

LING 450/550

6 – Spectrograms-2

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# Review: Reading Spectrograms: Manner Overview

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## **Stop**

- Abrupt attenuation of energy (“gap”), followed by brief aperiodic burst and abrupt onset of energy

## **Fricative**

- Aperiodic noise, especially at higher frequencies

## **Nasal**

- Fully voiced but with lower energy than vowels, attenuation of energy in higher frequencies, “zeroes,” nasal formants at around 250, 2500, and 3250 Hz

# Reading Spectrograms: Manner Overview

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## **Lateral**

- Some attenuation of higher frequencies, and vowel-like formants at 250, 1200, and 2400 Hz

## **Approximant**

- Vowel-like formants, rapidly changing

# Reading a Spectrogram: Voicing

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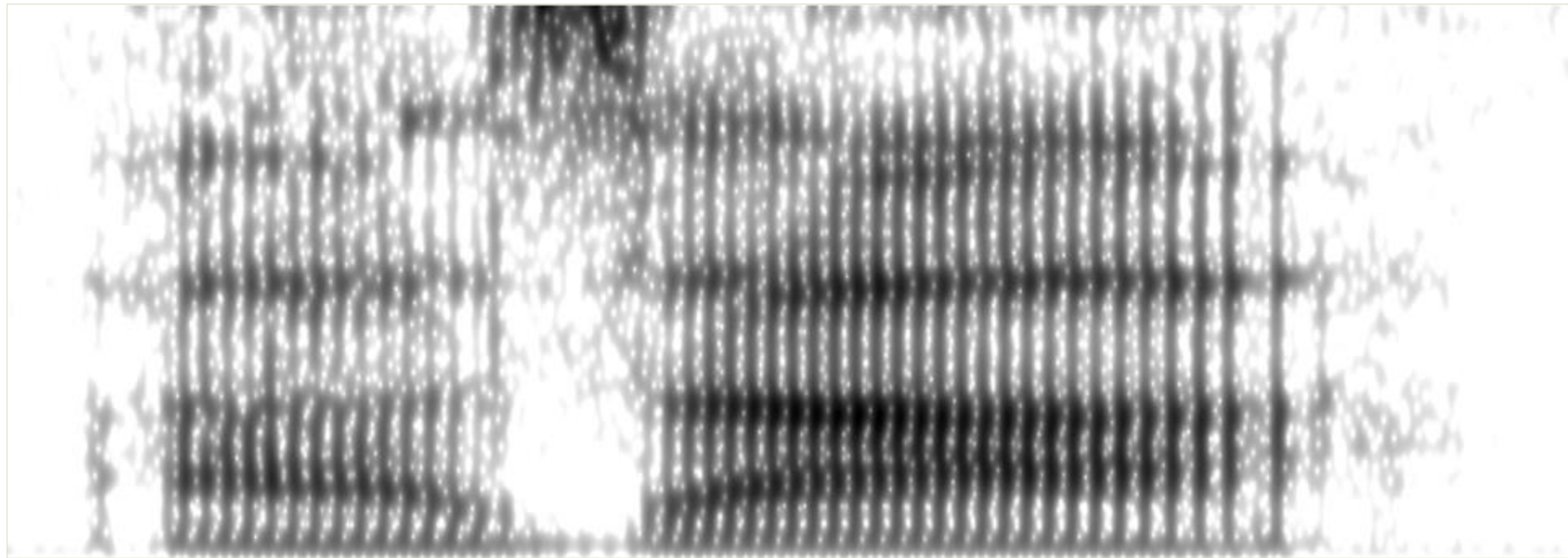
*Voiced sounds* have a dark band very close to the bottom of the spectrogram, corresponding to the fundamental frequency of the speaker's voice.

- Many “voiced” consonants are allophonically devoiced, so the absence of a voicing band does not guarantee that the sound is a voiceless phoneme.
- Other things besides speech (like electrical currents) vibrate in the frequency range of interest, so voicing is difficult to assess in recordings not made in carefully controlled environments.

