Language: My Favorite Sentence

Buffalo buffalo buffalo Buffalo buffalo

Language: Characteristics

Communication

Arbitrary (Mostly)

Structured

Generative

Dynamic

Language: Components

Phonemes

Morphemes

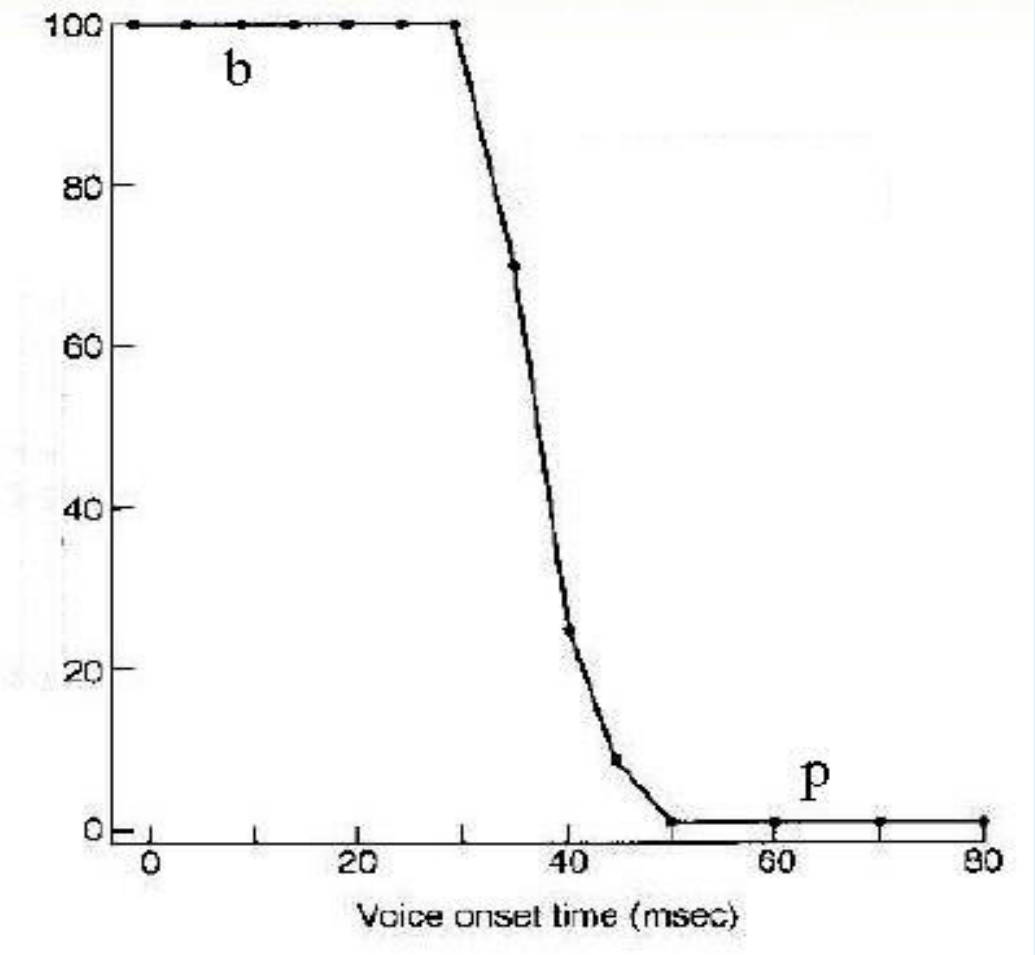
Phonology

Morphology

Semantics

Grammar

Categorical Perception of Phonemes



Linguistic Relativity Hypothesis

Language Shapes Thought

Strong: Sapir-Whorf Hypothesis

Hopi Indians perception of time

Weak: Language has limited effect on thought

English, Russian and Setswana Speakers

Different color names but group color chips in similar ways

Himba Color Perception

Where is the color that is different?

