

Applied Phonetics & Phonology

English Vowels

Tom Payne, TESOL at Hanyang University, 2007

Vowels and the ESL Learner

English has a rather “exotic” vowel system. Some problems often faced by ESL learners:

- There are up to 12 contrastive vowels in stressed syllables. Most languages have between 5 and 8.
- Vowel articulation is far more difficult to physically describe than consonant articulation.
- Spelling does little to help.

Vowels and the ESL Learner

- Pronunciation of vowels varies dramatically in stressed vs. unstressed syllables.
- English “tense” vowels usually involve an “off glide” that is hard for L2 learners to master.
- Much of the dialect variation in Englishes spoken around the world involves vowels.

Classification of Vowels

Vowels can be classified in terms of:

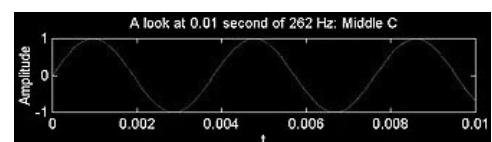
- Acoustic properties
- Articulation

The Acoustic Classification of English Vowels: Spectrograms

- **Spectrograms** display the resonating frequencies (or “formants”) that make up a speech sound.
- The spectrogram is a running short-term diagram – it displays a continuously changing pattern of frequencies (a sound “spectrum”).

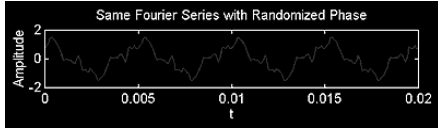
The Acoustic Classification of English Vowels: Spectrograms

- A **Pure Tone** is a sound that is composed of vibrations of only one frequency:



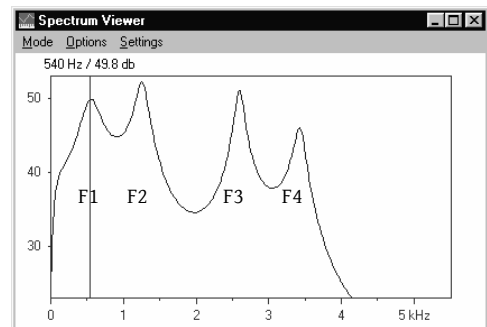
The Acoustic Classification of English Vowels: Spectrograms

- A **Complex Tone** is a sound that is composed of vibrations of more than one frequency:

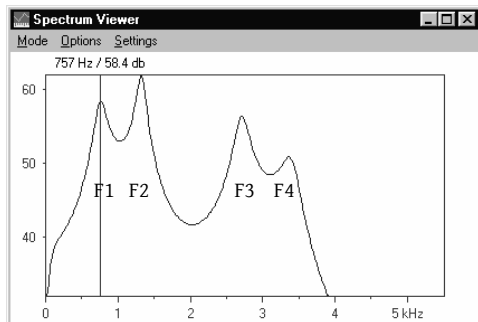


- Vowels are complex tones composed of four frequencies, of **formants**, designated as F1, F2, F3 and F4.

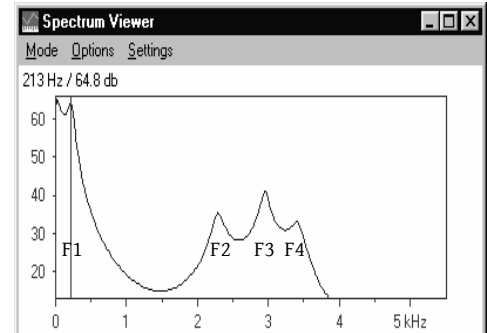
/ə/– Neutral (schwa) Vowel (LPC Spectrum)



