

LING 450/550

8-Measuring Vowels

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# In-Class Transcription #3

GERMAN

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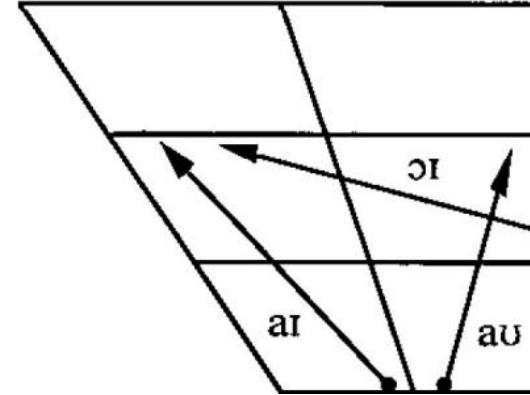
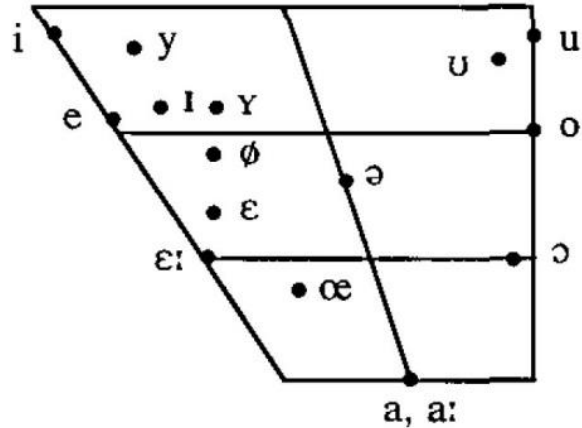
adapted from slides by Sharon Hargus and Valerie Freeman

# German Consonants

	Bilabial	Labio-dental	Dental	Alveolar	Post-alveolar	Palatal	Velar	Uvular	Glottal
Plosive	p b		t d				k g		ʔ
Nasal	m		n				ŋ		
Fricative		f v		s z	ʃ ʒ	ç		χ ʁ	h
Approximant						j			
Lateral Approximant			l						

<http://www.paulmeier.com/consonants/>

# German Vowels



ⓘ i <i>bieten</i> 'to offer'	ⓘ y <i>hüten</i> 'to guard'	ⓘ u <i>sputen</i> 'to hurry'
ⓘ ɪ <i>bitten</i> 'to request'	ⓘ ʏ <i>Hütten</i> 'huts'	ⓘ ʊ <i>Butter</i> 'butter'
ⓘ e <i>beten</i> 'to pray'	ⓘ ø <i>Goethe</i> (name)	ⓘ o <i>boten</i> 'offered' (1 pl)
ⓘ ε <i>Betten</i> 'beds'	ⓘ œ <i>Götter</i> 'gods'	ⓘ ɔ <i>Botten</i> 'clogs'
ⓘ ε: <i>bäten</i> 'if they requested'		
	ⓘ a <i>hatten</i> 'had' (1 pl)	
	ⓘ a: <i>baten</i> 'requested' (1 pl)	
	ⓘ ə <i>Beute</i> 'booty' (sg)	
ⓘ ai <i>beiden</i> 'both' (1 pl)	ⓘ ɔɪ <i>Beuten</i> 'booty' (pl)	ⓘ au <i>bauten</i> 'built'

# German Transcriptions

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- |                           |          |                        |          |
|---------------------------|----------|------------------------|----------|
| 1. 🗣️ 'had'               | ['hatɐ]  |                        |          |
| 2. 🗣️ 'requested' (1pl)   | ['ba:tɐ] | 10. 🗣️ 'built'         | ['baʊtɐ] |
| 3. 🗣️ 'to guard'          | ['hytɐ]  | 11. 🗣️ 'butter'        | ['bʊtə]  |
| 4. 🗣️ 'to hurry'          | ['ʃputɐ] | 12. 🗣️ 'huts'          | ['hytɐ]  |
| 5. 🗣️ 'if they requested' | ['bɛ:tɐ] | 13. 🗣️ 'offered' (1pl) | ['botɐ]  |
| 6. 🗣️ 'beds'              | ['bɛtɐ]  | 14. 🗣️ 'to request'    | ['bɪtɐ]  |
| 7. 🗣️ 'Goethe' (name)     | ['gøtə]  | 15. 🗣️ 'to pray'       | ['betɐ]  |
| 8. 🗣️ 'to offer'          | ['bitɐ]  | 16. 🗣️ 'clogs'         | ['bɔtɐ]  |
| 9. 🗣️ 'booty' (sg)        | ['bɔɪtə] | 17. 🗣️ 'both' (1pl)    | ['baɪdɐ] |
|                           |          | 18. 🗣️ 'gods'          | ['gøetə] |

