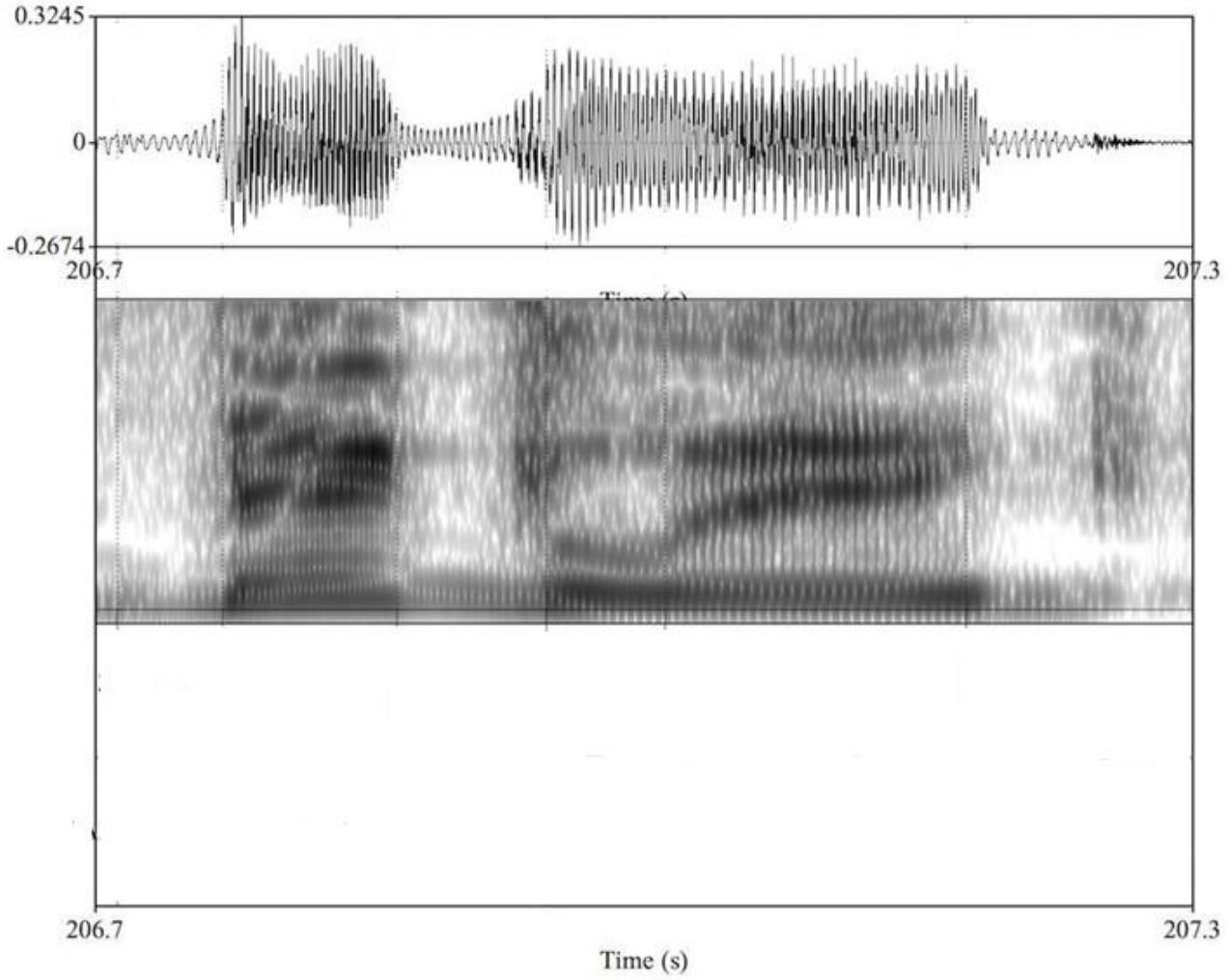
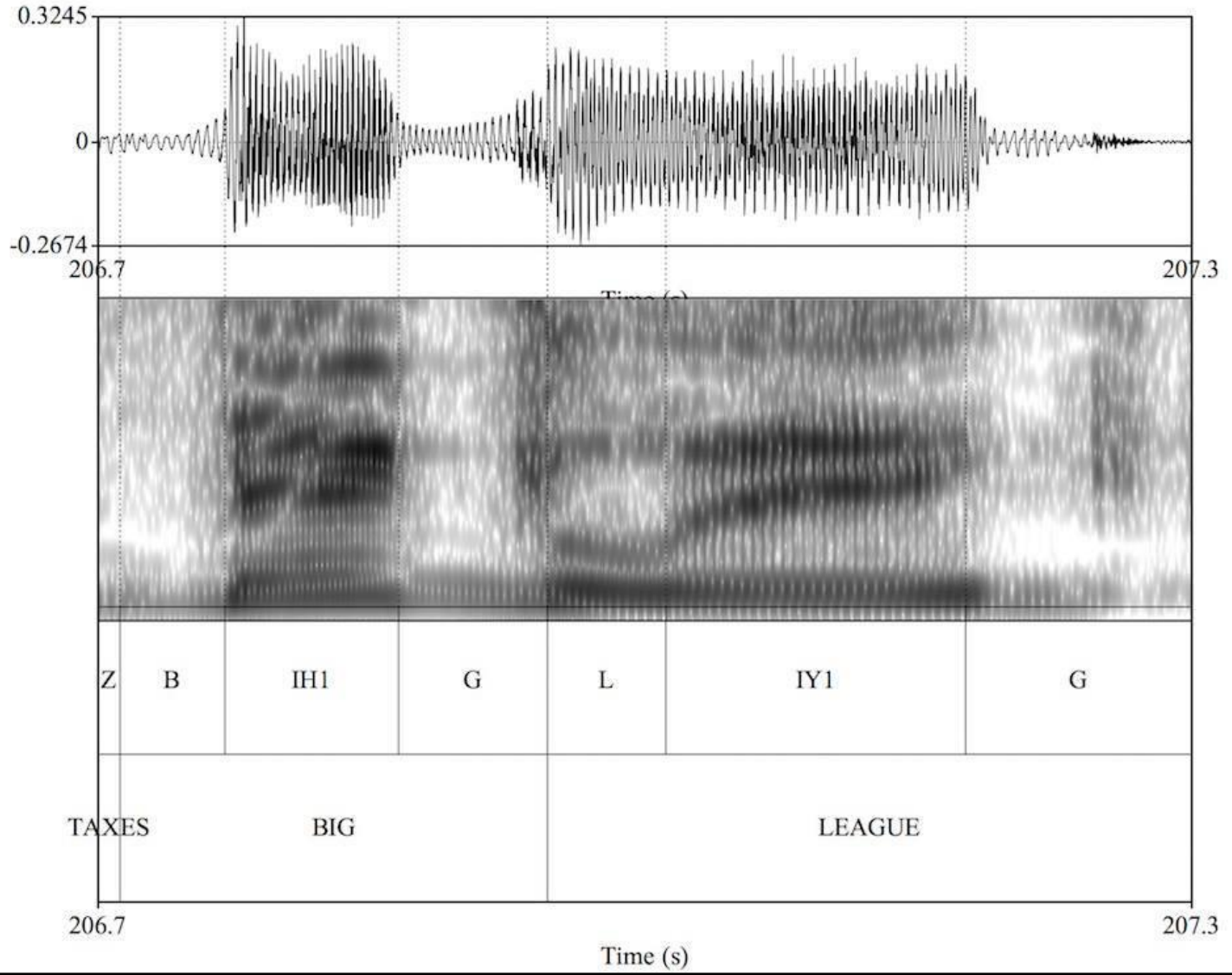
LING 450/550
7-Vowels

