Week 5: Consonants

Study Guide

In the first part of the course, we talked a lot about language as an unbounded discrete combinatorial system, in which we must acquire:

- The **discrete units** (parts)
- The **rules** for combining these parts

Next, we'll turn to the level of sounds[1] of the language. There are two fields of linguistics devoted to studying the sound systems of language:

(1) **Phonetics:** the study of the parts of the discrete combinatorial system. What are the sounds of human language?
(2) **Phonology:** the study of the rules for combining these parts (more on this in two weeks).

This week and next, we'll learn about **phonetics**, the study of the minimal units that make up language. There are three sub-disciplines to study of phonetics:

(1) **Articulatory phonetics**: What are the sounds of language and how do we produce them with our anatomy? Methods of study include X-rays, palatography, and ultrasound
(2) **Acoustic phonetics:** What are the characteristics of the sounds produced by these articulations? To study this, phonetitions use pictures of the sounds (spectrograph)
(3) **Auditory phonetics:** how do humans process speech sounds / perceive pronunciation. We can study these questions with perception experiments, fMRI, CT, etc.

A simple, yet fundamental method is **phonetic transcription**, in which we write down speech sounds in order to capture what is said and how it is pronounced. To do this, we use a special alphabet — the **International Phonetic Alphabet** — in which there is one symbol for each sound in human language.

- Phonetic symbols are written in **square brackets [ ]** to distinguish them from letters
- The symbols are **NOT** the same as letters of English
- Helpful table in the reading (section 2.1.4); and helpful interactive chart here (with sound).

Phonetitions divide the speech stream into two main categories:

(1) **Segments**, the discrete units of the speech stream (**consonants** and **vowels**)
(2) **Suprasegmentals**, "ride on top of" the segments **(stress**, **tone**, **intonation**) (more next week)

From an articulatory perspective, both types of **segments** (consonants and vowels) are produced by positioning the vocal tract in a particular configuration.

(1) **Consonants** are produced by creating an obstruction of airflow
(2) **Vowels** have at most slight narrowing and allow air to flow freely through the oral cavity

[1] Note that while we will be talking about sound in this part of the course, the concepts are all applicable to the hand movements of signed language. More on this in the American Sign Language lecture.

Consonants

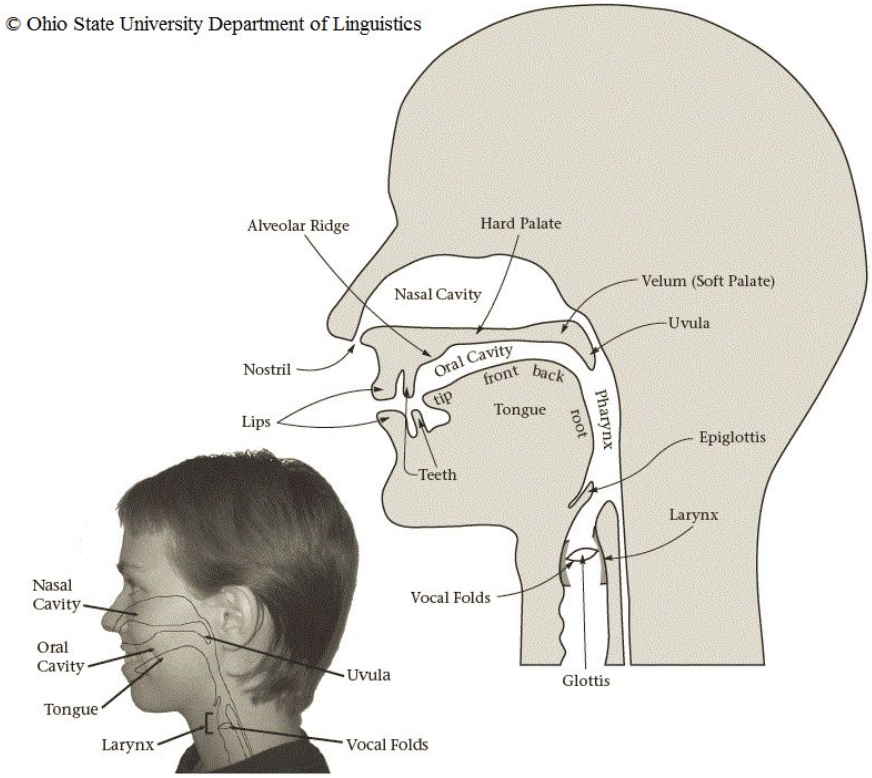
When describing a consonant, we need to provide information about three different aspects of its articulation (also known as **segmental features**):

