

# What is Phonetics?

A simple, formal definition: the study of the physical and physiological basis of speech sounds.

Among other things, phoneticians want to know:

- ① how speech sounds are made
- ② how to describe, represent, and categorize speech sounds
- ③ how speech sounds are transmitted and received

1

★

# Branches of Phonetics

- **Articulatory phonetics** is concerned with how sounds are made in the vocal tract.
- **Acoustic phonetics** is concerned with the physical properties of the speech sound waves and their transmission (frequency, wavelengths, etc.).
- **Clinical phonetics** is argued by speech-language pathologists to be a third branch of phonetics; it is equivalent to articulatory phonetics but has a special emphasis on disordered speech.

2

# Categorizing Speech Sounds

- Place: Labial, Dental, Alveolar, etc.
- Manner: Stop, Fricative, Nasal, etc.
- Voicing: Voiced, Voiceless, Murmur, etc.
- Airstream: Ejective, Click, Implosive, etc.

Moving Articulators. Again

3

# Representing Speech Sounds

① ≠ AA No language has a one-to-one correspondence between the sounds of the language and the alphabet that represents those sounds.

**In English we use:**

- Different symbols for same sounds (*won~one*)
- Same symbols for different sounds (*shoe~foe*)
- Symbols for no sounds (*knight, one*)
- No symbols for some sounds (*?one, c?ute*)

4

# International Phonetic Alphabet (IPA)

① = AA A consistent set of symbols that represents the range of speech sounds in language:

- One symbol for one sound
- No silent letters
- All sounds are written
- A sound is written the same all the time

5

# Two Key Things to Remember

- ① There is a distinction between sounds and letters. In phonetics we are talking about sounds. (See next slide).

②

**Practice  
Practice  
Practice**

6

## Don't Trip!

Sounds are **different** from letters:

___ slaughter	___	thumb	___
___ cough	___	axle	___
___ addition	___	knight	___
___ ringer	___	couch	___
___ linger	___	shrink	___

SOUNDS ≠ LETTERS

7

## Types of Transcription

### Phonemic (broad) transcription:

transcribe only the phonemes, /t/.

### Phonetic (narrow) transcription:

transcribe the allophones, [t].

“tick” ⇒ **broad/phonemic** = /tɪk/  
 ⇒ **narrow/phonetic** = [tʰɪk]

8

## The 3 Systems of Speech

### The Respiratory System

↳ lungs, rib cage, diaphragm, abdomen

### The Laryngeal System

↳ trachea, larynx, vocal folds

### The Supralaryngeal System (vocal tract)

↳ pharynx, oral/nasal cavities

9

## The Respiratory System

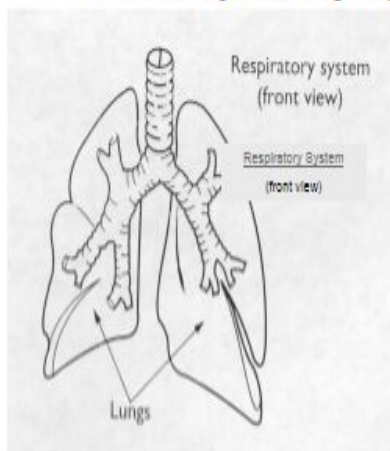


Image from Skolberg, L.D. &  
 Kent, R.D. (1995). *Clinical  
 Phonetics* (2nd Edition). Allyn &  
 Bacon, p. 15.

10

## Airstream Mechanisms: Pulmonic

When air is pushed out from the lungs, there is said to be a **pulmonic airstream mechanism** (from Latin *pulmon* = lung).

- Involves the lungs, diaphragm, rib cage, abdomen.
- Default airstream mechanism for most speech sounds.

11

## Airstream Mechanisms: Pulmonic

Most consonants in the world's languages involve an **egressive** or outward flow of air from the lungs and use the pulmonic airstream mechanism.

One type of egressive consonant is called a **plosive** or **stop** because air is completely obstructed in the mouth before it is released.

English has a number of stop consonants and all are produced with an egressive pulmonic airstream:

p t k b d g

Interestingly, these kinds of stop consonants can be produced with other airstream mechanisms as well.

12



## The Glottalic Airstream Mechanism

When air from the lungs is contained below the glottis, a rapid movement of the glottis up or down pushes the trapped air in those directions. When this happens, the **glottalic airstream mechanism** is being used.

→ An upward (egressive) movement of the glottis will push the air out of the mouth.

→ A downward (ingressive) movement of the glottis will cause air to be sucked into the mouth.

13

## Glottalic Egressive: Ejectives

Consonants made with an egressive glottalic airstream mechanism are called **ejectives**.

Because the vocal folds are shut, the sounds are necessarily voiceless.