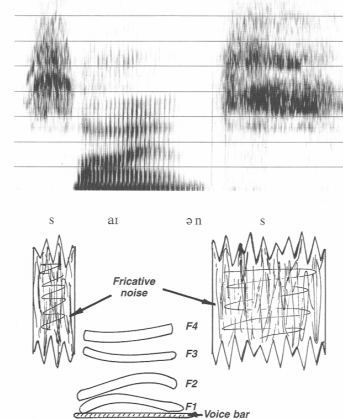
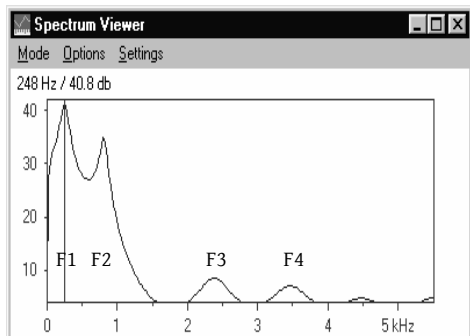
/a/– Formants



/i/ - Formants



/u/ Formants



Kent (1997). The Speech Sciences

Figure 9-11. Actual spectrogram (top) and stylized spectrogram (bottom) for the word science.

Articulatory Classification of English Vowels

There are 3 parameters needed to uniquely identify all phonemic vowels of English.

Tongue Height

Tongue Advancement

Tongue Tenseness

Articulatory Classification of English Vowels

Lip position is another property often used to characterize English vowels.

However, lip position is always redundant in English:

- All back vowels are “rounded,” and none of the front or central vowels are rounded.
- Low vowels are more neutral.
- High front vowels are more spread.

Articulatory Classification of English Vowels

Rounded



Neutral



Spread



The Articulatory Classification of English Vowels

	Front	Central	Back
High	iy (heed) I (hid)		uw (who'd) ʊ (hood)
Mid	ey (hayed) ɛ (head)	ʌ (Hud)	ow (hoed)
Low	æ (had)	ɑ (hod)	ɔ (hawed)

Black = “tense”, Gray = “lax”

(p. 95 of text)

Tongue Height

Tongue height has three values:

High refers to a relative location in the top third of the mouth

Mid refers to a relative location in the middle third of the mouth

Low refers to a relative location in the lower third of the mouth

Tongue Advancement

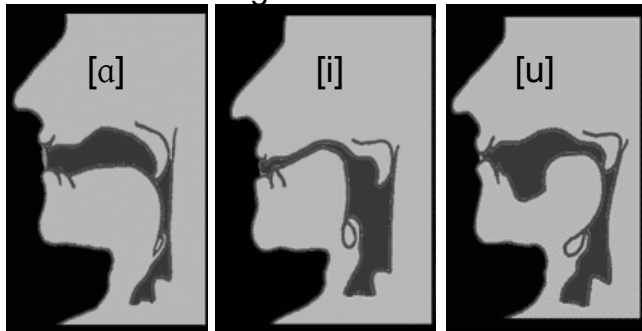
Tongue advancement has three values:

Front refers to a relative location in the front third of the mouth

Central refers to a relative location in the middle third of the mouth

Back refers to a relative location in the back third of the mouth

The Articulatory Classification of English Vowels



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The Relationship Between Articulation and Acoustics of Vowels

- Vowels are produced with a relatively open vocal tract.
- Vibration of the vocal folds is the sound source for vowel production – Vowel phonemes are always voiced (in English).
- The shape of the vocal tract determines the formant spectrum for a particular vowel.

General Rules of Vowel Formants

Rules:

F1 associated with Tongue Height

- /i/ & /u/ (high vowels): Low F1
- /æ/ & /a/ (low vowels): High F1

F2 associated with Tongue Advancement

- /u/ & /a/ (back vowels): Low F2
- /i/ & /æ/ (front vowels): High F2

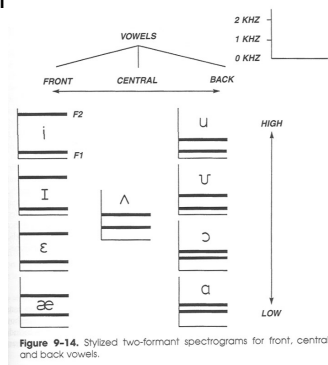


Figure 9-14. Stylized two-formant spectrograms for front, central, and back vowels.

