—— 発展英語 ——

INTRODUCTION TO ENGLISH PHONETICS

CLASS LECTURE NOTES

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[PART 01] -- THIS COURSE

What is this course about? As the title indicates, it is about phonetics. The reasons this course is being offered are many:

1) This is a 発展英語 class. 3rd and 4th year students should be given the chance to study something that other students (e.g., 1st and 2nd year students) cannot.
2) Some students in the School of Commerce have a greater interest in English than others. They should be offered more English or linguistic courses.
3) Students can study grammar and vocabulary on their own. They will have a more difficult time studying phonetics alone.
4) The chances are very good that all the students in this class have very good English abilities and probably even high TOEIC scores. However, speaking can sometimes be difficult, and things like pronunciation are rarely taught, meaning that students rarely get feedback on how to improve their speaking and their pronunciation.

WHAT CAN YOU EXPECT FROM THIS COURSE?

Be aware right now: this course *may or may not help you improve your pronunciation and speaking ability*. Although that is one central goal of this course, it is possible that some students will make only small steps toward improving their pronunciation. That is nothing to be discouraged about! Individual differences must be accounted for. At the very least, this course should give you an awareness of how to produce the sounds of English and how these sounds are put together into recognizable patterns.

The main aim of this (spring semester) class is phonetics. Many students desire to learn how to make English sounds (e.g., those smallest building blocks of speech) correctly. I will do my best to

focus only on phonetics, but it is nearly impossible to talk about phonetics without also talking about phonology and other linguistic areas. Conversely, if one wishes to talk about phonology, for example, phonetics will inevitably enter into the picture (so I'm not too worried!).

In this course, you will learn how English sounds are made as well as where they are made. We will do some practice with the sounds of English, and you will learn and practice using the phonetic symbols to the sounds of English.

Do not forget: this is only an introductory course! Don't panic, because I will try not to make the class too detailed. However, there is some intricacy to this course (after all, some people spend their entire lives researching phonetics!). In a lot of areas we could go much deeper and learn very complex ideas, but for us that is not really necessary. English language learners can gain a great amount of understanding from learning a few simple ideas that will (hopefully!) lead to a better understanding of how English is used and how they can use English.

This course WILL require work from students. Part of the course will be lectures. In these lectures, you may be given some notes from your teacher (this will make it easier for you). In other cases, you will have to take notes yourself. Many times, you will have to practice what you learn in the class. This might involve some pair work with classmates or it might involve a homework assignment.

As much as possible, I will try to avoid assigning homework. Homework assigned will be mainly for practice purposes.

For this course, in the second class and in the second-to-last class, we will do voice recording via computer and microphone (this is the plan, at least). These recordings will be analyzed, and students will receive feedback about their vocalizations. Depending on student numbers, some recordings may have to be conducted outside of regular classtime.

Be aware that the second semester (fall) class will be an extended class, that is, not just the pieces of English (i.e., the smaller sounds) but extensive practice with things like stress, intonation, and differences in meaning based on pronunciation.

→ IT IS HIGHLY RECOMMENDED
THAT STUDENTS TAKE THE
SPRING SEMESTER CLASS FIRST! ←

In case your friends (or you) are thinking that taking just the fall semester course would be good…well…the spring semester is the foundation course. Much of what is discussed in the fall semester will be based on the knowledge students have gained from the first semester.

At present, there are no restrictions about who can take the fall semester course. However:

1) Students who have taken the spring semester course get preferred treatment for fall class entrance.
2) If too many students only sign up for the fall semester course, I may make passing the spring semester course a requirement.

Let's have a good time and learn a few things about English phonetics!

[PART 02] -- BACKGROUND

What is the difference between phonetics and phonology? That's a good question. Here are some simple definitions:

phonetics:	the study of describing the speech sounds that occur in the languages of the world
phonology:	the study of the sound patterns of languages

The easiest way to distinguish these two branches of linguistics: PHONETICS deals with the individual sounds of a language. PHONOLOGY deals with how those sounds are used in a language to convey meanings.

Phonetics and phonology both make up pieces of the greater field of LINGUISTICS. In linguistics, people attempt to answer the question: "What does a speaker know that enables him or her to speak the language?"

This is an important question because:
- Speakers can produce and understand sentences they have never heard before.
- Therefore, knowledge of language cannot just be a list of memorized sentences.
- Speakers' knowledge of language consists of principles or rules for forming new sentences from a stock of stored items.
- This knowledge can be divided up into parts or components, and each can be studied separately.

The Lexicon:	Memorize the morphemes (meaning units) of the language?
Morphology:	How do you put morphemes together to make words?
Syntax:	How do you put words together to make sentences?
Phonology:	How do the shapes of different morphemes vary depending on their context and on their position in a word or sentence?
Phonetics:	How does the human vocal tract work to produce sounds?
Semantics:	How do we assign meanings to morphemes, words, and sentences?

LEXICON	→	MORPHOLOGY
SENTENCES	→	SYNTAX
SOUND PATTERNS	→	PHONOLOGY
SPEECH	→	PHONETICS

[PART 03] -- WHAT IS ENGLISH?

The obvious answer – the language spoken in England – is not the right one. English began as the language spoken in England, but as English colonists and English influence spread over the world, many different kinds of English developed.

People in different parts of the world, even though they all speak English as their first language, speak it differently.

Differences in language depending on who is speaking it are called DIALECT differences. Variants of a language based on location are known as GEOGRAPHIC DIALECTS. The differences might be in vocabulary, that is, in the words used (truck vs. lorry). More often, dialects use the same words, but they differ in their pronunciation.

Sometimes these differences can be so great that speakers may have difficulty understanding one another. English speakers from Scotland and Australia probably could not understand each other. Most dialect differences aren't that extreme, however. The commonalities between dialects of English are much greater than the differences.

Phonologists study differences in dialects, but make no judgments about them. They describe the way people *do* speak, not the way they *ought* to speak. There is no "right" dialect of English. Every dialect is "right" among the people who use it.

However, some dialects are seen as "prestige dialects", such as those used in the media or those used most widely. Many speakers from different dialect regions try to "lose their accents" so they won't be associated with the stereotypes of a particular region. Teachers of English usually teach the prestige dialect.

Received Pronunciation (RP*): prestige English of England
General American (GA): "prestige" by possessing no regional markedness

* RP is an old term and is fading away, although many people continue to use the term. In many places, RP has been replaced by the terms "BBC Pronunciation," "Oxford English," "Standard Southern British," and/or "General British" (to be in line with the term "General American"),

Another source of language variation we have to be aware of is differences not in the USERS of language but in the USES. The same person will use different forms of the language depending on

who is being spoken to and in what context. The language used in a formal lecture is different from the language used at an informal party. The language used also differs according to the person spoken to: you speak differently to your child, to your best friend, to your boss… These differences according to situation are called REGISTERS. The differences are of the same type: differences in words used and differences in pronunciation. Casual rapid speech in English is marked by pronunciation that can be very different from slow, careful delivery.

[PART 04] – MAKING SOUNDS

There are many sounds in the world. There are two types of non-speech sounds:

1) sounds humans cannot make (toilet flushing, glass breaking)
2) sounds humans can make but do not get incorporated into human languages (snoring, sneezing).

There are 6 articulators: lips, tongue tip and blade, tongue body (dorsum), tongue root, velum, and the larynx.

from Ladefoged 1993, p. 3

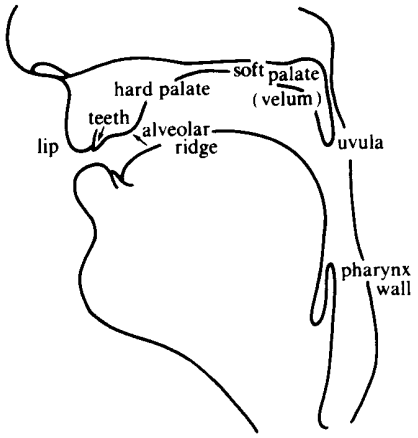


Figure 1.2 *The principal parts of the upper surface of the vocal tract.*

from Ladefoged 1993, p. 4

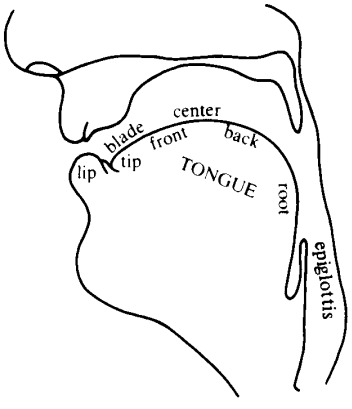


Figure 1.3 *The principal parts of the lower surface of the vocal tract.*

from Ladefoged 1993, p. 6

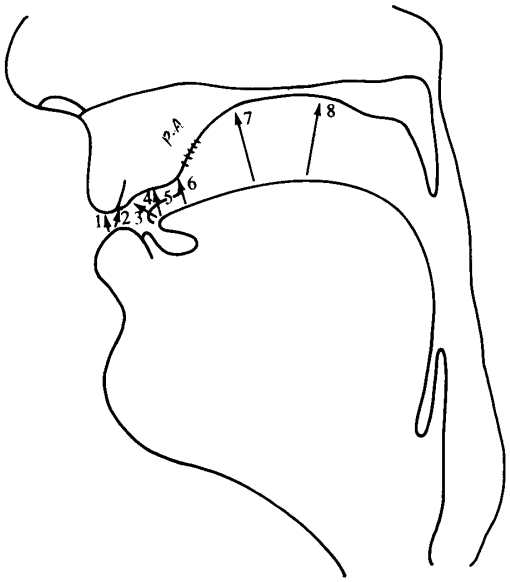


Figure 1.4 *Places of articulation: 1 Bilabial; 2 Labiodental; 3 Dental; 4 Alveolar; 5 Retroflex; 6 Palato-Alveolar; 7 Palatal; 8 Velar.*

ARTICULATOR	PLACE OF ARTICULATION	CONSONANTS
Lips	Bilabial	p b m w
	Labio-dental	f v
Tongue tip and blade	Dental/Interdental	θ ð
	Alveolar	t d s z n l
	Retroflex	ɹ
	Palato-Alveolar	ʃ ʒ tʃ dʒ
Tongue body (dorsum)	Palatal	j
	Velar	k g ŋ w
Tongue root	Pharyngeal	No consonants in English, but active for vowels
Velum		nasal vs. non-nasal
Larnyx		h ʔ active in voicing distinctions

Additional notes:
- /w/ is both bilabial and velar. θ is called *theta*. ð is called *thorn*.
- Tongue body: moves up to make palatal consonants: /j/, moves down to make velar consonants: k, ɡ, ŋ, w
- Velum: open when breathing, closed when speaking
- Larynx: open = not much sound (h). Tightly closed = glottal stop (glottis = space in larynx). Used when we say "uh-oh" in English. Also: British pronunciation: "bottle" "little"

MANNERS OF ARTICULATION		
Stop		
	Oral stop	pie, buy (bilabial closure) tie, dye (alveolar closure) kye, guy (velar closure)
	Nasal stop	my (bilabial closure) nigh (alveolar closure) sang (velar closure)
Fricative		fie, vie (labiodental) thigh, thy (dental) sigh, zoo (alveolar) shy (palato-alveolar)
Approximant		yacht we raw
Lateral		lie

Additional: trill, tap (flap), affricates ("church", "judge")

Consonants can be described by five factors:

1. **voiced vs. voiceless**
2. **place of articulation**
3. **central vs. lateral**
4. **nasal vs. oral**
5. **manner of articulation**