Indicated with an apostrophe after the sound:

[p']	[p'a]	[ap'a]
[t']	[t'a]	[at'a]
[k']	[k'a]	[ak'a]

Ejectives in Quechua

Ejectives in Navajo

14

## Glottalic Ingressive: Implosives

Consonants made with an ingressive (inward) glottalic airstream mechanism are called **implosives**.

In these sounds, the vocal folds are not completely closed, so the sound is usually voiced (vocal folds are vibrating):

[ɓ]	[ɓa]	[aɓa]
[ɗ]	[ɗa]	[aɗa]
[ɠ]	[ɠa]	[aɠa]

Implosives in Sindhi

Implosives in Igbo

15

## Airstream Mechanisms: Velaric

Movement of the air between two points of closure in the mouth (one at the *velum* and another further forward) is called a **velaric airstream mechanism**.

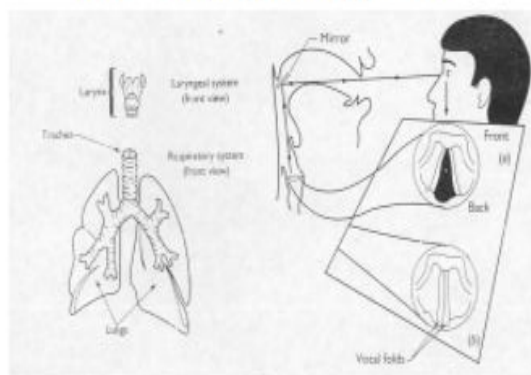
⇒ Consonants made with an ingressive velaric airstream mechanism are called **clicks**.

Clicks in Xhosa

Clicks in Nama

16

## The Laryngeal System



Images from Shenberg, L.D. & Kent, R.D. (1995). *Clinical Phonetics* (2nd Edition). Allyn & Bacon, pp. 15-16.

17

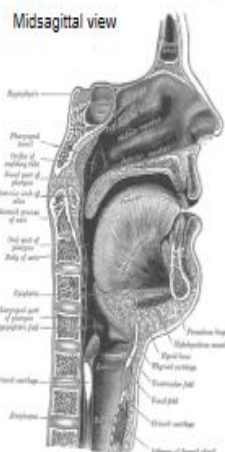
## The Laryngeal System - Terms

- **Larynx**: conduit for air between the lungs and the mouth
- **Thyroid cartilage, cricoid cartilage, trachea**: all support the larynx
- **Epiglottis**: works with the larynx to block food from going into the lungs and can serve as an articulator
- **Glottis**: opening between the vocal folds
- **Arytenoid cartilage**: adjusts the movement of the vocal folds by controlling their length and tension

18

## The Laryngeal System

Midsagittal view



Larynx - front view



Larynx - top view

19

## States of the Glottis

The space between the vocal folds is referred to as the **glottis**.

The glottis can assume four different shapes which results in four different types of phonation:

- 1 voiceless
- 2 voice
- 3 breathy/murmur
- 4 creaky/laryngealized

20

## (1) Voiceless

The vocal folds are pulled apart.

Air flows freely through the spread glottis. No vocal fold vibration does occur and no voicing is produced.

⇒ Truly voiceless sounds (like “f” and “s” in English) involve little or no flow of air through the glottis.

21

## (2) Voiced

The vocal folds are close together (but not shut).

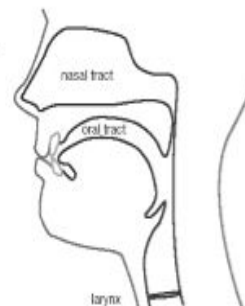
The air pushing through the constricted glottis causes the vocal folds to vibrate, producing voicing.

The vocal folds in action

22

## The Vocal Tract

Can be divided into the **oral tract** (mouth and pharynx) and **nasal tract** (the nose).



23

## The Vocal Tract

The parts of the vocal tract used to make sounds are called **articulators**.

Parts of the vocal tract

Moving Articulators

Moving Vocal Tract

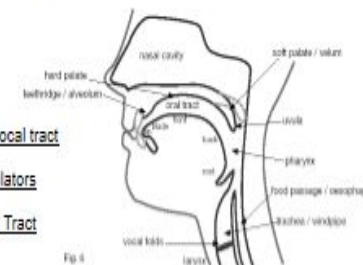
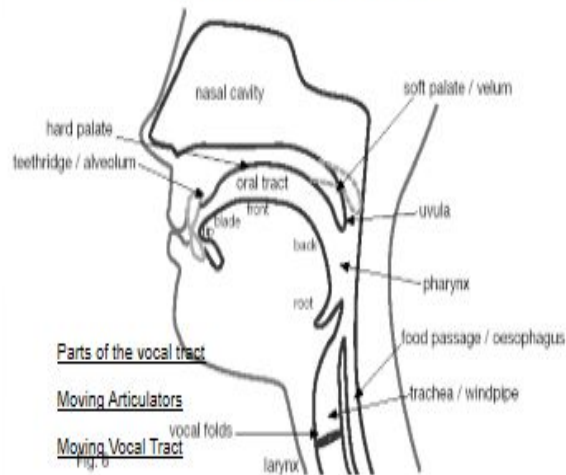


