

Psych 156A/ Ling 150:  
Psychology of Language Learning

Lecture 3  
Sounds I

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Quick Quiz 1

Will commence as soon as the quizzes are passed out.  
15 minutes, open-note, non-collaborative.

15 minutes left

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Quick Quiz 1

Will commence as soon as the quizzes are passed out.  
15 minutes, open-note, non-collaborative.

5 minutes left

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## Quick Quiz 1

Will commence as soon as the quizzes are passed out.

15 minutes, open-note, non-collaborative.

1 minute left

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## Announcements

Reminder: Homework 1 is due this Thursday, 4/10/08. It must be handed in during class. Typed homework preferred for legibility reasons.

Lecture notes are also now available in black & white (with a white background).

New information on the web page: reference readings. Like the lecture notes, these will be posted after the class session.

Date	Topic	Readings (to be read by this class)	Notices & Assignments	Reference Material (not required reading)
4/1/08	Introduction to Language Acquisition			
4/3/08	Knowledge of Language & Constraints on Learning	Jackendoff 1994: 3-34 [Chapters 1, 2, 3]	HW 1 assigned	Marr (1982): Ch.1, Jackendoff (1994): Ch.8

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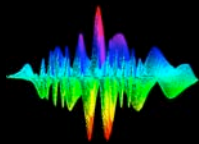
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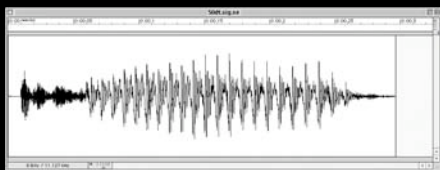
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## Learning Sounds



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## Sounds of Language (Speech Perception)

Learner's job: parse continuous stream of speech into sentences, clauses, words, syllables, and phonemes

big vs. dig

Phonemes are language-specific - r/l is a phonemic contrast (changes word's meaning) in English but not in Japanese  
Lisa = Risa for some of my Japanese friends

Kids of the world require knowledge of phonemes before they can figure out what different words are - and when different meanings are signaled by different words



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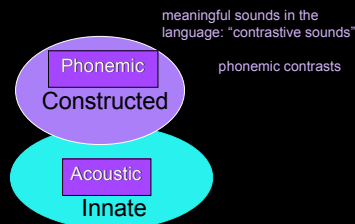
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## About Speech Perception

Important: Not all languages use the same sounds.  
Languages draw from a common set of sounds.

Child's task: Figure out what sounds their native language uses.



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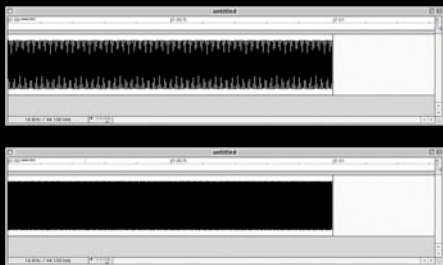
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## Acoustic-Level Information

Includes: timing and frequency  
Tones: frequency



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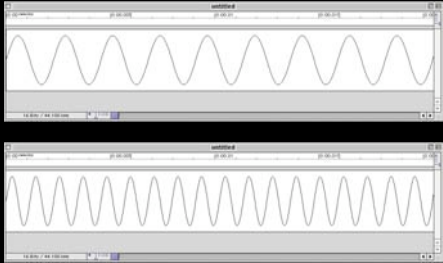
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## Acoustic-Level Information

Includes: timing and frequency

Tones: frequency (close-up)



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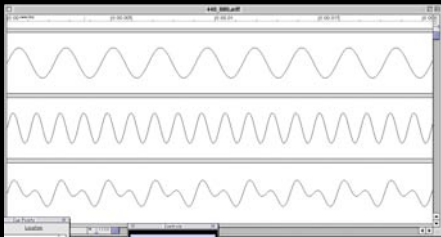
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## Acoustic-Level Information

Includes: timing and frequency

Tones: frequency (close-up)



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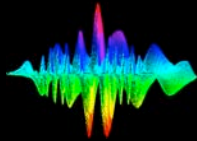
## Acoustic-Level Information

Language sounds

Vowels combine acoustic energy at a number of different frequencies

Different vowels ([a] "ah", [i] "ee", [u] "oo" etc.) contain acoustic energy at different frequencies

Listeners must perform a 'frequency analysis' of vowels in order to identify them  
(Fourier Analysis)



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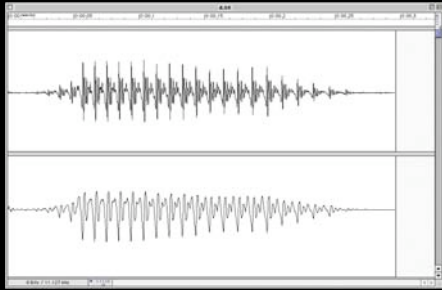
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## Acoustic-Level Information

Language sounds  
Male Vowels



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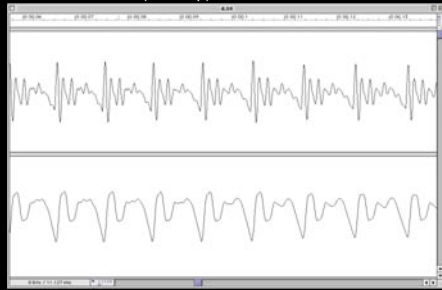
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## Acoustic-Level Information

Language sounds  
Male Vowels (close up)