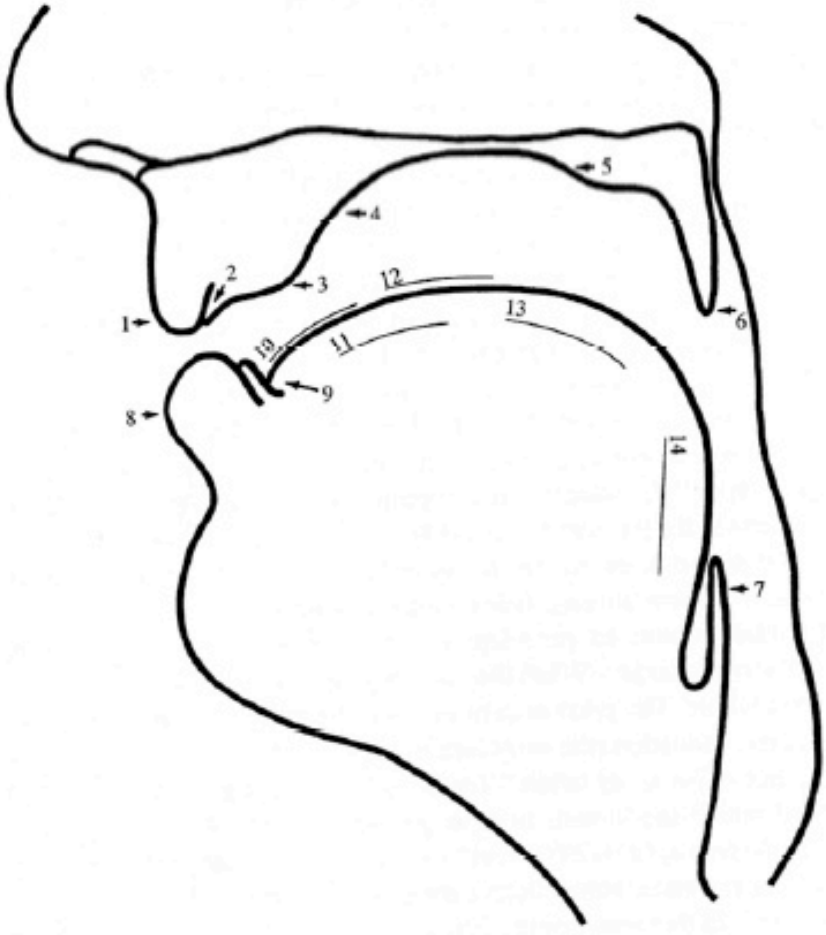
consonant at beginning of "sing":
- voiceless
- alveolar
- central
- oral
- fricative

consonant at end of "sing:
- voiced
- velar
- central
- nasal
- stop

▲ ▼ EXERCISE 01 ▲▼

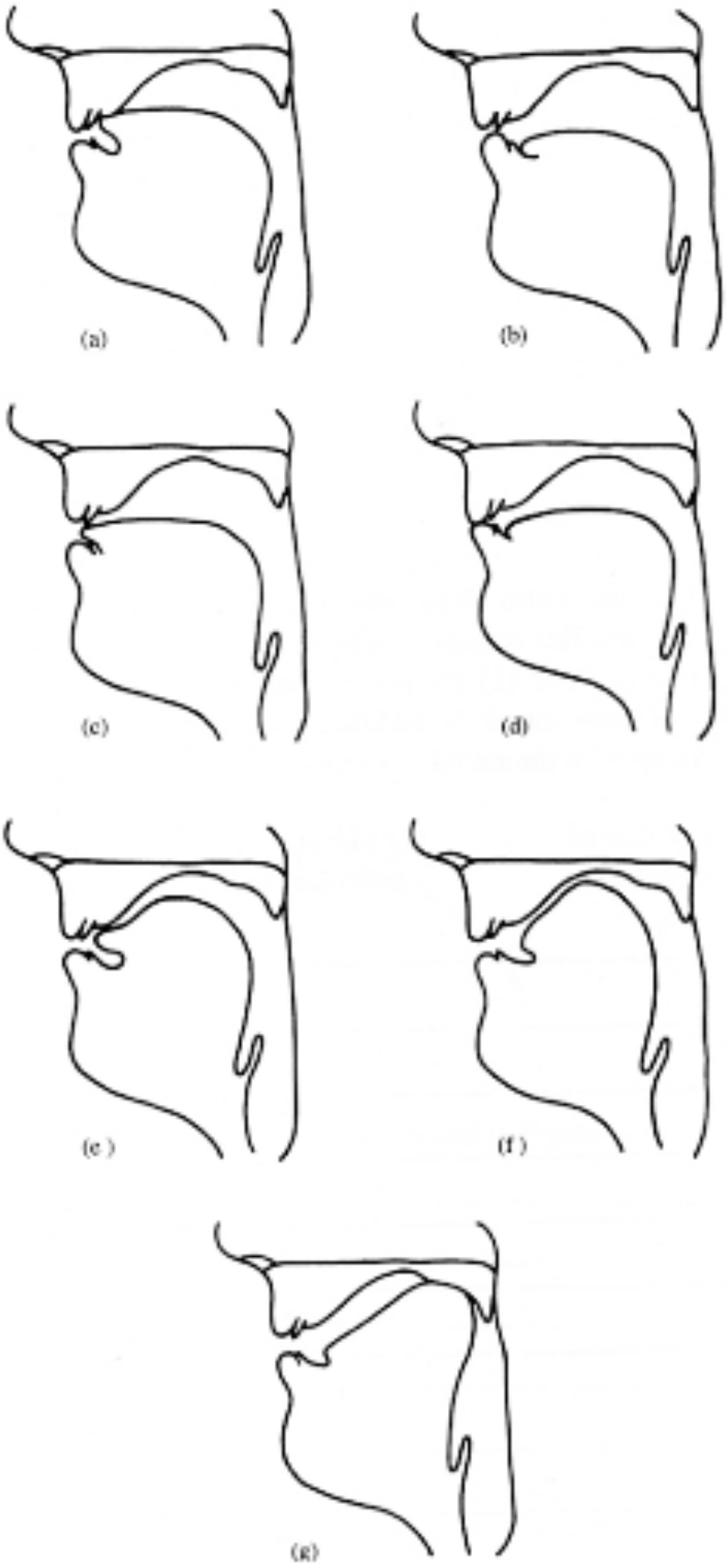
A Fill in the names of the vocal organs numbered in Figure 1.14 below.

1. _____ 8. _____
2. _____ 9. _____
3. _____ 10. _____
4. _____ 11. _____
5. _____ 12. _____
6. _____ 13. _____
7. _____ 14. _____



Look at the diagrams (a) through (g) on the next page. In the spaces provided, state (1) the place of articulation and (2) the manner of articulation of each sound. In addition, give (3) an example of an English word beginning with the sound illustrated.

(1) Place of articulation	(2) Manner of articulation	(3) Example
(a)		
(b)		
(c)		
(d)		
(e)		
(f)		
(g)		


(a)
(b)
(c)
(d)
(e)
(f)
(g)

B Describe the consonants in the word *skinflint* using the chart below Fill in all five columns, and put parentheses around the terms that may be left out, as shown for the first consonant.

	1	2	3	4	5
	voiced or voiceless	place of articulation	central or lateral	oral or nasal	ariculatory action
s	*voiceless*	*alveolar*	*(central)*	*(oral)*	*fricative*
k					
n					
f					
l					
t					

D Studying a new subject often involves learning a large number of technical terms. Phonetics is particularly difficult in this respect. Read over the definitions of the terms in Chapter 1 before completing the exercises below. Say each of the words, and listen to the sounds, Be careful not to be confused by spellings. Using a mirror may be helpful.

1. Mark the words that begin with a bilabial consonant:
   met net set bet let pet
2. Mark the words that begin with a velar consonant:
   knot got lot cot hot pot
3. Mark the words that begin with a labiodental consonant:
   fat cat that mat chat vat
4. Mark the words that begin with an alveolar consonant:
   zip nip lip sip tip dip
5. Mark the words that begin with a dental consonant:
   pie guy shy thigh thy high
6. Mark the words that begin with a palato-alveolar consonant:
   sigh shy tie thigh thy lie
7. Mark the words that end with a fricative:
   race wreath bush bring breathe bang
   rave real ray rose rough
8. Mark the words that end with a nasal:
   rain rang dumb deaf
9. Mark the words that end with a stop:
   pill lip lit graph crab dog hide
   laugh back

10. Mark the words that begin with a lateral:
    nut lull bar rob one
11. Mark the words that begin with an approximant:
    we you one run
12. Mark the words that end with an affricate:
    much back edge ooze
13. Mark the words in which the consonant in the middle is voiced:
    tracking mother robber leisure massive stomach razor
14. Mark the words that contain a high vowel:
    sat suit got meet mud
15. Mark the words that contain a low vowel:
    weed wad load lad rude
16. Mark the words that contain a front vowel:
    gate caught cat kit put
17. Mark the words that contain a back vowel:
    maid weep coop cop good
18. Mark the words that contain a rounded vowel:
    who me us but him

	Voiced or voiceless	Place of articulation	Manner of articulation
adder	*voiced*	*alveolar*	*stop*
fa**th**er			
sing**ing**			
et**ch**ing			
rob**b**er			
e**th**er			
plea**s**ure			
hop**p**er			
sel**l**ing			
su**nn**y			
lo**dg**er			

[PART 05] -- PHONOLOGY AND PHONETIC TRANSCRIPTION

There is the IPA (International Phonetic Alphabet). It was developed for two reasons:

1) So anyone in the world could write down in IPA exactly what they heard/want to convey. This makes it possible for others who know IPA to understand exactly what was pronounced.
2) No one language has all the symbols that correspond to all the sounds which can be produced in human language, and no one language possesses all the sounds. Therefore, an alphabet is necessary.

WARM-UP

How many distinct sounds are there in each of the following words? Circle the correct number.

1.	laugh	1	2	3	4	5	6	7
2.	begged	1	2	3	4	5	6	7
3.	graphic	1	2	3	4	5	6	7
4.	fish	1	2	3	4	5	6	7
5.	fishes	1	2	3	4	5	6	7
6.	fished	1	2	3	4	5	6	7
7.	batting	1	2	3	4	5	6	7
8.	quick	1	2	3	4	5	6	7
9.	these	1	2	3	4	5	6	7
10.	physics	1	2	3	4	5	6	7
11.	knock	1	2	3	4	5	6	7
12.	axis	1	2	3	4	5	6	7

Symbols for transcribing English consonants. (Alternative symbols that may be found in other books are given in parentheses.)

p	pie	pea	
t	tie	tea	
k	kye	key	
b	by	bee	
d	dye	D	
g	guy		
m	my	me	ra*m*
n	nigh	knee	ra*n*
ŋ			ra*ng*
f	fie	fee	
v	vie	V	
θ	thigh		
ð	thy	thee	
s	sigh	sea	lis*t*en
z		Z	mi*zz*en
ʃ (š)	shy	she	mi*ss*ion
ʒ (ž)			vi*s*ion
l	lie	lee	
w	why	we	
ɹ (r)	rye		
j (y)		ye	
h	high	he	
Note also the following:			
tʃ (č)	chi(me)	chea(p)	
dʒ (ǰ)	ji(ve)	G	

[PART 06] -- ENGLISH VOWELS & VOWEL ARTICULATION

Describing the articulation of vowels is more difficult than describing the articulation of consonants. With consonants (mostly) the articulators touch the surface of the vocal tract, and you can feel what they are doing. With vowels, the tongue does not come very close to the upper surface of the vocal tract, and the airstream is not obstructed. Thus, articulation is difficult to pinpoint. Also, everyone has their own positioning of the vowels in the vowel chart, and when they hear a vowel they may place the vowel where they think it should be in their own language/dialect. They hear what they want to hear or how they think it is.

Before we look more closely at English vowels, think for a moment about the vowels of Japanese. How many are there?

Now, think about how many vowels there are in English. Are you sure? Of course, as we will see, different dialects use a different number of vowels, but there certainly more vowels used overall in English than in Japanese!

Take a look at the tongue positions in the diagram below:

from Ladefoged 1993, p. 12

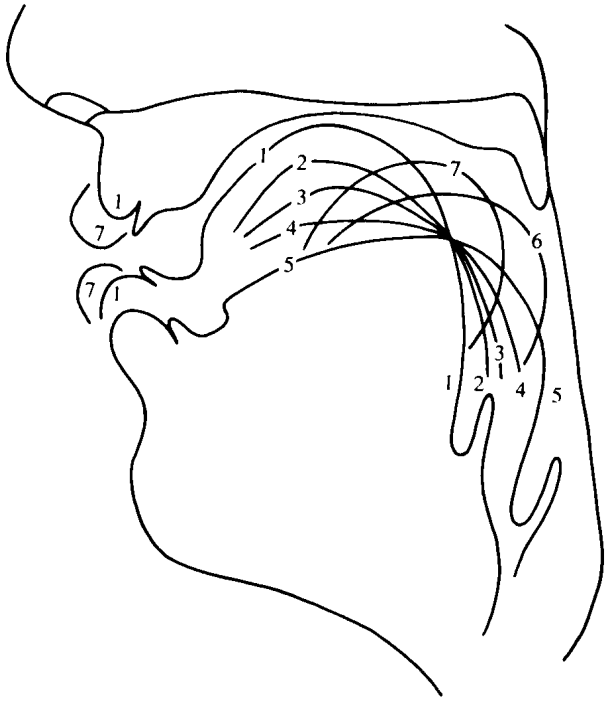


Figure 1.8 *The positions of the vocal organs for the vowels in the words 1 heed, 2 hid, 3 head, 4 had, 5 father, 6 good, 7 food. The lip positions for vowels 2, 3, and 4 are in between those shown for 1 and 5. The lip position for vowel 6 is between those shown for 1 and 7.*

There are three factors involved with vowels:

1. Height of the body of the tongue (high, mid, low)
2. Front/back position of the tongue (front/back)
3. Position of the lips (round/unrounded)

from Ladefoged 1993, p. 13

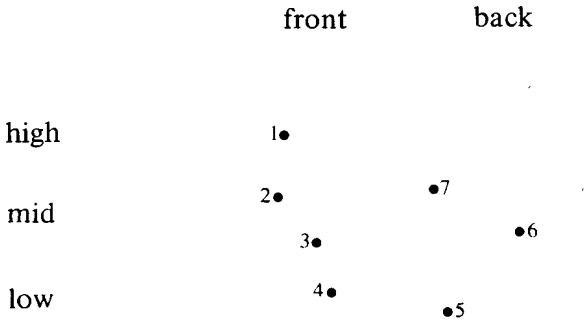


Figure 1.9 *The relative positions of the highest points of the tongue in the vowels in 1 heed, 2 hid, 3 head, 4 had, 5 father, 6 good, 7 food.*

Dipthong: movement from one vowel to another within a single syllable.