Fig. 4

24



## The Vocal Tract



## The Articulators

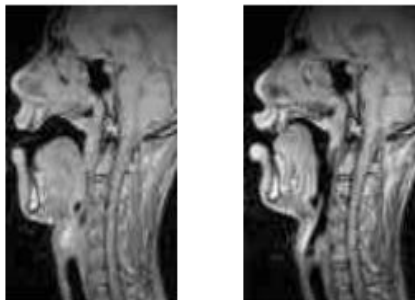
- |                          |          |          |
|--------------------------|----------|----------|
| ① Lips                   | ⑧ Tongue |          |
| ② Teeth                  | - tip    |          |
| ③ Alveolar Ridge         | - blade  |          |
| ④ Hard Palate            | - body   |          |
| ⑤ Soft Palate (or velum) | - back   | } Dorsum |
| ⑥ Uvula                  | - root   |          |
| ⑦ Pharynx                |          |          |

## Consonant~Vowel Distinction

**Consonant:** has significant obstruction of airflow, is temporally constrained, and is normally not a syllable nucleus.

**Vowel:** has no significant restriction of airflow, can be temporally sustained, and serves as a syllable nucleus.

## Which is the C and V?



## Consonants: Place of Articulation

We can classify consonants in loose terms according to *where* the airflow is obstructed.

- In general terms: **labial**, **coronal**, **dorsal**

## Labial Articulation

**Bilabial:** two lips

**Labiodental:** lower lip, upper teeth

**Labiovelar:** two lips, velum

**Linguo-labial:** upper lip, tongue tip

## Coronal Articulation

**Dental:** tongue tip/blade, upper teeth

**Alveolar:** tongue tip/blade, alveolar ridge

**Retroflex:** t. tip, back of alveolar ridge

**Alveopalatal:** t. blade, back of a.r.

**Palatal:** tongue front, hard palate

31

## Dorsal Articulation

### DORSAL

**Velar:** tongue back, soft palate

**Uvular:** tongue back, uvula

**Pharyngeal:** tongue root, pharyngeal wall

32

## Glottal Articulation

### GLOTTAL

**Glottal:** vocal folds

33

31

32

33

## Consonants: Manner of Articulation

We can also classify consonants according to *how* the airflow is obstructed.

- For example, in all three of these images the air is completely "stopped" at one point in articulation



34

## Stop Articulation

**Stop:** made with complete obstruction of airflow

- oral** - air stopped in oral cavity, velum up
- nasal** - air stopped in oral cavity, velum down

In English:

	<u>bilabial</u>	<u>alveolar</u>	<u>velar</u>	<u>glottal</u>
oral:	[p] [b]	[t] [d]	[k] [g]	[ʔ]

35

## Stop Articulation

In English:

	<u>bilabial</u>	<u>alveolar</u>	<u>velar</u>	<u>glottal</u>
oral:	[p] [b]	[t] [d]	[k] [g]	[ʔ]
nasal:	[m]	[n]	[ŋ]	

36

34

35

36

## Aspiration

For some stop consonants, there is a period of voicelessness between the release of the sound and the onset of the following vowel.

This period of voicelessness translates into a “puff of air” and is referred to as **aspiration**; it is indicated by a superscripted “h” placed after the consonant.

In English, all syllable-initial voiceless stops are aspirated:

pea [p<sup>h</sup>i]      tea [t<sup>h</sup>i]      key [k<sup>h</sup>i]

37

## Fricative Articulation

**Fricative**: made with a continuous, turbulent airflow due to only a narrow opening in the glottis or vocal tract; aka continuants.

In English:

<u>labiodental</u>	<u>interdental</u>	<u>alveolar</u>	<u>alveopalatal</u> *	<u>glottal</u>
[f] [v]	[θ] [ð]	[s] [z]	[ʃ] [ʒ]	[h]

\* [ʃ] [ʒ] also symbolized as [ʃ̺] [ʒ̺]

38

## English Fricatives

labiodental   interdental   alveolar

[f] [v]      [θ] [ð]      [s] [z]

alveopalatal\*   glottal

[ʃ] [ʒ]      [h]

\* [ʃ] [ʒ] also symbolized as [ʃ̺] [ʒ̺]

39

## Affricate Articulation:

**Affricates**: made with an initial obstruction of airflow, followed by a slow, turbulent release; combination stop and fricative.

