. (1986, 1987, 1990)

Two stages in parsing:

1. Modular syntax processor
   - Receives information on lexical categories
   - General (universal) principles of analysis:
     - Minimal attachment
     - Late closure
2. Thematic analyzer
   - Receives information on meaning, plausibility, frequency, etc.



Garden-path model

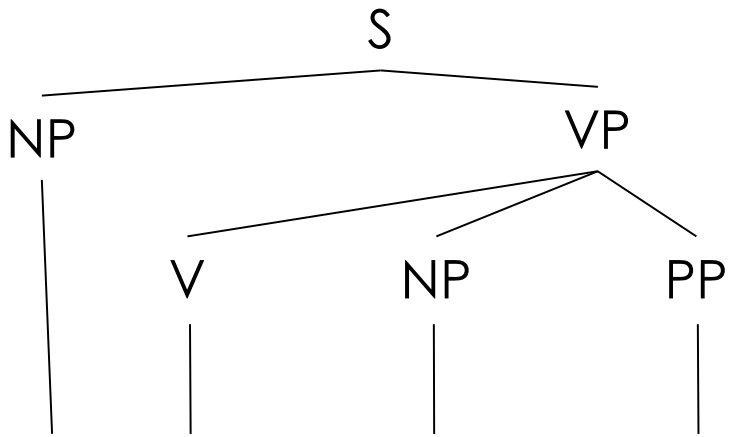
General principles of analysis:

- **Minimal attachment**: the syntactic representation of the sentence is organized in the easiest possible way

- **Late closure**: the new material is attached to the phrases or clauses that are being processed

