Phonetics:
The Sounds of Language

Sound Segments

- Knowing a language includes knowing the sounds of that language
- **Phonetics** is the study of speech sounds
- We are able to **segment** a continuous stream of speech into distinct parts and recognize the parts in other words
- Everyone who knows a language knows how to segment sentences into words and words into sounds

Identity of Speech Sounds

- Our linguistic knowledge allows us to ignore nonlinguistic differences in speech (such as individual pitch levels, rates of speed, coughs)
- We are capable of making sounds that are not speech sounds in English but are in other languages
  - The click *tsk* that signals disapproval in English is a speech sound in languages such as Xhosa and Zulu where it is combined with other sounds just like *t* or *k* is in English

Identity of Speech Sounds

- The science of phonetics aims to describe all the sounds of all the world's languages
  - **Acoustic phonetics**: focuses on the physical properties of the sounds of language
  - **Auditory phonetics**: focuses on how listeners perceive the sounds of language
  - **Articulatory phonetics**: focuses on how the vocal tract produces the sounds of language

The Phonetic Alphabet

- Spelling, or **orthography**, does not consistently represent the sounds of language

- Some problems with ordinary spelling:

  – 1. The same sound may be represented by many letters or combination of letters:

    he *people* *key*
    believe *seize* *machine*
    Caesar *seas*
    see *amoeba*

  – 2. The same letter may represent a variety of sounds:

    father *village*
    badly *made*
    many

The Phonetic Alphabet

– 3. A combination of letters may represent a single sound

shoot *character* *Thomas*

either *physics* *rough*

coat *deal*

– 4. A single letter may represent a combination of sounds

xerox

The Phonetic Alphabet

– 4. Some letters in a word may not be pronounced at all

autumn *sword* *resign*

pterodactyl *lamb* *corps*

psychology *write* *knot*

– 5. There may be no letter to represent a sound that occurs in a word

cute

use

The Phonetic Alphabet

- In 1888 the **International Phonetic Alphabet** (**IPA**) was invented in order to have a system in which there was a one-to-one correspondence between each sound in language and each phonetic symbol

- Someone who knows the IPA knows how to pronounce any word in any language

The Phonetic Alphabet

- Dialectal and individual differences affect pronunciation, but the sounds of English are:

A Phonetic Alphabet for English Pronunciation

Consonants						Vowels			
p	**p**ill	t	**t**ill	k	**k**ill	i	b**ee**t	ɪ	b**i**t
b	**b**ill	d	**d**ill	g	**g**ill	e	b**ai**t	ɛ	b**e**t
m	**m**ill	n	**n**il	ŋ	ri**ng**	u	b**oo**t	ʊ	f**oo**t
f	**f**eel	s	**s**eal	h	**h**eal	o	b**oa**t	ɔ	b**o**re
v	**v**eal	z	**z**eal	l	**l**eaf	æ	b**a**t	a	p**o**t/b**a**r
θ	**th**igh	tʃ	**ch**ill	r	**r**eef	ʌ	b**u**tt	ə	sof**a**
ð	**th**y	dʒ	**g**in	j	**y**ou	aɪ	b**i**te	aʊ	b**ou**t
ʃ	**sh**ill	ʍ	**wh**ich	w	**w**itch	ɔɪ	b**oy**		
ʒ	mea**s**ure								

The Phonetic Alphabet

- Using IPA symbols, we can now represent the pronunciation of words unambiguously:

Spelling	Pronunciation
though	[ðo]
thought	[θɔt]
rough	[rʌf]
bough	[baʊ]
through	[θru]
would	[wʊd]

Articulatory Phonetics

- Most speech sounds are produced by pushing air through the vocal cords
  - **Glottis** = the opening between the vocal cords
  - **Larynx** = ‘voice box’
  - **Pharynx** = tubular part of the throat above the larynx
  - **Oral cavity** = mouth
  - **Nasal cavity** = nose and the passages connecting it to the throat and sinuses