(1) **Voicing**: is the sound voiced or unvoiced?
(2) **Place of Articulation**: where is the airstream constricted?
(3) **Manner of Articulation**: how is the airstream constricted?

To answer these questions, we need to know about the anatomy of speech production. Three basic components are involved:

(1) The **larynx** (or voice box) is located in the throat and contains the **vocal folds** and **glottis**
(2) Above the larynx is the **vocal tract**, made up of the **oral** and **nasal cavities**.
(3) Below the larynx is the **subglottal system**, part of the respiratory system.

When air is inhaled, it is channeled through the nasal and/or oral cavity, through the larynx and into the lungs. When air is exhaled, it is forced out of the lungs, through the larynx and into the vocal tract. Many language sounds are formed via the exhale. The airstream makes the vocal folds vibrate or makes other sounds as air escapes through narrow openings in the mouth.

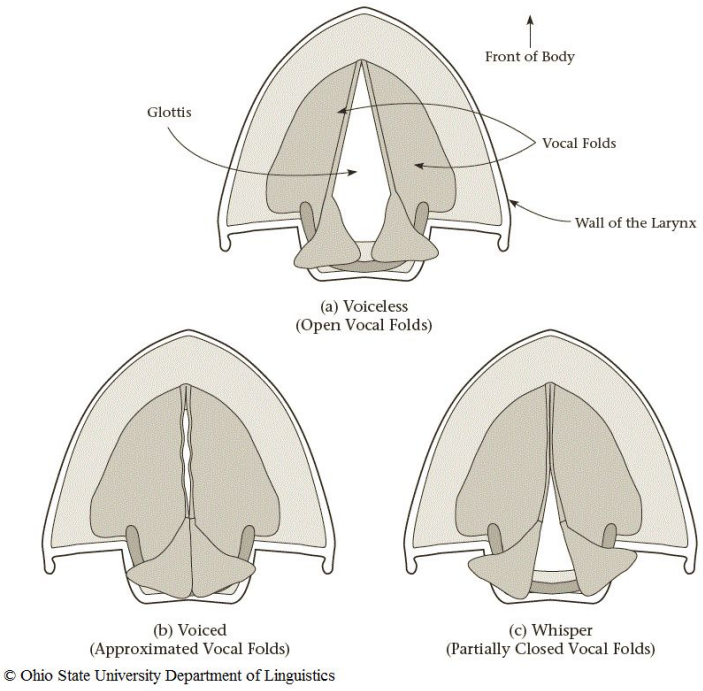


Voicing

How do we tell if a sound is voiced or unvoiced? Within the larynx are folds of muscle called **vocal folds** with an opening between them called the **glottis**. The vocal folds are attached to the front of the larynx, but can open and close (via moveable cartilage) at the back.

(1) **Voiceless:** the vocal folds are wide **open** (glottis looks like a triangle) and air can flow freely
(2) **Voiced:** the vocal folds are nearly or completely closed (**approximated**) and air flow is impeded, causing the folds to vibrate as air is forced through.
(3) **(intermediate) whisper:** vocal folds are partially closed, which happens when you whisper

You can feel this vibration by putting your hand lightly on your throat, or by putting your fingers in your ears. Try making a drawn-out [s] (voiceless) and a drawn-out [z] (voiced) to feel the difference.