Questions about actual experiment

Animal Language: In the Wild

Communication: Yes

Arbitrary (Mostly): Meh

Structured: Not really

Generative: Not really

Dynamic: Not really

Animal Language: Trained Chimps

Washoe & Koko (Beatrice and Gardener) Lexigrams

- 132 signs
- Some spontaneous language use

Sarah (Premack)

- Tokens (Nouns, Verbs, Relationship)
- Some understanding of sentence structure

Kanzi (Savage-Rumbaugh)

- Lexigrams
- Understood single words and simple sentences
- Spontaneous use of simple requests
- Stronger at comprehension (2.5 yr human) than production (1.5 yr human)

Animal Language: Trained chimps vs little humans

Chimps need lots of training, kids do not
Chimp generative capabilities much less than kids
Chimp understanding of grammar/syntax much less than kids

Himba Color Perception

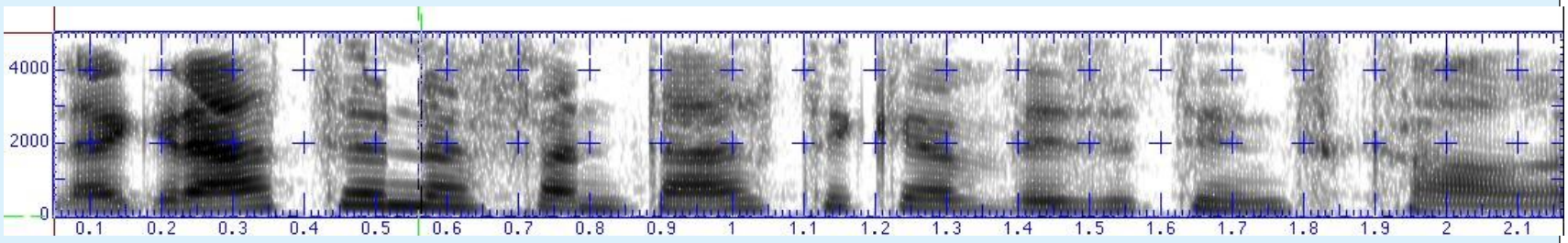
Where is the color that is different?

Questions about actual experiment

Language Acquisition
A Difficult nut to crack

The computational problem:

INPUT:



