**The so called organs of speech**

***Introduction***

In this lesson, you will be introduced to the major anatomical components of the speech system for human language.

***Major Terms***

* trachea
* larynx
* glottis
* pharynx
* vocal tract

***Subglottal System***

Sound in human language is produced by the regulation of airflow from the lungs through the throat, nose, and mouth. This airflow is altered in various ways by different aspects of this speech system. The first major segment of the speech system is the *subglottal system*. This subglottal system comprises the lungs, diaphragm and trachea.

The lungs are basically a pair of balloon-like sacs that inflate or deflate by the action of the diaphragm, a muscle just under the lungs, attached to them. When the diaphragm is lowered, the lungs inflate, and when the diaphragm is raised, air is pressed out of the lungs, allowing them to deflate.

When this air is pressed out of the lungs, air travels up the trachea, or windpipe, to the larynx, the next major segment of the speech system.



A diaphragm : in *Anatomy* A muscular membranous partition separating the abdominal and thoracic cavities and functioning in respiration. Also called *midriff*.

***The Larynx***

The *larynx* is a mass of cartilage at the top of the trachea. It is commonly called the voicebox.



The larynx contains folds of muscle called the *vocal folds* (sometimes called vocal cords). These vocal folds are connected to the larynx by the arytenoid cartilage at the front, but the other ends are left free. The opening between the vocal folds is known as the glottis. These folds can be relaxed, letting air flow freely through the glottis, or tensed, so that the air vibrates as it passes through the glottis.

Sounds that are produced with relaxed vocal folds are known as *voiceless* sounds, and sounds that are produced with tensed vocal folds are known as *voiced* sounds. If the folds are only partially closed, a whispered sound is produced.



**Voiceless**

**Voiced**

**Whisper**

***Above the Larynx***

The area above the larynx consists of three main areas: the pharynx, the nasal cavity, and the oral cavity. The pharynx consists of the area above the larynx and below the uvula. The oral cavity is the area from the back of the throat to the mouth. The major parts of the oral cavity that are used in speech production are the uvula, the velum, the tongue, the hard palate, the alveolar ridge, the teeth, and the lips. The uvula is that fleshy blob that hangs down in the back of the throat. The velum is the soft palate, and the alveolar ridge is a mass of hard cartilage behind the teeth.

The following graphic shows these major parts of the area, which is also known as the supraglottal system

|  |  |
| --- | --- |
| http://www.ic.arizona.edu/~lsp/Phonetics/head.gif | http://www.ic.arizona.edu/~lsp/Phonetics/Buttons/Pharynxoff.gif |
| http://www.ic.arizona.edu/~lsp/Phonetics/Buttons/Oraloff.gif |
| http://www.ic.arizona.edu/~lsp/Phonetics/Buttons/Nasaloff.gif |
| http://www.ic.arizona.edu/~lsp/Phonetics/Buttons/Uvulaoff.gif |
| http://www.ic.arizona.edu/~lsp/Phonetics/Buttons/Velumoff.gif |
| http://www.ic.arizona.edu/~lsp/Phonetics/Buttons/Tongueoff.gif |
| http://www.ic.arizona.edu/~lsp/Phonetics/Buttons/Palateoff.gif |
| http://www.ic.arizona.edu/~lsp/Phonetics/Buttons/Alveolaroff.gif |
| http://www.ic.arizona.edu/~lsp/Phonetics/Buttons/Teethoff.gif |
| http://www.ic.arizona.edu/~lsp/Phonetics/Buttons/Lipsoff.gif |

***Summary***

In summary, this lesson has outlined the major parts of the anatomy that relate to speech production. These parts are the following:

* Subglottal system, including lungs and trachea
* Larynx, including the vocal folds and glottis
* Supraglottal system, including the oral cavity, nasal cavity, and pharynx

## Introduction

In this lesson, the goals are to begin to learn how speech sounds are classified in terms of their use of the speech system.

## Major Terms

* voicing
* place of articulation
	+ bilabial
	+ labiodental
	+ interdental
	+ dental
	+ alveolar
	+ alveopalatal
	+ palatal
	+ velar
	+ uvular
	+ pharyngeal
	+ glottal

## Voicing

In the last lesson, you were introduced to the following states of the glottis: voiceless and voiced. These states are determined by the action of the vocal folds in the larynx. If the vocal folds are held apart, the glottis is in a voiceless state, while if the vocal folds are held together, and allowed to vibrate, the glottis is in a voiced state.