Spectrogram Review: Bigly vs Big League



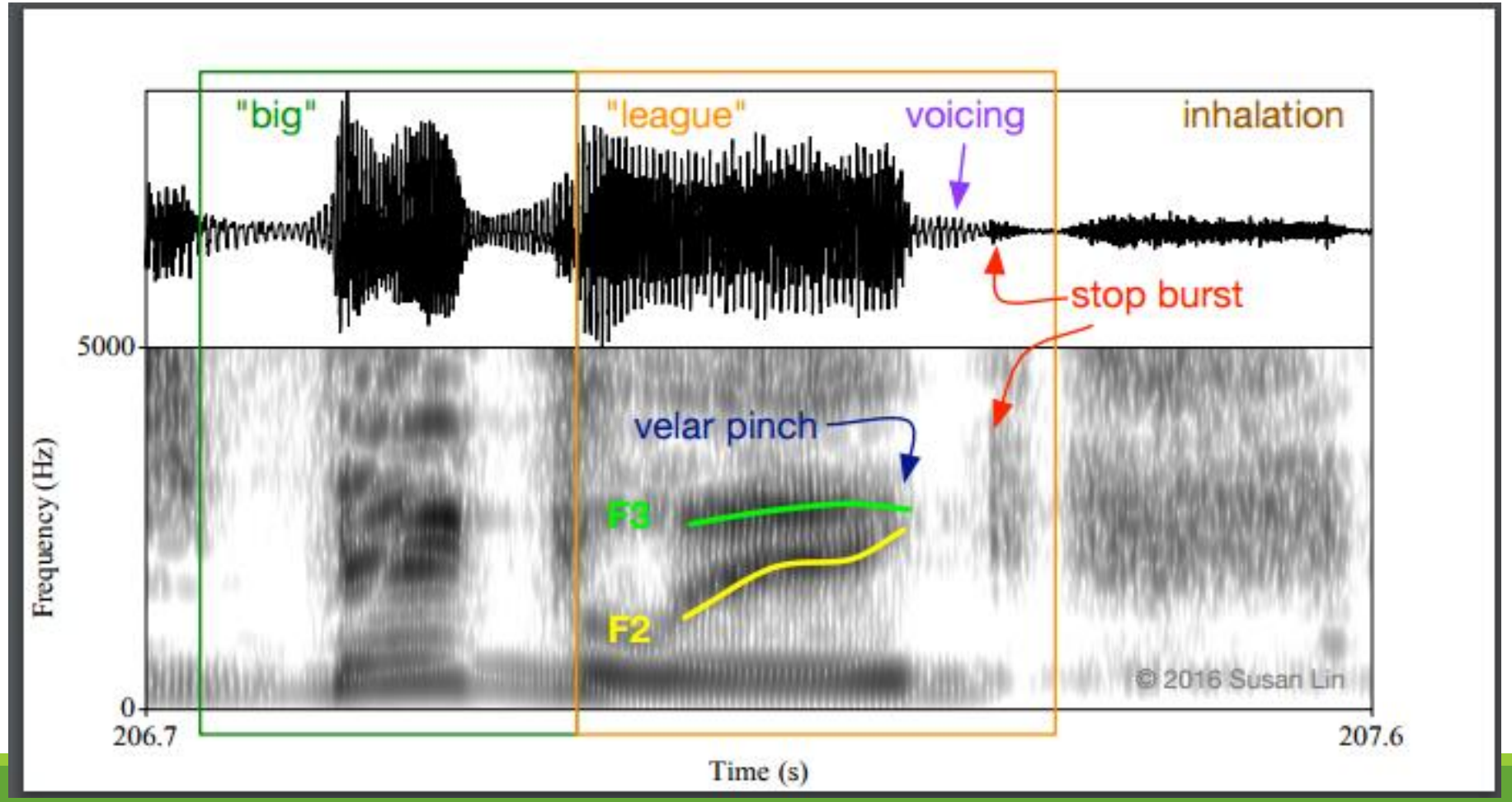
https://www.youtube.com/watch?v=G6Rte7NhCI0

Spectrogram Review: Bigly vs Big League



https://www.nytimes.com/2016/10/25/us/politics/trump-bigly-big-league-linguists.html

Spectrogram Review: Bigly vs Big League



Vowels and Vowel-Like Articulations

FEATURES AND DESCRIPTIONS

READ LADEFOGED & JOHNSON, CHAPTER 9

adapted from slides by Richard Wright and Dan McCloy

Distinguishing Vowels

Recall that we distinguish consonants based on *articulatory features* like *voicing*, *manner*, and *place* of articulation.