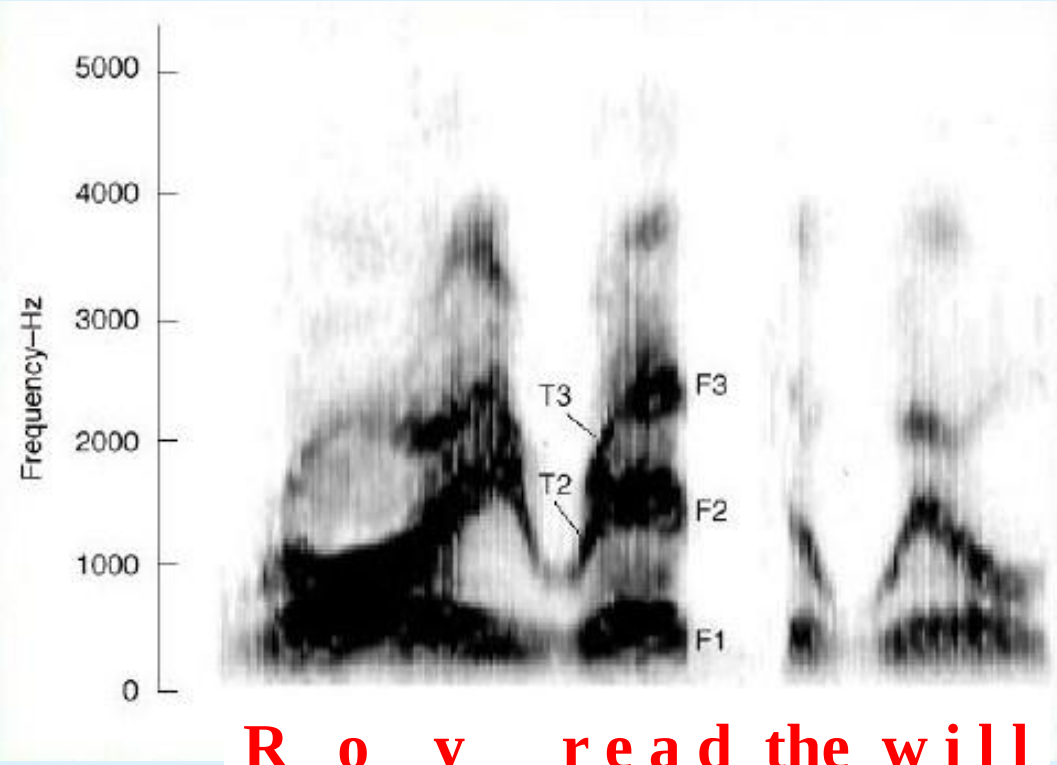
OUTPUT: ***The language!***

→ **should be able to correctly identify meanings of words**

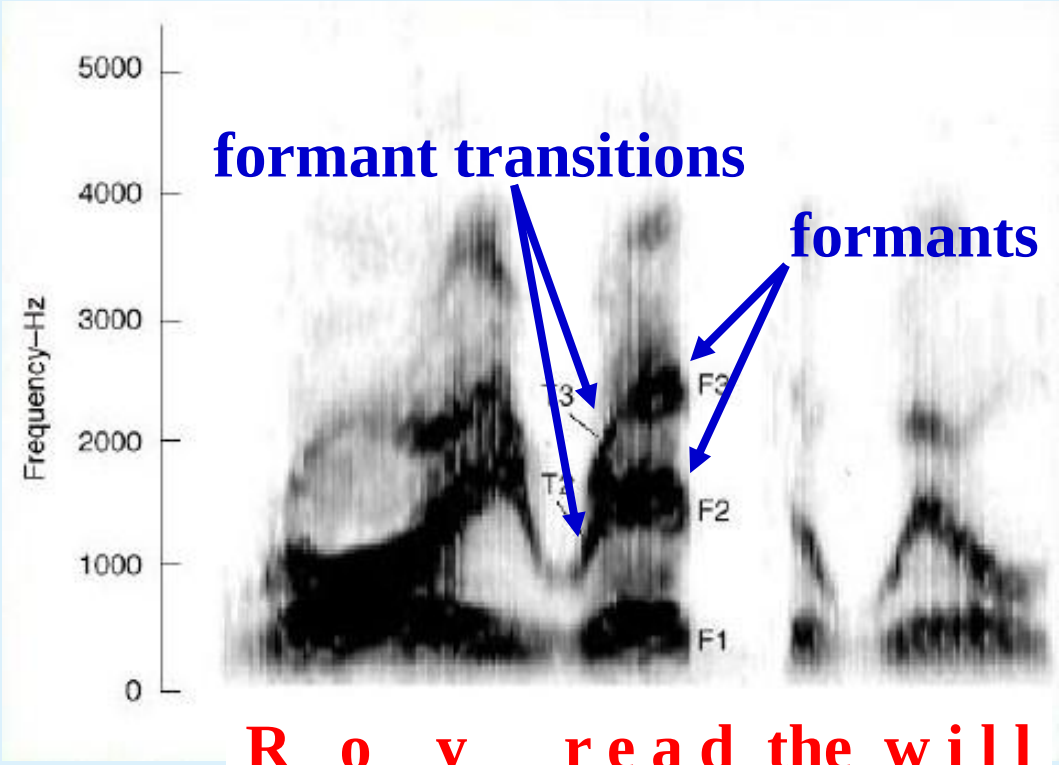
→ **should be able to correctly identify whether a sentence is grammatical or not**

Language Acquisition
What did you say?