Consonants: Place of Articulation

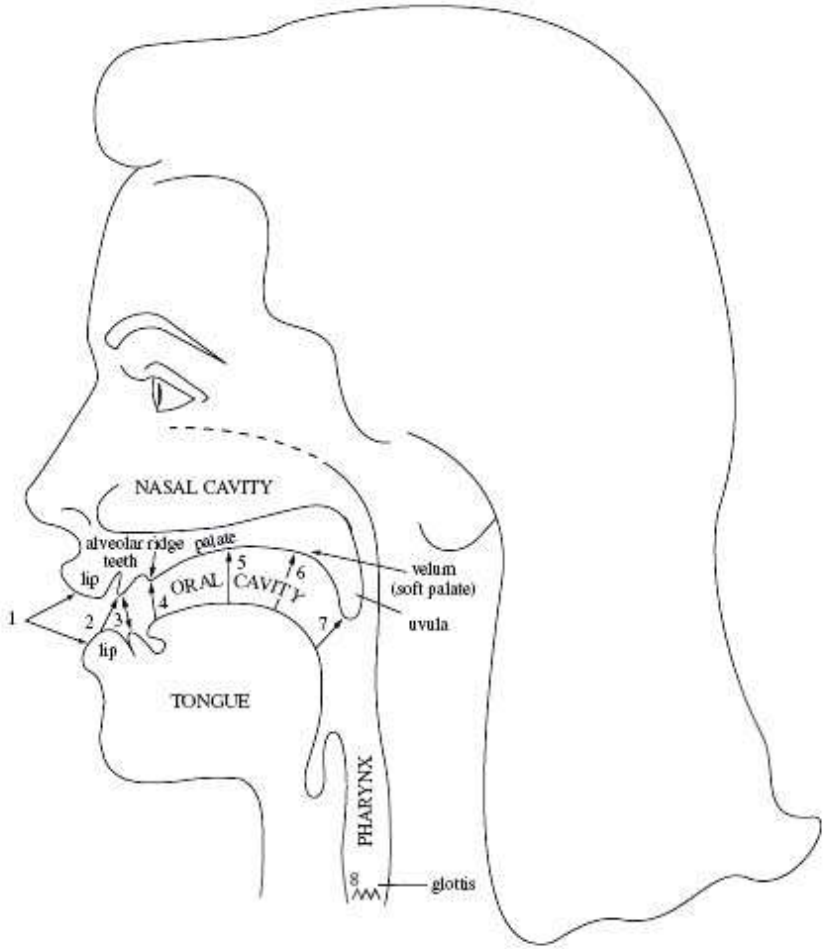
- Consonants are sounds produced with some restriction or closure in the vocal tract

- Consonants are classified based in part on where in the vocal tract the airflow is being restricted (the **place of articulation**)

- The major places of articulation are:

  bilabial, labiodental, interdental, alveolar, palatal, velar, uvular, and glottal

Consonants: Place of Articulation



The vocal tract. Places of articulation: 1. bilabial; 2. labiodental; 3. interdental; 4. alveolar; 5. (alveo)palatal; 6. velar; 7. uvular; 8. glottal.

Consonants: Place of ArOculaOon

- **Bilabials**: [p] [b] [m]
  - Produced by bringing both lips together
- **Labiodentals**: [f] [v]
  - Produced by touching the bo=om lip to the upper teeth
- **Interdentals** [θ] [ð]
  - Produced by pu@ng the Op of the tongue between the teeth

Consonants: Place of Articulation

- **Alveolars**: [t] [d] [n] [s] [z] [l] [r]
  - All of these are produced by raising the tongue to the **alveolar ridge** in some way
    - [t, d, n]: produced by the tip of the tongue touching the alveolar ridge (or just in front of it)
    - [s, z]: produced with the sides of the front of the tongue raised but the tip lowered to allow air to escape
    - [l]: the tongue tip is raised while the rest of the tongue remains down so air can escape over the sides of the tongue (thus [l] is a **lateral** sound)
    - [r]: air escapes through the **central** part of the mouth; either the tip of the tongue is curled back behind the alveolar ridge or the top of the tongue is bunched up behind the alveolar ridge

