

PHONETICS AND SPEECH PRODUCTION

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Phonetics is a branch of the discipline Linguistics. While linguistics deals with language in general scientifically, phonetics concerned with the scientific study of speech sounds. Speech sounds are also called as 'phones'. Phone or speech sounds are the result of the dynamic movement of speech organs. Phone is an abstract entity and it does not possess any meaning.

Phonetics studies speech sounds at three levels. They are: (i) the production level (ii) the propagation level and (iii) the perception level. The production of speech sounds are dealt with in 'Articulatory phonetics; the propagation of sounds is studied under 'Acoustic phonetics'; and the perception of speech sounds is taken care of by 'Auditory phonetics'.

Articulatory phonetics discusses production of speech sounds that is, what are the mechanisms involved in the production of speech sounds such as the 'air stream mechanism', 'phonatory mechanism' and 'articulatory mechanism'. It also describes the structure of speech organs. Articulatory phonetics tells us how to classify and describe different speech sounds namely, vowels and consonants. Besides, it provides a set of phonetic symbols for transcribing the speech sounds.

After the completion of the articulation of the speech sounds, that is once the speech sounds come out of the mouth (mouth cavity/oral cavity) and as they travel in the air what are the physical properties do they possess. The physical properties refer to pitch (frequency),

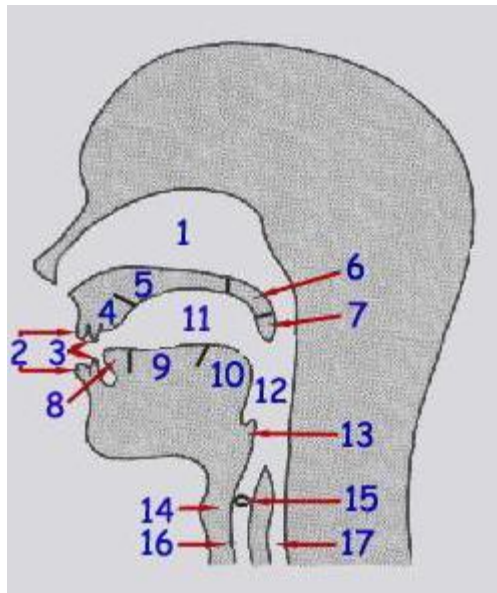
loudness (amplitude), duration aspect, tempo (the speed of travel of speech sounds) etc. Precisely, the acoustic aspects of speech sounds can be studied and the division of phonetics that deals with the things is called 'Acoustic Phonetics'.

As the speech sounds reach the ears of the listener and as they fall on the ear drum what happens thereafter is studied by the 'Auditory phonetics. How the neural system functions carrying the speech sounds, which are in the form of acoustic waves, to the brain through neural system and how they are decoded over there are explained in auditory phonetics.