Similarly, we distinguish vowels based on a combination of features, but many of these are *acoustic features* (characteristics of the vowel's wave properties) or *auditory features* (characteristics of how the vowel sounds) rather than articulatory ones.

- Phoneticians used to use *cardinal vowels* as auditory reference points, but modern technology makes the articulatory and acoustic approaches much easier than they used to be.

Vowel Quality

Vowel quality is a cover term for the auditory basis on which we distinguish one vowel from another.

- Recall that *quality* is a term for our perception of spectral differences (what musicians call *timbre*).
- Vowel quality is usually described with reference to four features: *height*, *backness*, *roundness*, and *tenseness*.
  - We'll also discuss a number of other features, but these four are the big ones, and are distinguished using entirely different IPA symbols rather than diacritics.

http://www.youtube.com/watch?v=_FatxGN3vAM

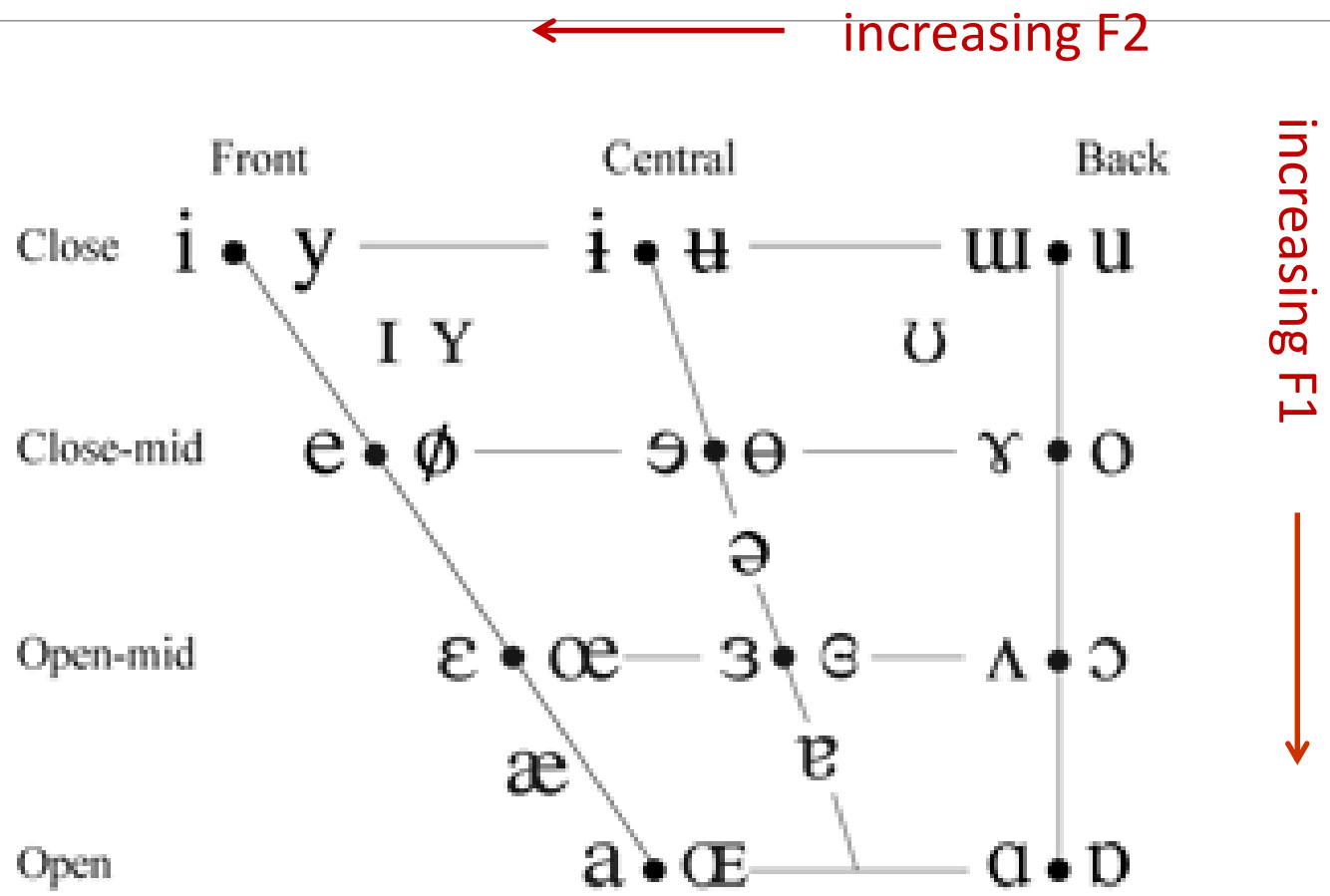
Vowel Height and Backness

The primarily classification of vowels occurs along two dimensions described by two features: high–mid–low (*height*) and front–central–back (*backness*).