Consonants: Place of ArOculaOon

- **Palatals**: [ʃ] [ʒ] [ʧ] [ʤ][j̟]
  - Produced by raising the front part of the tongue to the palate
- **Velars**: [k] [g] [ŋ]
  - Produced by raising the back of the tongue to the soI palate or velum
- **Uvulars**: [ʀ] [q] [ɢ]
  - Produced by raising the back of the tongue to the uvula
- **Glo5als**: [h] [ʔ]
  - Produced by restricOng the airflow through the open glo@s ([h]) or by stopping the air completely at the glo@s (a **glo5al stop**: [ʔ])

Consonants: Manner of Articulation

- The **manner of articulation** is the way the airstream is affected as it flows from the lungs and out of the mouth and nose
- **Voiceless** sounds are those produced with the vocal cords apart so the air flows freely through the glottis
- **Voiced** sounds are those produced when the vocal cords are together and vibrate as air passes through

Consonants: Manner of ArOculaOon

- The voiced/voiceless disOncOon is important in English because it helps us disOnguish words like:

rope/robe	*fine/vine*	*seal/zeal*
[rop]/[rob]	[faɪn]/[vaɪn]	[sil]/[zil]

- But some voiceless sounds can be further disOnguished as **aspirated** or **unaspirated**

aspirated		unaspirated	
pool	[p^{h}ul]	*spool*	[spul]
tale	[t^{h}el]	*stale*	[stel]
kale	[k^{h}el]	*scale*	[skel]

Consonants: Manner of Articulation

- **Oral sounds** are those produced with the velum raised to prevent air from escaping out the nose
- **Nasal sounds** are those produced with the velum lowered to allow air to escape out the nose
- So far we have three ways of classifying sounds based on **phonetic features**: by voicing, by place of articulation, and by nasalization
  - [p] is a voiceless, bilabial, oral sound
  - [n] is a voiced, alveolar, nasal sound

Consonants: Manner of ArOculaOon

- **Stops**: [p] [b] [m] [t] [d] [n] [k] [g] [ŋ] [ʧ][ʤ] [ʔ]
  - Produced by completely stopping the air flow in the oral cavity for a fracOon of a second
    - All other sounds are **con;nuants**, meaning that the airflow is conOnuous through the oral cavity
- **Frica;ves**: [f] [v] [θ] [ð] [s] [z] [ʃ] [ʒ] [x] [ɣ] [h]
  - Produced by severely obstrucOng the airflow so as to cause fricOon

Consonants: Manner of ArOculaOon

- **Affricates**: [ʧ] [ʤ]
  - Produced by a stop closure that is released with a lot of fricOon
- **Liquids**: [l] [r]
  - Produced by causing some obstrucOon of the airstream in the mouth, but not enough to cause any real fricOon
- **Glides**: [j] [w]
  - Produced with very li=le obstrucOon of the airstream and are always followed by a vowel

Consonants: Manner of ArOculaOon

- **Approximants**: [w] [j] [r] [l]
  - SomeOmes liquids and glides are put together into one category because the arOculators approximate a fricOonal closeness but do not actually fricOon cause
- **Trills and flaps**: [r]* [ɾ]
  - Trills are produced by rapidly vibraOng an arOculator
  - Flaps are produced by a flick of the tongue against the alveolar ridge
- **Clicks**:
  - Produced by moving air in the mouth between various arOculators
  - The disapproving sound *tsk* in English is a consonant in Zulu and some other southern African languages
  - The lateral click used to encourage a horse in English is a consonant in Xhosa

*The textbook uses [r] to represent the central liquid as in the word *ready* rather than as a trill

| Some Phonetic Symbols for American English Consonants

	Bilabial	Labiodental	Interdental	Alveolar	Palatal	Velar	Glottal
Stop (oral)							
voiceless	p			t		k	ʔ
voiced	b			d		g	
Nasal (voiced)	m			n		ŋ	
Fricative							
voiceless		f	θ	s	ʃ		h
voiced		v	ð	z	ʒ		
Affricate							
voiceless					tʃ		
voiced					dʒ		
Glide							
voiceless	ʍ					ʍ	
voiced	w				j	w	
Liquid (voiced)							
(central)				r			
(lateral)				l			