# Reading a Spectrogram: Voicing

[aʔa]

- Frequency range: 0 - 5000 Hz; duration:  $\approx 0.75$  s

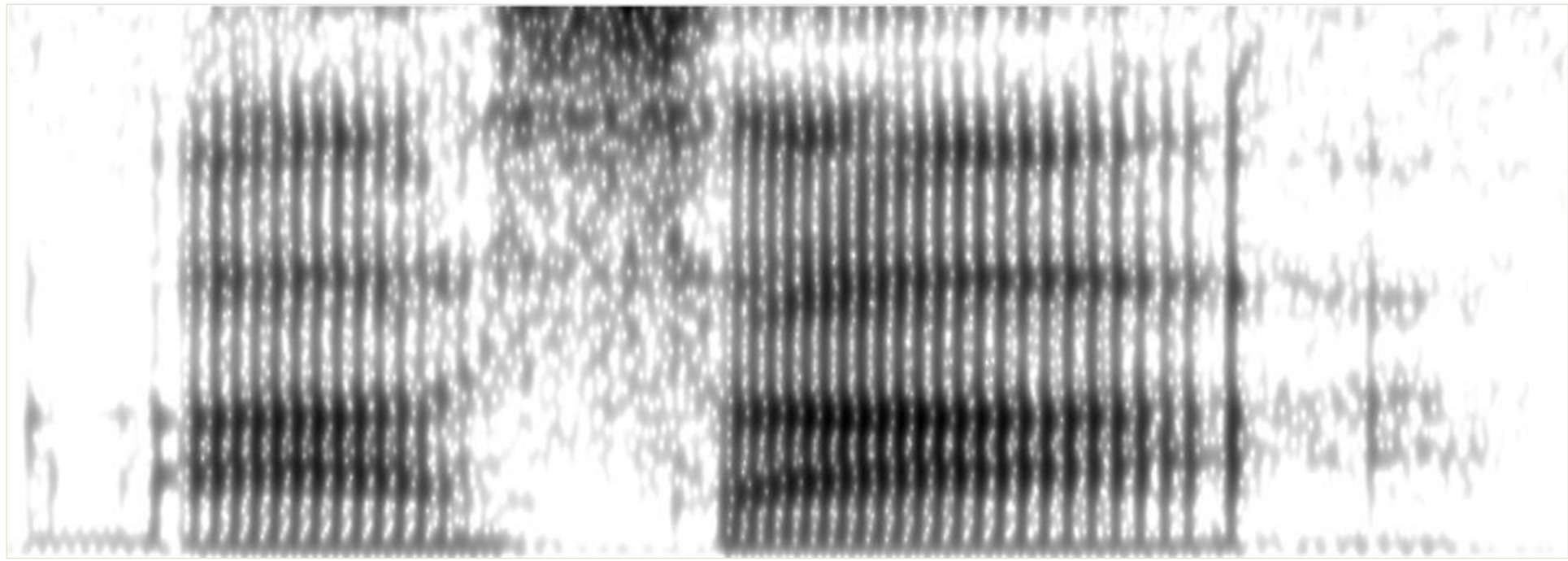


voicing band

# Reading a Spectrogram: Voicing

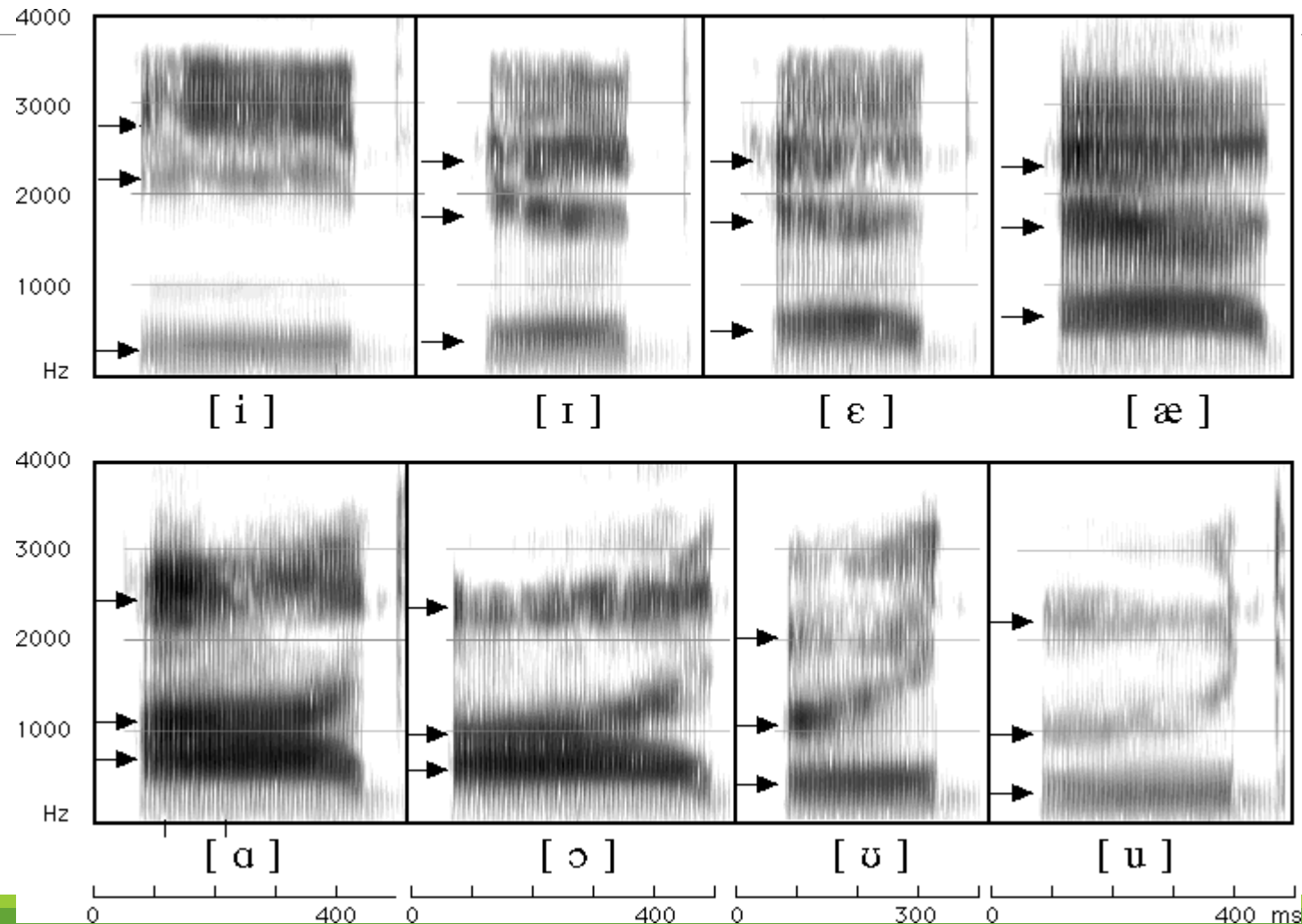
[asa]