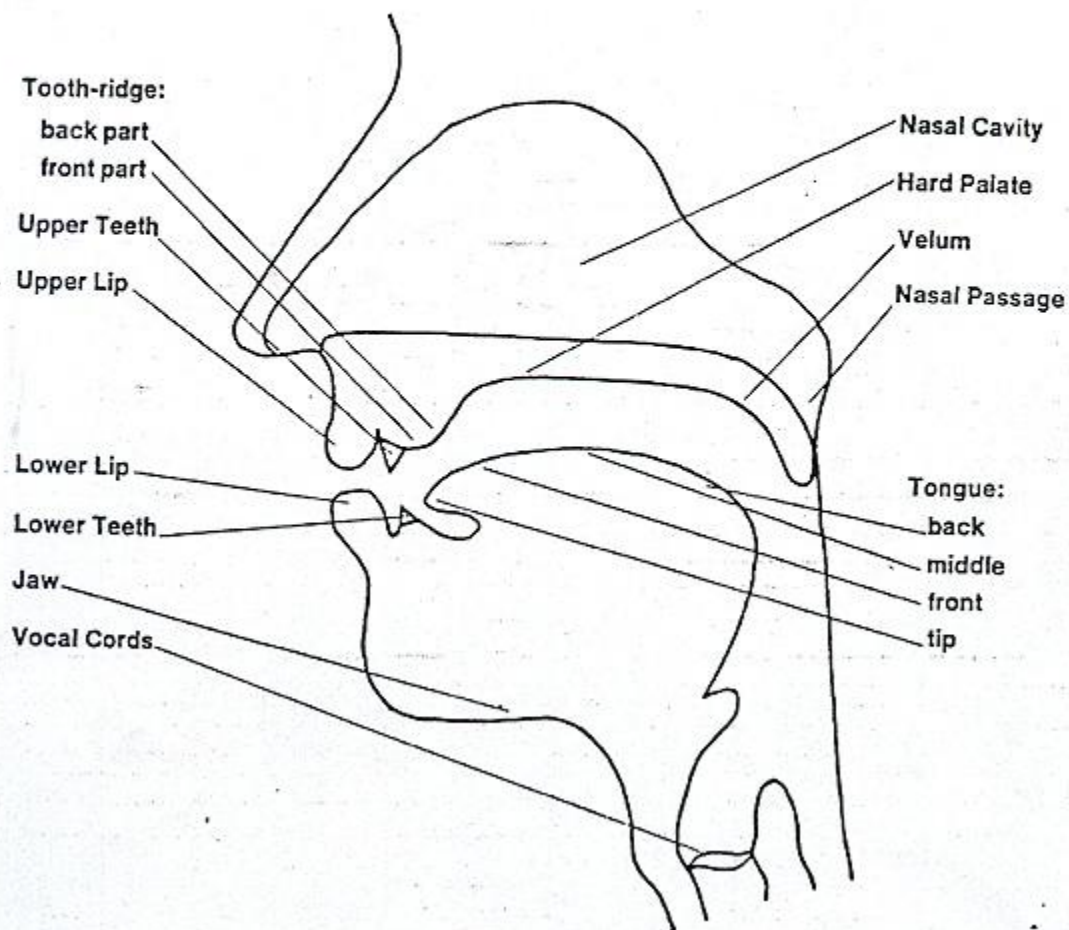
Now let us see about the Speech organs and it can be labeled.

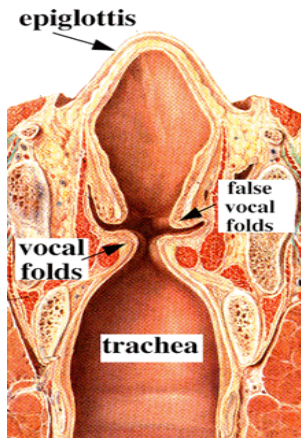
The Organs of Speech

- 1-nasal cavity
- 2-lips
- 3-teeth
- 4-aveolar ridge
- 5-hard palate
- 6-velum (soft palate)
- 7-uvula
- 8-apex (tip) of tongue
- 9-blade (front) of tongue
- 10-dorsum (back) of tongue
- 11-oral cavity
- 12-pharynx
- 13-epiglottis
- 14-larynx
- 15-vocal cords
- 16-trachea
- 17-esophagus



The Organs of Speech





Airstream mechanisms

Source of is essential for producing speech sounds. There is a speech mechanism in human body which supplies air which is modified to produce different sounds. Airstream mechanisms is of the following types:

- Air coming out of the lungs forms the basis of most speech sounds. A downward movement of the rib cage and/or an upward movement of the diaphragm forces the air out of the lungs, causing a **pulmonic airstream**. Thus the lung air is pushed out and it is called **pulmonic egressive air stream** which is in almost all the world languages for producing speech sounds. The **pulmonic ingressive air stream** mechanism the air is sucked in. In fact they respectively stand for 'expiration' and inspiration; of breathing process. The lung air is the source for producing the speech sounds in this air stream mechanism.
- A **glottalic airstream** is caused by closing the glottis so that the air in the lungs is contained below the glottis. The air in the vocal tract forms a body of air that can be moved. Moving the closed glottis upward will force the air out of the mouth, whereas moving the closed glottis downward will cause the air to be sucked into the mouth. Stops made with a glottal egressive (outward) airstream mechanism are called ejectives. Stops made with an ingressive (inward) glottalic airstream mechanism are called implosives.
- The **velaric airstream mechanism** is used in producing clicks, such as the click expressing disapproval ("tut-tut"). Clicks are stops made with an ingressive velaric airstream mechanism. For a dental click, there are both dental and velar closures, resulting in a trapping of air in between the two closures. A click is produced when the vacuum is released by lowering the tip of the tongue. If the vacuum is released by lowering the side of the tongue, a lateral click is produced, which is the sound normally used for encouraging horses and cows.
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The phonation process or Phonatory Mechanism

The vocal cords can be in one of several positions during the production of a sound. The muscles of the vocal cords in the glottis can behave in various ways that affect the sound. The effect of this series of vocal cord states is called the **phonation process**.