Kent (1997). The Speech Sciences

The English Vowel Inventory

Most languages have 5 to 8 vowels. Korean has a large vowel inventory with 10 vowels

The basic inventory of English vowels is 11, although many dialects of English actually have 12

In this section, we will concentrate on understanding the basics of the English vowel system

We will discuss the implications for second language learners of English in the subsequent section on interlanguage phonology of Korean-English

Tongue Tenseness

Tongue Tenseness refers to a comparative measure of how flexed the muscles in the tongue are during articulation.

Tongue tenseness has two values:

Tense vowels are produced with greater stiffness of the tongue – or with an advanced tongue root.

Lax vowels are produced with less stiffness of the muscles in the tongue – or with a retracted tongue root.

Vowel “Coloring”

“Coloring” occurs when a highly sonorant consonant (/r/, /l/ or a nasal) follows a vowel in the same syllable.

Vowel "Coloring"

R-coloring occurs as the vowel anticipates the glide towards the central "r" position.

Plain:	R-colored:
'pot' [p ^h at]	'part' [p ^h a ^r t] /pɑrt/
'coat' [k ^h owt]	'court' [k ^h o ^r t] /kɔrt/
'tie' [t ^h ay]	'tire' [t ^h a ^r y] /tayr/
'ow' [aw]	'our' [a ^r w] /awr/
'bead' [biyd]	'beard' [bɪ ^r d] /bɪrd/

(see p. 105 of text)

L-Coloring

A similar process occurs for the liquid /l/, although the effect is less obvious than with /r/ or the nasals:

Plain:	l-colored:
'seed' [siyd]	'seal' [siy ^l] /siyl/
'Mick' [mɪk]	'milk' [mɪ ^l k] /mɪlk/
'may' [mey]	'mail' [mey ^l] /meyl/
'pet' [p ^h ɛt]	'pelt' [p ^h ɛ ^l t] /pɛlt/
'tack' [t ^h æk]	'talc' [t ^h æ ^l k] /tælk/

(see p. 106 of text for more examples)

Nasal-Coloring

Vowels become nasalized before nasal consonants:

Plain:	l-colored:
'see' [siy]	'seem' [s̃iym] /siym/
'lit' [lɪt]	'lint' [l̃ɪnt]~[l̃ɪʔ] /lɪnt/
'say' [sey]	'same' [s̃eym] /seym/
'pet' [p ^h ɛt]	'pelt' [p ^h ɛ̃nt] /pɛnt/
'tack' [t ^h æk]	'tank' [t ^h æ̃nk] /tænk/

(see p. 107 of text for more examples)

Vowel Length

Vowel length refers to the duration of a vowel sound. There is a regular tendency for vowels to be lengthened in syllables closed by voiced consonants:

'heat' [hiyt]	'heed' [hiy:t]	/hiyt/
'hit' [hɪt]	'hid' [hɪ:d]	/hɪd/
'hat' [hæt]	'had' [hæ:d]	/hæd/
'hoot' [huwt]	'who'd' [hu:wd]	/huwd/

(see p. 103, ff.)

Vowel Length

Tense vowels and diphthongs are also lengthened in open syllables (syllables without codas) at the ends of words (remember, lax vowels do not occur at the ends of words):

'heat' [hiyt]	'he' [hiy:]	/hiy/
'hate' [heyɪt]	'hay' [he:y]	/hey/
'rote' [rowt]	'row' [ro:w]	/row/
'hoot' [huwt]	'who' [hu:w]	/huw/

(see p. 103, ff.)

Vowel Reduction

In English, vowels are **reduced** in unstressed syllables.

This means they are pronounced less distinctly, often becoming simply a schwa ([ə]).

Vowel Reduction

There are actually three levels of stress in English words:

- Primary stress: 'bánal' [béynəl]
- Secondary stress: 'bànálity' [bènæləri]
- No stress: 'banál' [bənúl]

We will discuss the English stress rule in more detail next week.

Variation and the ESL Student

Dialect variation is interesting and adds a certain richness to our language. It also creates many difficulties for students who are trying to learn English as a second language and who are trying to master its pronunciation.

While pronunciation continues to be an important measure of English proficiency, it is probably unreasonable to expect any second-language speaker of English to ever achieve "native speaker" pronunciation proficiency. The important skills are to understand and to be understood.