Vowels

Vowels and consonants

- Best way to differentiate is based on articulation
  - Consonants form a significant obstruction to the airflow
  - Vowels don't form a significant obstruction

Introspection

- *heed* vs. *had*: [i] vs. [æ]
- *heed* vs. *who'd*: [i] vs. [u]
- *heed* vs. *hard/hod*: [i] vs. [ɑ]

Visualization

- **High front**
- **High back**
- **Low front**
- **Low back**

[i]   [æ]   [ɑ]

Vowel space

- The area in the oral cavity within which the tongue can move without creating friction (i.e. without getting too close to any passive articulators, such as the palate and the pharynx)
- The vowel space is defined by the position of two extreme vowels, [i] and [ɑ]
  - [i] is as front and high as possible
  - [ɑ] is as back and low as possible

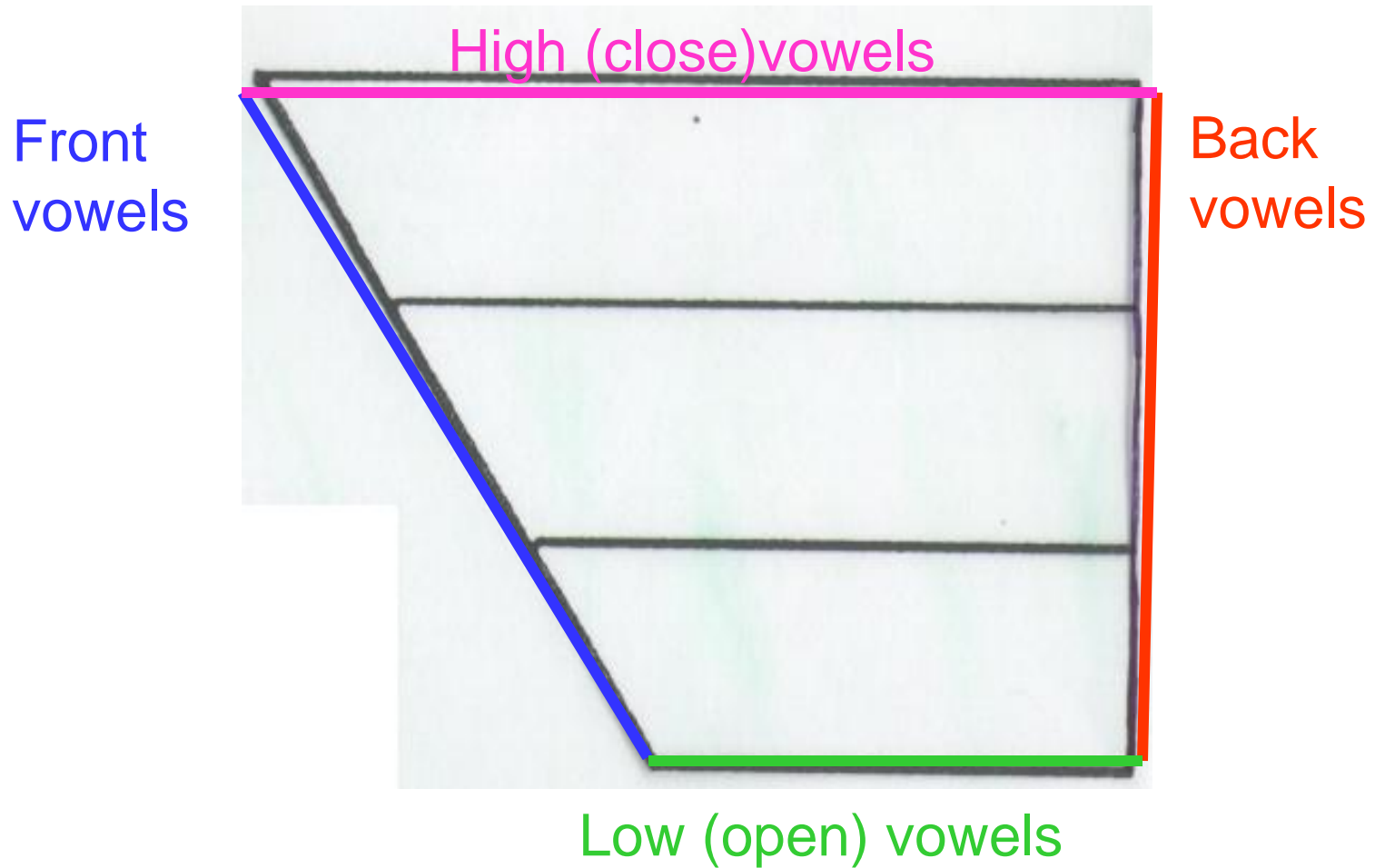# Making the mouth into an idealization
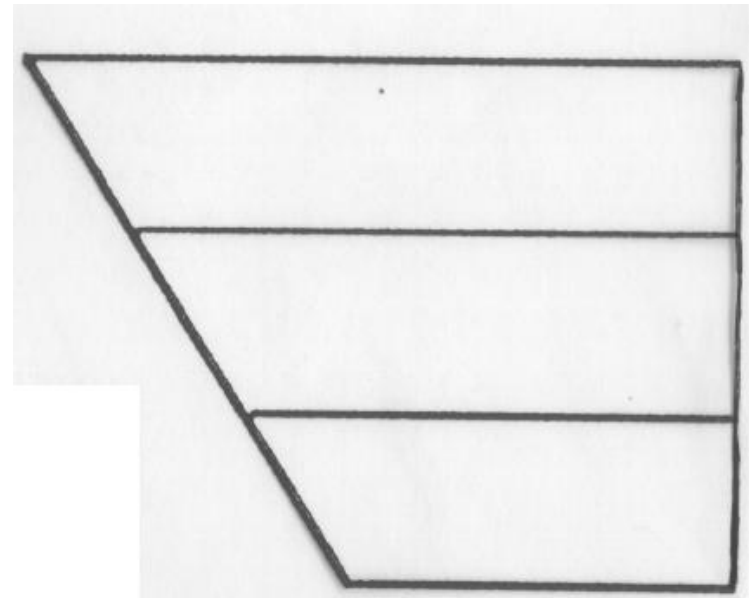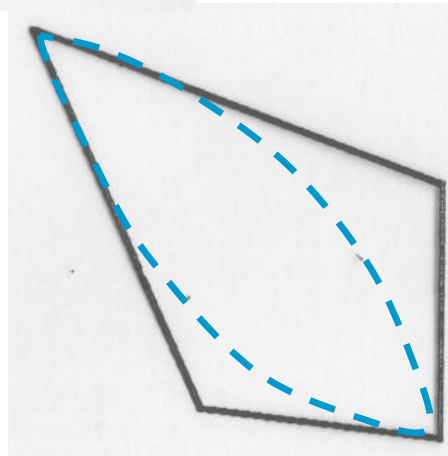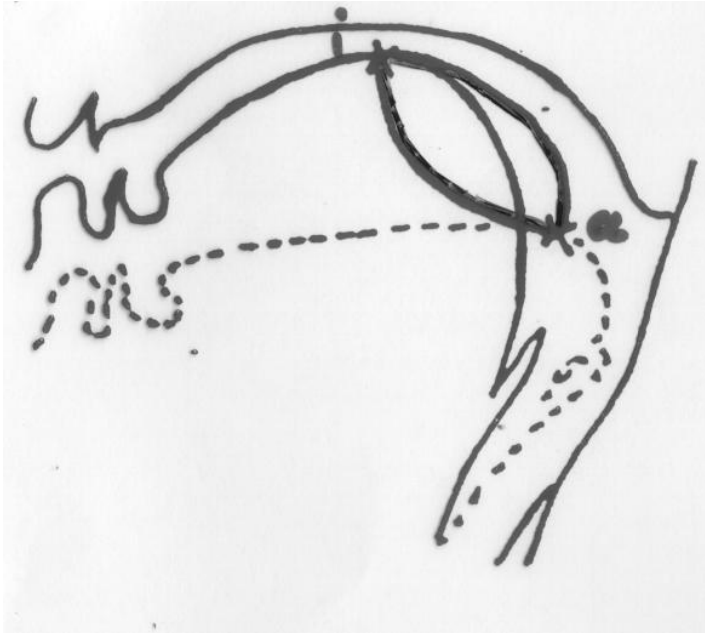
Articulation of vowels