- Our perception of vowel height is correlated with the frequency of the first vowel formant (F1).
- Our perception of vowel backness is correlated with the frequency of the second vowel formant (F2).
  - Occasionally, as in the textbook, this dimension is described as being correlated with the difference between the frequencies of the second vowel formant and the first vowel formant (F2 – F1).

Some linguists prefer the terms *close* and *open* instead of high and low (respectively).

Vowel Height and Backness



Vowel Roundness

The articulatory gesture of *roundness* or *lip rounding* affects several formants simultaneously, and its effect depends on the resonant properties of the rest of the vocal tract (i.e., where in the vowel space its unrounded counterpart lies).

- Generally speaking, the effect of lip rounding is to lower F2, and sometimes F3 and F4 as well.

http://www.youtube.com/watch?v=jl4zGRSYqkE

Vowel Tenseness/Laxness

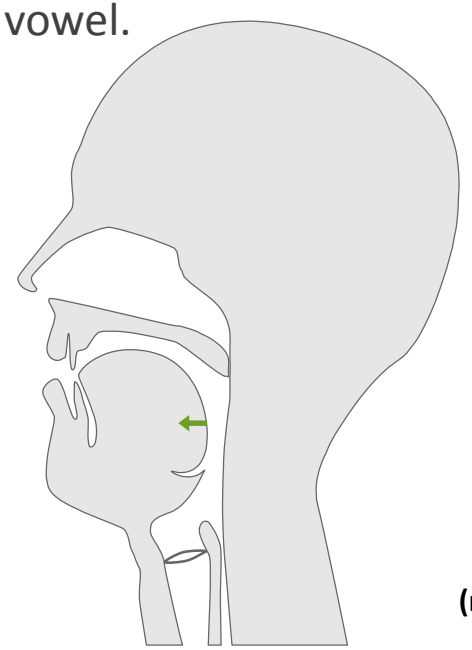
Tenseness (or *laxness*) is an additional acoustic feature needed to fully distinguish some pairs of vowels.

- The tense/lax distinction is effectively a shorthand for “more peripheral/more central,” and as such is a combination of F1 and F2 changes.
- Like roundness, the effect of tenseness depends on where in the vowel space its lax counterpart lies.

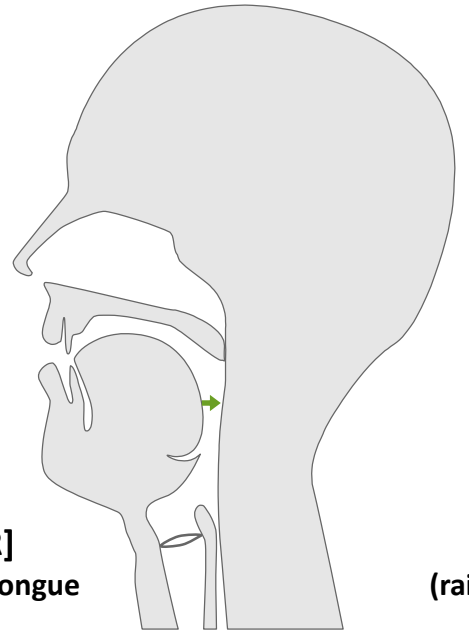
Advanced Tongue Root (ATR)

Some languages have an additional vowel quality contrast that comes from expanding the pharyngeal cavity.

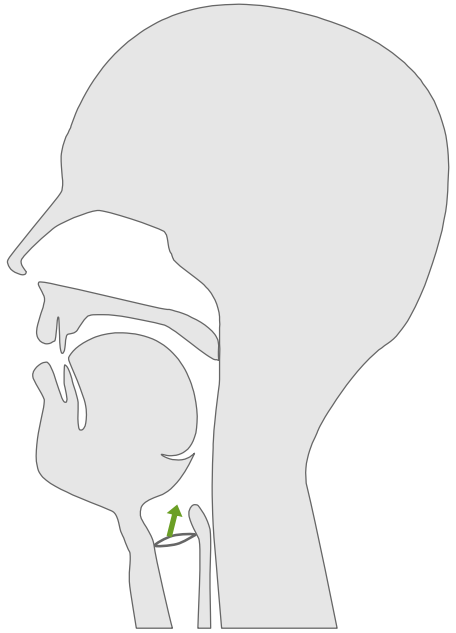
- Normally this is done by advancing or retracting the tongue root (represented as [+ATR] and [–ATR], respectively).
- Alternatively, the pharyngeal cavity can be contracted by raising the larynx during the vowel.



[+ATR]



[–ATR]
(retracted tongue root)



[–ATR]
(raised larynx)

Advanced Tongue Root (ATR)

Because speech sounds are the result of the resonating characteristics of the vocal tract (including the pharyngeal cavity), changing the volume of the pharyngeal cavity using either method has a corresponding effect on the vowel quality.

- Note, however, that the pitch and voice quality may change in the larynx raising method, even if the effect on vowel quality is equivalent to a tongue root retraction.

Some phonologists use ATR to specify differences between tense and lax English vowels, but there is no physiological basis for this classification.

Akan

+ATR

“wash”	[sí̱]
“break”	[bụ̱]

–ATR

“say”	[sị̱]
“get drunk”	[bụ̱]

http://archive.phonetics.ucla.edu/

Monophthongs, Diphthongs, and Triphthongs

Vowels which have a single consistent quality are called *monophthongs*.

- Monophthongs are written with a single IPA symbol.

Vowels which move between two qualities are *diphthongs*, and three qualities, *triphthongs*.

- Diphthongs are written with two symbols, and triphthongs with three.

Diphthongs are usually described as having a *nucleus* (the main or primary quality) and an *onglide* (before the nucleus) or an *offglide* (after the nucleus).

- Triphthongs often have both on- and off-glides, with the nucleus in the middle.

Diphthongs in English

In English diphthongs, onglides and offglides are almost always realized as lax vowels.