For Example:

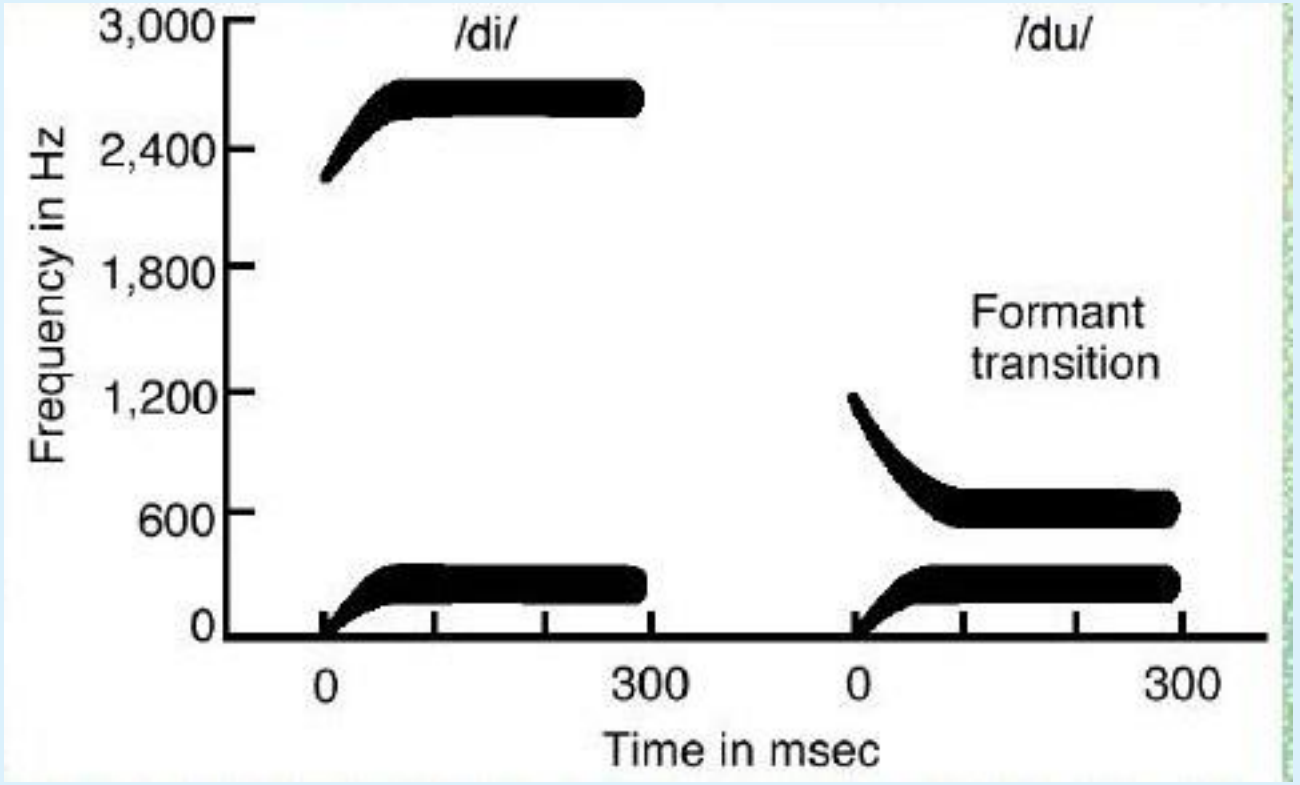


Understanding Language : What did you say?



Understanding Language : What did you say?

