Class 7
Vowel Features

2/2/2022

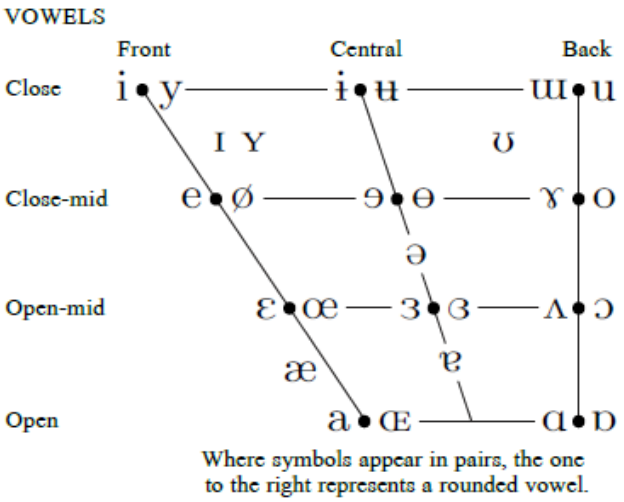
1 Vowels

- So far, we've talked almost entirely about consonants and their features. But vowels have features too!

- Vowels are made by moving the tongue body around the middle of the mouth (virtually no constriction).
  → This means that, by and large, different features are going to be relevant for vowels than are relevant for consonants.

- This is the way that the IPA represents vowels:

(1) IPA vowels [an interactive version: http://www.ipachart.com/]

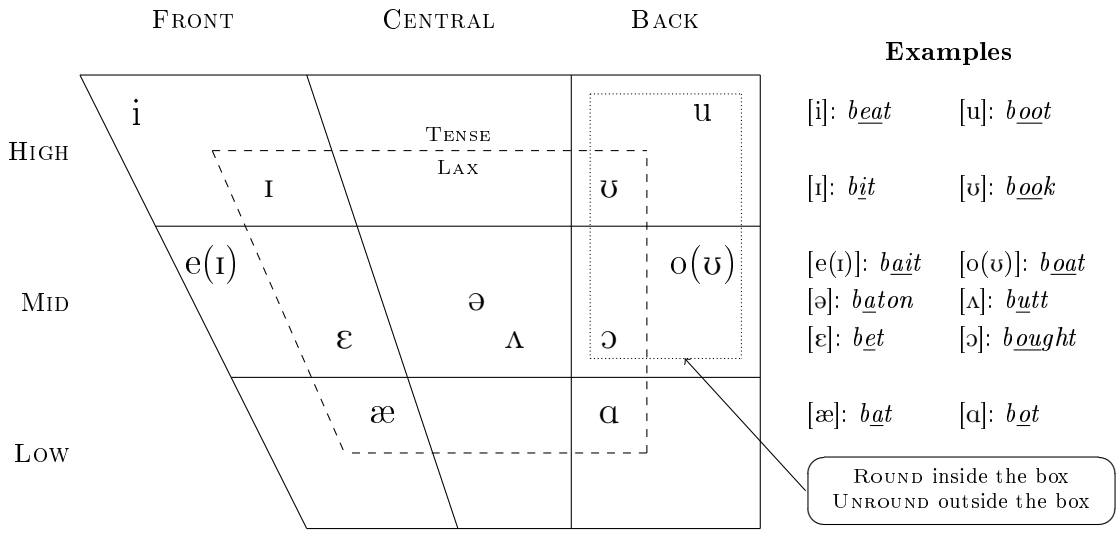


- The way that different vowels behave phonologically can differ by language, so it's best to investigate the features with reference to a particular language.

1.1 The vowels of English

- These are the vowel sounds of English (not including the real diphthongs):

(2) English vowel chart (monophthongs)



- We describe vowels with five primary features:

(3) Primary vowel features
  (i) **Height**
  (ii) **Backness**
  (iii) **Roundness**
  (iv) **Tenseness**
  (v) (**Monophthong or diphthong**)

1.2 Height

- Height refers to how high the tongue body is during articulation.