Voicing. Vocal cords can be narrowed along their entire length so that they vibrate as the air passes through them. All English vowels are voiced. Voiceless vowels also occur but are far rarer than voiceless consonants are much more common than voiceless vowels. Voiceless vowels usually occur between voiceless consonants, as in Japanese. No language has only voiceless vowels; a language has either only voiced vowels or voiced and a few voiceless vowels.

There are also several other vocal cord states that are used to modify sound in the world's languages. None is used as a regular feature of English.

Laryngealization. The posterior (artenuoid) portion of the vocal cords can be closed to produce a laryngealized or creaky sound.

Murmur. The anterior (ligamental) portion of the vocal cords can be closed, with the vocal cords vibrating. This produces murmured or breathy sounds

Whisper. A similar vocal cord state is used to produce the whisper. The vocal chords are narrowed but not vibrated, narrowing is more complete at the anterior end, less so at the posterior end. Whispered sounds do not contrast with non-whispered sounds to produce differences of meaning in any known language, but the whispered voice is common as a speech variant across languages. There is no IPA symbol for a whispered sound.

The oro-nasal process or Articulatory Mechanism

Regardless of which airstream mechanism is used, speech sounds are produced when the moving air is somehow obstructed within the vocal tract. The vocal tract consists of three joined cavities: the **oral cavity**, the **nasal cavity**, and the **pharyngeal cavity**. The surfaces and boundaries of these cavities are known as the **organs of speech**. What happens to the air within these cavities is known as the **oro-nasal process**.

The oral cavity also known as vocal cavity and mouth cavity consists of the articulators. The articulators are classified as '**Active articulator** and **Passive articulators**. The active articulators are the tongue and the lower lip. The passive articulators are the upper lip, upper front teeth, the alveolar, palates which is divisible into front palate and back palate. The front palatal region being hard in nature is called also as 'Hard palate' and the back palate being very soft is called as 'Soft palate' or 'Velum. In the end of the soft palate there is an appendage called **uvula** which is also a passive articulator. Palatal region is followed by pharynx (the pharyngeal cavity) and after this there is glottal region. In fact the passive articulators are arranged along the upper region of the oral cavity and the active articulators are arranged along the lower part or at the bottom of the oral cavity. The act of an active articulator moving towards the passive

articulator in an effort to produce a speech sound is called **Articulation**. The place or point where the active articulator meets the passive one is called **Place of articulation or point of articulation**

Let's see about the oro-nasal process in the articulation, or production, of consonants.

There are two major ways to classify the activity of the speech organs in the production of consonants: **Place of articulation and Manner of articulation**. In addition the state of vocal cords whether they vibrate or kept open (allowing the lung or pulmonic air to pass through freely) is also important to describe certain consonants.

Consonants:

place of articulation

The place of articulation is defined in terms of two **articulators**. These may be: lips, teeth, alveolar ridge, tongue tip (apex), tongue blade (laminus), or back of the tongue (dorsum), hard palate, soft palate (velum), uvula, glottis, pharynx, glottis (the "voice box," or cartilaginous structure where the vocal cords are housed).

bilabial [b, p, m, w]

labiodental, [f, v]

interdental, [t, d]

(apico)-dental the tip (or apex) of the tongue and the back teeth: Spanish [t, d, s, z].

alveolar (apico-or lamino-) tongue and alveolar ridge (compare 'ten' vs. 'tenth'). Examples: English [t, d, s, z]

postalveolar or palatoalveolar (apico- or lamino-) (English [ʃ]/[ʒ]),

retroflex (apico-palatal) bottom of the tongue tip and palate, or alveolar ridge: Midwest English word-initial [ɻ] and [t, d, n] in many Dravidian languages and many languages of Australia.

palatal (apico- or lamino-) (English [j]), [ʃ]/[ʒ] in many languages

velar or dorso-velar Eng. [k, g, ŋ] German [x]

uvular French [R], also found in many German dialects.

pharyngeal (constriction of the sides of the throat),

glottal (glottal stop, the vocal chords are the two articulators. cf. A-ha, *bottle*, Cockney English 'ave). [h] is a glottalic fricative sound.

