

# Unit 4

## Vowels (1)

Approaching vowels via acoustic and articulatory phonetics

Slides for the session of

*Phonetics with Listening Practice (British)*

held on

20 / 22 brumaire, an CCXXVIII de la République

11 / 13 November 2019

### Vowels (1)

#### Goals

Acoustic phonetics and vowels

Vowels: phonetics vs phonemics

Vowel quadrilateral and cardinal vowels

English vowel phonemes vs. cardinal vowel positions

Using diacritics for vowels

Vowels: comparing German and English

Robert Spence  
LangSciTech  
Saarland University

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## ⟨English Phonetics: Unit 4:⟩

/'ɪŋ ɡlɪf/ /fə 'net ɪks/ /'ju:n ɪt/ /'fɔ:/

[ 'ɪŋ.ɡlɪf fə.'net.ɪks 'ju:.nɪp̩ 'fɔ:] (AusE)

## Vowels (1)

/'vaʊəlz/ /wʌŋ/

[ 'væ̩əlz 'wʌŋ ] (AusE)

## ⟨Approaching vowels via acoustic and articulatory phonetics⟩

/ə 'prəʊtʃ ɪŋ/ /vaʊəlz/ /'vaɪ ə/ /ə 'ku:st ɪk/ /ən(d)/ /ɑ: 'tɪk jʊl ət əɹ i/ /fə 'net ɪks/

[ə.'prəʊtʃ.ɪŋ 'væ̩.əlz ,vaɪ.ə.ə.'kʰu:st.ɪk ən.ɑ:.'tʰɪk.jʊl.ət̩.i fə.'nɛt.ɪks

(modern RP)]

- 1 Goals
- 2 Acoustic phonetics and vowels
- 3 Vowels: phonetics vs phonemics
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- 6 Using diacritics for vowels
- 7 Vowels: comparing German and English

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## The goals of today's session are:

- 1 To briefly discuss the acoustics of sound, concentrating on vowel sounds as made in the human vocal tract (10 mins)

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- 3 To check which vowel phonemes in English fall close to cardinal vowels, and which do not (10 mins)
- 4 To prepare the ground for a comparison between German and English vowel phonemes and their typical phonetic realizations (allophones) (10 mins)

# Brief overview of acoustic phonetics in relation to vowels

- 1 Physics of sound waves
- 2 Overtones and formants
- 3 Distinguishing vowels by means of formants
- 4 How to read a spectrogram

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- Motion of particles in direction of propagation of wave ...

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- Motion of particles in direction of propagation of wave ...
- ... but can be represented perpendicular to it.
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- <http://www.spence.saar.de/akustik.jpg>

- voiced continuants and nasals have a fundamental frequency ( $F_0$ , “F zero”)

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## Overtones and formants

- voiced continuants and nasals have a fundamental frequency ( $F_0$ , “F zero”)
- partial overtones (or ‘upper harmonics’):
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- formants: *amplified* upper harmonics

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- identifying vowels by their formants ( $F_1$  and  $F_2$ )

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## Distinguishing vowels by means of formants

- The distinctive ‘quality’ of a vowel depends on how the vocal tract was shaped when it was being formed, and thus on the acoustic ‘formants’ (especially  $F_1$  and  $F_2$ )

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## How to read a spectrogram

- a spectrogram records: frequency (y), time (x), intensity (shading)

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- How many phonetically distinct vowels are there along the continuum [i] – [a] – [ɑ] – [u] ?

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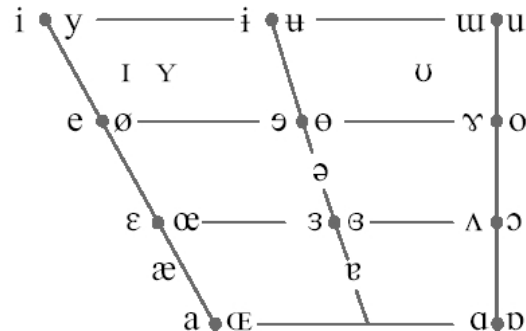
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- French has / i e ε a a ɔ o u /
- English has / i: ɪ e æ a: ʊ ʌ ɔ: ʊ u: /

## Vowel quadrilateral and cardinal vowels

highest point of tongue is:

front



jaw is:

close

open

lips are unrounded (symbol to the left of the dot) or rounded (symbol to the right of the dot); beware [ə] [ɐ] (unrounded), [ʊ] (rounded): NOTE: [a] is 'front' (just like [i])

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- the meaning of the vowel quadrilateral in terms of formants:

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  - close [i] [u] (low  $F_1$ )  
vs  
open [a] (high  $F_1$ );

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  - back [u] [ɑ] (low  $F_2$ , low  $F_2-F_1$  difference)  
vs  
front [i] (high  $F_2$ , high  $F_2-F_1$  difference)

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[https://de.wikipedia.org/wiki/Datei:Spectrogram\\_-iua-.png](https://de.wikipedia.org/wiki/Datei:Spectrogram_-iua-.png)
  - synthesize some vowels yourself:  
<http://www.asel.udel.edu/speech/tutorials/synthesis/vowels.html>
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## English vowel phonemes vs. cardinal vowel positions

- The cardinal vowel positions on the IPA chart are reference points, designed to ‘sound equidistant’.

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- See if you can identify other cardinal vowels that are used in pronouncing English phonemes.

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- Beware the English phoneme /ʌ/. This has evolved away from the [ʌ] position, and is now nearly [e]. (Should it be written as /e/?)
- Look at the **diacritics** on your IPA chart for ways of ‘fine-tuning’ phonetic transcriptions of vowels.

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## Using diacritics for vowels

e Raised

Lowered e

u Advanced

Retracted i

ä Centralized

Mid-Centralized i<sup>x</sup>

o More rounded

Less rounded o

ẽ Nasalized

Rhoticity ɹ

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Vowels (1)

Goals

Acoustic phonetics and vowels

Vowels: phonetics vs phonemics

Vowel quadrilateral and cardinal vowels

English vowel phonemes vs. cardinal vowel positions

Using diacritics for vowels

Vowels: comparing German and English

## Vowels: comparing German and English

- This will be the main topic we will be dealing with in the next session.

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- Look at the diagrams on pages 111 and 149 of Eckert & Barry.

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- Look at the diagrams on pages 111 and 149 of Eckert & Barry.
- Which English vowels do you think will be most problematic for native German speakers?

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- Look at the diagrams on pages 111 and 149 of Eckert & Barry.
- Which English vowels do you think will be most problematic for native German speakers?
- Which English diphthongs do you think will be most problematic for native German speakers?

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- Look at the diagrams on pages 111 and 149 of Eckert & Barry.
- Which English vowels do you think will be most problematic for native German speakers?
- Which English diphthongs do you think will be most problematic for native German speakers?
- Have a look at the discussion on page 109 of Eckert & Barry.

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