Look at the following table:

1	2						
i	i	heed	he	bead	heat	keyed	lower-case *i*
ɪ	ɪ	hid		bid	hit	kid	small capital *I*
eɪ	eɪ	hayed	hay	bayed	hate	Cade	lower-case *e*
ɛ	ɛ	head		bed			epsilon
æ	æ	had		bad	hat	cad	ash
ɑ	ɑ	hard		bard	heart	card	script *a*
ɑ	ɒ	hod		bod	hot	cod	(2) turned script *a*
ɔ	ɔ	hawed	haw	bawd		cawed	open *o*
ʊ	ʊ	hood				could	upsilon
o ʊ	əʊ	hoed	hoe	bode		code	lower-case *o*
u	u	who'd	who	booed	hoot	cooed	lower-case *u*
ʌ	ʌ	Hudd		bud	hut	cud	turned *v*
ɜ	ɜ	herd	her	bird	hurt	curd	reversed epsilon
aɪ	aɪ	hide	high	bide	height		lower case a (+ ɪ)
aʊ	aʊ		how	bowed		cowed	(as noted above)
ɔɪ	ɔɪ		(a)hoy	Boyd			(as noted above)
ɪ ɪ	ɪə		here	beard			(as noted above)
ɛɪ	ɛə		hair	bared		cared	(as noted above)
aɪ ɪ	aə	hired	hire				(as noted above)
ju	ju	hued	hue	Bude	cued		(as noted above)

This list presents words illustrating all the vowels of English. The list here compares the vowels used by most speakers of American English with the vowels used by most speakers of British English. In each column, all the words are the same except for the contrasting vowel. A set of words which differ only in one sound is called a MINIMAL PAIR.

The vowels of English differ much more from dialect to dialect than do the consonants. They differ in 3 ways:

1. Inventory of vowels. Some dialects have more contrasts (have more vowels) than other dialects do.
2. Incidence. May have the same vowels, but differ in which vowels occur in which words.
3. Realization. May have the same vowels (written with the same symbols), and use them in the same words, but differ in the exact way the vowel is realized. For example, /u/ in a word like "boot". Compare New York (very back, very round) with General Northeast (sort of back, sort of round), with California (not very back and not very round at all).

SYMBOLS FOR VOWELS

There is a great deal of variation in the way vowels are symbolized. Different authors use different symbols to describe the same vowel. Why?

- a matter of history
- different authors have different purposes:
    - symbols that are all on a typewriter
    - emphasize one kind of difference over another, e.g., length vs. quality
    - symbols that are easy for someone without special training to use
    - symbols that are as simple as possible
    - symbols that show only the major contrasts
    - symbols that give lots of detail for people learning the language

Since there will always be different reasons for transcribing vowels, there will probably always be different sets of symbols. For this class, we will just use IPA.

Extra information: ɛ is called *epsilon* æ is called *digraph*
ʌ is called a *wedge* ɜ is used by speakers of British English

ɜˠ is used by speakers of American English. It is for when the ɹ is fully combined with the vowel. The hook ˠ indicates ɹ -coloring of the vowel.
ə is called a *schwa*. It is always unstressed.

▲ ▼ EXERCISE 02 ▲▼

A Find the errors in the transcription of the consonant sounds in the following words. In each word there is one error, indicating an impossible pronunciation of that word for a native speaker of English of any variety. Make a correct transcription in the space provided after the word.

1.	strength	[strɛngθ]	should be	[ ]
2.	crime	[craɪm]		[ ]
3.	wishing	[wɪshɪŋ]		[ ]
4.	wives	[waɪvs]		[ ]
5.	these	[θiz]		[ ]
6.	hijacking	[haɪjækɪŋ]		[ ]
7.	chipping	[tʃɪppɪŋ]		[ ]
8.	yelling	['yɛlɪŋ]		[ ]
9.	sixteen	['sɪxtin]		[ ]
10.	thesis	['ðisɪs]		[ ]

B Now try another ten words in which the errors are all in the vowels. Again, there is only one possible error; but because of differences in varieties of English, there are sometimes alternative possible corrections.

11. man-made	['manmeɪd]	should be	[ ]
12. football	['fʊtbol]		[ ]
13. tea chest	['titʃest]		[ ]
14. tomcat	['tomkæt]		[ ]
15. tiptoe	['tiptoʊ]		[ ]
16. avoid	[æ'vɔɪd]		[ ]
17. remain	[rə'man]		[ ]
18. bedroom	['bɛdrɔm]		[ ]
19. umbrella	[um'brɛlə]		[ ]
20. manage	['mænædʒ]		[ ]

C Make a correct transcription of the following words. There is still only one error per word, but it may be among the vowels, the consonants, or the stress marks.

21. magnify	['mægnifaɪ]	should be	[ ]
22. traffic	['træfɪc]		[ ]
23. simplistic	['sɪmplɪstɪk]		[ ]
24. irrigate	['ɪrrɪgeɪt]		[ ]
25. improvement	[ɪm'pruvmənt]		[ ]
26. demonstrate	['dəmɑnstreɪt]		[ ]
27. human being	[humən 'biɪŋ]		[ ]
28. appreciate	[ə'preʃieɪt]		[ ]
29. joyful	['dʒɔyfʊl]		[ ]
30. wondrous	['wondrəs]		[ ]

D Transcribe the following words or phrases as they are pronounced by either the British or the American speaker on the CD. Be careful to put in stress marks at the proper places. Use a phonemic transcription, and note which speaker you are transcribing.

Speaker_____

31.	languages	[	]
32.	impossibility	[	]
33.	boisterous	[	]
34.	youngster	[	]
35.	another	[	]
36.	diabolical	[	]
37.	nearly over	[	]
38.	red riding hood	[	]
39.	inexcusable	[	]
40.	chocolate pudding	[	]

H Transcribe the following phrases as they are pronounced by either the British English or the American English speaker on the CD.
Say whether the British or American English speaker is being transcribed.

Speaker _____

1. We can see three real trees.
2. He still lives in the big city.
3. The waiter gave the lady stale cakes.
4. They sell ten red pens for a penny.
5. His pal packed his bag with jackets.
6. Father calmly parked the car in the yard.
7. The doll at the top costs lots.

8. He was always calling for more laws.
9. Don't stroll slowly on a lonely road.
10. The good-looking cook pulled sugar.
11. Sue threw the soup into the pool.
12. He loved a dull muddy colored rug.
13. The girl with curls has furs and pearls.
14. I like miles of bright lights.
15. He howled out loud as the cow drowned.
16. The boy was annoyed by boiled oysters.

EXTRA READING PRACTICE

1.	[tʌk]	11.	[hju]	21.	[meɪdʒi]
2.	[titʃ]	12.	[dʒ ɛ l]	22.	[sænd]
3.	[pæθ]	13.	[slaʊtʃ]	23.	[teɪm]
4.	[taɪmz]	14.	[θɹot]	24.	[dæzl]
5.	[kwin]	15.	[ful]	25.	[stʊd]
6.	[θɔt]	16.	[θɪŋ]	26.	[tæp]
7.	[dʒ ɛ st]	17.	[j ɛ s]	27.	[hjudʒ]
8.	[tʃeɪs]	18.	[nʌmbəɹ]	28.	[kɹ æŋk]
9.	[kɔf]	19.	[ʃʊk]	29.	[stɹ æp]
10.	[tʌf]	20.	[bɔj]	30.	[bot]

EXTRA TRANSCRIPTION PRACTICE

1.	heard	13.	ache	25.	beard
2.	moustache	14.	road	26.	doll
3.	five	15.	droll	27.	give
4.	paid	16.	steak	28.	said
5.	streak	17.	thing	29.	low
6.	deep	18.	cow	30.	glows
7.	friend	19.	fix	31.	eat
8.	simple	20.	ship	32.	think
9.	sheep	21.	that	33.	heat
10.	language	22.	hoot	34.	change
11.	look	23.	music	35.	palm
12.	garage	24.	look	36.	Brian

EXTRA EXTRA PRACTICE

(1) Each of the following words is reversible if you consider the pronunciation rather than the spelling. Give the English reversals.

kin	sick	keep
pass	gnat	ice
nap	knit	mash
stop	fix	peace
back	dare	pole
isle	spill	nuts

(2) Give the English equivalent for the following phonetic transcriptions.

[seIf]	[du]	[koɹn]
[m ɛ n]	[no]	[klæs]
[pliz]	[sIŋ]	[ni]
[kæp]	[hu]	[brum]
[n ɛ t]	[wIsl]	[æbeIt]
[ð ɛ n]	[hænd]	[wandəɹ]

(3) Which of these words are not real words? Pronounce them aloud and circle those that are real.

[up]	[sud]	[kon]
[s ɛ l]	[kul]	[pul]
[tɹon]	[mon]	[sp ɛ nd]

[PART 07] -- PHONETIC CHARTS

from Ladefoged 1993, p. 37

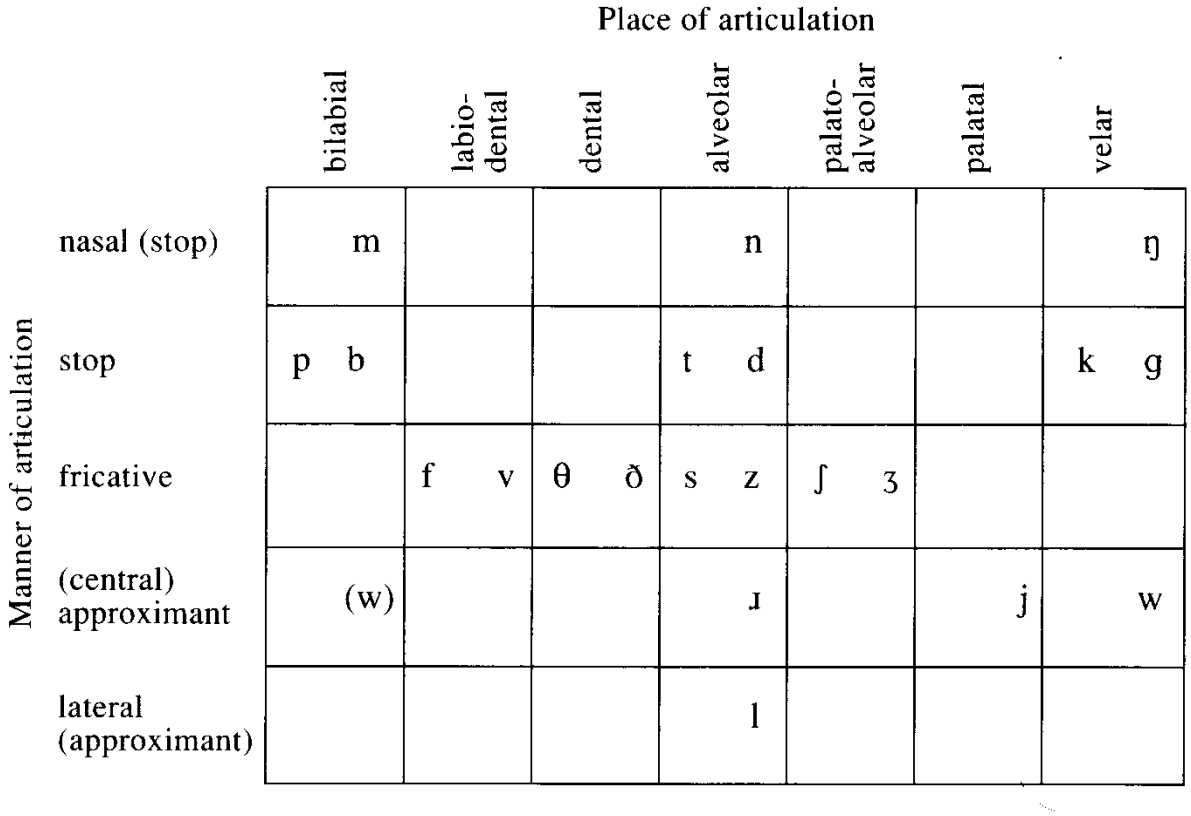


Figure 2.1 *A phonetic chart of the English consonants we have dealt with so far. Whenever there are two symbols within a single cell, the one on the left represents a voiceless sound. All other symbols represent voiced sounds. Note also the consonant* [h], *which is not on this chart, and the affricates* [tʃ, dʒ], *which are sequences of symbols on the chart.*