Certain consonants in human language are distinguished by which state is active during production of the sound. For example, pronounce the sound [m], as in *mat*, and hold the sound. While producing this sound, place your fingers at the base of your throat. You should feel the vibration of the vocal folds. Since the sound [m] is vibrating, this is a *voiced* sound.

Now make the sound [p], as in *pat*. You can't really hold this sound, but again put your fingers near the base of your throat while you say [p]. You shouldn't feel much vibration, if any. This is because the vocal folds are held apart, making a *voiceless* sound.

Now say the sounds [p] and [b], as in *bat*, with your fingers at the base of the throat. When you say [p], there should be no vibration, but when you say [b], there should be vibration. Think about what you are doing with your mouth to make both sounds. Both sounds are made in basically the same way, but one is voiceless and one is voiced.

***Speech and the Vocal Tract***

As described in the earlier lesson, speech sound is created by airflow through the vocal tract. In pulmonic sounds, which are the sounds we will consider here, the lungs push air up into the trachea, through the larynx, and outward through the vocal tract.

So how are different sounds made? In part 1, we discussed that one way to make different sounds is to vary the state of the glottis, making either a voiced or voiceless sound.

Another way is to vary the shape of the vocal tract. Imagine the vocal tract as a tube, through which air passes. If this tube is simply open, the airflow creates a sound. But if you alter the shape of that tube, the airflow moves differently, making a different sound.

Here's an experiment that some of you may have tried. Take an empty bottle and blow air across the top of the bottle. If you can get the airflow just right, you should be able to produce a low sound. Now fill the bottle halfway with water. Blow across the bottle opening again. This time the sound is higher. If you put some more water in the bottle, the sound will get even higher.

What's happening? For a more detailed discussion, you can view the lesson Acoustic Phonetics. However, for now, just understand that if the bottle (vocal tract) is not as filled with water (larger), the sound will be a deep, low sound. If the bottle (vocal tract) is filled with water (smaller), the sound will be a higher sound.

When we make speech sounds, one thing that is happening is that we are varying the shape of the vocal tract, making the sound different. For example, say the sound [t]. To make this sound, you are raising the tip of your tongue behind your teeth and then lowering your tongue. When you do this, the air builds up behind the closure made by your tongue and teeth and is then released. When the air is released by the tongue, the air travels outward through a small area, just from the teeth to outside the mouth.

Now say the sound [k]. To make this sound, you are bringing your tongue up to the velum, closing off the airflow, and then lowering your tongue to release the air. This time, when the air is released, it travels through a larger area before leaving the mouth. This space is from the velum to the lips. Thus, the sound made by the airflow is different from that made by [p].

The following diagrams illustrate the amount of space in the vocal tract available for [t] and [k]:

|  |  |
| --- | --- |
| http://www.ic.arizona.edu/~lsp/Phonetics/Images/TSpace.gif | http://www.ic.arizona.edu/~lsp/Phonetics/Images/KSpace.gif |
| [t] | [k] |

As the diagrams show, there is more space in the vocal tract for the release of air in the production of [k] than for [t]. Therefore, two distinct sounds are produced.

The point at which the vocal tract is altered is known as the place of articulation. In the next section, we will discuss the major places of articulation in classifying human speech sounds.

***Place of Articulation***

The term place of articulation, as discussed in the last section, classifies speech sounds in terms of where in the vocal tract the shape of the vocal tract is altered. In this section, we will present the major places of articulation.

***Bilabial***

Bilabial sounds are those sounds made by the articulation of the lips against each other. Examples of such sounds in English are the following: [b], [p], [m].

***Labiodental***

Labiodental sounds are those sounds made by the articulation of the upper teeth towards the lower lip. Examples of such sounds in English are the following: [f], [v].

***Interdental***

Interdental sounds are those sounds made by the articulation of the tongue between the teeth. Examples of such sounds in English are the following: , .