**English**: alveopalatal

[tʃ] [dʒ]

aka      [t͡ʃ] [d͡ʒ]

40

## Liquid Articulation

Only minor obstruction in the vocal tract. Includes varieties of [l] and [ɹ].

Lateral: air is obstructed at point of articulation but escapes along sides of tongue; usually voiced.

Retroflex: tongue tip is curled backwards behind alveolar ridge; usually voiced.

41

## English Liquids

In English: alveolar

lateral      [l] [ɭ]

retroflex      [ɭ̠] [ɭ̠̊]

42



## Glide Articulation

Made rapidly and with almost no obstruction in the vocal tract; usually voiced.

In English: palatal (labio)velar  
[j]\* [w]

\* also symbolized as: [ɹ]

Liquids and Glides are also referred to as "approximants".

43

## Flap or Tap

A single, rapid movement of tongue against alveolar ridge.

IPA symbol is [ɾ] as in *butter* and *pity*.

44

## Syllabic Liquids & Nasals

Liquids and nasals that act as syllables.

Indicated by a tic mark under the consonant, as in [m̩]

English: *riddle*, *litter*, *bottom*, *button*.

45

## Vowels

Relatively free passage of the airstream; the articulators do not touch and so do not significantly obstruct the flow of air from the lungs.

46

## Vowels

Changes in the position of the lips and tongue (and thus the jaw), result in changes to the shape of the oral cavity.

47

## Vowel Articulation

- the tongue body can move up or down (tongue height)
- the tongue can move forward or back (tongue frontness/backness)
- the lips can be rounded or not (lip rounding)

48



## Vowel Chart

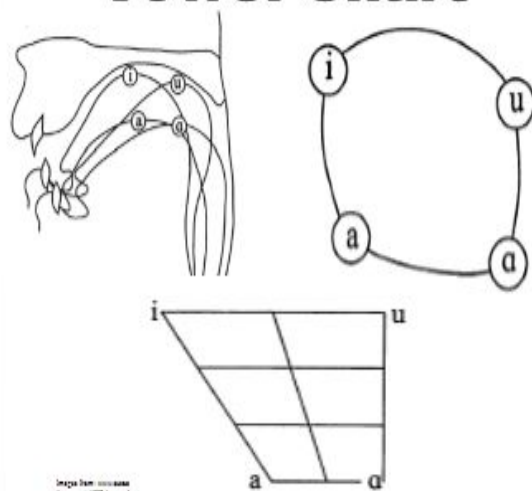


Image from: <https://www.grammar.com/vowel-chart/>

49

## Vowel Articulation

Typically, we describe these movements in the following way:

<u>Height</u>	<u>Frontness</u>	<u>Lip Rounding</u>
high	front	unrounded
mid-high	central	rounded
mid-low	back	
low		

50

## Diphthong

A vowel produced with a gradually changing articulation, like the vowel in English "cow".

51

### English Diphthongs (1)

/eɪ/ stressed version of /e/

➤ way, paid, trade, eight, steak

/oʊ/ stressed version of /o/

➤ rotate, mold, know, shoulder, boat

[Diphthong chart](#)

52

### English Diphthongs (2)

/aɪ/ low central to mid-high front

➤ sigh, aisle, tyke, rhyme, bike

/aʊ/ low central to mid-high back

➤ cow, doubt, round, chowder

/oɪ/ mid-low back to mid-high front

➤ toy, spoil, foyer, turquoise

[Diphthong chart](#)

53

## Tense/Lax Distinction

Refers to how stiffly the tongue is held during the production of a vowel.

- Tense: "deed"
- Lax: "did"

54

## Central Vowel

Schwa, [ə], is used to represent a range of mid central unstressed vowels.

All English vowels can “move” to become schwa when in an unstressed syllable, but do not always do so.

beauty vs. beautiful

55

## Rhotacization

“r-coloring”; the effect of [ɹ] on a preceding vowel.

Rhotacized vowels:

Stressed: [ɜ˞] bird, fur, her, herd

Unstressed: [ə] father, verbose

Both: murmur, further, perverse

56

## Nasalization

Occurs when a vowel precedes a nasal consonant.

team ⇒ [tɪ̃m]

seen ⇒ [sɪ̃n]

sing ⇒ [sɪ̃ŋ]

57

55

56

57

## Diphthongization

Occurs when a vowel normally pronounced as a monophthong is produced as a diphthong.

yes /jɛs/ ⇒ /jɪɛs/

cat /kæt/ ⇒ /kiæt/

58

## Monophthongization

Occurs when a vowel normally pronounced as a diphthong is produced as a monophthong.

59

58

59

## Coarticulation

Occurs when the articulation of one sound affects another.

❶ key vs. coo

❸ tip vs. trip

❷ hat vs. hand

❹ kick vs. quick

60

60