Place of articulation

Manner of articulation	bilabial	labio-dental	dental	alveolar	palato-alveolar	palatal	velar
nasal (stop)							
stop							
fricative							
approximant							
lateral							

from Ladefoged 1993 p. 38

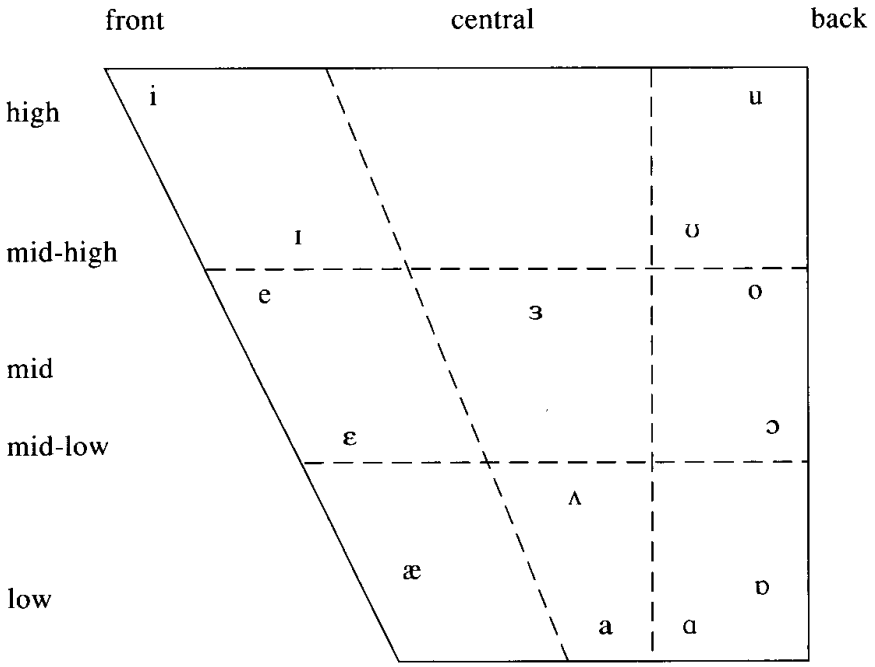


Figure 2.2 *A vowel chart showing the relative vowel qualities represented by some of the symbols used in transcribing English. The symbols* [e, a, o] *occur as the first elements of diphthongs.*

from Ladefoged 1993, p. 81

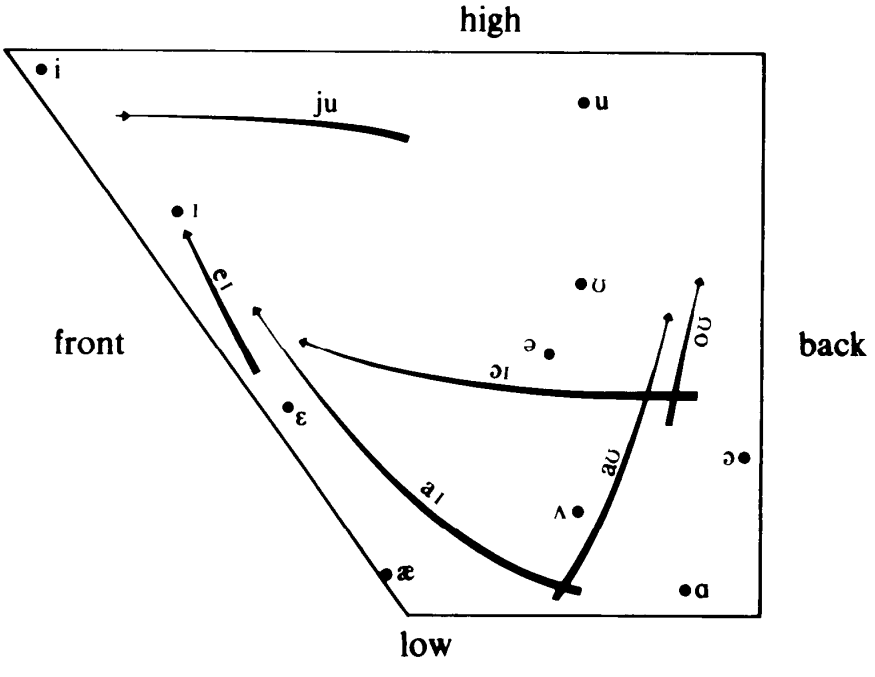


Figure 4.2 *The relative auditory qualities of some of the vowels of American English.*

TENSE AND LAX VOWELS

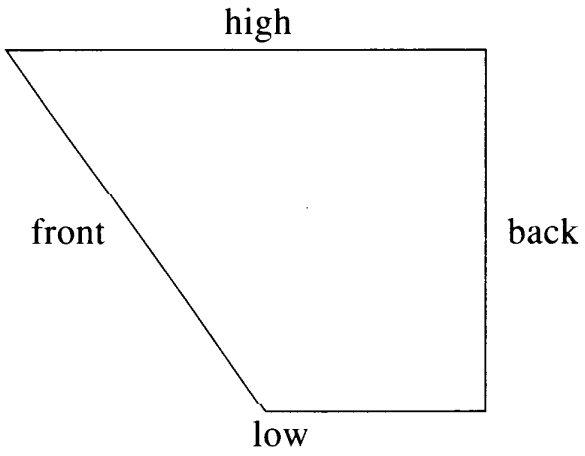
from Ladefoged 1993, p. 87

The distribution of tense and lax vowels in stressed syllables in American English.

Tense Vowels	**Lax Vowels**	**Most closed syllables**	**Open syllables**	**Syllables closed by [ɹ]**	**Syllables closed by [ŋ]**	**Syllables closed by [ʃ]**
i		beat	bee	beer		(leash)
	ɪ	bit			sing	wish
eɪ		bait	bay			
	ɛ	bet		bare	length	fresh
	æ	bat			hang	crash
ɑ		hot	pa	bar		slosh
ɔ		bought	saw	bore	long	(wash)
oʊ		boat	low	(boar)		
	ʊ	good				push
u		boot	boo	tour		
	ʌ, ɝ	but		purr	hung	crush
aɪ		bite	buy	fire		
aʊ		bout	bough	hour		
ɔɪ		void	boy	(coir)		
ju		cute	cue	pure		

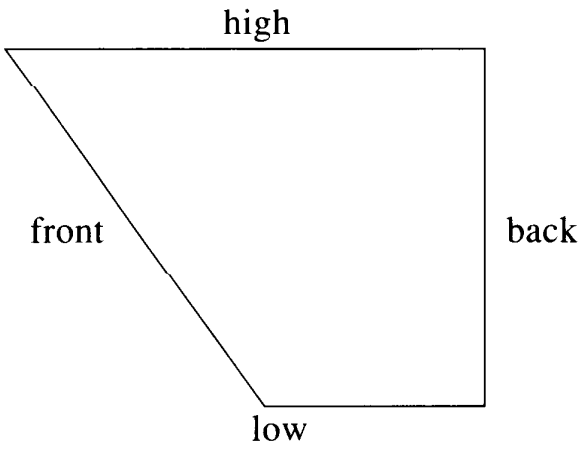
▲ ▼ EXERCISE 03 ▲▼

A Put your own vowels in this chart, using a set of words such as that given in Table 4.1. Listen to each vowel carefully and try to judge how it sounds relative to the other vowels. You will probably find it best to say each vowel as the middle vowel of a three-member series, with the vowels on either side forming the first and last vowels in the series. In the case of the diphthongs, you should do this with both the beginning and the ending points.



B Try to find a speaker of a dialect different from your own (or perhaps a foreigner who speaks English with an accent) and repeat Exercise **A**, using this blank chart.

accent: _____



[PART 08] -- PHONOLOGY AND TRANSCRIPTION

BROAD VS. NARROW

Broad transcription uses a simple set of symbols, enough to show all contrasts, but no details. /ped/ /bed/ /bod/ /bon/. In most cases, broad transcriptions can be used for this class.

Narrow transcription uses more specific symbols and shows more phonetic detail.
[pʰeId] [beId] [boʊd] [bõʊn]

Systematic phonetic transcription: an attempt to show ALL the details.

Diacritics: special symbols that modify the value of another symbol.

voicing ceases:	◌̥	aspiration:	◌ʰ
dental:	◌̪	nasal:	◌̃
primary stress:	◌ˈ	length:	◌ː
unexploded:	◌̚		

Examples: [tɛn̪θ] [wɛl̪θ] [biːd] [kud] [kuːd] [pl◌̥ ai] [səˈɹin] [pʰʊʃ]

Flap (e.g., in Japanese): [ɾ]

▲ ▼ EXERCISE 04 ▲▼

First, transcribe the following English words using a broad IPA transcription. Then, transcribe them narrowly. For narrow transcriptions, mark stress on words of more than one syllable.

shoes	lightning	boxes
father	coffee beans	would
muddy	that boy	lamb chops
couch	computer disk	thought
actions	headache	pleasure

▲ ▼ EXERCISE 05 ▲▼

A Which of the two transcriptions below is the narrower?
"Betty cried as she left in the red plane."
(**a**) ['bɛti 'kraɪd əz ʃɪ 'lɛft ɪn ðə 'rɛd 'pleɪn]
(**b**) ['bɛdi 'kɻaɪd əz ʃɪ 'lɛft ɪn̪ ðə 'ɹɛd 'pl̥eɪn]

B State rules for converting the transcription in (a) into that in (b). Make your rules as general as possible, so that they cover not only this pair of transcriptions but also other similar sentences (for example, [t]→ [d] when it occurs after a stressed vowel and before an unstressed vowel).

C Read the following passages in phonetic transcription. Both passages use a fairly broad style of transcription, showing few allophones. The first represents a form of British English of the kind I speak myself. The second represents an American pronunciation typical of a Midwestern speaker. By this time you should be able to read transcriptions of different forms of English, although you may have difficulty in pronouncing each word exactly as it is represented. Nevertheless, read each passage several times and try to pronounce it as indicated. Take care to put the stresses on the correct syllables, and say the unstressed syllables with the vowels as shown. Note any differences between each transcription and your own pronunciation of the corresponding words.

British English

[ɪt ɪz 'pɒsəbl tə træn'skraɪb fə'nɛtɪklɪ 'ɛnɪ 'ʌtrəns, ɪn 'ɛnɪ 'læŋgwɪdʒ, ɪn 'sɛvrəl 'dɪfrənt 'weɪz 'ɔl əv ðəm 'juzɪŋ ði 'ælfəbɛt ənd kən'vɛnʃnz əv ði 'aɪ pi 'eɪ, (ðə 'seɪm 'θɪŋ ɪz 'pɒsəbl wɪð 'məʊst 'ʌðə ɪntə'næʃənl fə'nɛtɪk 'ælfəbɛts.) ə træn'skrɪpʃn wɪtʃ ɪz 'meɪd baɪ 'juzɪŋ 'lɛtəz əv ðə 'sɪmpləst 'pɒsəbl 'ʃeɪps, ənd ɪn ðə 'sɪmpləst 'pɒsɪbl 'nʌmbə, ɪz 'kəld ə 'sɪmpl fəʊ'nimɪk træn'skɹɪpʃn.]

American English

[ɪf ðə 'nʌmbɚ əv 'dɪfɹənt 'lɛdɚz ɪz 'mɔɹ ðən ðə 'mɪnəməm æz də'faɪnd ə'bʌv ðə tɹæn'skɹɪpʃn wɪl 'nɑt bi ə fə'nimɪk, bəd ən ælə'fɑnɪk wʌn. 'sʌm əv ðə 'foʊnimz, 'ðæd ɪz tə 'seɪ, wɪl bɪ ɹɛpɹə'zɛntəd baɪ 'mɔɹ ðən 'wʌn 'dɪfɹənt 'sɪmbl. ɪn 'ʌðɚ 'wɝdz 'sɝtn 'æləfoʊnz əv 'sɝtn 'foʊnimz wɪl bɪ 'sɪŋgld 'aʊt fɚ 'ɹɛpɹəzɛn'teɪʃn ɪn ðə tɹæn'skɹɪpʃn, 'hɛns ðə 'tɝm ælə'fɑnɪk.]

D Transcribe the following phrases as you would say them yourself using (a) a fairly broad transcription, and (b) a narrower transcription.

accent:_____

“Please come home.”

(a)

(b)

“He is going by train.”

(a)

(b)

“The angry American.”

(a)

(b)

“His knowledge of the truth.”

(a)

(b)

“I prefer sugar and cream.”

(a)

(b)

“Sarah took pity on the young children.”

(a)

(b)

As I said in the preface, it is extremely important to develop practical phonetic skills and at the same time learn the theoretical concepts. One way to do this is to learn to pronounce nonsense words. You should also transcribe nonsense words that are dictated to you. By using nonsense words you are forced to listen to the sounds that are being spoken. Accordingly, you should find another student to work with, so that you can do the following exercises in pairs.

A Learn to say simple nonsense words. A good way is to start with a single vowel, and then add consonants and vowels one by one at the beginning. In this way you are always reading toward familiar material, rather than having new difficulties ahead of you. Make up sets of words such as:

ɑː

zɑː

ɪ'zɑː

tɪ'zɑː

'ætɪ'zɑː

'mætɪ'zɑː

ʌ'mætɪ'zɑː

tʌ'mætɪ'zɑː

B Choose an order in which to say the following "words" (for example, say the second word first, the fourth word next, and then the fifth, third, and first words). Write this order down as you dictate the words to your partner—whose task is, of course, to write down the order in which you have said them. Reverse roles and repeat the exercises. You may find it advisable to repeat each word twice.

spoken	**heard**
pi'suz	
pi'sus	
pi'zus	
pi'zuz	
pi'zuʒ	

C Repeat this exercise with the following sets of words:

spoken	**heard**	**spoken**	**heard**
	tɑ'θɛð		'kipik
	tɑ'θɛθ		'kɪpik
	tɑ'ðɛθ		'kipɪk
	tɑ'ðɛð		'kɪpɪk
	tɑ'fɛð		'kɪpɪt
spoken	**heard**	**spoken**	**heard**
	'læmæm		'mʌlʌl
	'læmæn		'mʌɹʌl
	'lænæm		'mʌwʌl
	'lænæn		'nʌlʌl
	'lænæŋ		'nʌɹʌl

D Look at the following nonsense words, and either say these to your partner or (preferably, since your partner has seen these words, too) make up a set similar to them, and say these instead. Your words can differ from the sample set in as many sounds as you like. But I suggest that you should not make them much longer at first. You will also find it advisable to write down your words and practice saying them for some time by yourself, so that you can pronounce them fluently when you say them to your partner.