- Position of the tongue body
  - Tongue height (high or low relative to the palate)
  - Tongue backness (front or back relative to the lips and the pharynx)
- Other parameters
  - Lip rounding (rounded, spread or neutral)
  - Nasality (nasal or oral)

Description

High (close)vowels

Front vowels

Back vowels

Low (open) vowels

Defining cardinal vowels

- Cardinal vowels are positioned at extreme edges of the vowel quadrilateral
- They are not used in natural languages but the vowels of natural languages can be better described with the help of Cardinal vowels.
- [i] – the tongue is as high and far forward as possible without creating friction; the lips are spread – cardinal vowel 1 (CV1)
- [ɑ] – the tongue is as low and far back as possible without creating friction; the lips are neutral – cardinal vowel 5 (CV5)

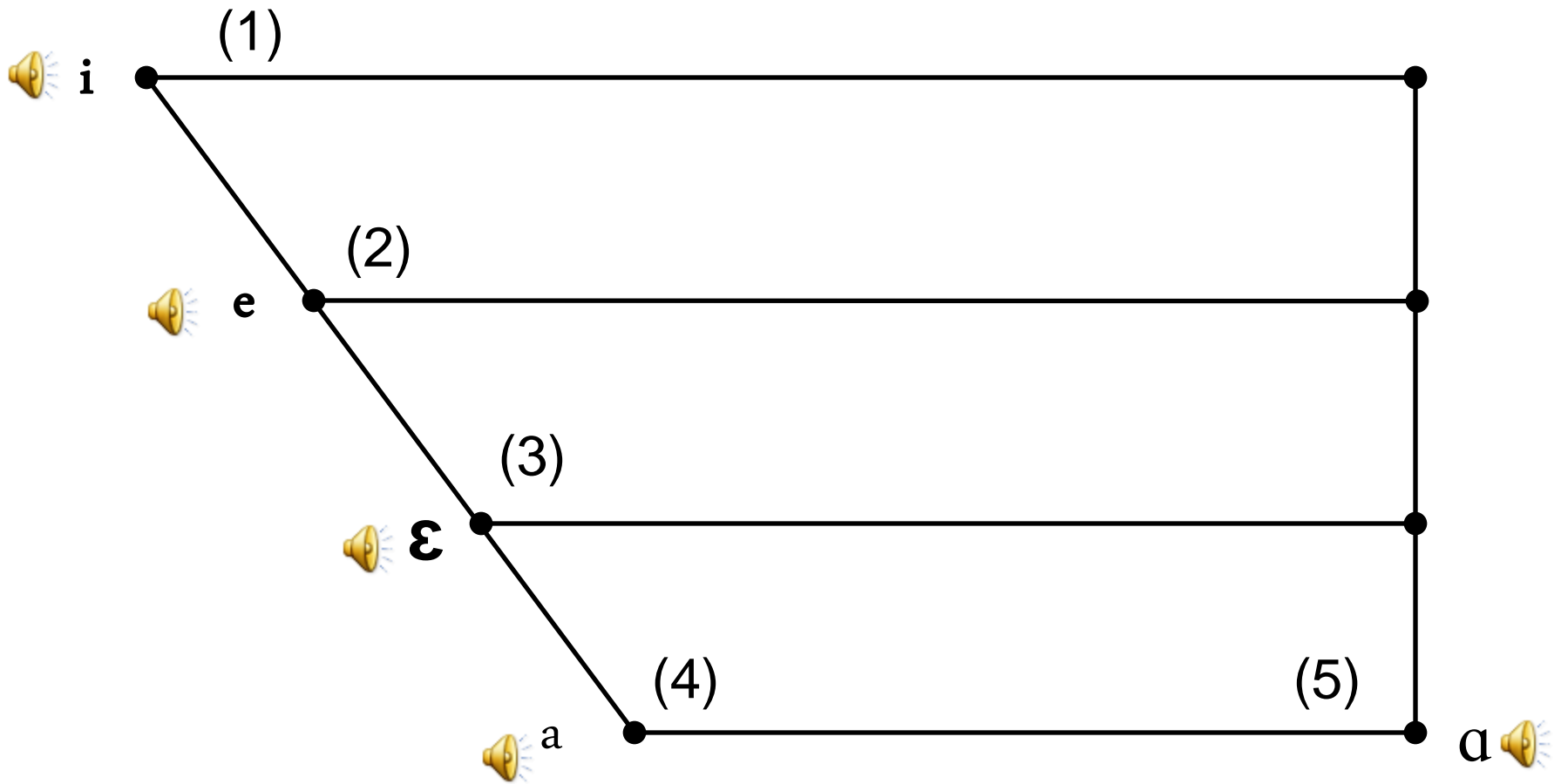# Defining cardinal vowels

i (1)

(5)