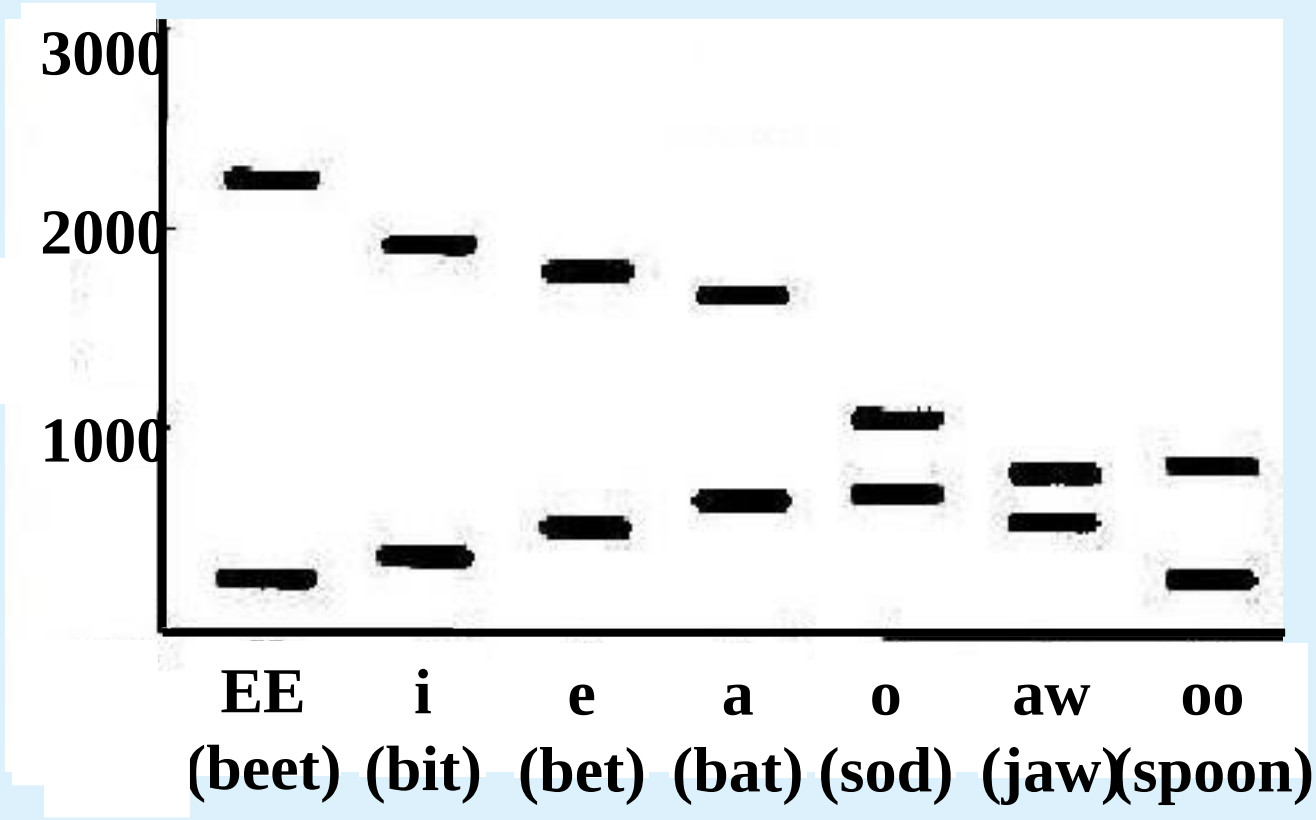
INPUT:



Schematic representation of formants and transitions

Understanding Language : What did you say?