'skɑnzil
'bɹaɪgbluzd
'dʒɪŋsmæŋ
flɔɪʃ'θɹaɪðz
pjut'peɪtʃ

When you have finished saying each word several times and your partner has written the words down, compare notes. Try to decide whether any discrepancies were due to errors in saying the words or in hearing them. If possible, the speaker should try to illustrate discrepancies by pronouncing the word in both ways, saying, for example, "I said ['skɑnzil] but you wrote ['skɑnsil]."

There is no one best way of doing ear training work of this kind. I find it helpful to look carefully at a person pronouncing an unknown word, then try to say the word myself immediately afterwards, getting as much of it right as possible, but not worrying if I miss some things on first hearing. I then write down all that I can, leaving blanks to be filled in when I hear the word again. It seems important to me to get at least the number of syllables and the placement of the stress correct on first hearing, so that I have a framework in which to fit later observations.

Repeat this kind of production and perception exercise as often as you can. You should do a few minute's work of this kind every day, so that you spend at least an hour a week doing practical exercises.

[PART 09] -- FEATURES

Using FEATURES is another way to specify sounds. They are phonetic properties used to classify sounds.

Some of the features required for classifying English segments.

Feature name	Classificatory possibilities	English segments
Voice	[+ voice]	b, d, g, m, n, v, ð, z, ʒ, ɹ, l, j (and all vowels)
	[– voice]	p, t, k, f, θ, s, ʃ
Labial	—	p, b, m, f, v
Coronal	[+ anterior]	θ, ð, t, d, n, s, z, l, ɹ
	[– anterior]	ʃ, ʒ, j (and front vowels)
Dorsal	—	k, g, w (and back vowels)
Stricture	[stop]	p, t, k, b, d, g, m, n
	[fricative]	f, θ, s, ʃ, v, ð, z, ʒ
	[approximant]	w, ɹ, l, j (and all vowels)
Nasal	[+ nasal]	m, n
	[– nasal]	(all other segments)
Lateral	[+ lateral]	l
	[– lateral]	(all other segments)
Sibilant	[+ sibilant]	s, ʃ, z, ʒ, (and č, ǰ)
	[– sibilant]	(all other segments)
Height	[maximum]	(all consonants except w, j)
	[4 height]	i, u, w, j
	[3 height]	e, ɪ, o, ʊ
	[2 height]	ɛ, ɔ
	[1 height]	æ, ɑ
Back	[+ back]	u, o, ʊ, ɔ, w, k, g
	[– back]	i, e, ɪ, ɛ, æ (and all other consonants)
Syllabic	[+ sy̓llabic]	(all vowels)
	[– syllabic]	(all consonants, including w, j)

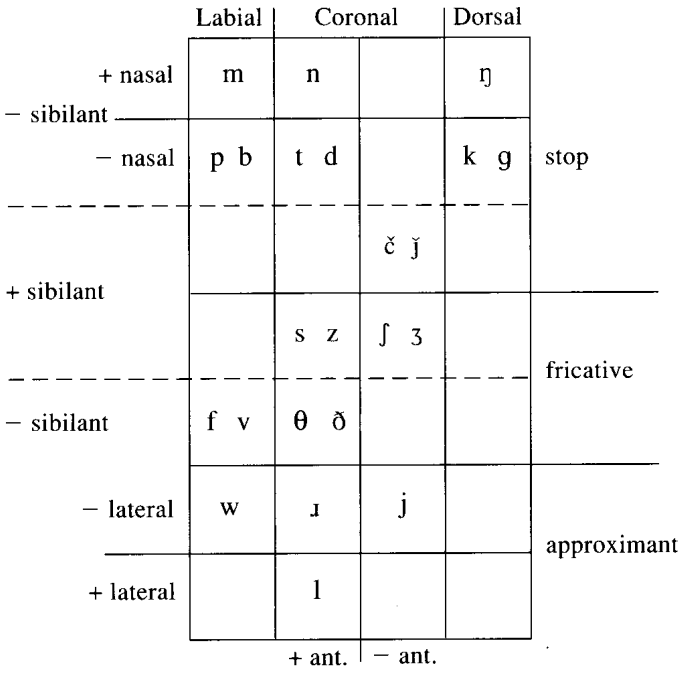


Figure 2.3 *A phonological chart illustrating some of the distinctive features of English consonants.*

[PART 10] -- SYLLABLES

Syllables are important units. Many writing systems, like Japanese, have one symbol per syllable. Representing vowels and consonants separately happened only once in history. About 4000 years ago, the Greeks modified the Semitic syllabary so as to represent consonants and vowels by separate symbols. The later Aramaic, Hebrew, Arabic, Indic, and other alphabet writing systems can all be traced back to the principles first and last established in Greek writing.

It seems that although nearly everybody can identify syllables, almost nobody can define them. People know how many syllables are in a word. There are a few cases of disagreement, for several reasons:

1. differences in pronunciation: predatory, temperate, bottling, brightening
2. nasals that may or may not count as separate syllables: prism vs. prison
3. high front vowels followed by /l/: feel, meal, seal
4. /r/s that may or may not be syllabic: hire, hour, fire
5. unstressed high vowels followed by another vowel: mediate, heavier

Still, in the vast majority of words, there is perfect agreement. What are we agreeing on? What are there 1, 2, 3 and 4 of in words? Is it a vowel? Usually, but consider: bottle, Carl

Syllables have something to do with **sonority**. Ladefoged 1993: defines it as relative loudness. Loudness is certainly related to openness in the vocal tract.

UNSTRESSED SYLLABLES

from Ladefoged 1993, p. 85

Examples of vowels in stressed and unstressed syllables and in reduced syllables. The dark type shows the vowel under consideration.

	Stressed syllable	**Unstressed syllable**	**Reduced syllable**
i	depr**e**ciate	cr**e**ate	depr**e**cate
ɪ	impl**i**cit	s**i**mplistic	impl**i**cation
ɑɪ	expl**ai**n	ch**a**otic	expl**a**nation
ɛ	all**e**ge	t**e**mpestuous	all**e**gation
æ	emph**a**tic	f**a**ntastic	emph**a**sis
ɑ, ɒ	dem**o**nstrable	pr**o**gnosis	dem**o**nstration
ɔ	c**au**se	c**au**sality	
oʊ, əʊ	inv**o**ke	v**o**cation	inv**o**cation
ʊ	h**oo**dwink	neighborh**oo**d	
u	ac**ou**stic	ac**ou**stician	
ʌ	confr**o**nt	**u**mbrella	confr**o**ntation
ɝ, ɜ	confirm	v**e**rbose	confirmation
aɪ	rec**i**te	c**i**tation	rec**i**tation
aʊ	dev**ou**t	**ou**tsider	
ɔɪ	expl**oi**t	expl**oi**tation	
ju	comp**u**te	comp**u**tation	circ**u**lar

[PART 11] -- SUPRASEGMENTALS

Until now, we have been discussing SEGMENTALS, or the basic building blocks of speech. SUPRASEGMENTALS are the characteristics that pertain to strings of speech larger than the segmentals.

Citation form: the form in which a word is pronounced when it is considered in isolation.

When learning the sounds of a language, learning the citation form is only so-so helpful. They are words that are alone. Usually, when speaking, words are strung together. Putting words together in sentences can drastically alter the sound of consonants and vowels.

from Ladefoged 1993, p. 108

Strong and weak forms of some common English words. Over five times as many could easily have been listed.

Word	Strong form	Weak form	Example of a weak form
a	eɪ	ə	a cup [ə'kʌp]
and	ænd	ənd, n̩d, ən, n̩	you and me ['ju ən 'mi]
as	æz	əz	as good as [əz 'gʊd əz]
at	æt	ət	at home [ət 'hoʊm]
can	kæn	kən, kn̩	I can go [aɪ kn̩ 'goʊ]
has	hæz	həz, əz, z, s	he's left [hɪz 'lɛft]
he	hi	i, hɪ, ɪ	will he go? [wɪl ɪ 'goʊ]
must	mʌst	məst, məs, mṣ	I must sell [aɪ mṣ 'sɛl]
she	ʃi	ʃɪ	did she go? ['dɪd ʃɪ 'goʊ]
that	ðæt	ðət	he said that it did [hɪ 'sɛd ðət ɪt 'dɪd]
to	tu	tʊ, tə	to Mexico [tə 'mɛksɪkoʊ]
would	wʊd	wəd, əd, d	it would do ['ɪt əd 'du]

INTONATION

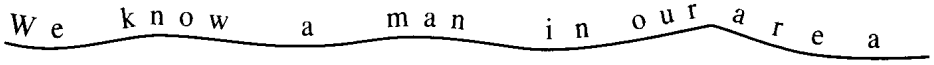
Changes in pitch. Not used in English to distinguish words, but can affect the meaning of sentences.

Pitch: that auditory property that enables a listener to place it on a scale going from low to high, without considering its acoustic properties.

Learning intonation patterns can be one of the most difficult things for a non-native speaker of English. When you listen to English speakers talking, you find that the pitch in their voices changes continuously. Throughout every syllable in a normal conversation utterance, the pitch is going up or down. (Try talking with steady-state pitches and notice how odd it sounds).

The intonation of a sentence is the pattern of pitch changes that occurs. The part of a sentence over which a particular pattern extends is called a TONE GROUP.

Look at (1) below:



(1) We 'know a 'man in our *area

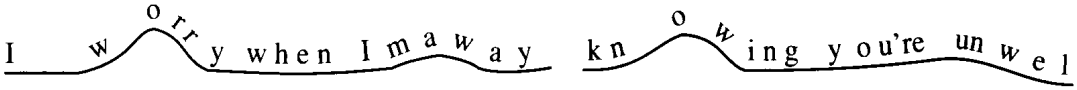
The line above the sentence shows the pitch change that occurred when the sentence was produced by a speaker of American English. The positioning of the individual words above this line gives an indication of their relative timing. The sentence is shown below the line in ordinary spelling but with IPA stress marks added, and one syllable preceded by an asterisk.

Within a tone group, each stressed syllable has a minor pitch increase; but there is usually a single syllable that stands out because it carries the major pitch change. A syllable of this kind is called the TONIC SYLLABLE, and will be marked by an asterisk.

In sentence (1), the first syllable of "area" is a tonic syllable and, as can be seen, has the greatest pitch change. Each of the stress syllables is accompanied by a small increase in pitch, but the major pitch movement starts on the first syllable of the last word.

(2) We 'know a *millionaire in our 'area

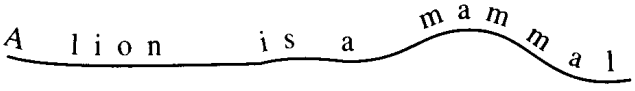
The pitch changes that start on the tonic syllable are continued on the following syllables. In (1) and (2), the fall in pitch continues until the end of the sentence. Sometimes there are two or more tone groups within a sentence.



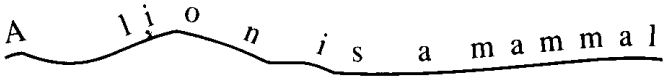
(3) I *worry when I'm a 'way, ‖ *know ing you're un 'well

In these cases, the beginning of a new tone group may be marked, as in (3), by double lines. The pitch changes that begin on the tonic syllable continue only until the beginning of the next tone group.

What is the difference between (4) and (5)?



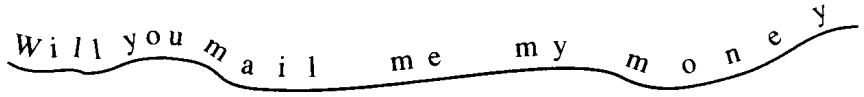
(4) A 'lion is a * mammal



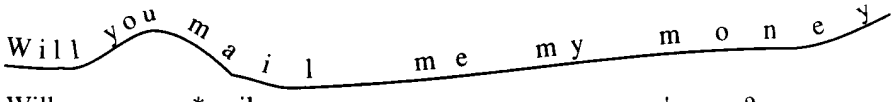
(5) A *lion is a 'mammal

In (4), the topic of discussion is lions, and the comment on the topic is that it is a mammal. In (5), the topic of discussion is mammals, and the speaker is considering all the animals that fit into that category.

In (1) through (5), the intonation is falling. Rising is also possible. This is typical in questions requiring an answer of "yes" or "no".

