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

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.

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

Representing Speech Sounds
≠ ≠ ≠ 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-see)
- Symbols for no sounds (knight, one)
- No symbols for some sounds (?one, ?ute)

International Phonetic Alphabet (IPA)
≠ ≠ ≠ 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

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
Don’t Trip!
Sounds are different from letters:

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

SOUNDS # LETTERS

Types of Transcription

Phonemic (broad) transcription:
transcribe only the phonemes, /t/.

Phonetic (narrow) transcription:
transcribe the allophones, [t].

“tick” ⇔ broad/phonemic = /tʃk/
⇔ narrow/phonetic = [tʃk]

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

The Respiratory System

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.

Airstream Mechanisms: Plosive or stop because air is completely obstructed in the mouth before it is released.

- Involves the lungs, diaphragm, rib cage, abdomen.

- 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.

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

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']
- [t']
- [k']

Ejectives in Quechua Ejectives in Navajo

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):

- [s]
- [z]
- [g]

Implosives in Sindhi Implosives in Igbo

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**.

The Laryngeal System

- **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

The Laryngeal System - Terms

- Clicks in Xhosa
- Clicks in Nama
The Laryngeal System

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

(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.

(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 Tract

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

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
The Vocal Tract

The Articulators

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

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

Dorsal Articulation
DORSAL
Velar: tongue back, soft palate
Uvular: tongue back, uvula
Pharyngeal: tongue root, pharyngeal wall

Glottal Articulation
GLOTTAL
Glottal: vocal folds

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

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:
oral: [p] [b]
velar: [k] [g]

In English:
bilabial alveolar velar glottal
oral: [p] [b] [t] [d] [k] [g] [ʔ]
nasal: [m] [n] [n]

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 [pʰ], tea [tʰ], key [kʰ].

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:

labiodental interdental alveolar
tʃ [ʃ] tɹ [ɹ] t [t]

* [ʃ] [ʒ] also symbolized as [ʃ] [ʒ]

English Fricatives

labiodental interdental alveolar
[tʃ] [ɹ] [θ] [s] [z]
alveopalatal glottal
[f] [ʒ] [h]

* [ʃ] [ʒ] also symbolized as [ʃ] [ʒ]

Affricate Articulation:

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

English: alveopalatal

[tʃ] [ɹʃ]

aka [ʃ] [ʒ]

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.

In English: alveolar

lateral [l] [ɹ]

retroflex [ɾ] [ɹ]
**Glide Articulation**
Made rapidly and with almost no obstruction in the vocal tract; usually voiced.

In English: **palatal** (labio)velar

\[ ji^* \quad [w] \]

* also symbolized as: \[ v \]

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

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**Flap or Tap**
A single, rapid movement of tongue against alveolar ridge.

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

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**Syllabic Liquids & Nasals**
Liquids and nasals that act as syllables.
Indicated by a tic mark under the consonant, as in \[ m \]

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

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**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.

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

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**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)
Vowel Articulation

Typically, we describe these movements in the following way:

- **Height**: high, mid-high, mid-low, low
- **Frontness**: front, central, back
- **Lip Rounding**: unrounded, rounded

- **/i/**: typically described as high front unrounded
- **/u/**: typically described as high back unrounded
- **/a/**: typically described as mid-high central rounded, or mid-low central rounded
- **/o/**: typically described as mid-low back to mid-high front unrounded
- **/æ/**: typically described as low central to mid-high front rounded, or low central to mid-high back unrounded
- **/ə/**: typically described as low central to mid-high front unrounded
- **/ɝ/**: typically described as low back to mid-high front rounded
- **/ɜ/**: typically described as mid-low front rounded
- **/ʌ/**: typically described as low central rounded
- **/əʊ/**: typically described as mid-low back to mid-high front unrounded
- **/ɔ/**: typically described as mid-low front unrounded
- **/ɒ/**: typically described as mid-low back unrounded
- **/aɪ/**: typically described as mid-high front rounded
- **/ai/**: typically described as mid-high front rounded
- **/ɔɪ/**: typically described as mid-low back to mid-high front rounded
- **/aʊ/**: typically described as mid-high back rounded
- **/uə/**: typically described as high back rounded
- **/ɛ/**: typically described as low central unrounded
- **/æ/**: typically described as low central rounded
- **/eɪ/**: typically described as mid-high front rounded
- **/i/**: typically described as high front unrounded
- **/ɪ/**: typically described as low front unrounded
- **/ʊ/**: typically described as high back unrounded
- **/ʌ/**: typically described as low central rounded
- **/ɔ/**: typically described as mid-low back unrounded
- **/ɒ/**: typically described as mid-low back unrounded
- **/ɜ/**: typically described as mid-low front unrounded
- **/ɪə/**: typically described as mid-low front rounded
- **/ʊə/**: typically described as high back rounded

Diphthong

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

English Diphthongs (1)

- /ei/ stressed version of /e/
  - way, paid, trade, eight, steak
- /ow/ stressed version of /o/
  - rotate, mold, know, shoulder, boat

English Diphthongs (2)

- /ai/ low central to mid-high front
  - sigh, aisle, tyke, rhyme, bike
- /aw/ low central to mid-high back
  - cow, doubt, round, chowder
- /oi/ mid-low back to mid-high front
  - toy, spoil, foyer, turquoise

Tense/Lax Distinction

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

- **Tense**: “deed”
- **Lax**: “did”
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

Rhotacization
"r-coloring"; the effect of [ɹ] on a preceding vowel.

Rhotacized vowels:
Stressed: [ɹ] bird, fur, her, herd
Unstressed: [ɹ] father, verbose
Both: murmur, further, perverse

Nasalization
Occurs when a vowel precedes a nasal consonant.

team → [tim]
seen → [sin]
sing → [sin]

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

yes /jɛs/ → /jɛs/
cat /kæt/ → /kiæt/

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

Coarticulation
Occurs when the articulation of one sound affects another.

1 key vs. coo
2 hat vs. hand
3 tip vs. trip
4 kick vs. quick