- Consequently, many linguists consider English onglides and offglides to be **phonemically** lax (e.g., “pie” /paɪ/, instead of /pai/).
- Regardless, English onglides and offglides are nearly always **phonetically** lax (e.g., [p^{h}aɪ]).

Diphthongs in English

Some linguists transcribe diphthongs as vowel-glide or (especially) glide-vowel sequences (e.g., “kite” /kajt/, “cute” /kjut/).

- Strictly speaking, this is incorrect, because using a /j/ implies that the sound is behaving phonologically like a *consonant*, and only *vowels* can form diphthongs.
  - Phonologically, the sound in question in “kite” clearly acts like a vowel and should be transcribed as such.
  - In “cute,” the status of the sound in question is somewhat debated, but it doesn’t seem to be a typical consonant. The “on-glide” /j/ sound is more accurately transcribed as a true diphthong (/kɪut/), or as palatalization of the preceding consonant ([k^{hj}ut]).

Rhotic Vowels

A *rhotic vowel* is a vowel produced with an “r-like” quality.

- Rhotic vowels are not necessarily the result of coarticulation with a following /ɹ/ sound. In some languages, certain vowels are always rhotic regardless of the following sound.
- Rhotic vowels are usually transcribed by a small “wing” attached to the vowel symbol: “purr” [pʰəˠ], “heard” [həˠd], “murder” [ˈməˠrəˠ]. Another possible analysis is to consider them syllabic consonants: “murder” [ˈmɻrɻ].

Rhotacization

In contrast to rhotic vowels, *rhotacization* or *r-coloring* is caused by overlap between a normal vowel and a following /ɹ/-like sound.

R-colored vowels have a lowered third formant (F3).

Some linguists treat vowels followed by /ɹ/ as diphthongs or triphthongs, rather than vowel-consonant sequences.

- Transitions are very smooth between vowels and approximants, and r-coloring may extend far into adjacent vowels, making it difficult to identify boundaries.
- Examples: “are” [ɑɹ], “err”[ɛɹ], “or”[ɔɹ], “ear” [iɹ], “ire” [aɪɹ]

Nasal Vowels and Nasalization

Because vowels do not rely on oral cavity air pressure (as stops, fricatives, and affricates do), the velum may be open or closed during their production. When the velum is open, nasal cavity resonances are added to oral cavity resonances. Vowels pronounced with the velum open are called *nasal vowels.*

- Nasal vs. non-nasal vowel contrasts are fairly common. Languages with phonemic nasal/non-nasal contrasts include: French, Polish, Portuguese, Navajo, Bengali, Irish, Southern Min, and Yorùbá.
- Many languages that do not have phonemic nasal/non-nasal contrasts have vowels that are *nasalized* allophonically (e.g., when followed by a nasal consonant).
- Nasal vowels and nasalized vowels are marked using a tilde above the vowel symbol ([ẽ, õ]).

Nasal Vowels and Nasalization

Example of Nasal Vowel Contrast-French:

las	lent	lot	long
la	**lɑ̃**	**lo**	**lõ**
'tired'	'slow'	'prize'	'long'




http://www.phonetics.ucla.edu/vowels/chapter14/french2.html

Nasal Vowels and Nasalization

It is thought that nasal/non-nasal contrasts are common because they increase the number of vowel phonemes without increasing the number of oral articulations a child must learn.

- In this way, nasalized vowels increase the size of the phonemic vowel inventory without increasing its complexity.
- However, nasalization is known to obscure some vowel quality contrasts that are more easily heard in oral vowels. Therefore, many languages have lost certain contrasts among their nasal vowels that are still present in their oral counterparts (a process called *neutralization*).

Acoustics of Vowels, in Brief

Some features of vowels have clear, consistent acoustic correlates.

- Height (F1), backness (F2), rhotacization (F3)

Other features of vowels are acoustically more complex, in that they involve multiple acoustic correlates and/or involve different changes depending on the vowel.

- Roundness, tenseness, ATR, nasalization

Stressed and Unstressed Vowels

In many languages some syllables are more prominent than others. They are often louder and have a different pitch than neighboring syllables, and are usually longer in duration. These are called *stressed syllables*.

In *unstressed syllables*, vowel quality contrasts may become diminished or may merge into a single quality. This is called *vowel reduction*. The quality of reduced vowels is often central, similar to the vowel /ʌ/ found in the word “cup.”

By convention, reduced vowels are often transcribed with the symbol [ə] (called *schwa*). Depending on the language or dialect, there may be a variety of reduced vowel qualities that actually occur in unstressed syllables. The lax high front vowel [ɪ] and the high central vowel [ɨ] are common in unstressed syllables for many speakers of English.

Schwa

This is Schwa.

Schwa is not stressed.

Schwa is cool.

Be like Schwa.

Vowel Length

Some languages have vowels that can be phonemically long or short (i.e., changing vowel length can change word meaning).

- The difference in duration varies from language to language, but long vowels are usually about 1.5-1.7 times as long as their corresponding short vowels.
- Many languages (e.g., most dialects of English) use vowel length differences as a secondary feature of vowel quality differences.
- A few languages are claimed to have phonemic three-way vowel length contrasts, though it is controversial whether such claims are accurate.

Vowel Length

Length contrast is transcribed by using a symbol resembling a colon made of facing triangles after the vowel ([aː]). A regular colon may be substituted if necessary ([a:]).

- Example: Estonian [saːta] “to get” vs. [sata] “hundred.”
- It is common in orthography to use vowel-doubling (e.g., *saata*) or macrons (e.g., *sāta*) to mark long vowels. This is non-standard and should not be done in phonetic transcriptions.