Examples of Consonants in English Words

	Bilabial	Labiodental	Interdental	Alveolar	Palatal	Velar	Glottal
Stop (oral)							
voiceless	***p***ie			***t***ie		***k***ite	(ʔ)uh-(ʔ)oh
voiced	***b***uy			***d***ie		***g***uy	
Nasal (voiced)	***m***y			***n***ight		si***ng***	
Fricative							
voiceless		***f***ine	***th***igh	***s***ue	***sh***oe		***h***igh
voiced		***v***ine	***th***y	***z***oo	meas***u***re		
Affricate							
voiceless					***ch***eese		
voiced					***j***ump		
Glide							
voiceless	***wh***ich					***wh***ich	
voiced	***w***ipe				***y***ou	***w***ipe	
Liquid (voiced)							
(central)				***r***ye			
(lateral)				***l***ye			

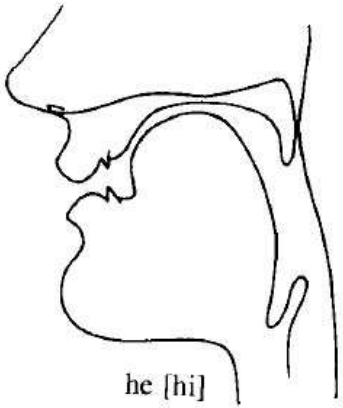
Vowels

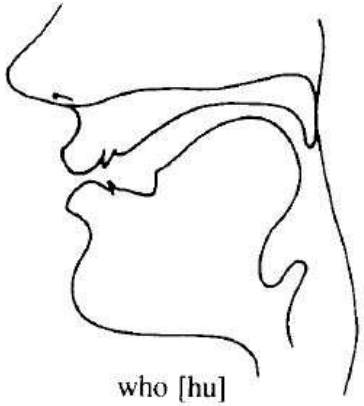
- Vowels are classified by how high or low the tongue is, if the tongue is in the front or back of the mouth, and whether or not the lips are rounded

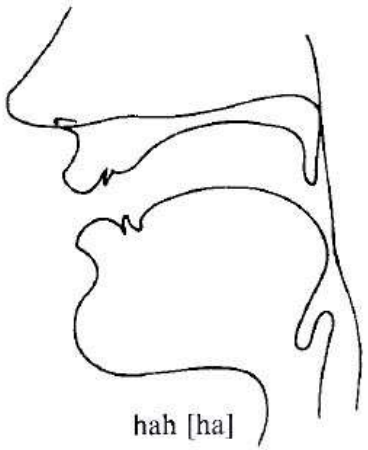
- **High** vowels: [i] [ɪ] [u] [ʊ]
- **Mid** vowels: [e] [ɛ] [o] [ə] [ʌ] [ɔ]
- **Low** vowels: [æ] [a]

- **Front** vowels: [i] [ɪ] [e] [ɛ] [æ]
- **Central** vowels: [ə] [ʌ]
- **Back** vowels: [u] [ɔ] [o] [æ] [a]

Vowels







Vowels

- **Round** vowels: [u] [ʊ] [o] [ɔ]
  - Produced by rounding the lips
  - English has only back round vowels, but other languages such as French and Swedish have front round vowels

- **Diphthongs**: [aɪ] [aʊ] [ɔɪ]
  - A sequence of two vowel sounds (as opposed to the **monophthongs** we have looked at so far)