- There are three different vowel heights.

(4)

Vowel height	Vowels of English
a. **High**	[i,ɪ,u,ʊ]
b. **Mid**	[(eɪ),ɛ,ə,ʌ,(oʊ),ɔ]
c. **Low**	[æ,a]

  ⋆ (**NB:** This differs slightly from the official IPA terminology.)

- We can capture this three-way height distinction using two binary features: **[±high]** and **[±low]**.

(5) Vowel heights in features
  a. **High** = [+high,−low]
  b. **Mid** = [−high,−low] (i.e., neither low nor high)
  c. **Low** = [−high,+low]
  ∗ *[+high,+low] is articulatorily impossible*

1.3 Backness/frontness

- Backness refers to the front/back position of the tongue body during articulation.

- There is also a three-way distinction for backness:

(6)

Vowel backness	Vowels of English
a. **Front**	[i,ɪ,eɪ,ɛ,æ]
b. **Central**	[ə,ʌ]
c. **Back**	[u,ʊ,oʊ,ɔ,a]

- We can capture this three-way backness distinction using two binary features: **[±front]** and **[±back]**.

(7) Vowel backness in features
   a. **Front** = [+front,−back]
   b. **Central** = [−front,−back] (i.e., neither front nor back)
   c. **Back** = [−front,+back]
   ∗ *[+back,+front] is articulatorily impossible*

- Languages very rarely make a distinction between central and back vowels that can't be described with a different feature, so it's typical to use just the feature [±back] to describe backness.

1.4 Roundness

- Roundness refers to whether the lips are rounded during articulation.

- Two-way distinction: rounded **[+round]** vs. unrounded **[−round]**

(8)

Vowel Roundness	Vowels of English
a. **Round**	[u,ʊ,oʊ,ɔ]
b. **Unround**	[i,ɪ,eɪ,ɛ,æ,ə,ʌ,a]

- In English, as in many languages, there's a correlation between backness and roundness: back vowels are round (except the low back vowel) and non-back vowels are unround.

(9) **Implicational universals involving roundness:**
   a. If a language has round vowels, it has back round vowels.
   b. If a language has unrounded vowels, it has non-back unrounded vowels.

   ◦ There are plenty of languages with round front vowels (e.g. French) and unrounded back vowels (e.g. Mongolian), but they (almost?) all also have unrounded front vowels and rounded back vowels.

1.5 Tenseness

- Tenseness refers to whether the vowel is articulated at the exterior of the vowel space (tense) or in the interior of the vowel space (lax).

- Two-way distinction: tense **[+tense]** vs. lax **[−tense]**

(10)

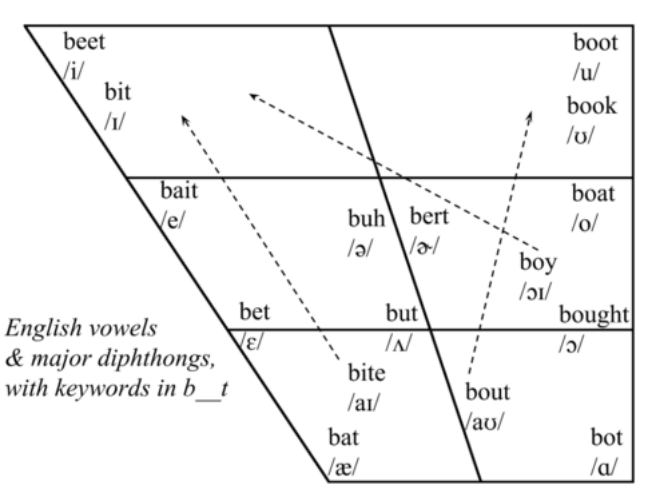
Vowel Tenseness	Vowels of English
a. **Tense**	[i,u,(eɪ,oʊ)]
b. **Lax**	[ɪ,ʊ,ɛ,ɔ,ə,ʌ,æ,a]

- Another name for this feature is **Advanced Tongue Root** [ATR]: [+ATR] = tense, [−ATR] = lax

1.6 Monophthong vs. Diphthong

- Vowels can be single articulations (monophthongs) or movements from one articulation to another (diphthongs).