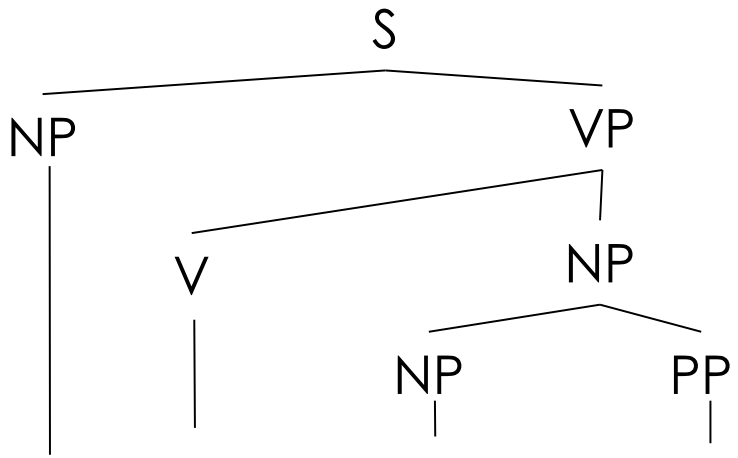
Garden-path model

Parsing strategies



The tourist saw the woman with the binoculars

MINIMAL ATTACHMENT

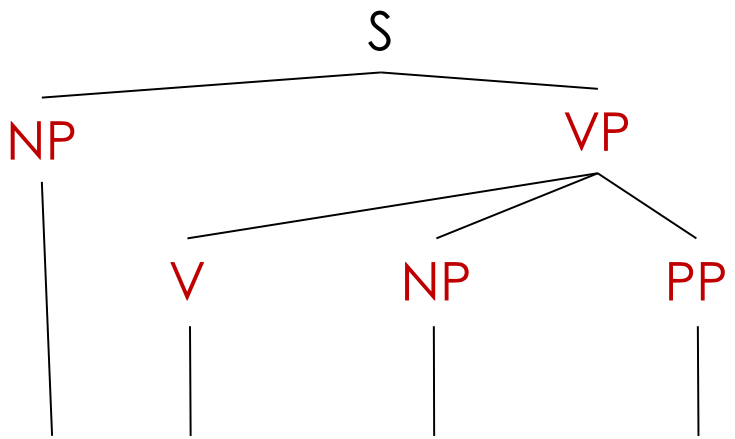


The tourist saw the woman with the binoculars

LATE CLOSURE

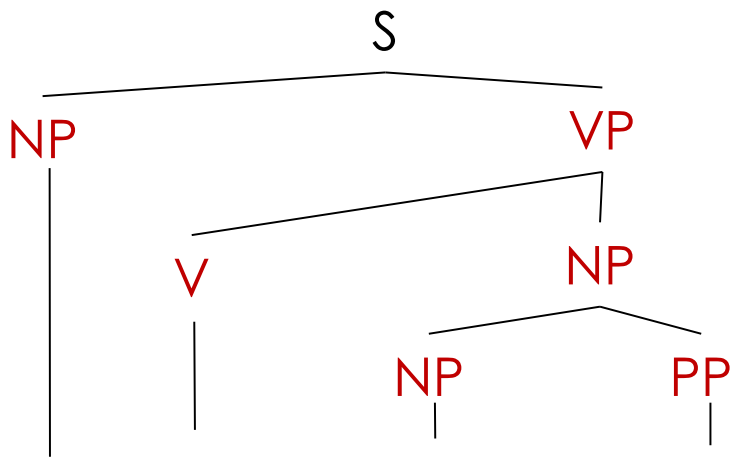
Garden-path model

Parsing strategies



The tourist saw the woman with the binoculars

5 NODES

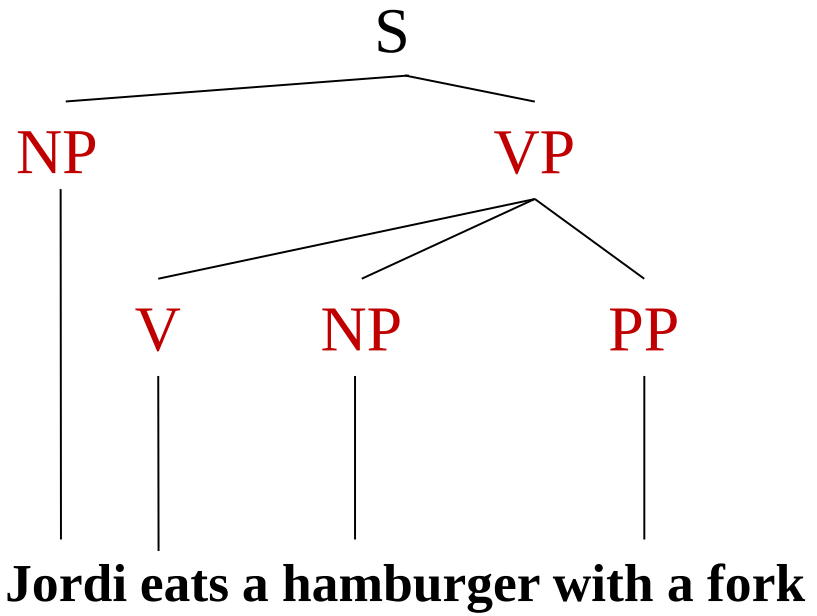


The tourist saw the woman with the binoculars

6 NODES

Garden-path model

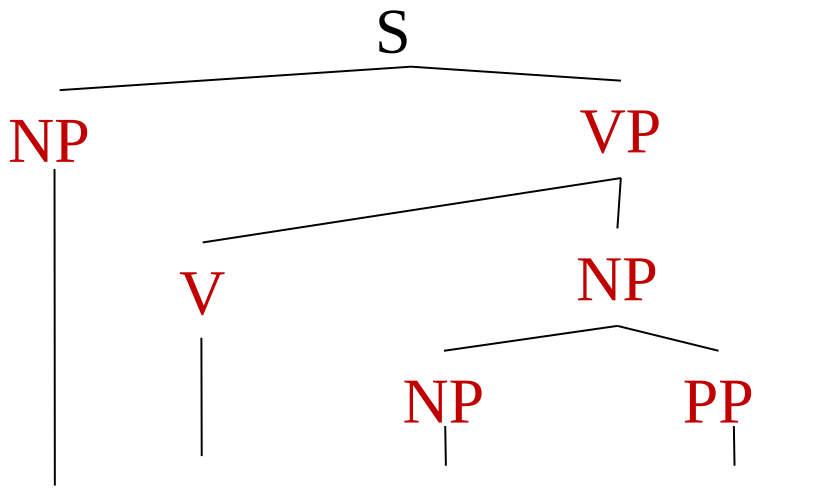
Semantic induction to MINIMAL ATTACHMENT