- Frequency range: 0 - 5000 Hz; duration:  $\approx 0.75$  s

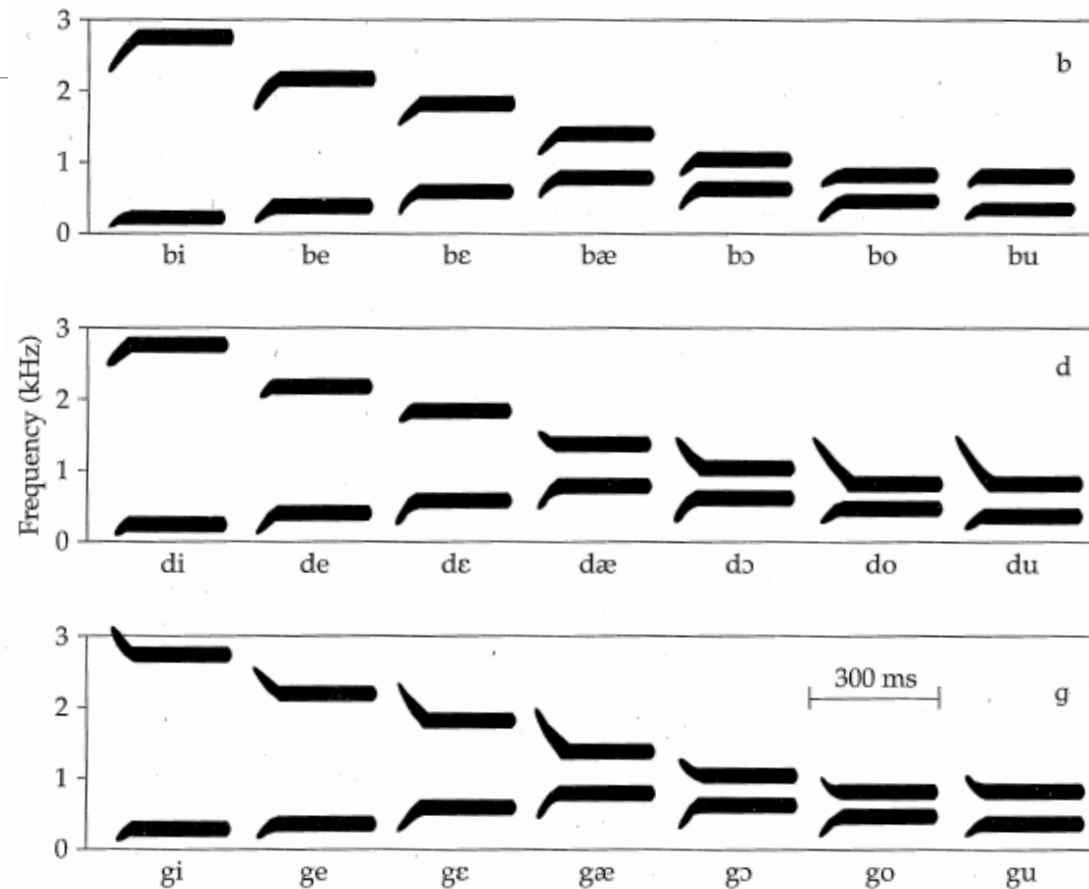


no voicing band

# Reading a Spectrogram: Vowels



# Vowel Formant Transitions: Cues to Place of Articulation

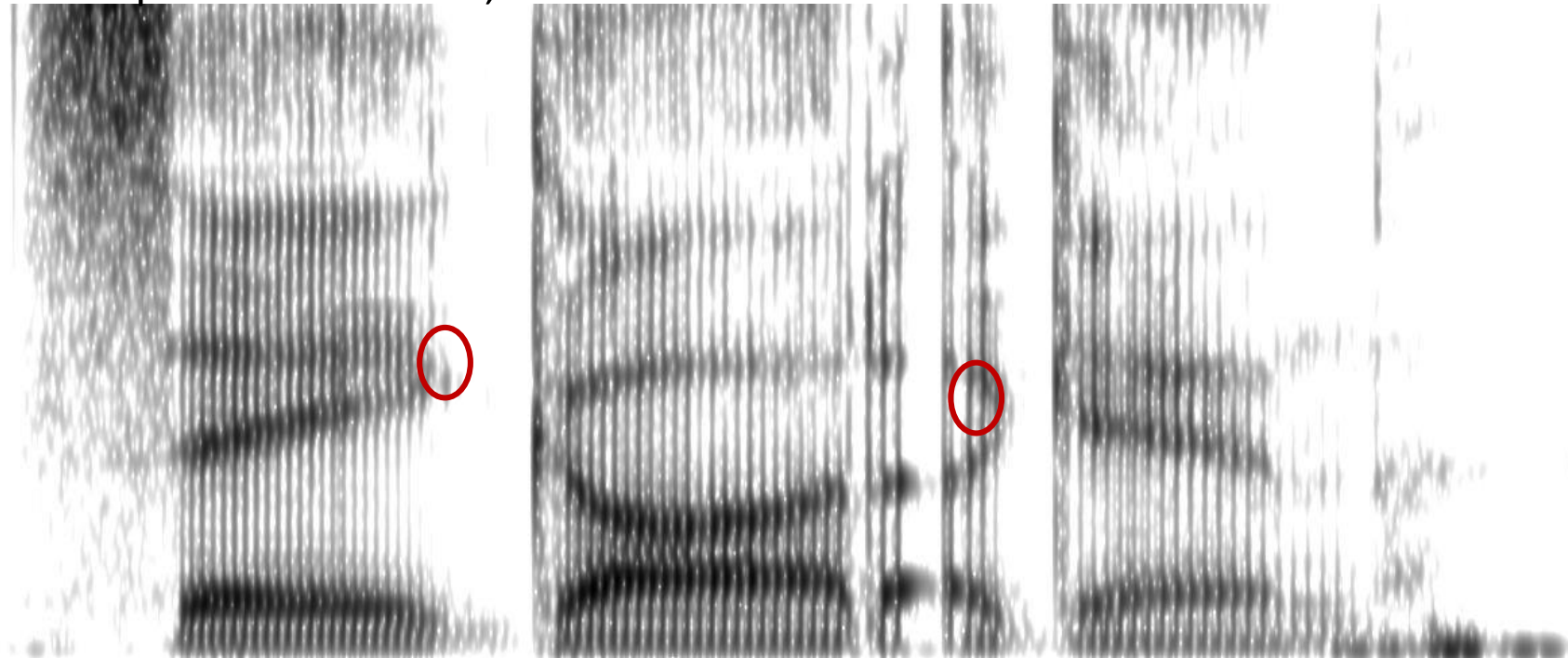


**Figure 8.7**  $F_1$  and  $F_2$  transition patterns in stop release used to synthesize [b], [d], and [g] followed by various vowels. Adapted from Delattre et al., 1955, p. 770, and published with permission.