Manner of articulation

Now let's look at the ways that moving air can be blocked and modified by various speech organs. There are several methods of modifying air when producing a consonant, and these methods are called **manners of articulation**. We have already examined where the air is blocked. Now let's look at how the air can be blocked.

1) Sounds that completely stop the stream of exhaled air are called **plosives**: [d], [t], [b], [p], and [g], [k], glottal stop. Another word for plosive is stop (nasals are also stops, however, since the air is stopped in the oral cavity during their production).

2) Sound produced by a near complete stoppage of air are called **fricatives**: [s], [z], [f], [v], [ʃ], [ʒ], [x], [χ], [h], pharyngeals. Fricatives are produced with audible friction caused by the contact of articulators at the time producing a speech sound.

3) Sometimes a plosive and a fricative will occur together as a single, composite sound called an **affricate**: [tʃ], [dʒ], [tʃʃ], [dʒʒ], [pf].

4) All other types of continuant are produced by relatively slight constriction of the oral cavity and are called **approximants**. Approximants are those sounds that do not show the same high degree of constriction as fricatives but are more constricted than are vowels. During the production of an approximant, the air flow is smooth rather than turbulent. There are four types of approximants.

a) The glottis is slightly constricted to produce [h], a glottalic approximant.

b) If slight stricture occurs between the roof of the mouth and the tongue a palatal **glide** is produced [j]. If the constriction is between the two lips, a labiovelar glide is produced. The glides [j] and [w] are also called **semivowels**, since they are close to vowels in degree of blockage.

c) If the stricture is in the middle of the mouth, and the air flows out around the sides of the tongue, a **lateral** is produced. Laterals, or lateral approximants, are the various l-sounds that occur in language. In terms of phonetic features, l-sounds are + lateral, while all other sounds are + central.

d) The fourth type of approximant includes any of the various **R-sounds** that are not characterized by a flapping or trilling: alveolar and retroflex approximants. This includes the American English r (symbolized in the IPA by an upside down [ʁ], but we will use the symbol [r]).

If the air flow is obstructed only for a brief moment by the touch of the tongue tip against the teeth or alveolar ridge, a **tap**, or tapped [ɾ] is produced: cf. Am Engl *ladder*; British Engl. *very*.

If the tongue tip is actually set in motion by the flow of air so that it vibrates once, a **flap** or flapped r is produced: this is the sound of the Spanish single r. Flaps can even be labio-dental, as in one African language, Margi, spoken in Northern Nigeria.

If the air flow is set into turbulence several times in quick succession, a **trill** is produced. Trills may be alveolar, produced by the apex of the tongue: the Spanish double rr *perro*; the French uvular [R]: *de rien*; Bilabial trills [B] have been found to occur in two languages of New Guinea: *mBulei* = rat in Titan.

Degree of blockage

In discussing manner of articulation, it is also relevant to classify consonants according to the total degree of blockage. Remember that all sounds that involve significant stoppage of air in the vocal tract are known as consonants (this distinguishes them from vowel, which are produced by very little blockage of the airstream). Consonants differ in the manner as well as the degree to which the airstream is blocked. While we are discussing the manner in which air is blocked, we can also classify sounds as to the degree of blockage.

Plosives, fricatives, and affricates are all sounds made by nearly complete or complete blockage of the airstream. For this reason they are known collectively as **obstruents**.

Consonants produced by less blockage of the airstream are called **sonorants**. With little blockage the airstream flows out smoothly, with relatively little turbulence. There are several types of sonorants, depending upon where the airstream is blocked in the vocal tract and how air flows around the impediment.

Sonorants are produced using the following manners of articulation:

1) Sounds produced by stoppage at the vocal tract and release through the nose are called **nasals**. The nasals [m], [n], and [ŋ] have the same point of articulation as the **plosives** [d], [b], and [g], except that the velum rises and air passes freely through the nose during their production; the oral stoppage is not released. Plosives are also known as **oral stops**, to distinguish them from the **nasal stops**. All known languages have at least one nasal. The division of consonants into obstruents and sonorants is not absolute. In some languages, such as Russian, the glide [j] is produced by much more blockage and could almost as easily be called a fricative.