MINIMAL ATTACHMENT

Garden-path model

Semantic induction to LATE CLOSURE

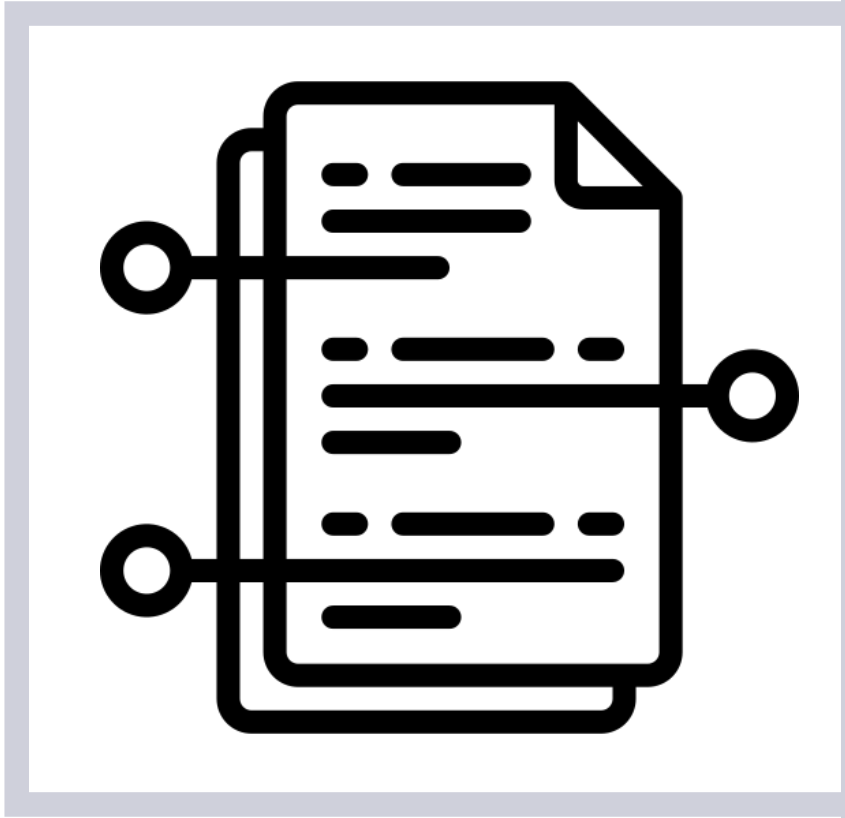


LATE CLOSURE

Universally preferred strategy

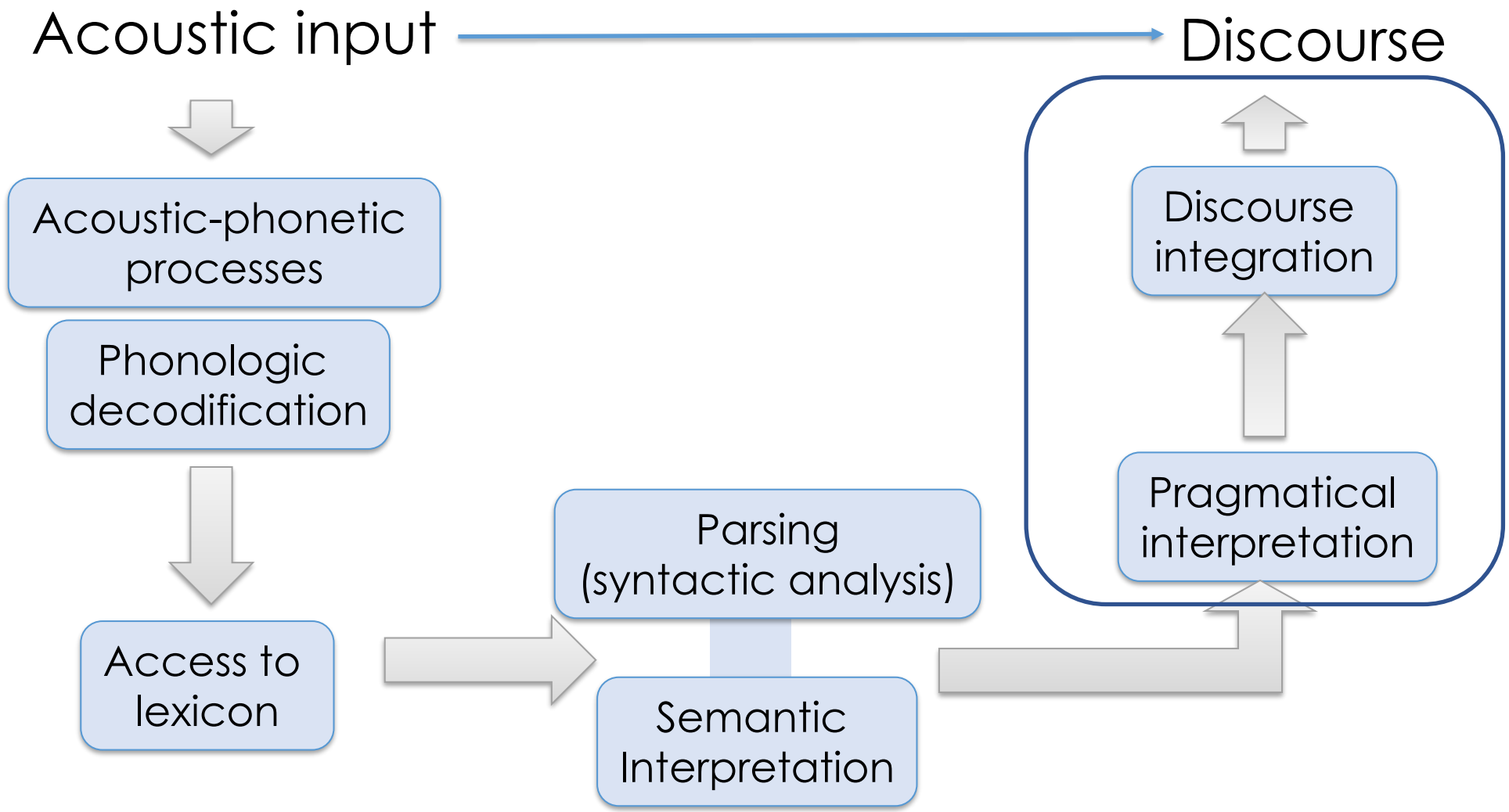
- Double antecedent sentences:
  - Minimal Attachment
  - Is the alternative that generates the simpler parsing (less nodes)
    - "The tourist saw the woman with the binoculars"

- Double antecedent sentences **with a relative clause**:
  - Late Closure
  - Both alternatives generate the same number of nodes
    - "The journalist interviewed the daughter of the colonel **who had the accident**"



Parsing and Pragmatics

Language Processing



Pragmatics

"Making a sporting analogy, one could say that phonology, lexicon, semantics and syntax are technical resources that we need to master to communicate properly. However, pragmatics is a tactical skill that allows us to read how, when and with whom we are communicating"

Aparici & Ramis (2018)

Material components

- Sender
- Receiver
- Message
- **Context (space-time situation)**

Relational components

- Pragmatic information
  - General
  - Situational
  - Contextual
    - *Hypotheses about each other's information*
- Intention
- Social relationship