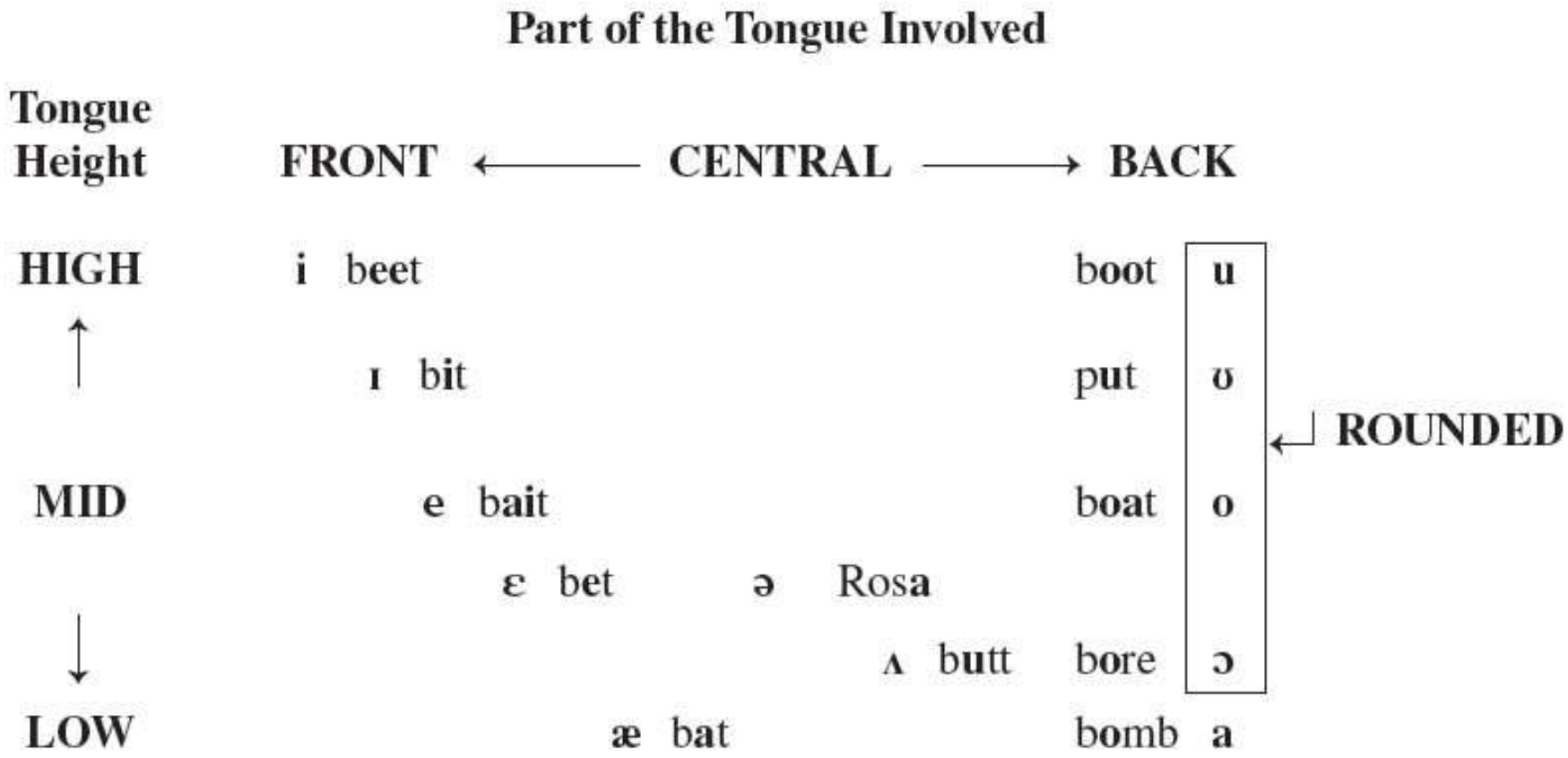
- **Nasaliza;on**:
  - Vowels can also be pronounced with a lowered velum, allowing air to pass through the nose
  - In English, speakers nasalize vowels before a nasal sound, such as in the words *beam*, *bean*, and *bingo*
  - The nasalizaOon is represented by a diacriOc, an extra mark placed with the symbol: *bean* [bĩn]

Vowels

- **Tense** vowels:
  - Are produced with greater tension in the tongue
  - May occur at the end of words
- **Lax** vowels:
  - Are produced with less tongue tension
  - May not occur at the end of words

Tense		Lax	
i	beat	ɪ	bit
e	bait	ɛ	bet
u	boot	ʊ	put
o	boat	ɔ	bore
a	hah	ɔɪ	boy
aɪ	high	æ	hat
aʊ	how	ʌ	hut
		ə	about