ɑ
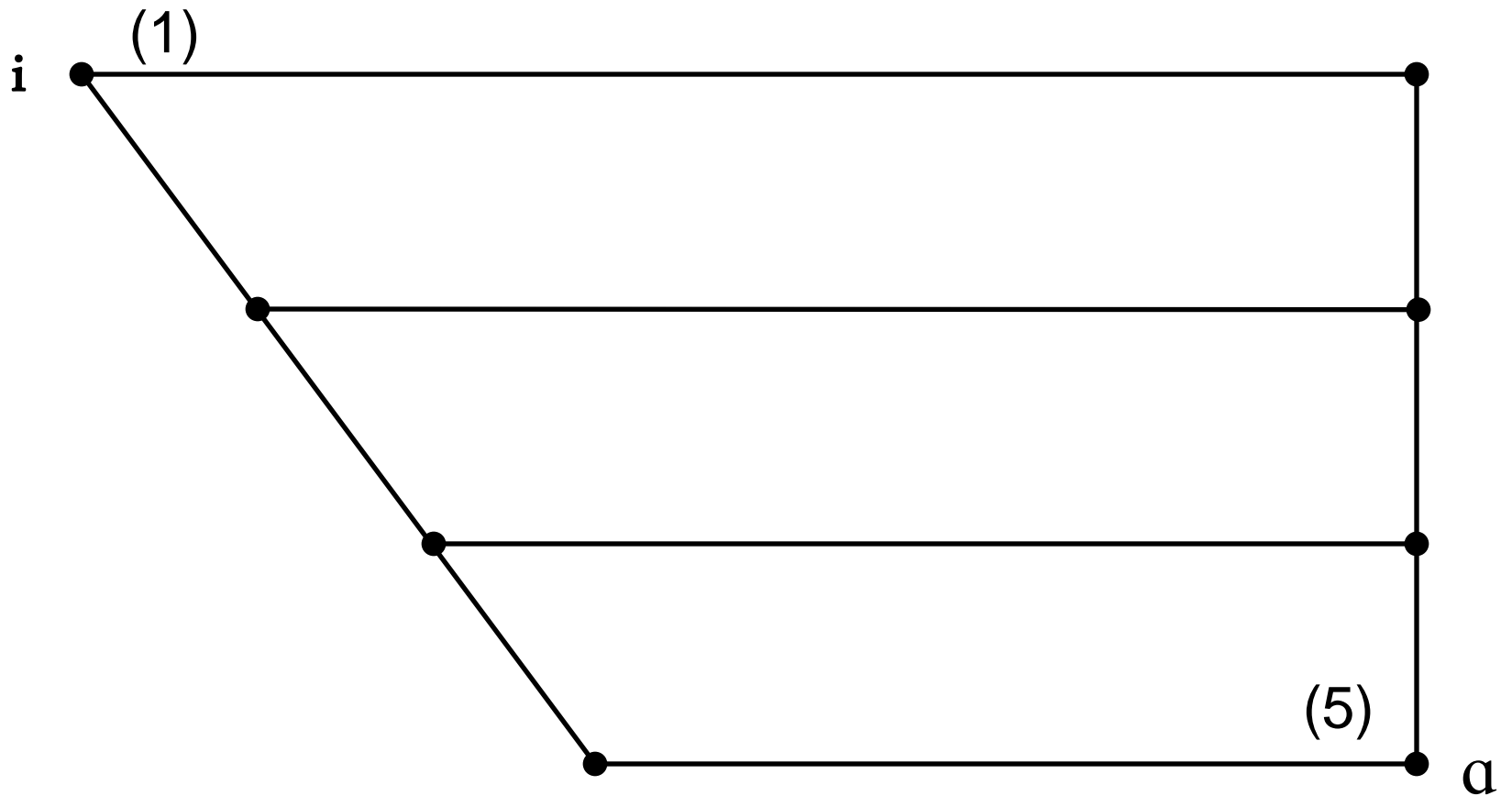
The front cardinal vowels

- The front cardinal vowels are auditorily equidistant steps between (1) and (4), the lowest front vowel

    [i]   [e]   [ɛ]   [a]

- The front cardinal vowels are unrounded

- Note: For CVs and the IPA, [a] is a front vowel; it does not really exist in English

The front cardinal vowels

The back cardinal vowels

- The back vowels are at the same equidistant steps as the front vowels, but articulated with the tongue bunched towards the back of the oral cavity
- Thus we have the following correspondences:

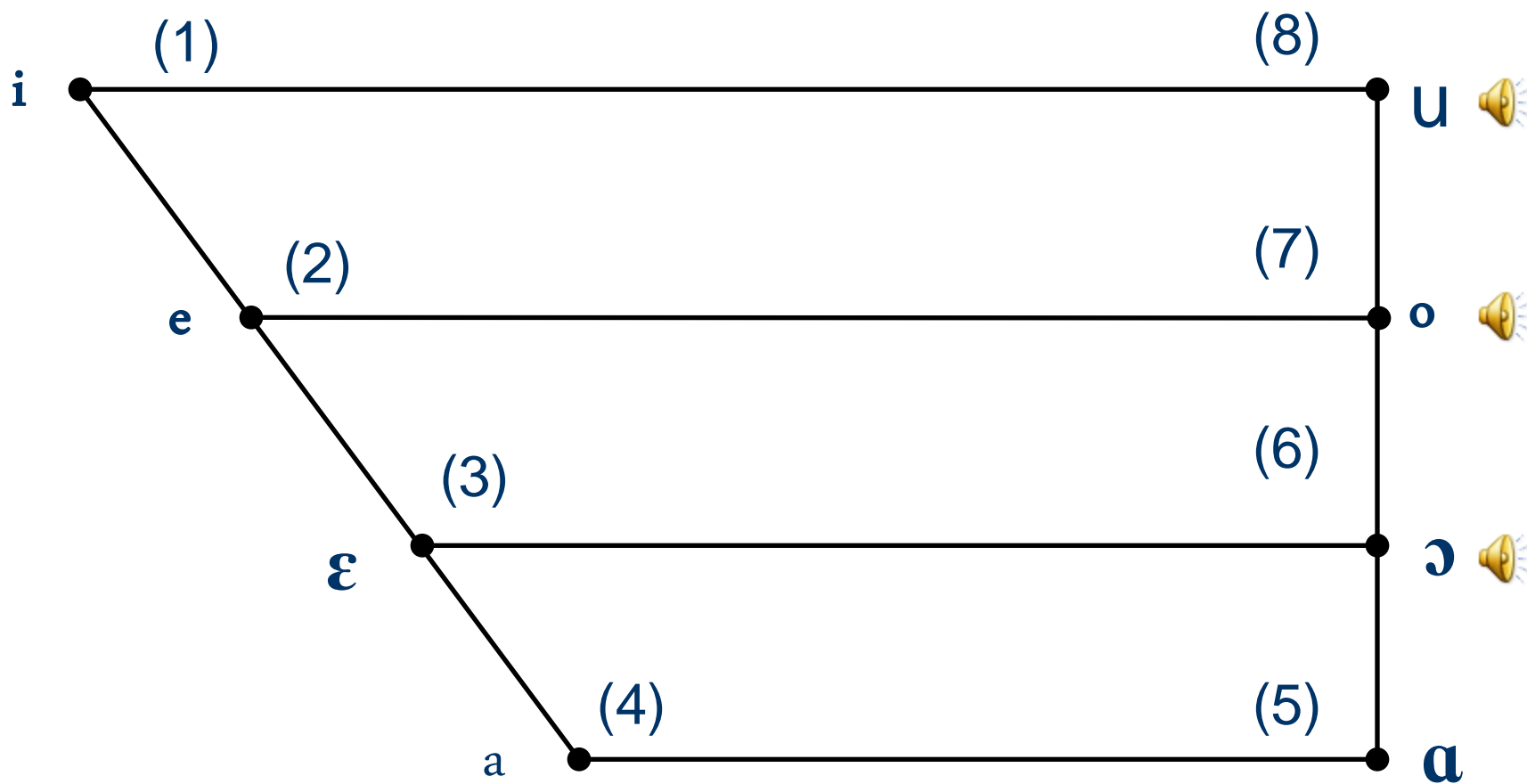$$[i] \qquad [u]$$

$$[e] \qquad [o]$$

$$[\varepsilon] \qquad [\mathbf{ɔ}]$$

$$[a] \qquad [\mathbf{ɑ}]$$

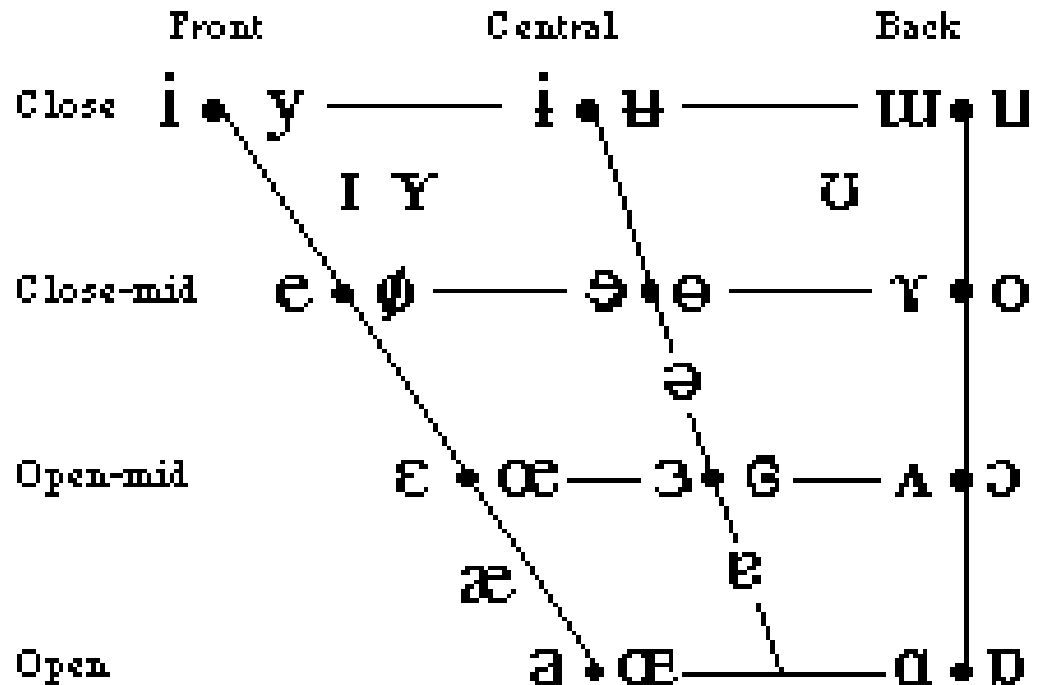- The back vowels, except [ɑ], are rounded

All (primary) cardinal vowels
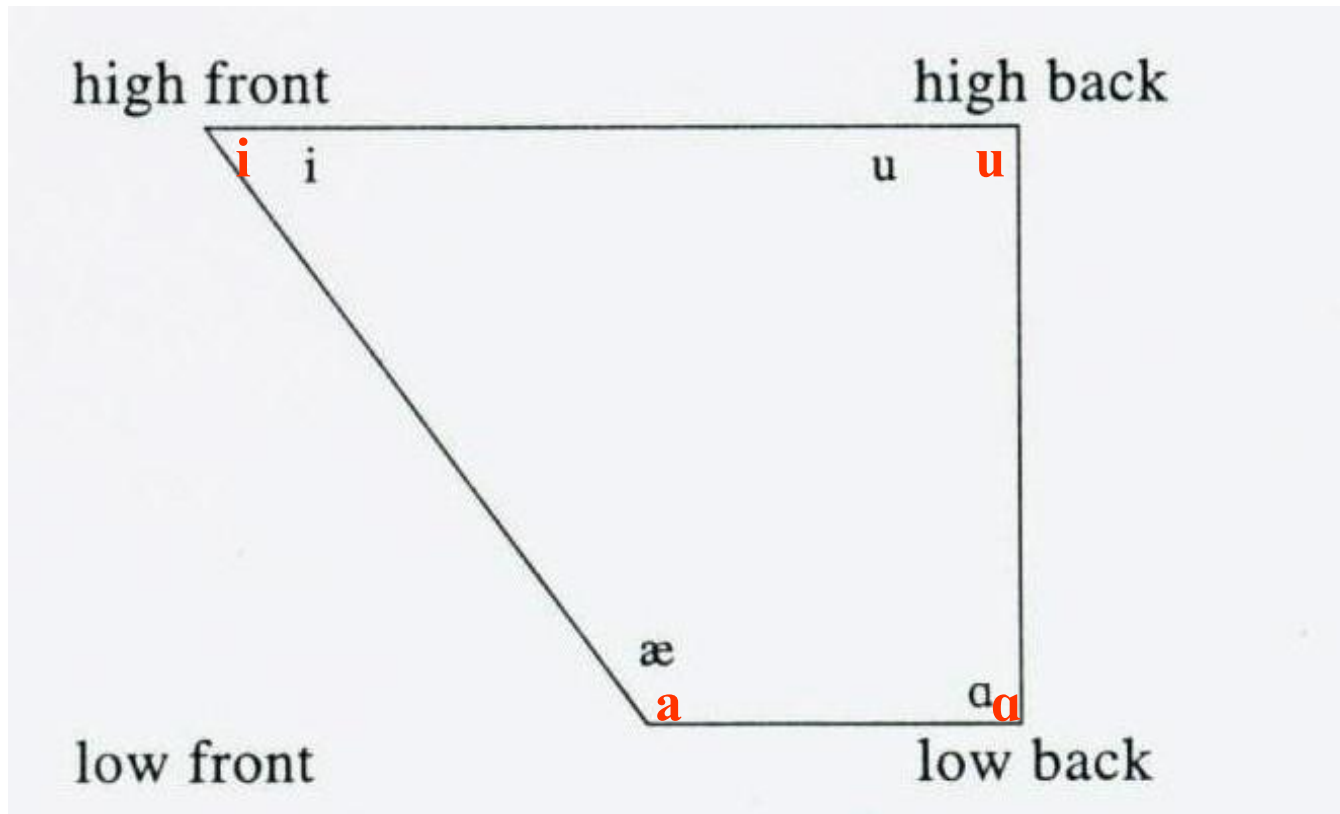
Summary: full IPA vowel chart