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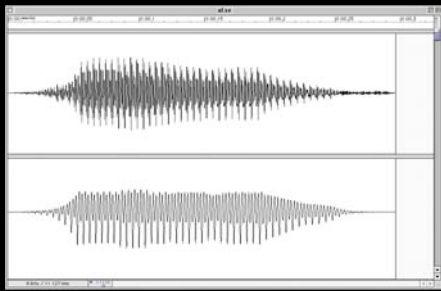
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## Acoustic-Level Information

Language sounds  
Female Vowels



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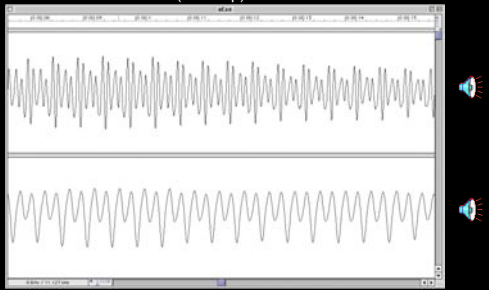
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## Acoustic-Level Information

Language sounds  
Female Vowels (close up)



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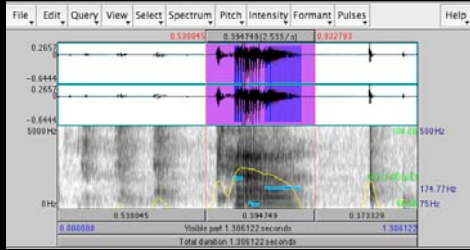
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## Synthesized Speech

Allows for precise control of sounds  
Valuable tool for investigating perception



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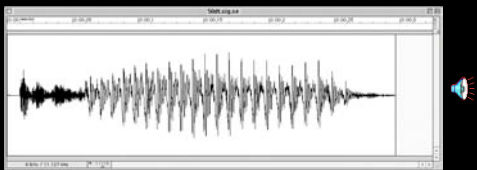
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## Acoustic-Level Information

Language sounds  
Timing: Voicing



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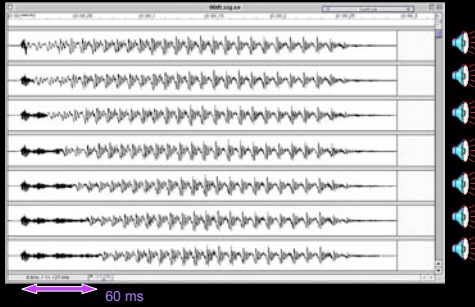
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## Acoustic-Level Information

Language sounds  
Timing: Voice Onset Time (VOT)




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## English VOT production

Not uniform - there are 2 categories

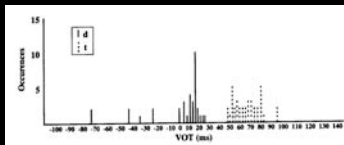


Figure 5-3. VOT productions of a single normal adult speaker of American English for words beginning with /d/ and /t/. (Figure adapted with permission from Blumstein, Cooper, Goodglass, Stussler, & Gottlieb, [1980]. Production Deficits in Aphasia: A Voice Onset-Time Analysis. *Brain and Language*, 9, 153-170. Copyright 1980 by Academic Press.)

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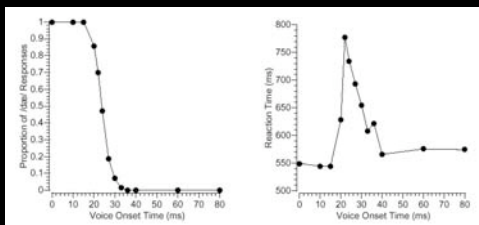
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## Perceiving VOT

\*Categorical Perception\*: dæ vs. tæ



Decision between d/t

Time to make decision

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### Discrimination

Same/Different  
0ms 60ms

Same/Different  
0ms 10ms

Same/Different  
40ms 40ms

← Why is this pair difficult?

(i) Acoustically similar?  
(ii) Same Category?

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### Discrimination

Same/Different  
0ms 60ms

Same/Different  
0ms 10ms

Same/Different  
40ms 40ms

#### A More Systematic Test

D 0ms [Speaker] [Speaker] 20ms D

D 20ms [Speaker] [Speaker] 40ms T

T 40ms [Speaker] [Speaker] 60ms T

Within-Category Discrimination is Hard

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### Cross-language Differences

[Speaker] [Speaker]  
R L

[Speaker] [Speaker] [Speaker] [Speaker] [Speaker] [Speaker] [Speaker]  
R L

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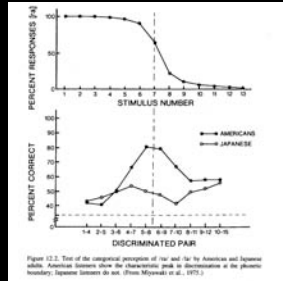
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## Cross-Language Differences

English vs.  
Japanese R-L



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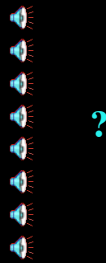
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## Cross-Language Differences

English vs. Hindi  
alveolar [d]  
retroflex [ɖ]



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## Human and Non-Human Perception

Perceptual biases shared with other animals:  
Discriminate native language rhythm only  
when played forward, not backward



Categorical discrimination of some contrasts  
(ex: voice onset time "d" vs. "t")

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## Human and Non-Human Perception

Perceptual biases **possibly** shared with other animals:

Preference for speech over acoustically matched non-speech sounds



Sensitivity to cues that indicate word boundaries

(From cognitive neuroscience studies): unique cortical activation to forward speech vs. backward speech

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