Communicative interaction

The speaker (sender)

- Sends statements according to
  - Principles of cooperation
  - Theory of relevance
- SPEECH ACTS
  - Locutionary
  - Illocutionary
  - Perlocutionary

1. Principles of cooperation in conversation (Grice, 1975)

Sender and receiver actively cooperate between them

Make your contribution to the conversation (or verbal interaction) conform to what is requested (what is required), at the time it is requested, in accordance with the purpose or direction of the exchange in which you take part

- *Quantity:*
  - Make your contribution to the conversation as informative as necessary.
  - Do not make your contribution more informative than you need to.
- *Quality*:
  - Make your contribution true. Don't say anything you think is false or acknowledge your doubts if you have one
- *Relatedness*:
  - Make your contribution relevant (talk about things that are related to what's said)
- *Form*:
  - Be clear, avoid obscurity in expression, ambiguities, be brief and organized

2. Teoria de la rellevància (Sperber & Wilson, 1986)

La rellevància: selecció dels enunciats més informatius, més eficaços, i més ràpids de processar

- informació que aporta el missatge
- context cognitiu previ dels interlocutors

És rellevant la informació...:

- ...nova
- ...que es pugui relacionar amb coneixements previs

L'acte comunicatiu altera el context cognitiu mutu del comunicador i de l'audiència

Communicative interaction

- **Cooperation in conversation**
  - ***Quantity***: Make your contribution to the conversation as informative as necessary; but not more informative than you need to.
  - ***Quality***: Make your contribution true. Don't say anything you think is false or acknowledge your doubts if you have one
  - ***Relatedness***: Make your contribution relevant (talk about things that are related to what's said)
  - ***Form***: Be clear, avoid obscurity in expression, ambiguities, be brief and organized
- **Relevance theory**
  - Selection of the information most useful, most effective, and faster to process
  - Depends on the previous cognitive context message of the interlocutors
  - Relevant information:
    - New...
    - …that can be related to previous knowledge
  - The communicative act alters the mutual cognitive context of the communicator and the audience

Speech acts

*"How to do things with words" (*Austin 1955/1962)

- *Locutionary act*
  - It has meaning and consists of what is said. It's the diction of a text.
- *Illocutionary act*
  - It consists of the intention of the speaker or what he intends.
- *Perlocutionary act*
  - It consists of the effect achieved on the listener by the speaker.

Felicity conditions

Illocutionary acts

1. *Representatives* (or assertives): the speaker says how things are, describes stats or events.
2. *Directives*: the speaker tries to make the receiver do something.
3. *Comissives* (or of commitment): the speaker commits to a future action.
4. *Expressives*: speaker shares an inner state.
5. *Declarations* (or performatives): the speaker makes changes by using his or her words.

→ Direct acts/indirect acts

Activity 1.
Classify this illocutionary acts

1. To attend the party you must dress formally
2. Have a good day!
3. Bathing is not allowed.
4. We do not serve at tables.
5. We find the accused guilty of the charges.
6. I'll wait for you outside.
7. I bet a dinner on it.
8. I will be looking forward to attend the party.
9. Homemade cake is served today.
10. I love plants.

Discourse representations

Propositional representation

- Network of propositions. Semantic interpretation
  Once the section is understood, it is included on the propositional representation.

  Example:

  Peter enter the house.

  He had a dirty paint shirt.

Activation of schemas

The seaside is better than a street. At first it is better to run than to walk. Maybe you have to try it more than once. It demands a lot of skill, but it is easy to learn from it. Even children can enjoy it. If successful, complications are minimal. Birds rarely come close. But with the rain it will get wet quickly. If there are a lot of people who do the same, we can get into trouble. Everyone needs a lot of space. If there are no complications it is a very pleasant activity. A stone can be used as an anchor. But if you let go, you won't get another chance.

106508.
Cognitive Processes

Language Processing

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