- High-low

(close-open)

- Front-back

- Rounded-unrounded

- Oral-nasal

VOWELS

Where symbols appear in pairs, the one
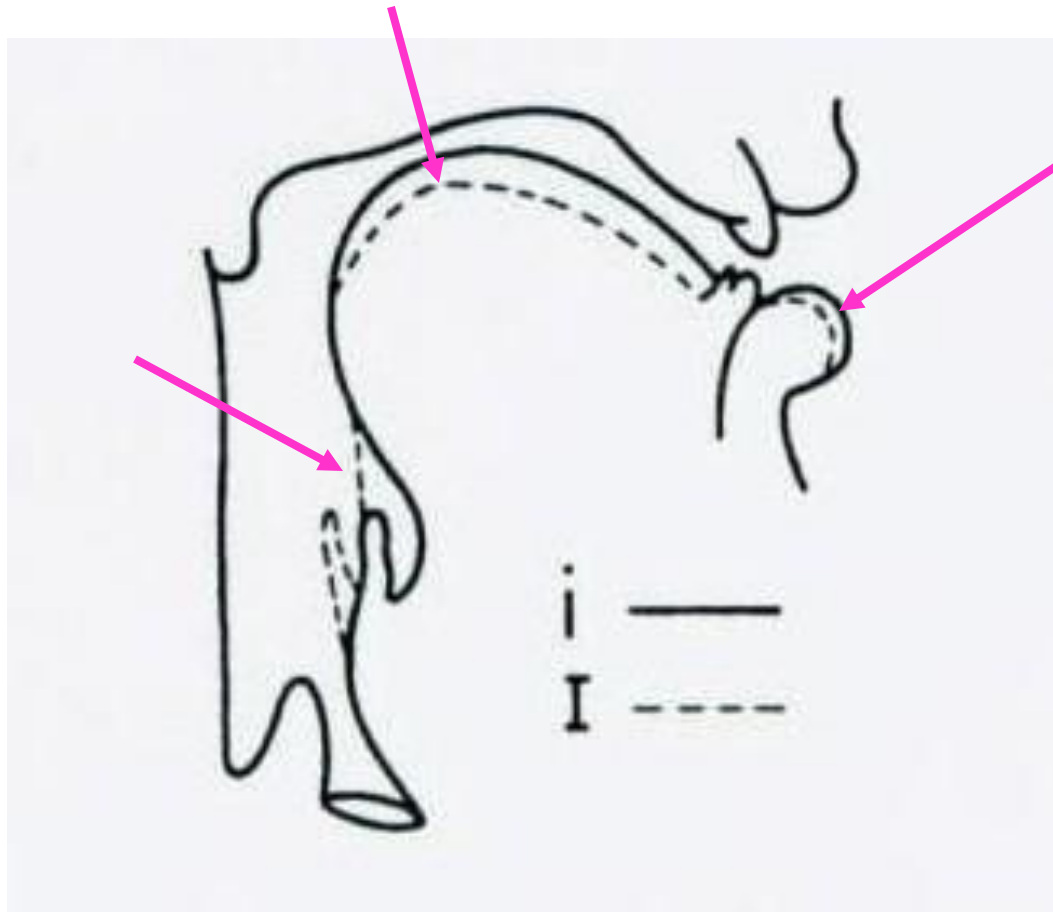to the right represents a rounded vowel.