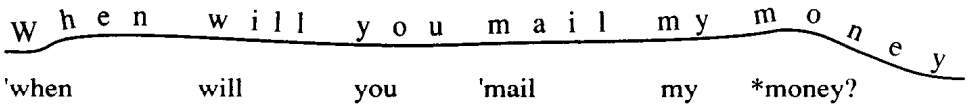


(6) Will you 'mail me my *money?



(7) Will you *mail me my 'money?

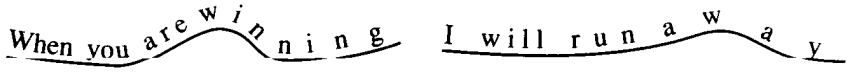
If it is not a yes/no question:



(8) 'when will you 'mail my *money?

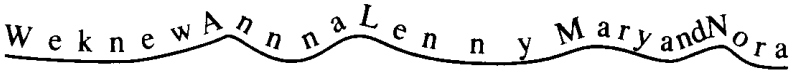
So, we see there is [+falling] and [+rising].

[+rising] often occurs in the middle of sentences, typically at the end of a clause:



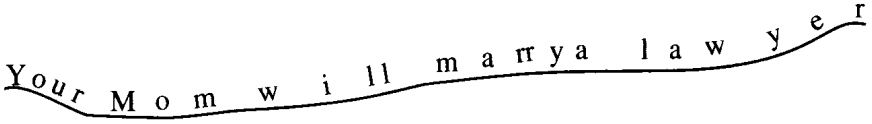
(9) 'When you are *winning ‖ I will run a *way

Also, take a look at a list of items:



(10) We knew 'Anna 'Lenny 'Mary and *Nora

Both rising and falling can occur in the same tonic accent. If you tell something that surprises me, I might have a distinct fall on the tonic syllable followed by a rise on the remainder of the tone group.



(16) Your *Mom will 'marry a 'law yer?

(17) Laura (18) Laura (19) Laura

(17) = calling someone
(18) = trying to get someone's attention
(19) = calling to get attention as a chant

STRESS

One syllable is more prominent than another. In words of more than one syllable in English, one syllable always bears the **primary stress**. Other syllables may have **secondary stress**, or be **unstressed**.

What is stress? Stressed syllables are:

- louder (more airflow)
- longer
- higher pitched
- more distinctly articulated
- some combination of the above

Basically, we will look at stress as having 3 functions:

(1) Sometimes stress can distinguish words (lexical function). In many verbs, stress is on the second syllable, in many nouns on the first. Compare the following:

insult overflow impact reject

English word stress alternations.

ˈ— – —	— ˈ— — —	— – ˈ— –
diplomat	diplomacy	diplomatic
photograph	photography	photographic
monotone	monotony	monotonic

Predicting where the stress falls in English words is a major problem in English phonology.

(2) Stress can be used for emphasis. "I love her **so** much."
(3) Stress can also be used for contrast. "I want a **red** pen, not a black one."

[PART 12] -- DISTINCTIVE FEATURES

Look at a table of the most common consonants in the world's languages. In the table, each of the consonants can be seen as the product of a specific choice for each of the articulators. Larynx open or closed? Velum raised or not? Airflow stopped or not?

These gestures – distinctive features – are the building blocks of the sound system. Each sound is made up of a combination of **distinctive features**.

	labial	coronal	velar
voiceless stop	p	t	k
voiced stop	b	d	ɡ
nasal stop	m	n	ŋ
voiceless fricative	f	s	x
voiced fricative	v	z	ɣ

Why is this a good way to organize a language?
In the normal course of development, a child learns 80,000 words. Adults may have vocabularies of more than 300,000 words.

VOCAL WHOLES
One possibility: words represented as "vocal wholes" that cannot be broken down. For example, a groan, a giggle, and a whistle are easily distinguishable. Imagine a language where "groan" meant father, "giggle" meant food, "whistle" meant up, "yodeling sound" meant cold, "raspberry" meant cat, etc. You would still need 79,995 more "words"!!! A system like this would not be very easy to operate. Thus, no language encodes its vocabulary in "vocal wholes."

STRINGS
More efficiency is found with strings. A stipulated number of building blocks are used with a simple method of combining them into structures. For example, with just 10 symbols (digits 0 – 9) and only three repetitions you can distinguish a vast number of items: 000, 001, 002, 136, 631, etc. Five levels would get you 100,000 items. Imagine learning only 10 symbols and the rule that you can string them together in any order, in strings up to five symbols long.

Every language organizes its vocabulary in this basic fashion.
- a certain set of speech sounds is stipulated as raw material (segmentals)
- distinct lexical items are constructed by chaining these elements together like beads on a string.
- the vocabulary of a language comprises a set of strings of speech sounds.
- two lexical items are distinct if they differ in length (ex: us, bus, bust, burst, bursts) or if they have different elements anywhere in the string (ex: bus, sub, rub, urb)

DIFFERENCES BETWEEN LANGUAGES AND STRINGS OF NUMBERS
- languages use more than 10 basic elements
- Digits 0 – 9 can be combined in any order. Languages impose strict constraints on how sounds may be combined.
- EXAMPLE: long strings of consonants are not preferred: airflow is cut off, and sound transmission stops. So no English word begins with /tpk/ or /pt/. (DON'T BE CONFUSED BY THE SPELLING!) This type of constraint is based on the mechanics of the vocal tract.
- Other constraints cannot be explained that way, for example, no word in English begins with the sound /tl/. (USE * TO INDICATE NOT POSSIBLE) This is perfectly easy to say. Lots of languages use this sound (Tlingit, Navajo). /tr/ is fine, and so is /sl/ and /pl/. This is just a special fact about sound combinations in English.

- SO: in one sense, the study of phonology is the study of constraints on combinations of sounds.

While speech can be broken down horizontally into strings of speech sounds, each sound can be broken down into a number of components based on the articulators that are used to produce it.

Efficient way of cataloging speech sound inventories: Four parameters – place, voicing, nasality, continuancy – produce fifteen different sounds. You can therefore cross-classify. Features or parameters define **natural classes**.

/p/ shares the property "labial" with /b/ and /f/. *pw *bw *fw *vw *mw
/p/ shares the property "voiceless" with /k/ and /s/. Vowels in English are longer before voiced sounds.
/p/ shares the property "stop" with /t/ and /m/. Can't have a sequence of two stops at the beginning of a word or syllable (unless the second is /l/). *pm, *bt, *dn, etc. (the study of what sounds can go together is called phonotactics).

You can use two features to define a class. Example: voiceless stops.

These parameters can be expressed as a plus or minus contrast, cutting across the place of articulation.

Properties of +/- voice, +/- nasal, +/- continuant distinguish the coronal consonants:

	t	d	s	z	n
continuant	-	-	+	+	-
voice	-	+	-	+	+
nasal	-	-	-	-	+

Each feature has two functions:

1. characterizes a class of sounds
2. represents an articulatory or acoustic parameter. Not arbitrary (though perhaps somewhat abstract)

Each consonant is described by a unique combination of features.

n = [+nas, +vce, -cont]
s = [-nas, -vce, +cont]

Note that not all feature combinations are allowed. No [-voice] [+nasal]. Voiceless nasals are very rare. Some languages also disallow voiced fricatives.

Features perform three functions:

1. Represents an articulatory or acoustic parameter. Not arbitrary. (articulatory = the way it is made, acoustic = sound properties)
2. Each consonant is described by a unique combination of features.
   n = [+nas, +vce, -cont]
   s = [-nas, -vce, +cont]
3. Characterizes a class of sounds.

We can use two features to define a class—voiceless stops. Voiceless stops can occur after /s/ in initial clusters in English.
SO: it turns out that articulation (what is going on in the mouth) is relevant not just for describing the way people make noises, but also for describing the sound **system**.

Breaking sounds down into articulatory features works well for describing the sound system of human language.

- Increased efficiency. Efficient way of cataloging speech sound inventories. Four parameters (place, voicing, nasality, continuancy) produce 15 different sounds
- Ease of transmission. More information per unit of time.
- Ease of learning. These dimensions are in some sense given biologically. Every human has the same vocal tract and the same ability to manipulate the articulators. All the child has to learn is what combinations are used in his or her language and what combinations are not.
- Cross-classify. Features or parameters define **natural classes**: groups of sounds that pattern together. (more on this later).

There is much MUCH more that can be discussed regarding distinctive features, but this is as far as we will go in this class.

PHONEMES AND ALLOPHONES

PHONEME = unit of contrast
If two different sounds can occur in the same environment and create a different lexical item (that is, a contrast), they are two different phonemes.

pie, buy rum, run

MINIMAL PAIR = two words that differ by a single sound in the same position, have different meanings, but are otherwise identical. You can't predict which sound will occur there. If you can find just one minimal pair, the two sounds must be phonemes. If two sounds never occur in the same environment, they are in COMPLEMENTARY DISTRIBUTION. You can predict which sound will occur in which position.

In English, you can predict that [p^h] will always occur in syllable-initial position, and [p] will always occur after /s/.

Sounds in complementary distribution are ALLOPHONES of the same phoneme.

In English [p] and [p^h] are allophones of the phoneme /p/.
In Hindi, /p/ and /p^h/ are different phonemes.
In English, /l/ and /r/ are different phonemes (words can differ in just those sounds).
In Korean, [l] and [r] are allophones of the same phoneme (predict that [r] only occurs between vowels).

If sounds can occur in the same environment but do NOT make a lexical distinction, they are in FREE VARIATION. Word-finally, [t], [t$^{?}$], and [ʔ] are in free variation in English.

f, h Two phonemes:

s, ʃ Two phonemes:

t, t^{h} Two allophones:

n, ŋ Two phonemes:

t, θ Two phonemes:

r, r$_{\circ}$ Two allophones:

t, t̪ Two allophones:

[PART 13] -- ACOUSTIC PHONETICS

SOUND WAVES

Sound consists of small variations in air pressure that occur very rapidly one after another. These variations are caused by actions of the speaker's vocal organs that are (for the most part) superimposed on the outgoing flow of lung air. Thus, in the case of voiced sounds, the vibrating vocal cords chop up the stream of lung air so that it becomes turbulent, with irregularly occurring peaks of pressure. The same principles apply in the production of other types of sounds.

Variations in air pressure in the form of sound waves move through the air somewhat like the ripples on a pond. When they reach the listener's ear, they cause the eardrum to vibrate. A graph of a sound wave is very similar to a graph of the movements of the eardrum.

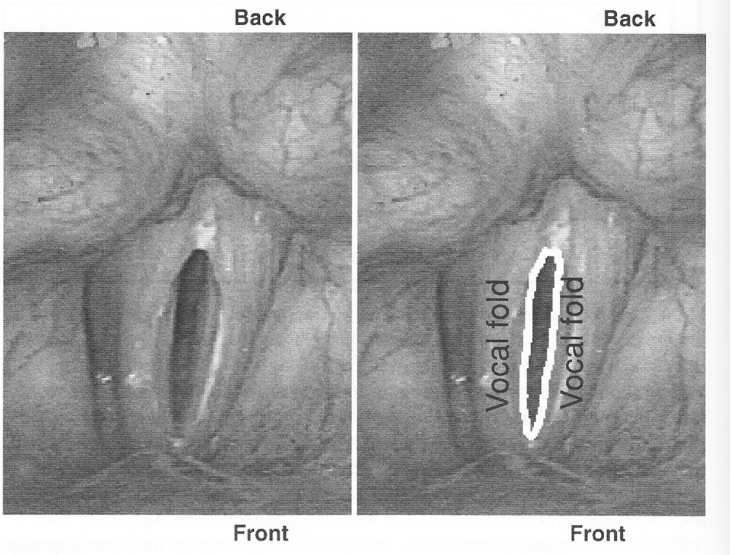


Figure 2.14 View of the vocal folds. In the copy of this picture on the right the vibrating inner edges of the vocal folds have been outlined.

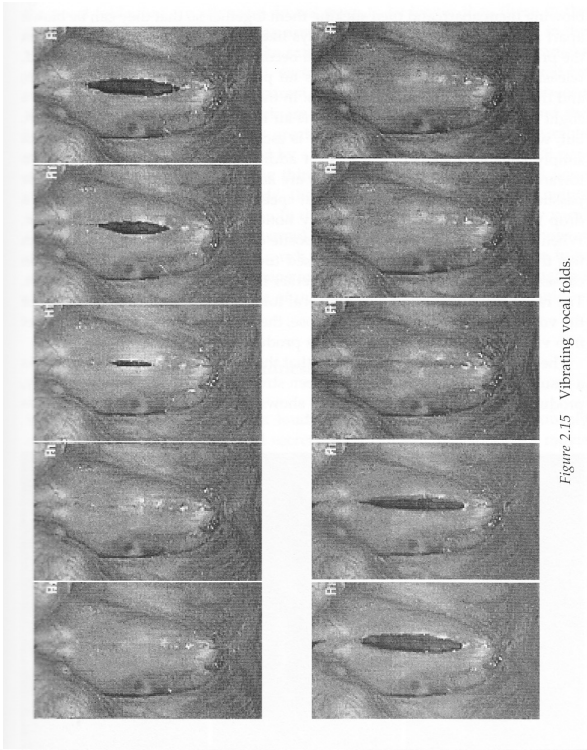


Figure 2.15 Vibrating vocal folds.