Place of Articulation

Where in the vocal tract are we constricting the air flow? You'll need to look at the sagittal section of the vocal tract as you consider these places.

(1) **Bilabial**: both lips brought close together
    - [p] pat, [b] bat, [m] mat, [w] with, and [w̥] where (for some speakers)
(2) **Labiodental**: lower lip against the upper front teeth
    - [f] fat and [v] vat
(3) **Interdental**: tip of the tongue protruding between the front teeth
    - [θ] thigh and [ð] thy
(4) **Alveolar**: tip of the tongue at or near the front of the **upper alveolar ridge** (the bony ridges of the upper and lower jaws that contain the sockets for the teeth)
    - [t] tab, [d] dab, [s] sip, [z] zip, [n] noose, [ɾ] a̱tom, [l] loose, and [ɹ] red
(5) **Post-alveolar**: just behind the alveolar ridge, at the the front of the **hard palate**

- [ʃ] leash, [ʒ] measure, [tʃ͡] church, and [dʒ͡] judge

(6) **Retroflex**: tip of the tongue curled back
- Occurs in 20% of the world's language (especially South Asian and Western Pacific)
- /r/ as in rip for some English speakers

(7) **Palatal**: body of the tongue near the center of the hard palate
- [j] yes

(8) **Velar**: back part of the tongue body raised near the velum (**soft palate**)
- [k] kill, [g] gill, and [ŋ] sing

(9) **Uvular**: tongue back raised toward **uvula**
- Uvular stops [q] and [G] occur in (e.g. Arabic)
  Uvular trills [ʀ] and fricatives occur in (e.g.) German and French) 'je ne **r**egrette **r**ien…'

(10) **Pharyngeal:** back of the tongue intersects with **pharynx**
- Occur in (e.g.) Arabic and Danish

(11) **Epiglottal:** pronounced in the lower **pharynx**, but the tongue isn't the important articulator

(12) **Glottal:** air constricted at the **larynx**
- [h] high and [ʔ] uh-oh

Manner of Articulation

How is the air flow being constricted in the vocal tract? This usually depends on the degree of closure of the articulators (how close together or far apart are they?).

(1) **Nasals:** velum (soft palate) is relaxed and lowered, opening the nasal passage to the vocal tract

(2) **Stops (plosive):** complete obstruction of airflow
- [b] bat, [p] pat, [t] tip, [d] dip, [k] ba<u>ck</u>, [g] ba<u>g</u>, [m] ram, [n] ran, [ŋ] rang, and [ʔ] uh-oh

(3) **Fricatives:** nearly complete obstruction of the vocal tract (very small opening)
- [f] fan, [v] van, [θ] bath, [ð] bathe, [s] sap, [z] zap, [ʃ] shine, [ʒ] treasure, and [h] hit

(4) **Affricates** briefly stopping the airstream completely, then releasing the articulators slightly (in other words, beginning with the stop and ending with a fricative)
- [tʃ͡] watch and [dʒ͡] judge

(5) **Approximants**: constriction is not narrow enough to block the vocal tract or cause turbulence; when studying the phonetics of English, we often consider two types of approximates
  (a) **liquids**: slightly more constricted than glides, and quality changes ("liquid") depending on where they occur, as in [l] lip and [] rip
  (b) **glides**: slight closure of the articulators, and they require some movement ("gliding") as in [j] yes and [w] weather

(6) **Trill:** a vibration of one articulator against another
- [r] as in Spanish perro (an alveolar trill)
- [] as in French and German (but often pronounced as a fricative)

(7) **Flaps/taps:** a brief stop, with no build up of pressure
- city in careful speech ([t] an alveolar stop), in casual American speech ([ɾ] an alveolar flap) and in casual British speech ([ʔ] a glottal stop).

On the exam, you'll be provided with the International Phonetic Alphabet, but you'll need to know how to interpret it. It is **really important** for you to try the practice questions in order to do well on the next exam.