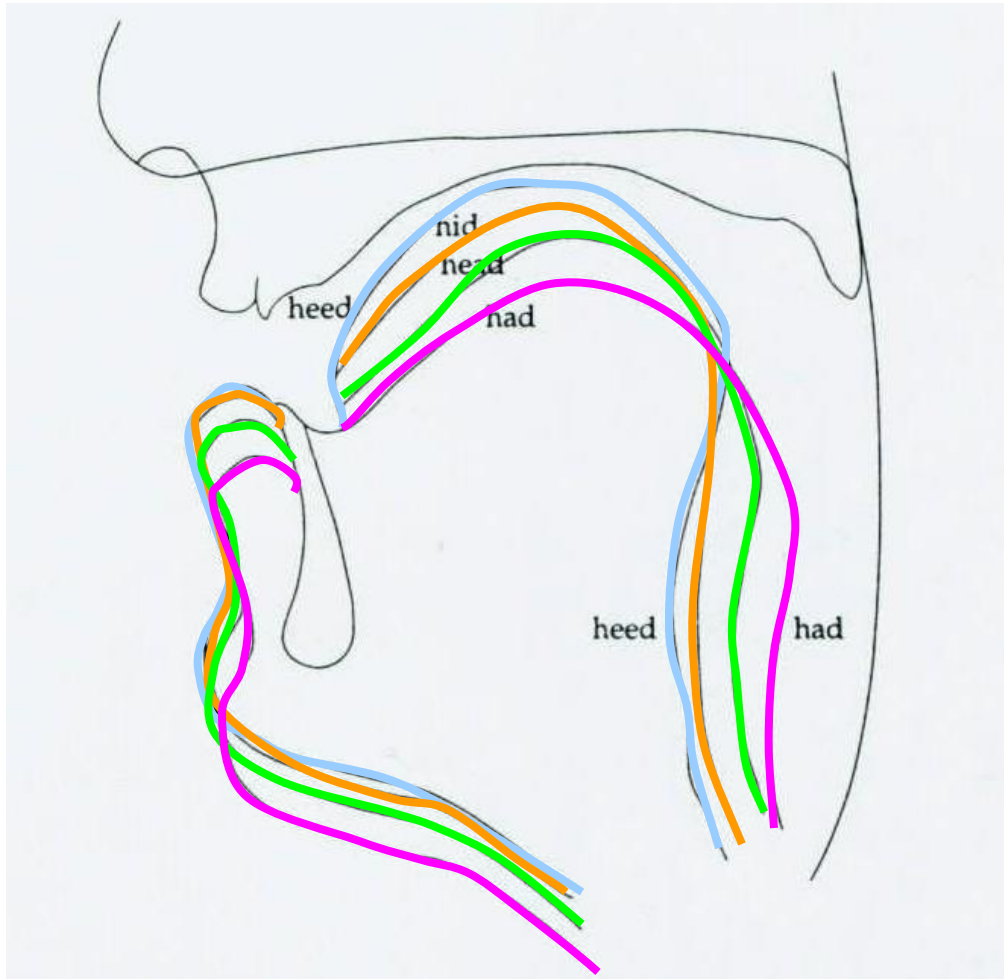# Defining the vowel space for English

CVs in red

From Ladefoged, 2001

Tense and lax [i] and [ɪ]

From Ladefoged & Maddieson 1996

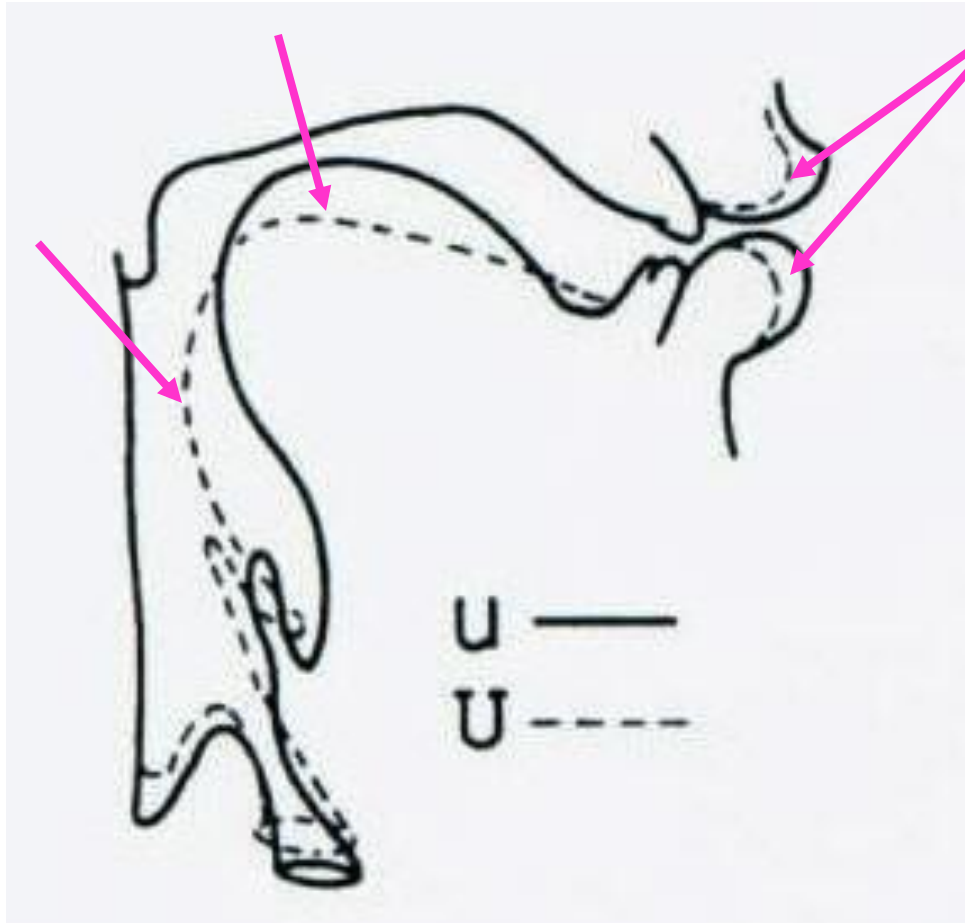# Tongue position for English front vowels

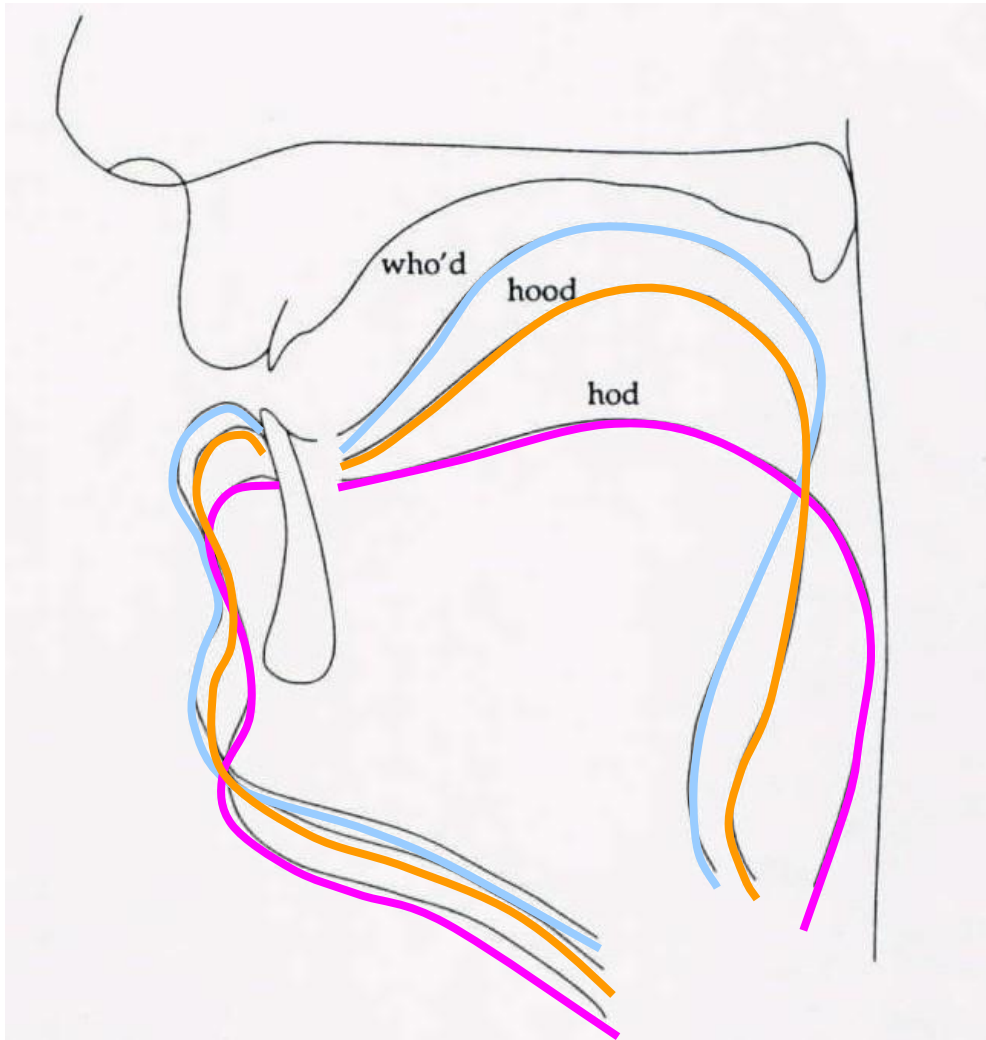heed [i]

hid [ɪ]

head [ɛ]

had [æ]