# Vowel Duration and Formants

MEASURING AND PLOTTING VOWELS

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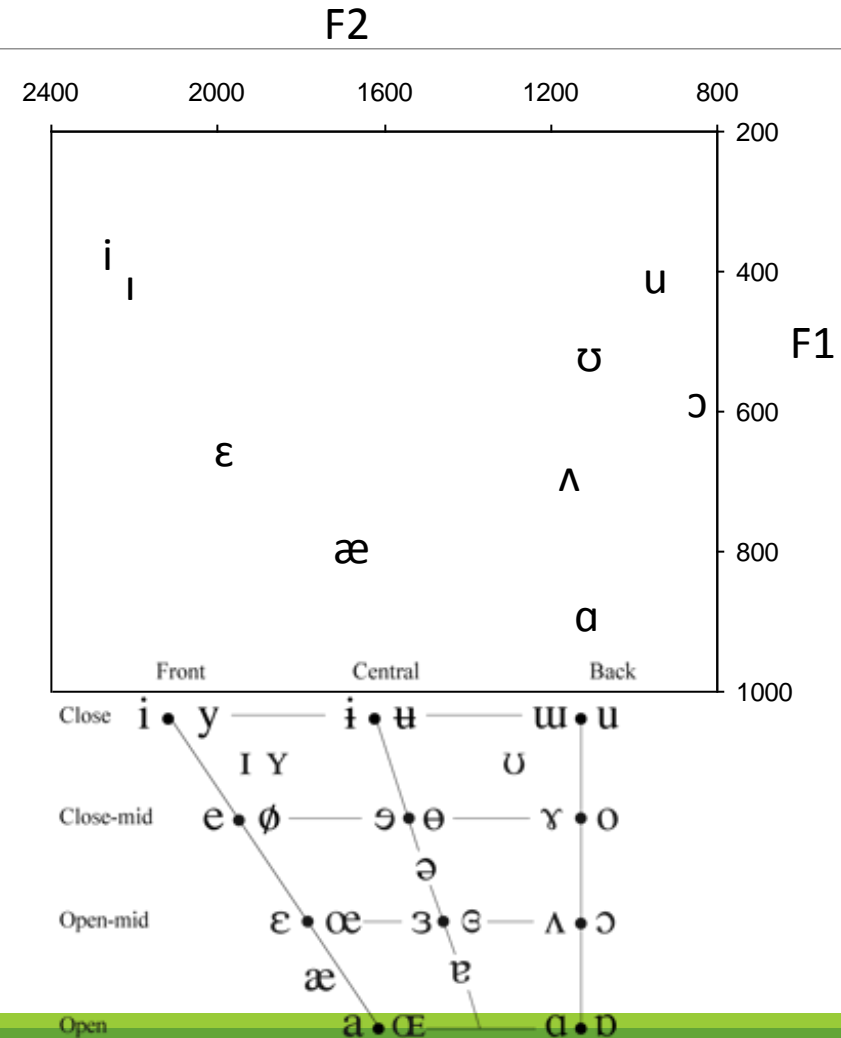
READ LADEFOGED & JOHNSON, CHAPTER 9

# Plotting Vowel Formants

The main features used to describe vowels are *high/low* and *front/back*.

- Early linguists treated height and backness as physical measures of tongue position during vowel articulation.
- Today these features represent differences in the F1 and F2 values for each vowel:
  - High vowels have low F1 values.
  - Back vowels have low F2 values.

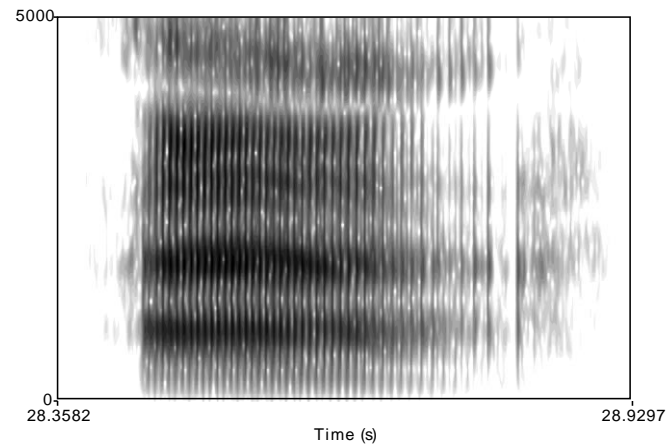
To maintain the historical charting standards of *high=up* and *back=right*, we plot the formant values so they increase downwards and leftwards.