# Spectrogram Examples: Velar Pinch

Velar pinch = Raised F2, lowered F3 near velars

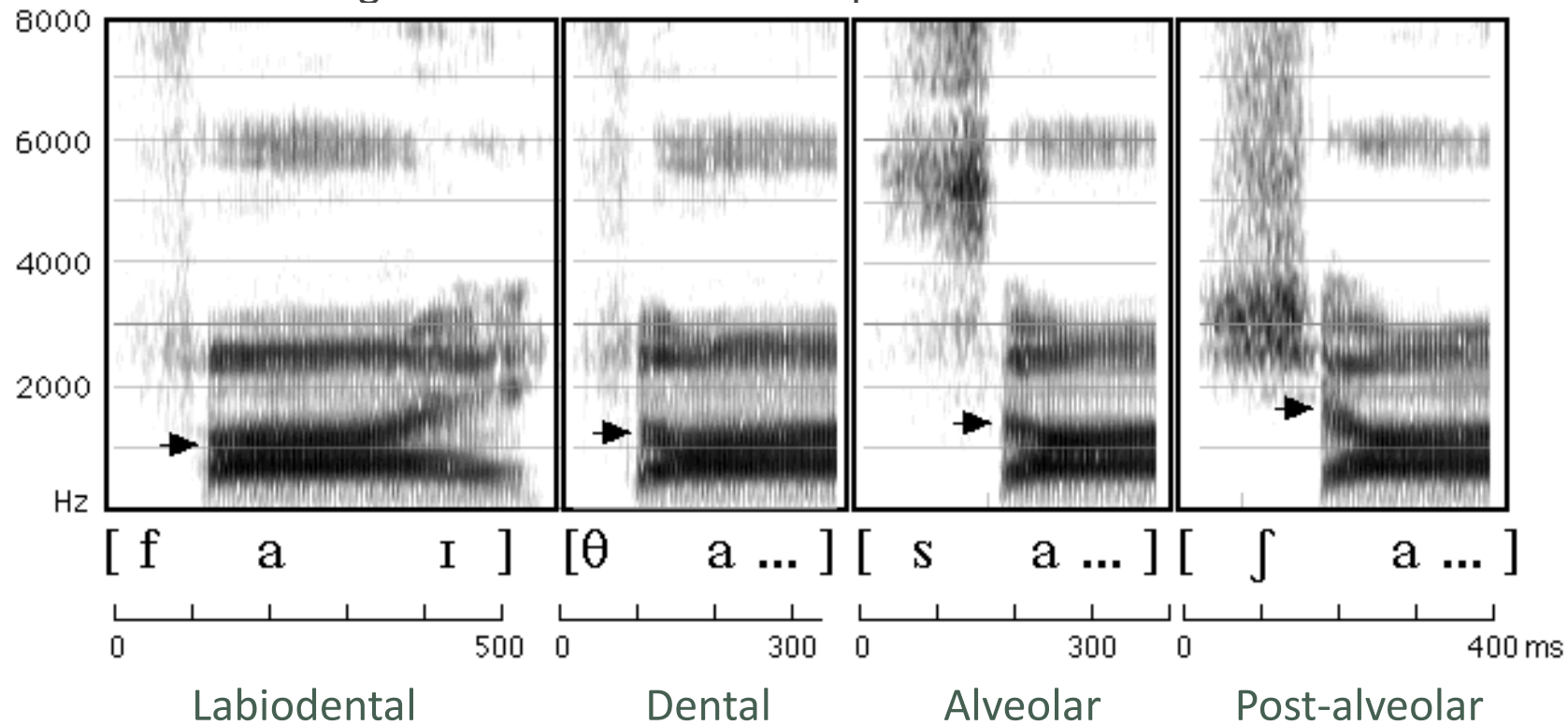


[ s e ɪ 'g a d ə 'g ɛ n ]

"Say god again"