Vowels


Part of the Tongue Involved
Tongue Height
FRONT
CENTRAL
BACK
HIGH
i beet
boot u
ɪ bit
put ʊ
ROUNDED
MID
e bait
boat o
ɛ bet
ə Rosa
ʌ butt
bore ɔ
LOW
æ bat
bomb a

Major Phonetic Classes

- **Noncontinuants**: the airstream is totally obstructed in the oral cavity
  - Stops and affricates
- **Continuants**: the airstream flows continuously out of the mouth
  - All other consonants and vowels
- **Obstruents**: the airstream has partial or full obstruction
  - Non-nasal stops, fricatives, and affricates
- **Sonorants**: air resonates in the nasal or oral cavities
  - Vowels, nasal stops, liquids, and glides

Major PhoneOc Classes: Consonantal

- **Consonantal**: there is some restricOon of the airflow during arOculaOon
  - All consonants except glides
- Consonantal sounds can be further subdivided:
  - **Labials**: [p] [b] [m] [f] [v] [w] [ʍ]
    - ArOculated with the lips
  - **Coronals**: [θ] [ð] [t] [d] [n] [s] [z] [ʃ] [ʒ] [ʧ][ʤ] [l] [r]
    - ArOculated by raising the tongue blade

Major PhoneOc Classes

- Consonantal categories cont.:
  - Anteriors: [p] [b] [m] [f] [v] [θ] [ð] [t] [d] [n] [s] [z]
    - Produced in the front part of the mouth (from the alveolar area forward)
  - Sibilants: [s] [z]] [ʃ] [ʒ] [ʧ][ʤ]
    - Produced with a lot of fricOon that causes a hissing sound, which is a mixture of high--frequency sounds
- **Syllabic Sounds**: sounds that can funcOon as the core of a syllable
  - Vowels, liquids, and nasals

dazzle [dæz̩]

rhythm [rɪðm̩]

Prosodic Features

- **Prosodic**, or **suprasegmental** features of such as length, stress and pitch, are features above sounds,

  the segmental values such as place and manner of

  arOculaOon

  length of a consonant or a vowel can change

- **Length**: in some languages, such as Japanese, the the

  meaning of a word:

  - *biru* [biru] “building” *biiru* [bi:ru] “beer”
  - *saki* [saki] “ahead” *sakki* [sak:i] “before”

Prosodic Features

- **Stress**: stressed syllables are louder, slightly higher in **pitch**, and somewhat longer than unstressed syllables
  - The noun *digest* has the stress on the first syllable
  - The verb *digest* has the stress on the second syllable
  - English is a stress-timed language, meaning that at least one syllable is stressed in an English word
    - French functions differently, so when English speakers learn French they put stress on certain syllables which contributes to their foreign accent

Tone and IntonaOon

- **Tone languages** are languages that use pitch to contrast the meaning of words

  - For example, in Thai, the string of sounds [naː] can be said with 5 different pitches and can thus have 5 different meanings:

[˩]	L	low tone	[nàː]	"a nickname"
[˧]	M	mid tone	[nāː]	"rice paddy"
[˥]	H	high tone	[náː]	"young maternal uncle or aunt"
[˥˩]	HL	falling tone	[nâː]	"face"
[˩˥]	LH	rising tone	[nǎː]	"thick"

Tone and Intonation

- **Intonation** languages (like English) have varied **pitch contour** across an utterance, but pitch is not used to distinguish words
  - However, intonation may affect the meaning of a whole sentence:
    - *John is here* said with falling intonation is a statement
    - *John is here* said with rising intonation is a question

Phonetics of Signed Languages

- Signs can be broken down into segmental features similar to the phonetic features of speech sounds (such as place and manner of articulation)
  - And just like spoken languages, signed languages of the world vary in these features
  - Signs are formed by three major features:
    - 1. The **configuration** of the hand (handshape)
    - 2. The **movement** of the hand and arm towards or away from the body
    - 3. The **location** of the hand in signing space

Phonetics of Signed Languages

- The configuration of the hand (handshape)
- The movement of the hand and arm
- The location of the hand in signing space