# Spectrograms

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But how do we get from something like this...



...to something like this?

- F1 of 980 Hz
- F2 of 1700 Hz



# Praat How-To

## Step 1: Open Sound File

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1. Open Praat.
2. Close the picture window.
  - We don't need this window for our current purposes.
3. In the objects window, select "Open" from the top menu and then "Read from file..." In the window that pops up, select the sound file(s) you want to analyze. Click "Open."
  - The name(s) of your file(s) appears in the objects list.

# Praat How-To

## Step 2: Open Spectrogram

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1. In the objects list, click on the sound file that you want to analyze.
2. Click on the “View & Edit” button to the right.
  - An edit window opens, and shows a waveform and probably a spectrogram.
  - If you see a waveform but no spectrogram, click on “Spectrum” in the top menu and then “Show spectrogram.”

# Praat How-To

## Step 3: Locate Vowel

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1. Find generally where the vowel you want to analyze appears.
  - You'll be looking for high amplitude and periodicity in the waveform and clear formant structure in the spectrogram.
2. Zoom in to this portion using the buttons in the lower left corner.
  - Be careful not to cut off any of the vowel on either end! You don't yet need to be exact, so it's best to include some extra time before and after the vowel.

# Praat How-To

## Step 3: Locate Vowel

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3. Determine the exact timepoint when the vowel begins, and click on this point in the waveform or spectrogram. Follow the dashed vertical line upward. The timestamp of this point is shown above this line in red.
  - To find the appropriate timepoint, consider what the sound that comes before the vowel should look like, and that the waveform of the vowel should show generally periodic movement.
  - It is helpful to choose a consistent location in the wave cycle to measure beginnings and ends. For both, I always measure the point where the waveform crosses 0 just before the highest peak. Get the cursor as close to this point as possible, and then choose “Select” in the top menu and “Move cursor to nearest zero crossing” to get the exact time.

# Praat How-To

## Step 3: Locate Vowel

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4. Record the value of this timepoint.
  - If you're doing a lot of analyses like this, you can make a TextGrid, which is basically a text file tied associated with the sound file that makes noting times a lot more convenient. Our labs don't involve enough sound files to justify adding this level of complexity, but if you do a lot of measuring in Praat you'll probably want to use them.
5. Using the same procedure, determine the exact timepoint when the vowel ends, and record the value of this timepoint.

# Measuring Vowel Duration

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When locating the beginning and the end of a vowel, the first things to look for are abrupt changes in signal amplitude, changes in periodicity, and the presence of formant structure.

- When measuring near fricatives, look for abrupt reductions in the intensity of turbulence and the onset of higher formants (F2, F3, and sometimes F4).
- When excluding the following consonant's closure, look for a marked drop in overall intensity and a loss of energy in the higher formants.
- When measuring around approximants, it is often extremely difficult to choose a boundary point. Choose a method that minimizes experimenter bias and is suited to the comparisons you plan to make in your analysis.

# Measuring Vowel Formants

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Since formant frequencies can change through the course of a vowel articulation, it is not always a straightforward task to measure them.

Monophthongs typically have minimal movement of formant frequencies, usually restricted to the beginning and ending 10% of the vowel's duration.

- This beginning and ending formant movement is usually the result of coarticulation with the preceding/following consonant.
- Thus, a measurement anywhere during the *steady state* of the vowel (typically between the 20% and 80% points of the vowel's duration) is usually adequate.

# Measuring Vowel Formants

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Diphthongs involve substantial movement of the formant frequencies, and often do not show an obvious beginning and ending steady state.

- It is common to consider the 20% point to be the *nucleus* of the diphthong and the 80% mark to be the *offglide*.
- Diphthongs are often measured shortly after the nucleus begins and shortly before the nucleus ends.
- The 50% point is also sometimes measured to give a sense of how quickly the diphthong moves from nucleus to offglide.

When comparing monophthongs to diphthongs, they should usually be compared at the 20% mark for both vowels.