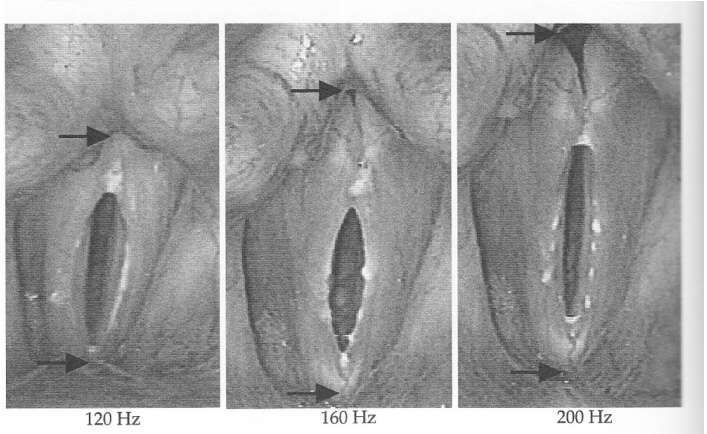
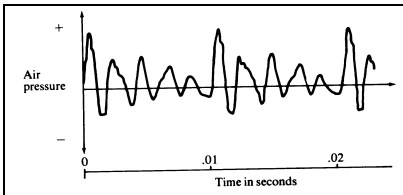


Figure 2.16 Views of the vocal folds vibrating at different pitches. The arrows indicate comparable points on the vocal folds.

The figure below shows the variations of air pressure that occur during a small part of the pronunciation of the vowel [ɔ], as in "caught." The vertical axis represents air pressure (relative to the normal surrounding air pressure), and the horizontal axis represents time (relative to an arbitrary starting point). As you can see, the major peaks in air pressure recur about every 0.01 seconds (that is, every one-hundredth of a second). This is because on this particular occasion, the vocal cords were vibrating at a rate of approximately one hundred times per second. The smaller variations in air pressure that occur within each one-hundredth of a second period are due to the way air vibrates when the vocal tract has the particular shape required for the vowel [ɔ].



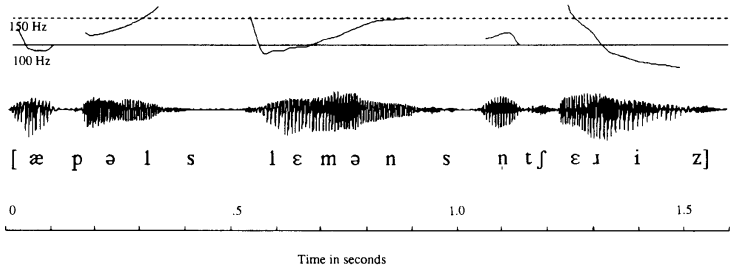


Figure 8.2 *Acoustic records of the phrase "apples, lemons, and cherries." The upper part of the figure shows the fundamental frequency (pitch). The waveform is in the middle, with a narrow phonetic transcription below it. At the bottom is a time scale.*

Above is a waveform. The small vertical lines in the waveform correspond to the pulses produced by the vibrating vocal cords. As you can see, there were about twelve pulses of the vocal cords during the first vowel before the silence of the closure for [p]. The release of [p], which is just visible on the waveform, was followed by a vowel with about 13 pulses, and the lateral [l] with a slightly larger number of pulses. In both the latter sounds, the pulses are closer together because the vocal cords were vibrating more rapidly in the second syllable of this word, which was on a higher pitch.

It is often difficult to look at a waveform and determine what sounds occurred. The waveforms of many sounds are much too similar to one another to be analyzable by the eye. They can be interpreted only by resolving them into their components (spectrograms). But if one knows what sound occurred, it is often possible to look at the waveform and see at which point one sound changed into another.

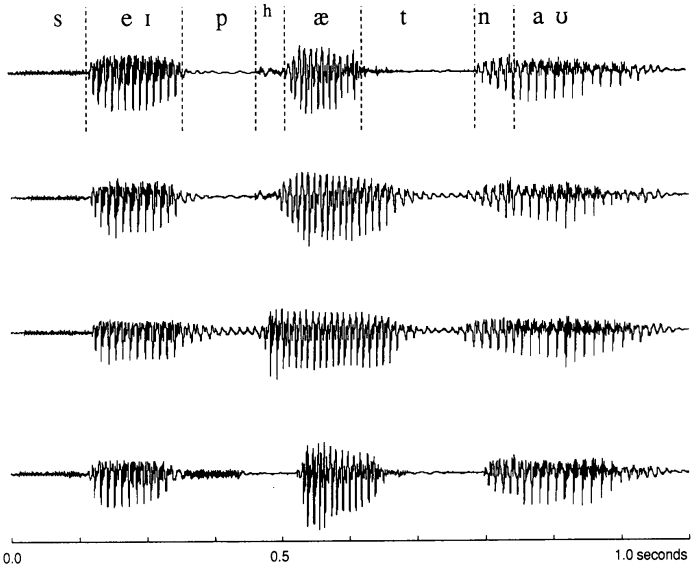


Figure 8.3 *Waveforms of "Say pat now; say pad now; say bad now; say spat now." Only the first of these phrases has been segmented. You should try to segment the other three phrases yourself.*

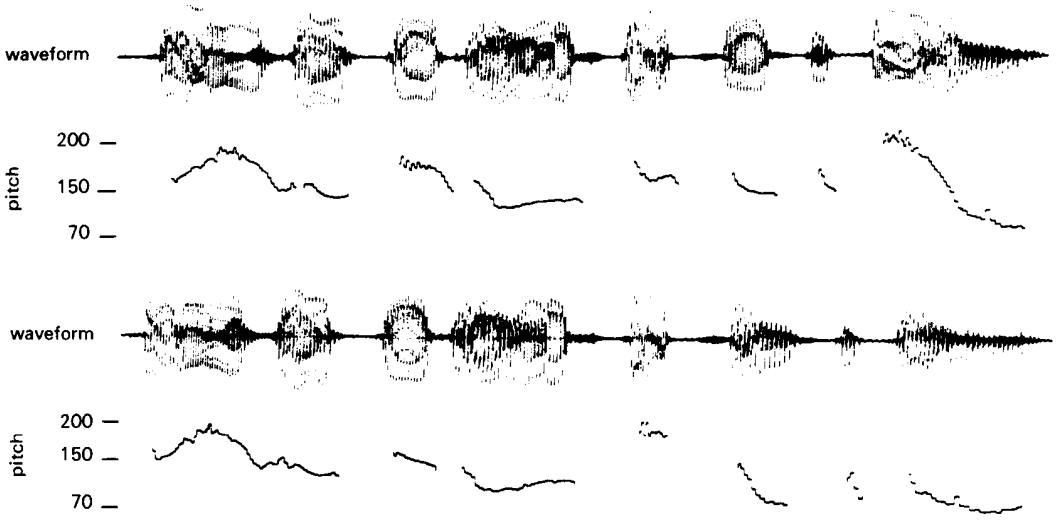
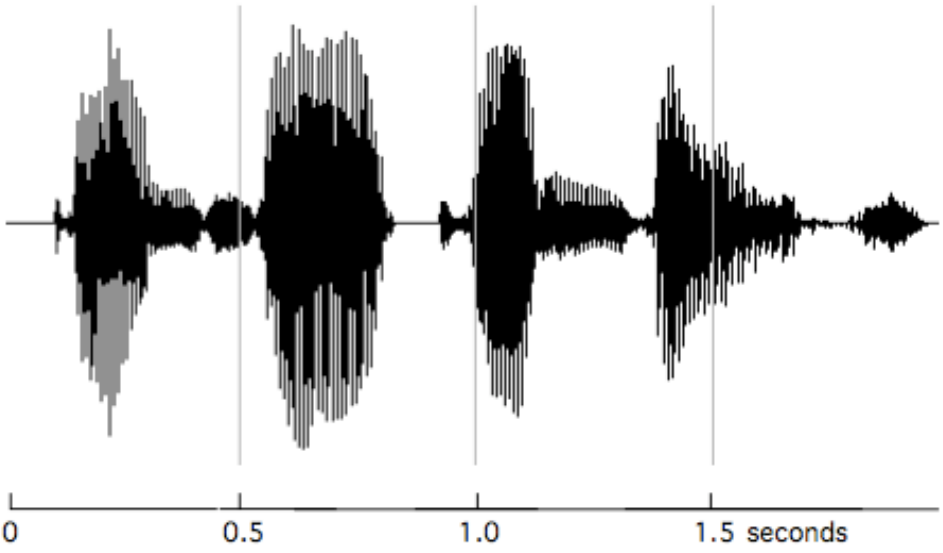


Figure 8.4 *Waveform and pitch records of "Jenny gave Peter instructions to follow," said in two different ways.*

▲ ▼ EXERCISE 06 ▲▼

G Figure 1.17 shows the waveform of the phrase *Tom saw nine wasps*. Mark this figure in a way similar to that in figure 1.10. Using just ordinary spelling show the center of each sound, Also indicate the manner of articulation.



[PART 14] -- SPECTROGRAMS

Waveforms are good, but they only record pitch and loudness. A SPECTROGRAM will allow you to see the quality of sounds. The quality of sounds is present in FORMANTS. Formants are the characteristic overtones.

1829: English physicist Robert Willis: "A given vowel is merely the rapid repetition of its peculiar note." Now: we would say it is the rapid repetition (corresponding to the vibrations of the vocal cords) of its peculiar notes (corresponding to its formants).

Reading spectrograms is more an art than a science.

Third formant:	Lip rounding. More rounding = higher formant frequencies decrease. Effect is greater in third formant for front vowels, in the second formant for back vowels. In many cases, really doesn't give much information about anything.
Second formant:	Backness, or tongue position. Decreases as go from front to back. Not as clear as first formant. **LOW = BACK**
First formant:	Height, or how open the mouth is. Inversely related to vowel height. **LOW = CLOSED**

In the chart below, the average of a number of authorities' values of the frequencies of the first three formants in eight American English vowels.

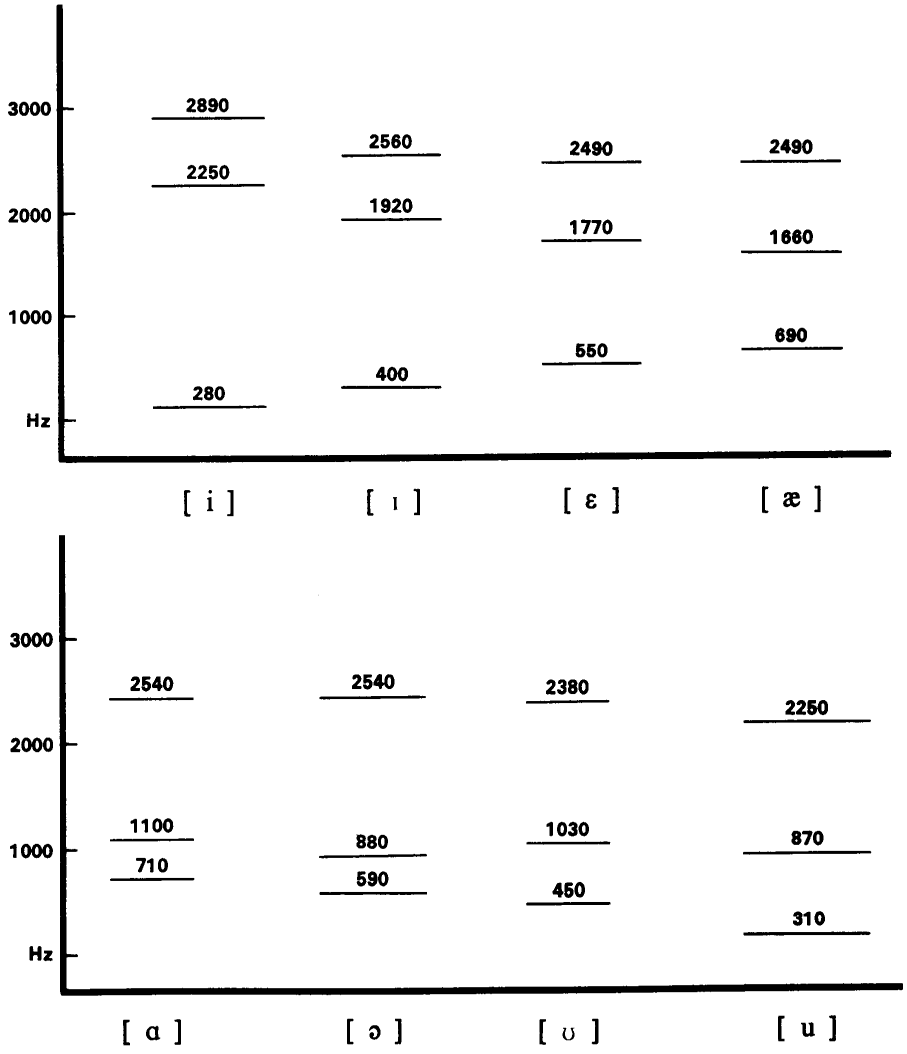


Figure 8.5 *The frequencies of the first three formants in eight American English vowels.*