Voice Quality

Because vowels are inherently voiced, voice quality contrasts can be phonemic as well. Just as for consonants, the three voice qualities are:

- *Normal voice* (or *modal*): [e, o, æ]
- *Creaky voice* (or *laryngealized*), which is marked using a tilde under the vowel: [ḛ, o̰, æ̰]
- *Breathy voice* (or *murmured*), which is marked using two dots under the vowel: [e̤, o̤, æ̤]

All languages have modal vowels. Voice quality differences are relatively rare as phonemic contrasts in the world's languages.

Semivowels (Glides)

Like the liquids, *semivowels* or *glides* are approximants (narrow constriction, but not enough to generate turbulence). They are very short versions of the high vowels which are really just formant transitions. The most common glides are:

- the palatal [j] (counterpart of the vowel [i])
- the labiovelar [w] (counterpart of the vowel [u])
- the labiopalatal [ɥ] (counterpart of the high front vowel [y])

Consonantal Effects on Vowel Formants

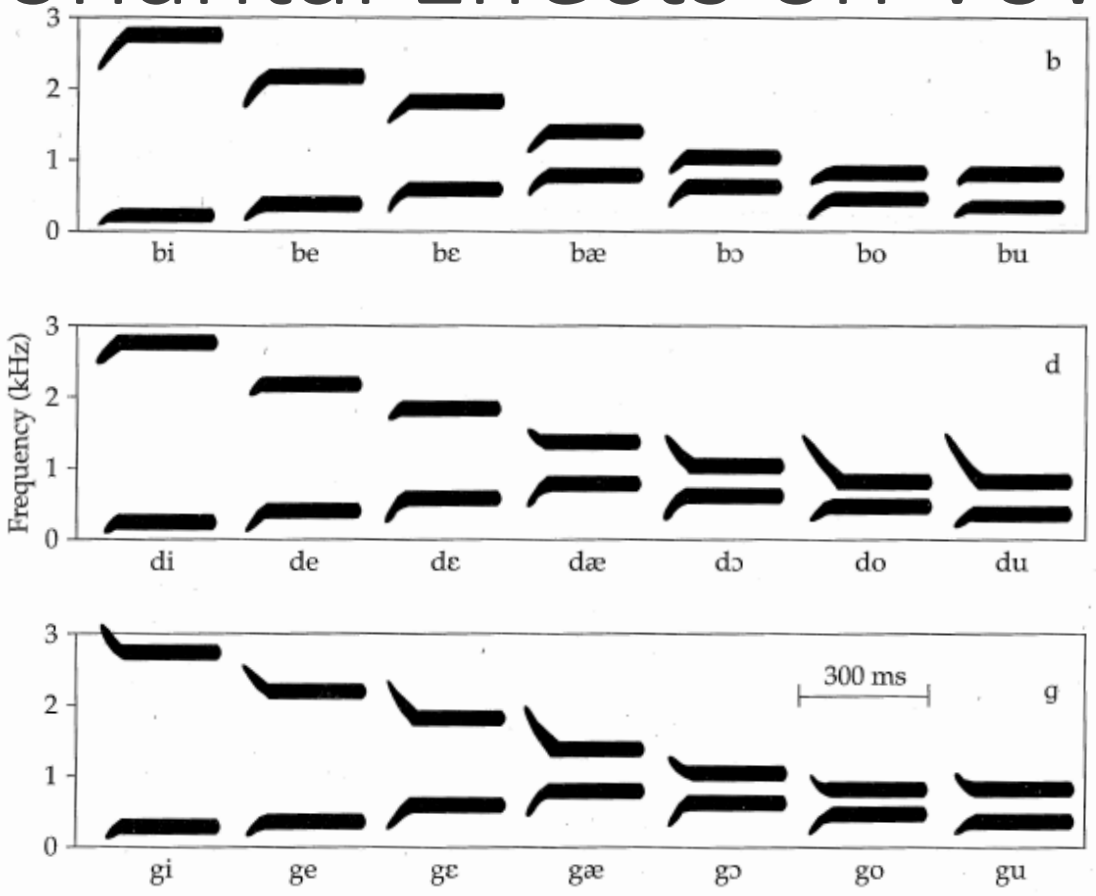
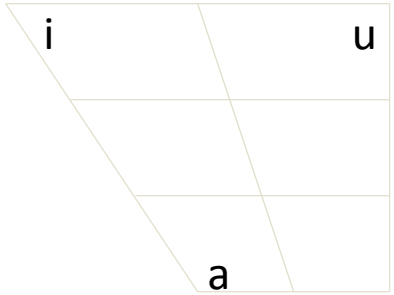


Figure 8.7 F_1 and F_2 transition patterns in stop release used to synthesize [b], [d], and [g] followed by various vowels. Adapted from Delattre et al., 1955, p. 770, and published with permission.

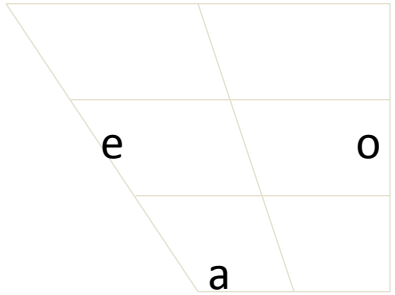
from Johnson, K. (2003). *Acoustic & Auditory Phonetics (2nd ed.)*. Malden, MA: Blackwell.