From Ladefoged, 2001

Tense and lax [u] and [ʊ]

From Ladefoged & Maddieson 1996

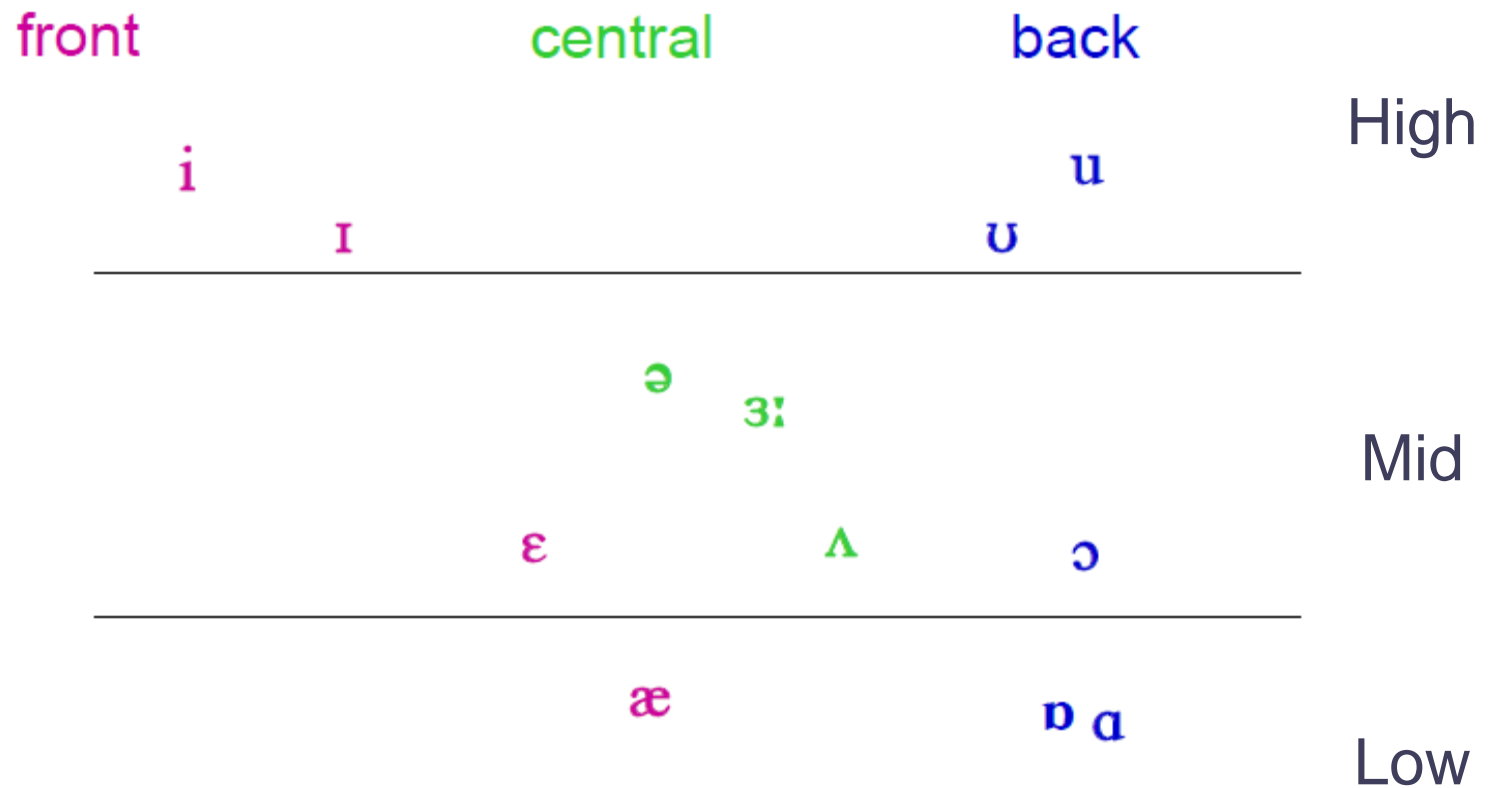# Tongue position for some back vowels

who'd [u]
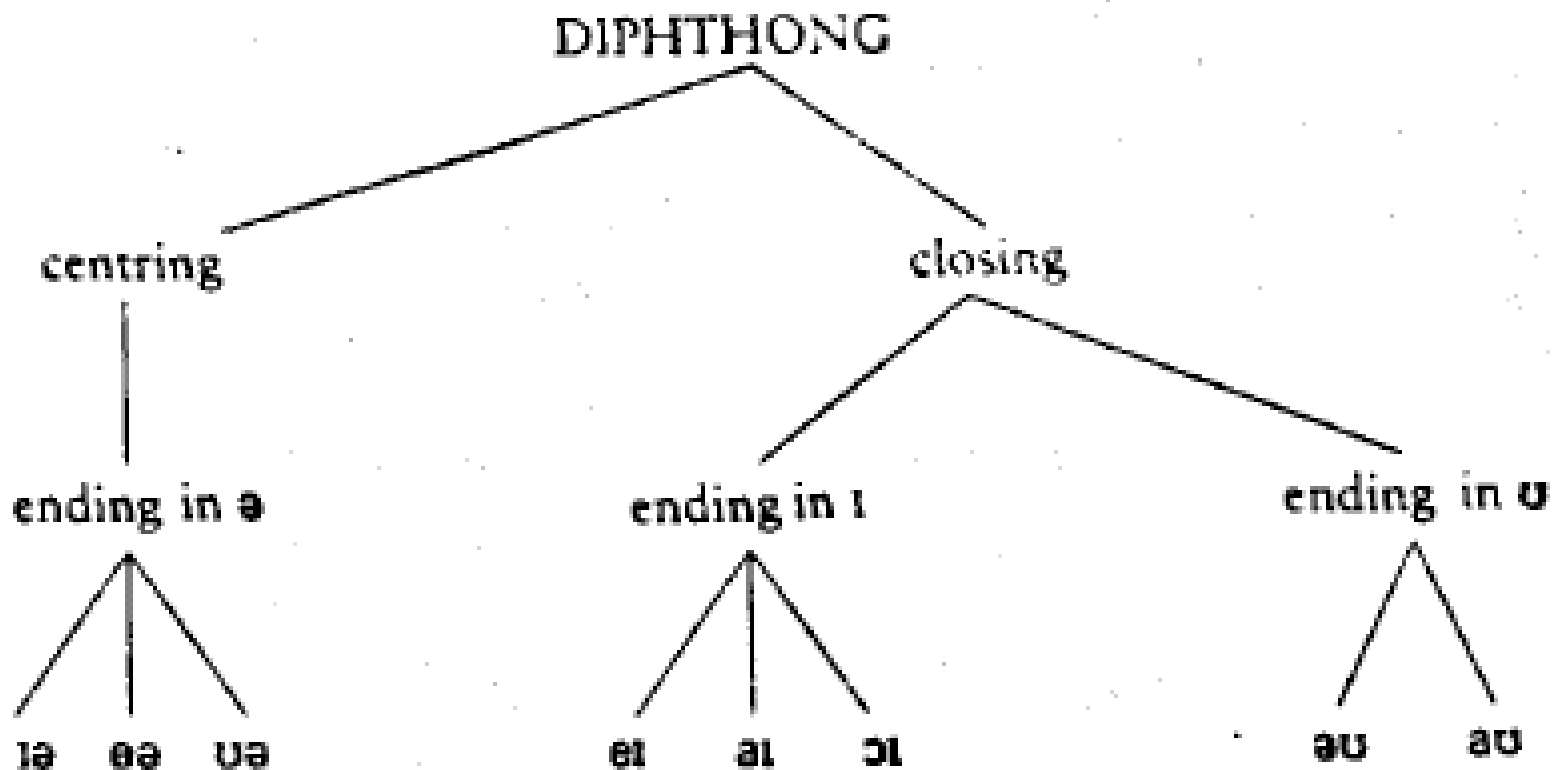
hood [ʊ]

hod [ɑ]

From Ladefoged, 2001

English monophthongs

Tense vs. Lax

- **Tense** (e.g. bead) (can be found anywhere in a word)
  - [i] [ɑ] [ɔ] [u] [aɪ] [aʊ] [ɔɪ] [eɪ] [oʊ]
- **Lax** (e.g. bid) (can't be found word-finally)
  - [ɪ] [ɛ] [ʌ] [æ] [ʊ] ([ə])

Diphthongs

From P. Roach, p. 20

Triphthongs

- Closing diphthongs + [ə]
- Only in BE
- Middle part is often omitted in casual speech

English vowels in context

- Stress
  - Louder, longer, more peripheral in stressed position
  - Mostly schwa in unstressed position