# Reading Spectrograms: Place of Articulation

F2 transition is higher the farther back the place of articulation



# Reading Spectrograms: Place Overview

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## **Bilabial**

- Locus of F2 and F3 relatively low

## **Alveolar**

- Locus of F2 relatively high, around 1700-1800 Hz

## **Retroflex**

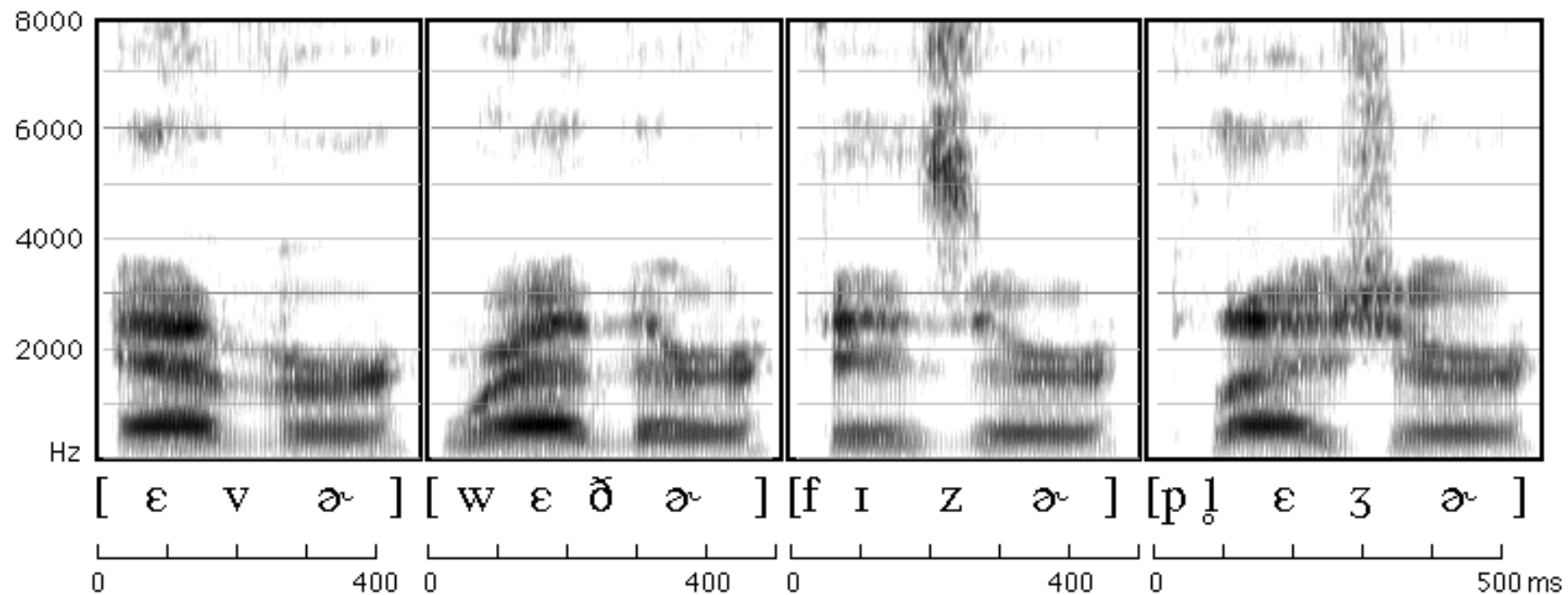
- Low F3 and F4

## **Velar**

- Locus of F2 relatively high, velar pinch with F3