Vowel Systems: Examples

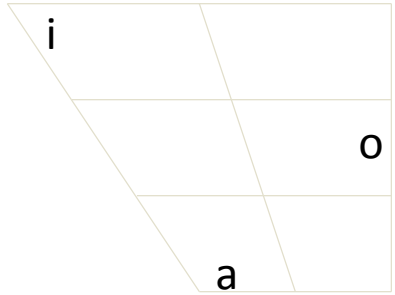
3-vowel Systems



Aleut, Nuxálk, Caddo, Dyirbal, Kalaallisut, Haida, Inuit, Tsimshian

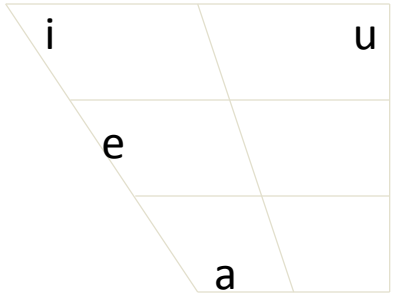


Alabama, Amuesha

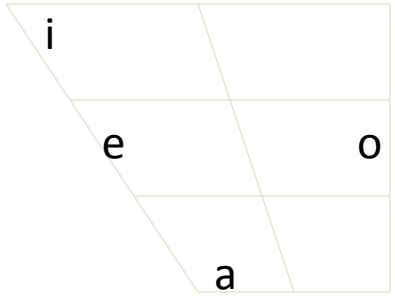


Piraha̋

4-vowel Systems

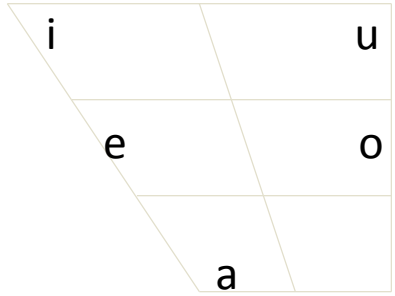


Bandjalang, Moxo, Murihpatha, Shasta



Campa, Klamath, Malagasy, Nahuatl, Tacana

5-vowel System



Ainu, Basque, Hawaiian, Japanese, Luiseño, Nubian, Russian, Spanish, Tagalog, Tlingit, Yaqui, Zulu, Zuni

all data from UCLA Phonological Segment Inventory Database (UPSID)

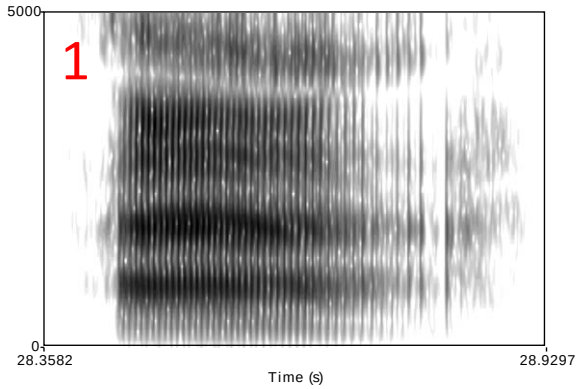
Reference Chart: Vowels

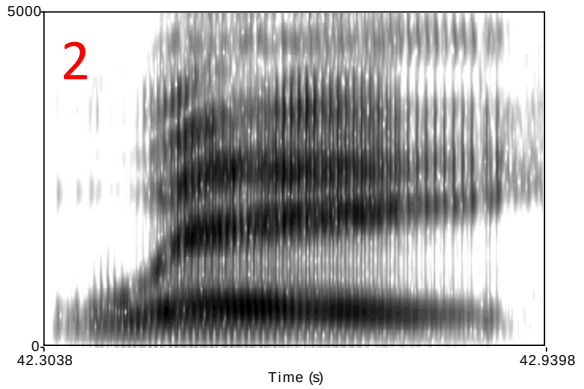
	Front		Central		Back	
	Unround	Round	Unround	Round	Unround	Round
High Tense	i	y	ɨ	ʉ	ɯ	u
High Lax	ɪ	ʏ	—	—	—	ʊ
Mid Tense	e	ø	ɘ	ɵ	ɤ	o
Mid Lax	ɛ	œ	ə (ɜ)	ɞ	ʌ	ɔ
Low	æ	ɶ	a	ɐ	ɑ	ɒ

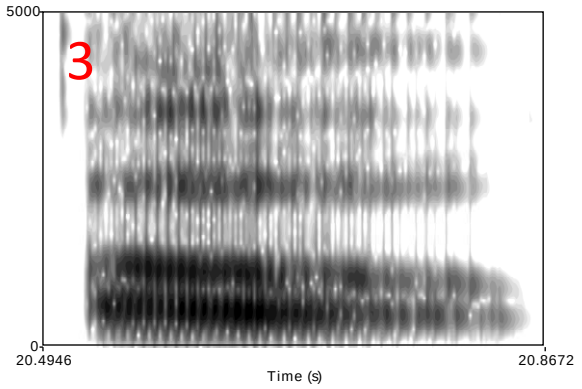
Feature values based on Hayes (2009). *Introductory Phonology,* p. 98

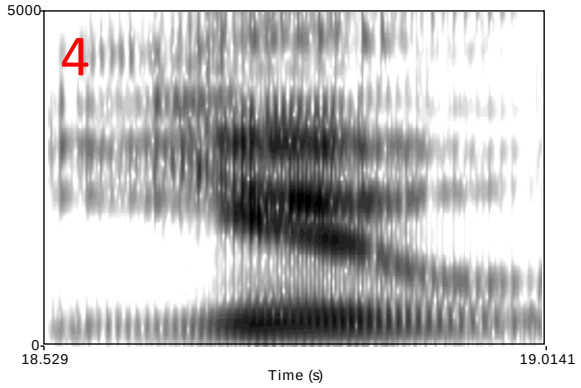
Spectrogram Reading

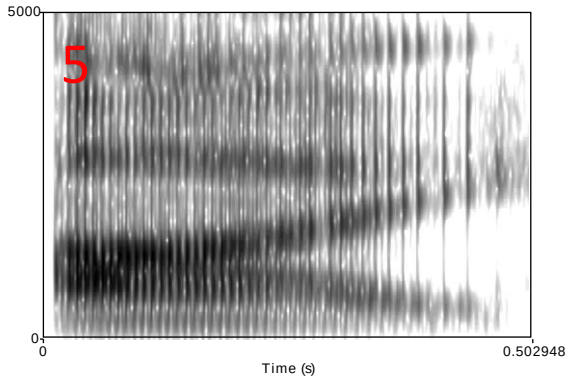
[æ, aɪ, oʊ, weɪ, wi, ju]