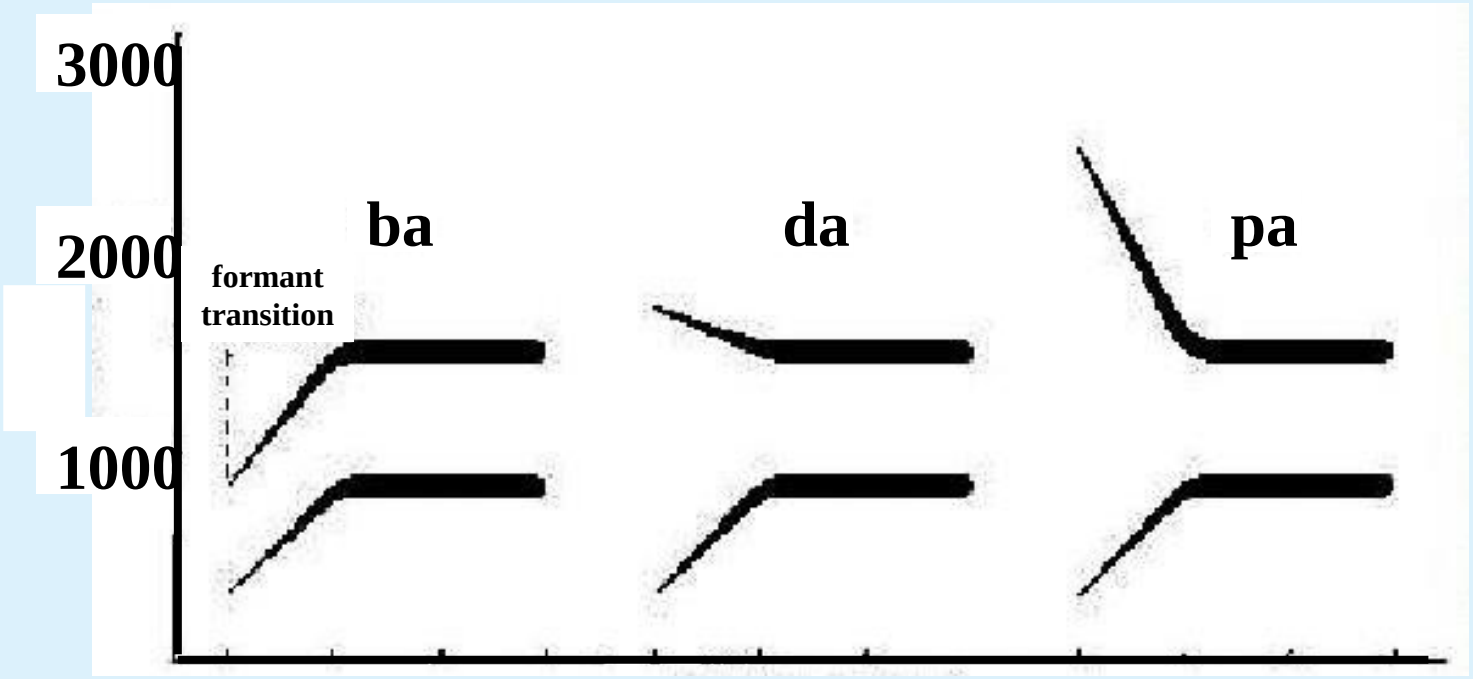
INPUT:



Vowel sounds are distinguished by relative frequencies of the first two formants

Understanding Language : What did you say?

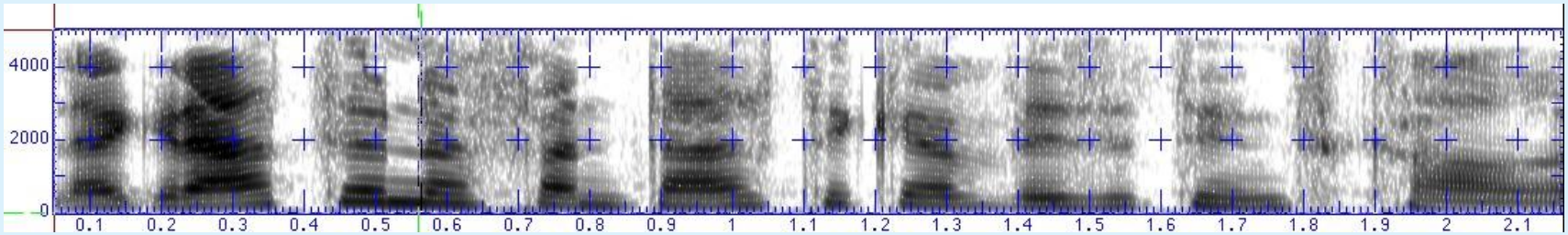
INPUT:



Consonants are determined by the slopes of fast transitions (less than 100 ms).

Understanding Language : What did you say?