***Dental***

Dental sounds are those sounds made by the articulation of the tip of the tongue towards the back of the teeth. Such sounds are not present in Standard American English, but in some Chicano English dialects and certain Brooklyn dialects, the sounds [t] and [d] are pronounced with a dental articulation.

***Alveolar***

Alveolar sounds are those sounds made by the articulation of the tip of the tongue towards the alveolar ridge, the ridge of cartilage behind the teeth. Examples of such sounds in English are the following: [t], [d], [s], [z], [n], [l], .

***Alveopalatal***

Alveopalatal sounds are those sounds made by the articulation of the front of the tongue towards the area between the alveolar ridge and the hard palate. Examples of such sounds in English are the following: , , , .

***Palatal***

Palatal sounds are those sounds made by the articulation of the body of the tongue towards the hard palate. An example of such a sound in English is [j].

***Velar***

Velar sounds are those sounds made by the articulation of the body of the tongue towards the velum. Examples of such sounds in English are the following: [k], [g], .

***Uvular***

Uvular sounds are those sounds made by the articulation of the back of the tongue towards the uvula. Uvular sounds do not exist in English, but the French "r" is pronounced by the uvular sounds and .

***Pharyngeal***

Pharyngeal sounds are those sounds made by the articulation of the tongue root towards the back of the pharynx. Pharyngeal sounds do not exist in Standard American English, but are found in languages such as Arabic and Hebrew.

***Glottal***

Glottal sounds are those sounds made at the glottis. Examples of glottal sounds in English are the following: , .

On the next page is a diagram that illustrates all the places of articulation.

***Introduction***

In this lesson, the goals are to continue learning how speech sounds are classified in terms of their use of the speech system.

***Major Terms***

* manner of articulation
	+ plosive
	+ fricative
	+ affricate
	+ nasal
	+ approximant
	+ glide

***Manner of Articulation***

In the last lesson, you were introduced to the places of articulation. These are the points in the vocal tract at which the articulators alter the shape of the vocal tract to produce distinct consonant sounds.

However, consonants are further distinguished on the basis of how the articulators alter the shape of the vocal tract. That is, how is the airflow regulated by the tongue or lips.

In the following sections, you will be introduced to the major manners of articulation for pulmonic consonants.

***Plosives***

A plosive is formed by the complete obstruction of the vocal tract by the articulators. This obstruction is then released, allowing the air to "explode" out of the mouth.

When the air is blocked by the articulator, it begins to raise in pressure. Then, when the air is released, the high pressure air rushes out into the lower pressure area beyond the blockage. This results in a burst of air, signifiying a plosive. In the following diagram, the dots represent the pressure of the air. The higher pressure area have more dots per area, while the lower pressure areas have fewer dots per area.



Watch the air pressure for the stop [p]

Examples of plosives in English are , , , , , .

In the next section, you will be introduced to the fricative manner of articulation.

***Fricatives***

A fricative is formed by a constriction in the vocal tract by the articulators, such as the tongue or the lips. However, unlike stops, the occlusion (blockage) in the vocal tract is not complete. Some of the air is allowed to come through a very narrow opening. This air becomes turbulent, because of the friction between the airflow and the narrow passage.

Fricatives happen in two ways. One way is simply for the air to flow through a narrow opening, like in the sound . Another ways is for the air to be sped up through a narrow passage and then forced across another area, like the teeth, which is the way the sound is formed. In the following diagram, the dots represent moving air particles. The air behind the occlusion is relatively slow, but the air that is forced between the tongue and the roof of the mouth is much faster and more turbulent.



Watch the airflow for the fricative 

Examples of fricatives in English are , , , , , .

In the next section, you will be introduced to the affricate manner of articulation.

***Affricates***

An affricate combines the manners of articulation for the plosive and the fricative. Like a stop, the articulation of the affricate begins with a complete closure of the vocal tract by an articulator. However, when the closure is released, the release is somewhat gradual, providing a narrow space between the articulator and the mouth for the airflow to move through. This narrow space creates an environment similar to a fricative, in that the airflow moving out becomes turbulent for a brief period until full release of the closure.

Examples of affricates in English are , .

In the next section, you will be introduced to the nasal manner of articulation.

***Nasals***

A nasal is formed by the obstruction of the vocal tract and the lowering of the velum. This lowering of the velum alows the airflow to flow out through the nasal cavity, rather than through the oral cavity.