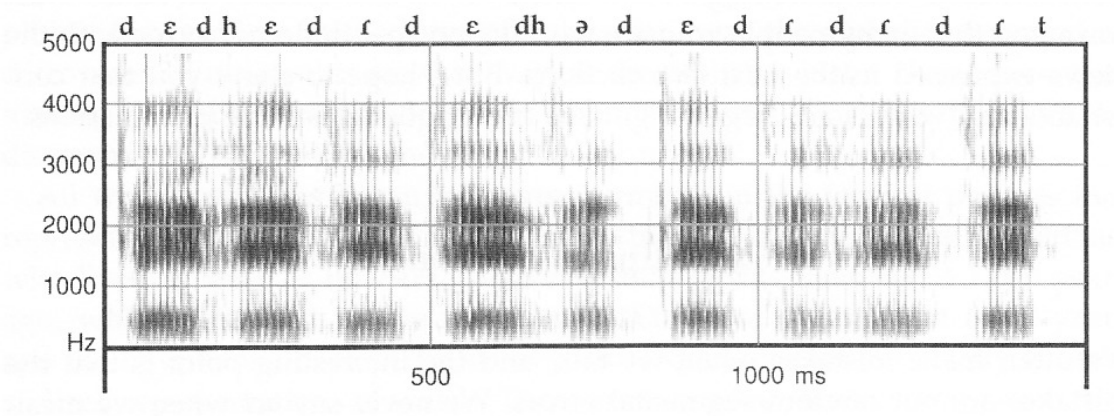


Figure 16.1 Spectrogram of my saying *Deadheaded Ed had edited it.*

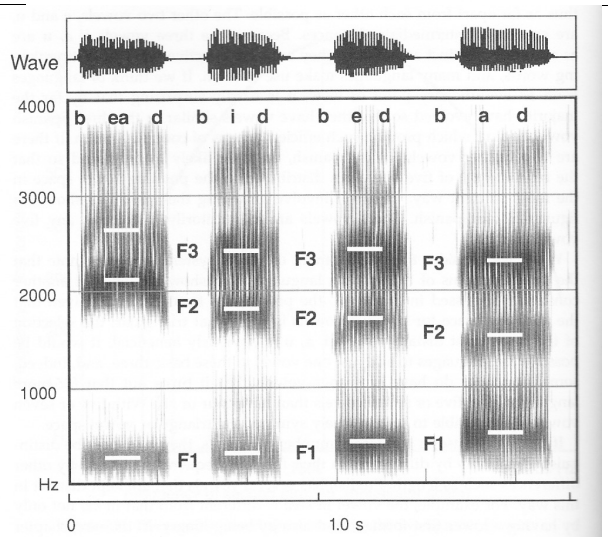


Figure 4.4 Upper part: sound waves produced when the author said the words *bead, bid, bed, bad*. Lower part: spectrogram of these sound waves in which the complex sound waves are split into their component frequencies (overtone pitches), the amplitude (loudness) of each frequency being shown by the darkness. The three principal groups of overtones (the first three formants) are marked by white lines, labeled F1, F2, and F3.

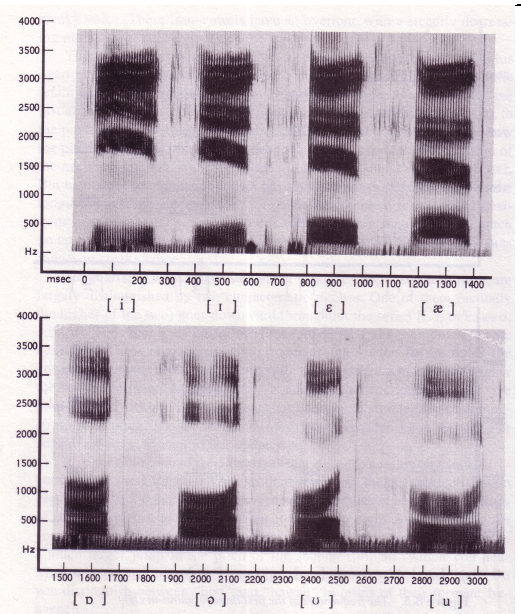


Figure 8.6 *A spectrogram of the words "heed, hid, head, had, hod, hawed, hood, who'd" as spoken in a British accent.*

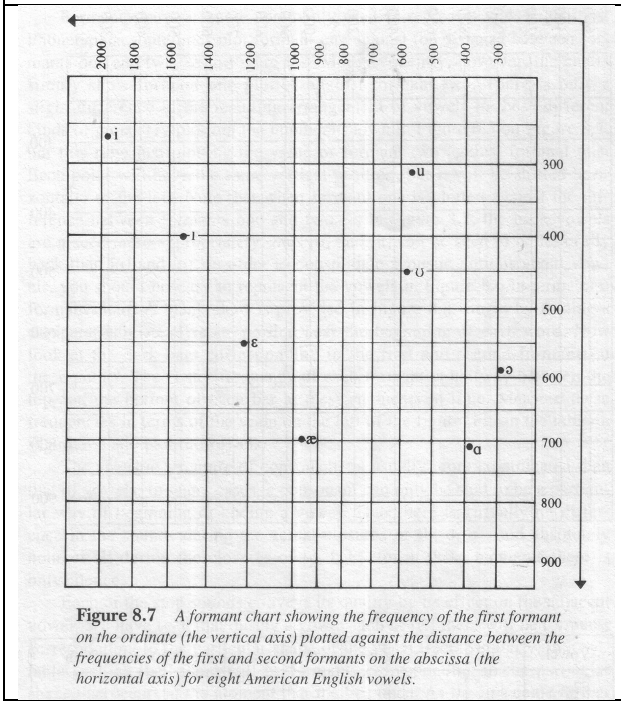
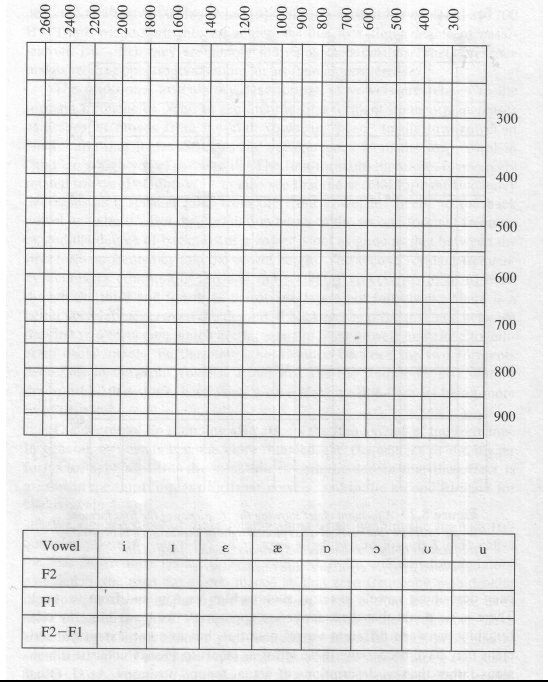


Figure 8.7 *A formant chart showing the frequency of the first formant on the ordinate (the vertical axis) plotted against the distance between the frequencies of the first and second formants on the abscissa (the horizontal axis) for eight American English vowels.*



Vowel	i	ɪ	ɛ	æ	ɒ	ɔ	ʊ	u
F2								
F1								
F2−F1								

The acoustic structure of consonants is usually more complicated than that of vowels. In many cases, a consonant can only be said to be a particular way of beginning or ending a vowel. Thus, there is virtually no difference in the sounds during the actual closures of [b, d, ɡ], and absolutely not at all during the closures of [p, t, k], for at these moments there is only silence.

Each of the stop sounds conveys its qualities by its effect on the adjacent vowel.

Consider the following spectrums. The first one is "bab, dad, gag." The second is "pin, Tim, king." Do you notice anything?

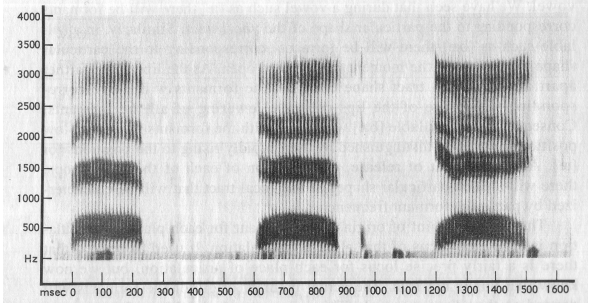


Figure 8.9 *A spectrogram of the words "bab, dad, gag" (British accent).*

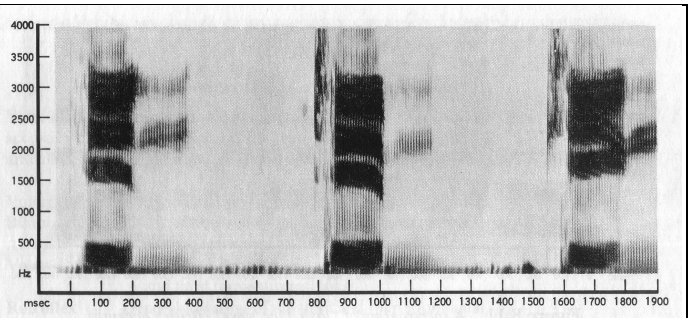


Figure 8.10 *A spectrogram of "pin, Tim, king" (British accent).*

For bab: increase in all three formants. At the end: rapid decrease.
For dad: first formant = increase. Second and third formants = slight decrease.
For gag: narrowing between second and third formants. This coming together at the end is a very common characteristic of velar consonants. Notice also: [ɡ] at the beginning is not the same as [ɡ] at the end. Why? They are not made in exactly the same place.

For "pin, Tim, king," we see apparently random patterns in the upper frequencies. This is really aspiration. The release of aspirated stops in each word is marked by a sharp onset of a burst of noise.
How about the ending nasal consonants? They are located at 250, 2500, and 3000 or so.

Acoustic correlates of consonantal features.

Note: These descriptions should be regarded only as rough guides. The actual acoustic correlates depend to a great extent on the particular combination of articulatory features in a sound.

Voiced	Vertical striations corresponding to the vibrations of the vocal cords.
Bilabial	Locus of both second and third formants comparatively low.
Alveolar	Locus of second formant about 1700–1800 Hz.
Velar	Usually high locus of the second formant. Common origin of second and third formant transitions.
Retroflex	General lowering of the third and fourth formants.
Stop	Gap in pattern, followed by burst of noise for voiceless stops or sharp beginning of formant structure for voiced stops.
Fricative	Random noise pattern, especially in higher frequency regions, but dependent on the place of articulation.
Nasal	Formant structure similar to that of vowels but with nasal formants at about 250, 2500, and 3250 Hz.
Lateral	Formant structure similar to that of vowels but with formants in the neighborhood of 250, 1200, and 2400 Hz. The higher formants are considerably reduced in intensity.
Approximant	Formant structure similar to that in vowels, usually changing.

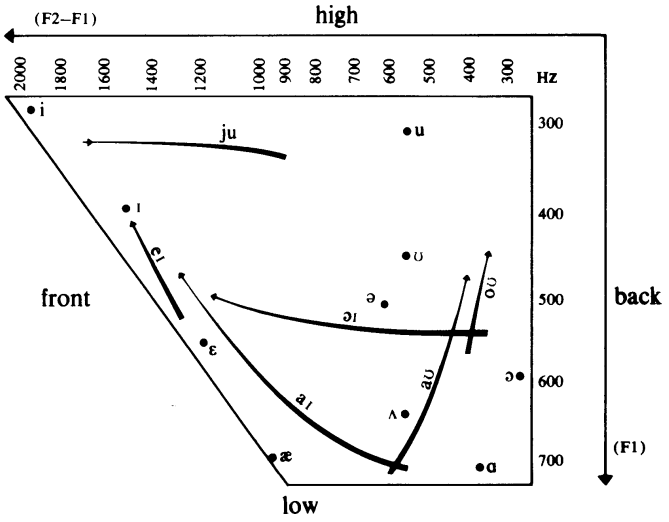
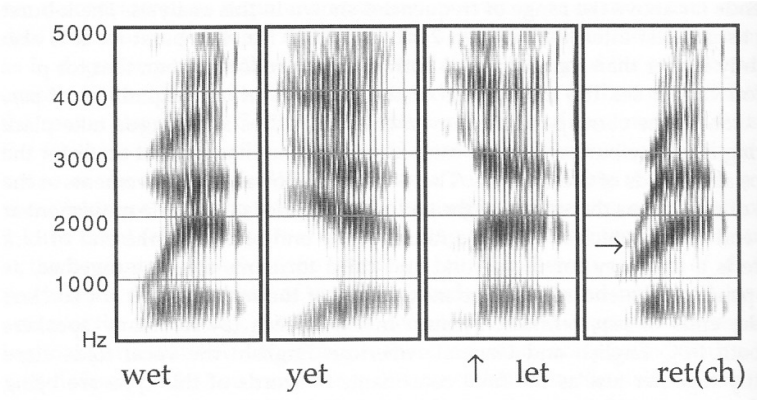


Figure 9.1 *A combined acoustic and auditory representation of some of the vowels of American English. (Compare Figures 4.2 and 8.7.)*

L and R



End of Spring Semester Class Lecture Notes