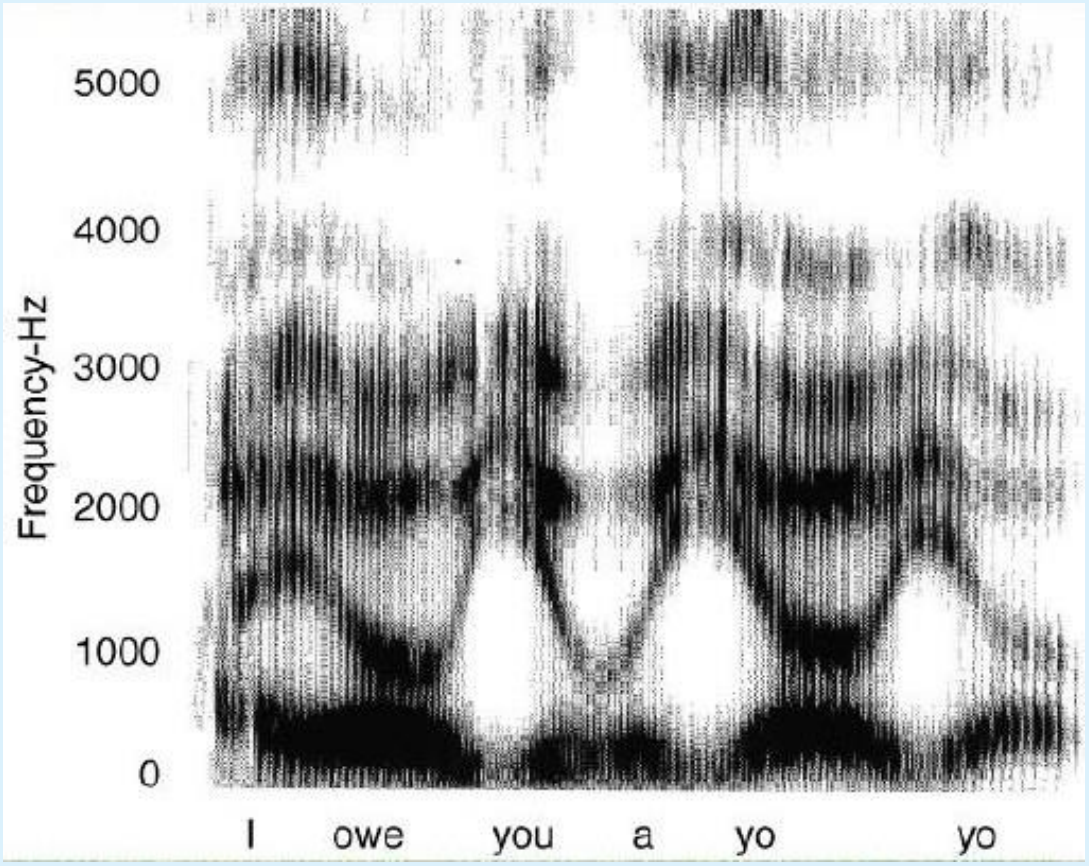
INPUT:



- **Identify the first two formants**
- **Calculate relative position of two formants (vowels)**
- **Calculate slopes of formant transitions (consonants)**

→ This allows you to learn phonemes in a language

Understanding Language : Identifying words



Understanding Language : Semantics and Grammar

In addition to learning words, we need to learn

- Categories of words (nouns, verbs, etc.)
- Meanings of words (semantics)
- How words combine to form sentences (Grammar)

How is this done?

- Domain specific (Innate language module)
- Domain general (Statistical learning, like other perceptual/cognitive functions)

Language Acquisition: Critical Period?

Wild boy of Averyon

- Grew up in forest
- Dr. tried to each him language but mostly failed

Genie

- Horrible deprivation environment began at 20 months
- Discovered at 13 years 9 months
- No Speech at first
- Imitating words after a few days
- After a year could produce/understand some words and names
- Developed language of 2.5 yr old
- Did have some generative capacity

Language Comprehension
Modality Integration

How does brain integrate visual and auditory information?

Visual information has high priority

McGurk Effect

Language Comprhension By Artificial Minds

Watson destroying humans on Jeapordy
Huge response time advantage (8ms vs 200ms for humans)
What is Watson's understanding of language?