(11) English vowel chart with diphthongs and example words



- English has three "real" diphthongs and two "inherent diphthongs" (tense mid vowels with a slight rise at the end)

(12) English diphthongs
  a. Real diphthongs: [aɪ] as in 'buy', [aʊ] as in 'cow', and [ɔɪ] as in 'boy'
  b. Inherent diphthongs: [eɪ] as in 'bay', [oʊ] as in 'go'

- Diphthongs can be difficult to describe in terms of features. The best way to go is usually to just use describe the features of the two parts separately.

2 Consonants review

- Linguists describe consonants with three primary features:

(13) Primary consonant features
  (i) **Voicing**
  (ii) **Place** of articulation
  (iii) **Manner** of articulation

- The IPA consonant chart is arranged in terms of these features:

(14) The IPA chart of English consonants

	Bilabial	Labiodental	Interdental	Alveolar	Postalveolar	Palatal	Velar	Glottal
Stops	p b			t d			k g	ʔ
Affricates					ʧ ʤ			
Fricatives		f v	θ ð	s z	ʃ ʒ			h
Taps/Flaps				ɾ				
Nasals	m			n			ŋ	
Central Liquids				ɹ				
Lateral Liquids				l				
Glides	w					j		

2.1 Voicing

- Voicing refers to whether or not the vocal folds vibrate while you produce the consonant

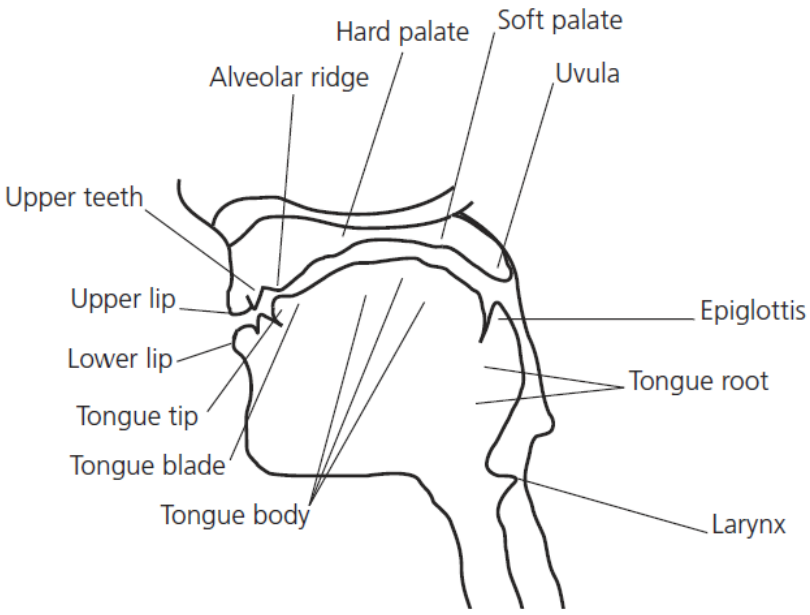
(15) Voicing
  a. **Voiced** [+voice] = vibrating
  b. **Voiceless** [−voice] = not vibrating

- In each cell of the chart, the one on the left is voiceless (e.g. [s]), the one on the right is voiced (e.g. [z]).