Also, some l- and r- sounds are definitely fricatives rather than approximants. Some types of l- and r-sounds are characterized by a highly turbulent flow of air over the tongue, even more than for the trilled [r].

In Czech, besides the regular flapped r, there is a strident trilled and tensed [r] which is much more like an obstruent than a sonorant. Because all l- and r- sounds (whether approximant and non-approximant) are produced in the same way--with the air flowing around or over the tongue

like water moving around a solid object--there is a collective term for these sounds: **liquids**. Liquids and nasals are sometimes able to carry a syllable. Syllabic n and l in English, r and l occur in Czech and Slovak: *StrCprstskrzkrk*. The IPA uses a dot beneath them to signify syllabicity.

Review of some articulatory terminology

Stops (air completely blocked in the oral cavity)-nasal and oral (plosives).

Obstruents (high degree of blockage) include: plosives, fricatives, and affricates.

Sonorants (low degree of blockage)include: nasals and approximants.

Approximants (the lowest degree of blockage) include: the glottal approximant [h], the glides [j] and [w], and most l- and r-sounds.

Liquid: all l- and r- sounds, whether fricative or approximant.

Secondary articulation features in consonants

Lack of release. Plosives may not be released fully when pronounced at the end of words. This occurs with English [p} b}, t}, d}, k}, g}]

Length. Consonants may be relatively **long** or **short**. Long consonants and vowels are common throughout the world, cf. Finnish, Russian: zhech/szhech *to burn*; Italian: *pizza*, *spaghetti*. Long or double consonants are also known as **geminate** consonants and are indicated in the IPA by the symbol [...]. Geminate plosives and affricates are also known as **delayed release consonants**.

Nasal release. In certain African languages: [dn].

Palatalization. Concomitant raising of the blade of the tongue toward the palate: *cannon/canyon*, *do/dew*.

Labialization. Concomitant lip rounding cf. sh in *shoe* vs. *she* (IPA uses a superscript w to transcribe labialization). In some languages of Africa the contrast between labialized and non-labialized sounds signal differences in meaning, as in Twi: *ofa' he finds/ ofwa' snail*.

Velarization. The dorsum of the tongue is raised slightly. Compare the l in *wall*, *all* (velarized or dark l) vs. *like*, *land* (continental or light l). The glide [w] is also slightly velarized. In Russian all non-palatalized consonants are velarized.

Pharyngealization. Concomitant constriction of throat. Afroasiatic languages of north Africa, such as Berber: zurn *they are fat*/ zghurn *they made a pilgrimage*.

Tensing. The muscles of the articulators can be or lax when pronouncing a sound. Cf. Korean stops: Lax unvoiced p, lax voiced b, tense unvoiced pp. Tensing also occurs in the vocal cords during the production of tensed stops, so tenseness could also have been listed under phonation processes.

The Oro-Nasal process in vowels

Sounds produced by no blockage other than a slight raising of the tongue or a narrowing of the lips are called vowels. Vowels differ in several phonetic features. Three are most important.

- 1) which part of the tongue is **raised**: front/central/
- 2) how high the tongue is raised: high, middle, low
- 3) whether or not the lips are rounded.

Several other features distinguish vowels on a more limited basis across the world's languages.

- 4) whether or not the tongue is tense (bunched up; in English, diphthongalized) or lax (relaxed and slightly shorter, closer to the center of the oral cavity). In English, stressed lax vowels only occur in closed syllables, tense vowels occur in either open or closed syllables:

Tense= **by, too, way, so, ma**

Lax= **bit, but, full, get, oil/or, and**, (also, **hard**, in New England pronunciation), as well as schwa: **sofa**

- 5) nasal vs. non-nasal (describe the velum and oro-nasal process)
- 6) long vs. short. Many languages have a distinction between short and long vowels: Hawaiian, Navajo, etc. Estonian has three vowel lengths; in English vowels are slightly longer before voiced consonants and slightly shorter before voiceless.
- 7) Different phonation processes involving the vocal cords produce several featural contrasts in vowels as in consonants: voiced/voiceless (whispered) laryngealized (creaky), murmured (breathy).

There are three diphthongs in General American English