- Nasalization
  - If following nasal consonant in the same syllable
- Duration
  - Tense vs. Lax
  - following consonant

Articulation vs. acoustics

- Potential problems with articulatory descriptions
  - Vowels are produced with a wide-open vocal tract. Hence, the descriptions of vowel articulations are not as reliable as for consonants.
  - This was particularly a problem at the time when phonetic work had to rely exclusively on ears and kinesthesis
- Potential solution
  - Better articulatory descriptions (EMA, fMRI, Ultrasound)
  - acoustics

Formant signatures
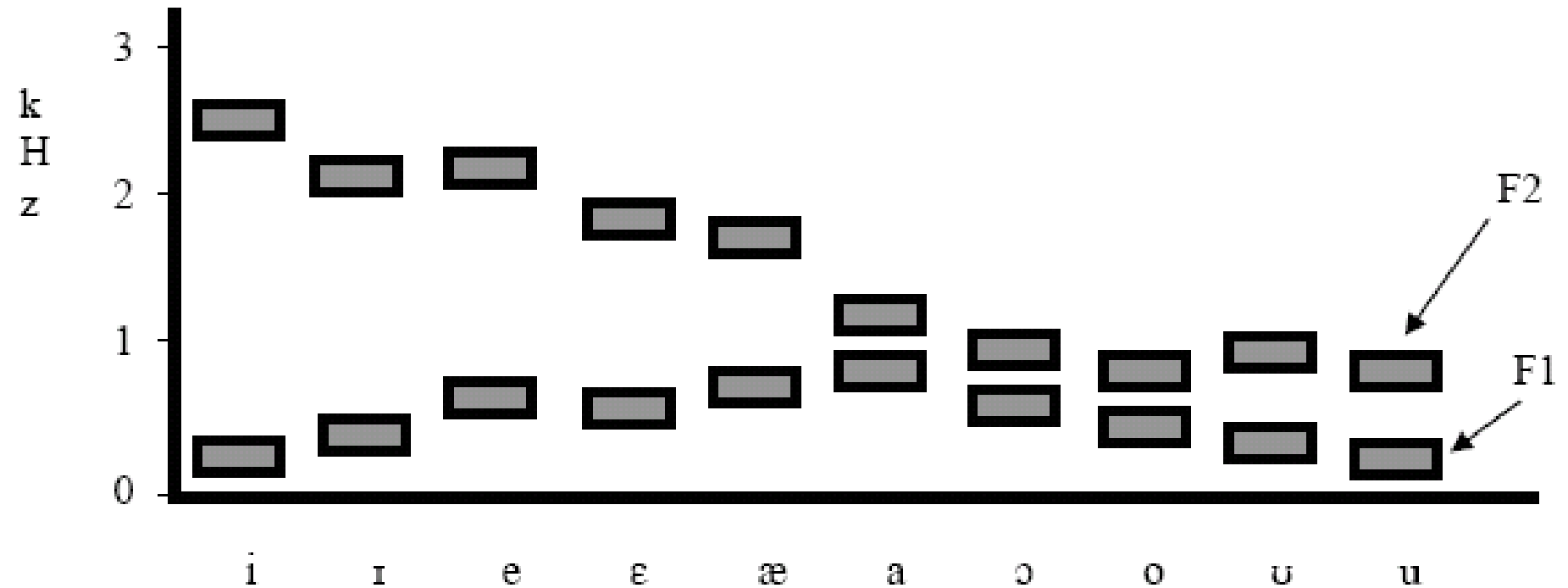
- What is the acoustic correlate of the tongue body height?
- the tongue body front-back dimension?

Formants and the vowel quadriliteral