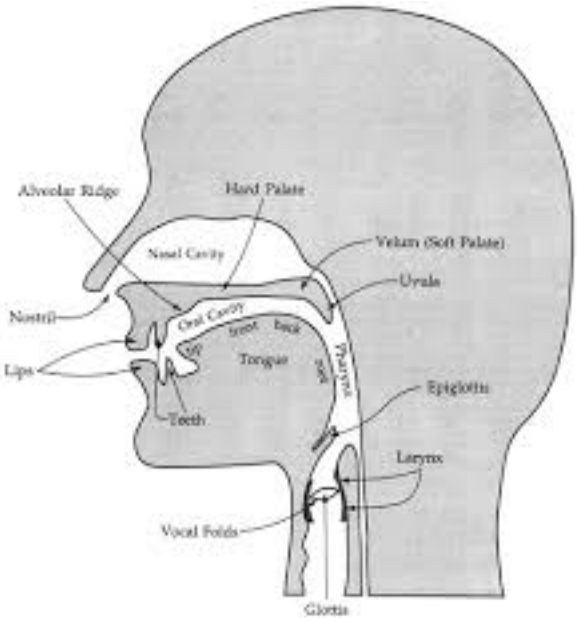
2.2 Place

- Place of articulation refers to the position in the oral cavity where you make a constriction.
- From left-to-right, the IPA chart goes from places at the front of the mouth to places at the back of the mouth.
  - A diagram of the vocal tract is called a "midsaggital diagram".
  - Interactive midsaggital diagram here: http://smu-facweb.smu.ca/~s0949176/sammy/

(16) Midsaggital diagram of the vocal tract (minus nasal cavity)



(17) Midsaggital diagram of whole head



- Major places of articulation: *labial, coronal, dorsal, (glottal)* Consonants of English
  - **Labial** = lips
    - *Bilabial*: bringing the two lips together [p,b,m,w]
    - *Labiodental*: bringing the lower lip to the upper teeth [f,v]
  - **Coronal** = tip/front of the tongue
    - *(Inter)dental*: putting the tip of the tongue between the teeth ("th" sounds) [θ,ð]
    - *Alveolar*: putting the tip of the tongue right behind the teeth (on the "alveolar ridge") [t,d,s,z,n,ɹ,l]
    - *Postalveolar*: putting the tip of the tongue right behind the alveolar ridge ("sh" sounds) [ʃ,ʒ,ʧ,ʤ]
    - *Palatal*: putting the front/middle of the tongue up to the hard palate (consonantal "y") [j]
  - **Dorsal** = middle/back of the tongue
    - *Velar*: raising the middle/back of the tongue up to the soft palate [k,g,ŋ]
  - ⋆ *Glottal* (≈ the absence of oral place): constriction of the vocal folds [h,ʔ]

2.3 Manner

- Manner of articulation refers primarily to the **degree of constriction** used to produce a consonant.
  → how closed is the vocal tract; for everything except labials, how close is the tongue to the top/back of the mouth
- The IPA chart is arranged from most constricted on the top to least constricted on the bottom

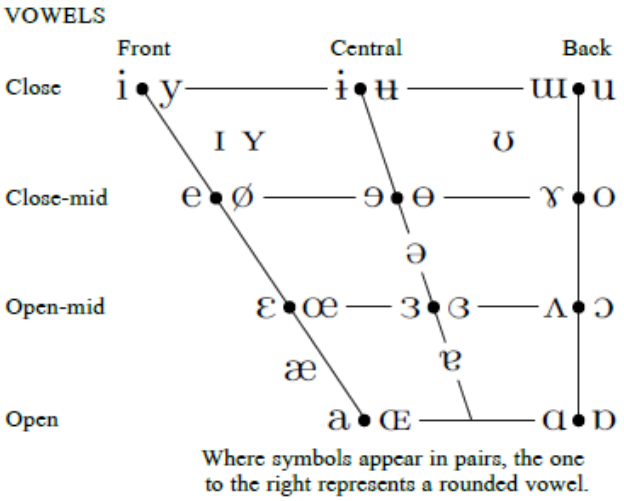
- Manners of articulation (≈ from most constricted to least constricted) Consonants of English
  - **Stops** ("oral stops"): complete closure of the oral cavity [p,b,t,d,k,g,ʔ]
  - **Fricatives**: nearly complete closure of the oral cavity [f,v,θ,ð,s,z,ʃ,ʒ,h]
  - ⋆ **Affricates**: begin with complete closure (∼stop) but end with partial closure (∼fricative) [ʧ,ʤ]
    ↪ *Basic IPA consonant chart does not include affricates because they are complex articulations, built up of two primary symbols.*
  - **Nasals** ("nasal stops"): complete closure of the oral cavity but opening of the nasal cavity [m,n,ŋ]
  - **Taps/flaps**: a very brief complete constriction [ɾ]
  - **Liquids**: medium constrictions [ɹ,l]
  - **Glides** (a.k.a approximants): minimal constriction, almost like vowels [w,j]