# Reading a Spectrogram: Distinguishing Fricatives

Look at the spread and density of frication

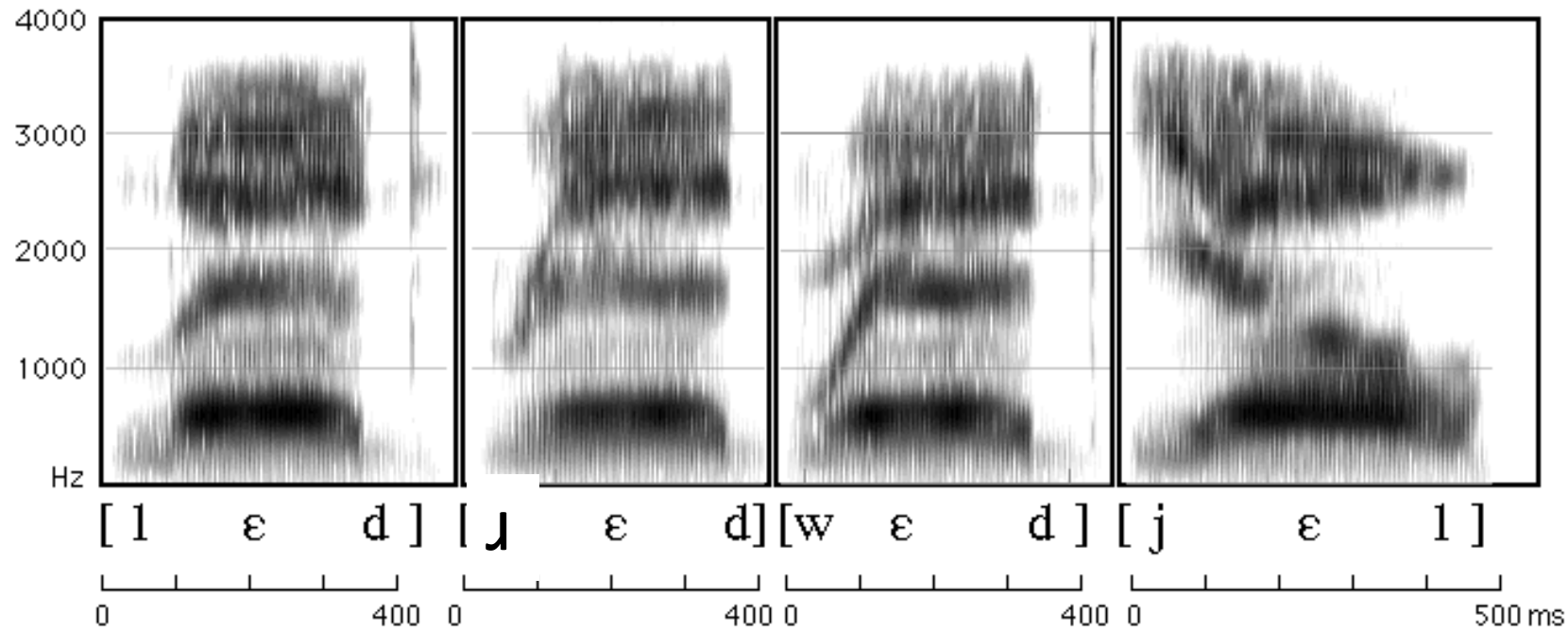


Quiet: Frication light, spread out, present in lower frequencies

Loud (*sibilants*): Dense, concentrated in high frequencies

# Reading a Spectrogram: Distinguishing Approximants

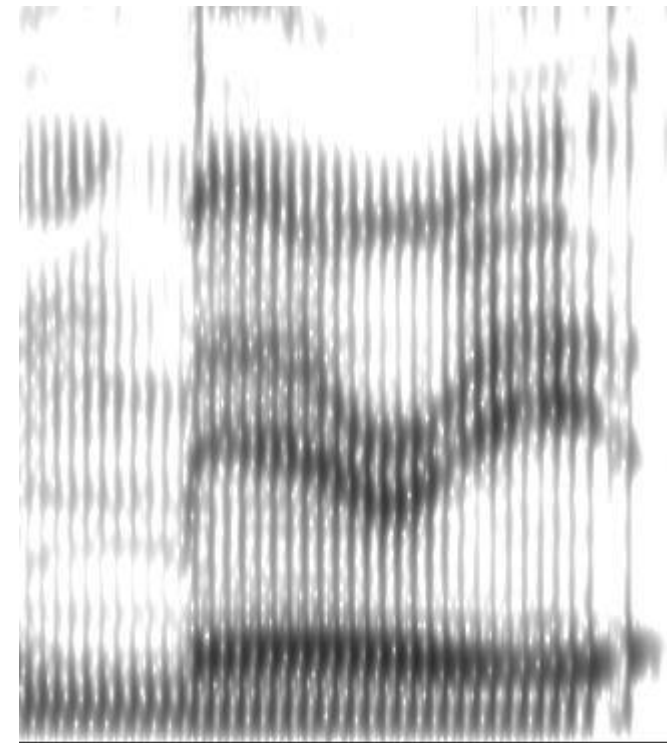
Approximants flow smoothly into vowels



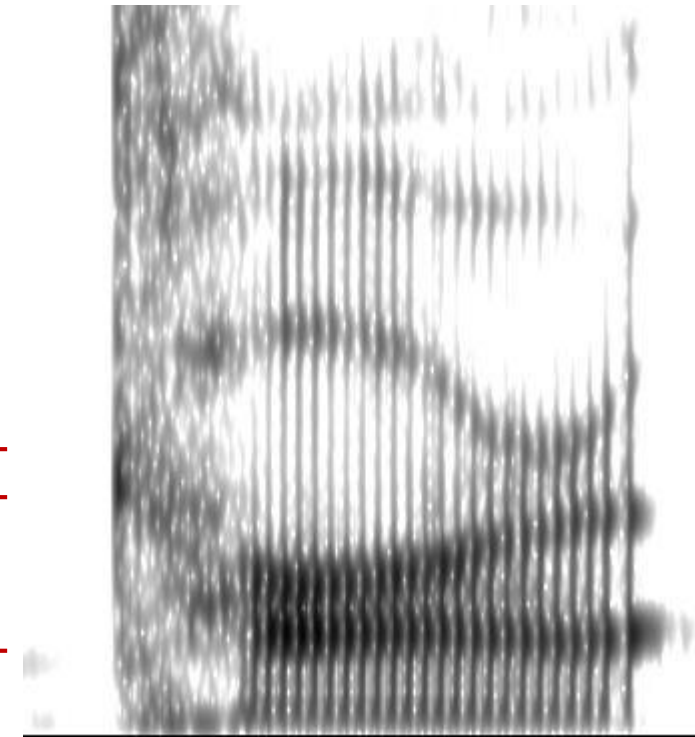
- [l] – dip in F2, slight rise in F3
- [ɹ] – central F2, scoop in F3
- [w] – like high back vowel [u/ʊ]
- [j] – like high front vowel [i/ɪ]

# Spectrogram Examples: [ɹ]

- SCOOP SHAPE TO F3
- F2 CENTRAL (BETWEEN FRONT & BACK VOWELS)



[ m ε ɹ i ]



[ k ɑ ɹ ]

# Spectrogram Practice

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<http://corpus.linguistics.berkeley.edu/acip/course/chapter8/hw/exercise8L.html>

# Reminders

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Do HW 5

Read Ladefoged & Johnson chapter 9

Final Exam Dec 5-6 (Thursday/Friday)