# Praat How-To

## Step 4: Locate Point to Measure

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1. Now that you know when the vowel begins and ends, calculate the timepoint(s) at which to measure formants.
  - This is often the midpoint (halfway between the beginning and the end), but in some cases, especially when dealing with diphthongs, you may want to measure elsewhere.
  - In this class, your assignments will clearly tell you where to take measurements.
2. Place the cursor at this timepoint by clicking “Select” in the top menu and then “Move cursor to...” Type the value of the timepoint for measurement and click “OK.”

# Praat How-To

## Step 5: Measure Formants

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1. Click “Formants” in the top menu and then “Show formants.”
  - Small red dots appear on the spectrogram.
2. Make sure that the horizontal lines of red dots align well with the dark bars that represent formants.
  - To hide the red dots and better see the spectrogram itself, simply click “Formants” in the top menu and then “Show formants” again. You can toggle between these views as often as you’d like.
  - If the dots don’t align well with the bars, click “Formants” on the top menu and “Formant settings...” Try having Praat look for a different number of formants (maybe 4 or 6) or changing the maximum formant value (maybe 5000 Hz, especially for a male talker).

# Praat How-To

## Step 5: Measure Formants

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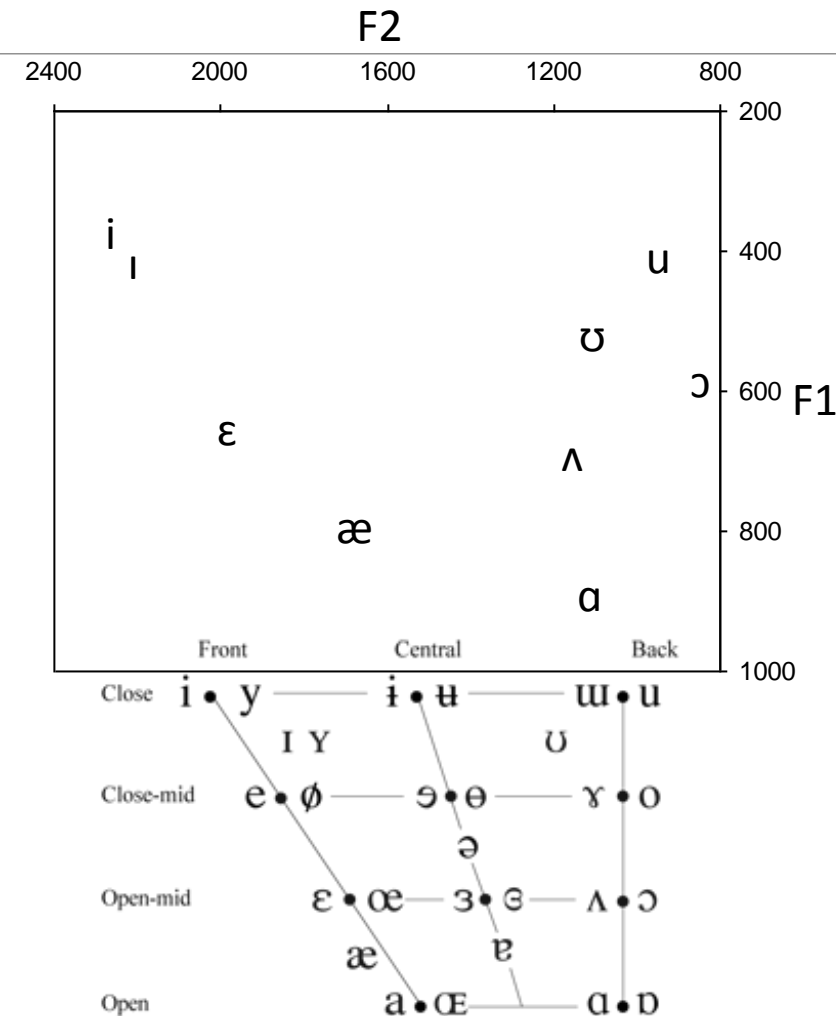
3. With your cursor at the desired timepoint, click on “Formant” on the top menu and then “Get first formant.” Record the value of the F1.
4. With your cursor still at the desired timepoint, click on “Formant” on the top menu and then “Get second formant.” Record the value of the F2.

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# Reminders

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Read L&J Ch 7

HW 6 Due Wednesday

Work on Lab 1 (Due Monday 11/4)/Projects Part I (Due Wed 11/6)