3 Non-English speech sounds

3.1 Vowels

- English has a lot of vowels, relatively speaking. But there are many more that it doesn't have.

(18) IPA vowel chart [an interactive one: http://www.ipachart.com/]



- This visualization may be more helpful:

(19) IPA vowels in terms of "features"

The IPA Vowel Chart in Features

		Front		Central		Back	
		unrounded	rounded	unrounded	rounded	unrounded	rounded
Close (high)	(upper)	i	y	ɨ	ʉ	ɯ	u
	(lower)	ɪ	ʏ				ʊ
Mid	(upper)	e	ø	ɘ	ɵ	ɤ	o
	(lower)	ɛ	œ	ɜ	ɞ	ʌ	ɔ
Open (low)	(upper)	æ		ɐ			
	(lower)	a	ɶ	(a)[1]		ɑ	ɒ

Plus: ə, a central vowel. Placed on the IPA chart between Upper and Lower Mid; normally used to show that a vowel is stressless and very short.

- The "upper/lower" distinction in (19) sort of maps to the tense/lax distinction used above.

3.2 Consonants

- Among the places and manners of articulation that English uses, there are many other *place-manner* combinations attested in the world's languages. [Play on http://www.ipachart.com/]

3.2.1 Places of articulation

- There are also additional places of articulation that English doesn't use.

(20) a. *Retroflex*: curling the tongue tip back towards the hard palate [English's /ɹ/ has some retroflex-like properties]
b. *Uvular*: raising the back of the tongue to the uvula (bottom part of the velum)
c. *Pharyngeal*: retracting the root of the tongue back towards the back of the throat (the pharynx)
d. *Labio-velar*: simultaneous constriction at the velum and the lips [English has /w/]

3.2.2 Manners of articulation

- There are also additional manners of articulation that English doesn't use.

(21) a. *Trills*: rapid, repeated constrictions btw. closely held articulators driven by continuous airflow
b. *Taps/Flaps*: a single rapid constriction between closely held articulators driven by continuous airflow [English has /ɾ/ as an allophone of /t,d/]
c. *Lateral fricatives and affricates*: Fricatives and affricates made with one side of the tongue lowered

- What counts as an "r" (rhotic) in a given language varies significantly: taps, trills, approximants, even fricatives.

3.2.3 "Non-Pulmonic" consonants

- Most consonant sounds are produced by air flowing from the lungs out the vocal tract.
- But some consonants are produced with different sorts of airflow; these are the non-pulmonic consonants.

- Three main types of non-pulmonic consonants:

(22) **Clicks**
- Two closures in the oral cavity (one at the velum, one further forward).
- Lowering the tongue while maintaining both closures decreases the air pressure, so when you release the the further-forward closure, air is sucked into the mouth (but stops at the velar closure).

(23) **Implosives**
- One closure in the oral cavity.
- Lowering the glottis while maintaining the closure decreases the air pressure, so when you release the closure, air is sucked into the mouth (all the way down to the glottis).

(24) **Ejectives**
- Two closures in the vocal tract (one in the oral cavity, one at the glottis).
- Raising the glottis while maintaining both closures increases the air pressure, so when you release the further-forward closure, air is pushed out of the mouth