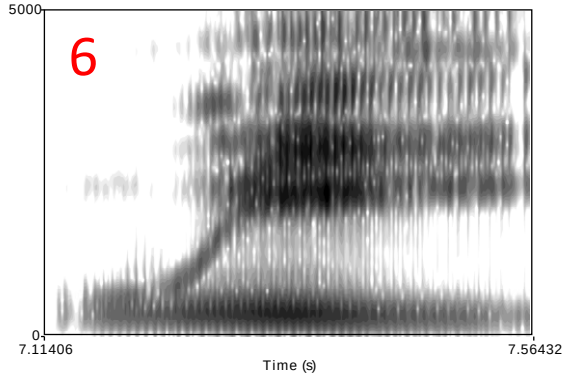






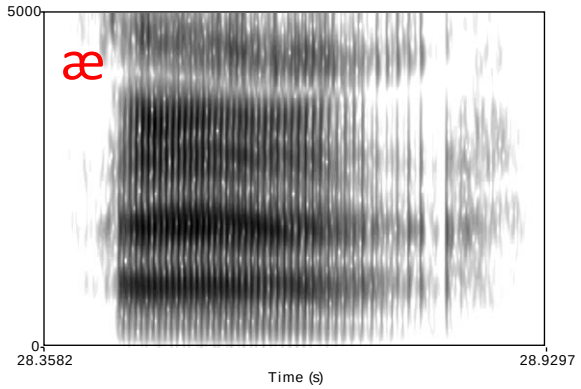


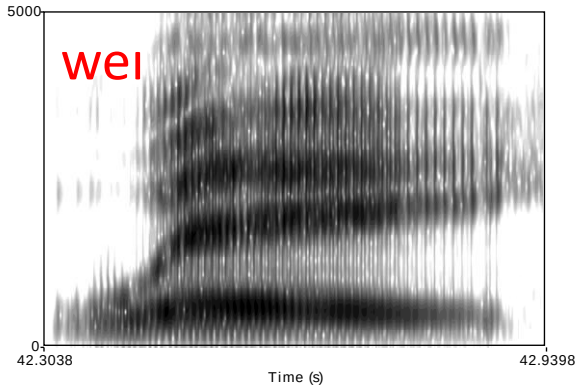


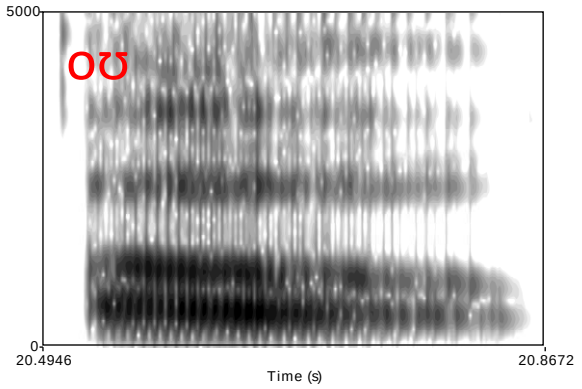


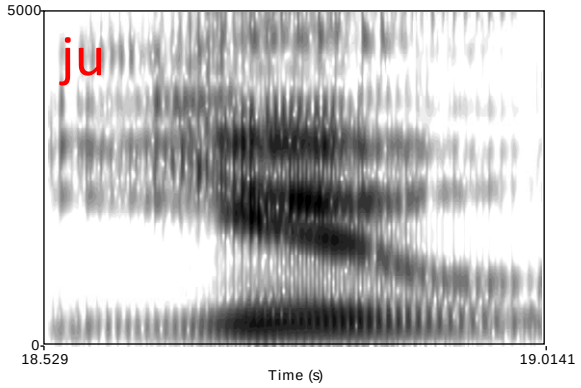
Spectrogram Reading

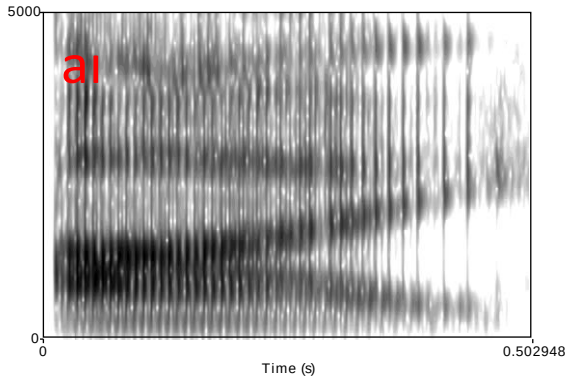
[æ, aɪ, oʊ, weɪ, wi, ju]

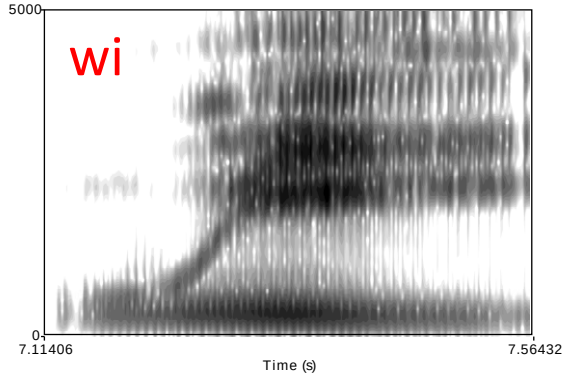












Reminders

Quiz 1 Spectrograms due Monday

Lab 1 (introduced in class-have a chance to work on it)