Watch the airflow for the nasal 

Examples of nasals in English are , , .

In the next section, you will be introduced to the approximant manner of articulation.

***Approximant***

An approximant is formed by the constriction of the vocal tract, but with no obstruction in the vocal tract. Therefore, no turbulent airflow, as in a fricative. Instead, the air is allowed to flow freely through the vocal tract.

Examples of approximants in English are , , , .

The sound is also known as a lateral approximant, since the articulators do touch at a central point, but the air is allowed to flow through one or both sides of the contact point.

***Other Articulations***

There are two other articulations in varieties of English that should be noted here: the tap and the trill.

A tap is formed by a quick contact between an articulator and the vocal tract. In Standard American English, for example, there is the tap , which can be found in the middle of words such as ladder, and butter.

A trill is formed by the rapid vibration of the tongue tip against the roof of the mouth. This vibration is caused by the motion of a current of air. This sound, represented by , is found, for example, in varieties of British and Scots English. It is also known as a "rolled r".

***Summary***

In this lesson, you have been introduced to several manners of articulation. These are listed below:

* Plosive
	+ Formed by a blockage of the vocal tract, followed by an explosive release of air
* Fricative
	+ Formed by slight contact between articulators, allowing turbulent airflow
* Affricate
	+ Formed by a blockage of the vocal tract, like plosive, followed by a gradual release of turbulent air, like a fricative
* Nasal
	+ Formed by the lowering of the velum, allowing air to flow through the nasal cavity
* Approximant
	+ Formed by the constriction of the vocal tract, but with no blockage of the airflow
* Tap
	+ Formed by a quick contact between articulators
* Trill
	+ Formed by the rapid vibration of the tongue tip by a current of air

In the next lesson, you will be introduced to the classification of vowel sounds.

***Introduction***

In this lesson, the goals are discuss how vowel sounds are classified in terms of their use of the speech system.

***Major Terms***

* tongue height
* tongue backness
* lip rounding
* tense
* lax

***Vowel Classification***

In the last two lessons, you were introduced to the classification of consonant sounds. The classification of consonants were shown to be based on three aspects of articulation: place of articulation, manner of articulation, and voicing.

In this lesson, you will be introduced to the classification of vowel sounds. The classifcation of vowels is based on four major aspects: tongue height, tongue backness, lip rounding, and the tenseness of the articulators.

In the first section, you will be introduced to the classification of vowels based on tongue height.

***Tongue Height***

The first aspect of vowel classification that you will be introduced to is that of tongue height. Vowels are classified in terms of how much space there is between the tongue and the roof of the mouth, which is determined by the height of the tongue.

There are three primary height distinctions among vowels: high, low, and mid.

In English, examples of high vowels are , , , . These are vowels with a relatively narrow space between the tongue and the roof of the mouth. Examples of low vowels are , . These are vowels with a relatively wide space between the tongue and the roof of the mouth. Examples of mid vowels are [e], , , . These are vowels whose tongue positions are roughly between the high and low vowels.

These classifications are quite relative, as different languages have different canonical tongue heights for different classifications.

As illustration of tongue height, observe the following diagrams for the vowels , , .

|  |  |  |
| --- | --- | --- |
| http://www.ic.arizona.edu/~lsp/Phonetics/Images/TongueHeight1.gif | http://www.ic.arizona.edu/~lsp/Phonetics/Images/TongueHeight2.gif | http://www.ic.arizona.edu/~lsp/Phonetics/Images/TongueHeight3.gif |
| http://www.ic.arizona.edu/~lsp/Features/Data/ibrack.gif | http://www.ic.arizona.edu/~lsp/Features/Data/laxebrack.gif | http://www.ic.arizona.edu/~lsp/Features/Data/ashbrack.gif |

As you can see from the diagrams, the tongue height of the high vowel is much higher than that for the low vowel , while the tongue height for the mid vowel lies somewhere in between the two.

***Tongue Backness***

The second aspect of vowel classification that you will be introduced to is that of tongue backness. Vowels are classified in terms of how far the raised body of the tongue is from the back of the mouth, which is called the backness of the tongue.

There are three primary height distinctions among vowels: front, back, and central.

In English, examples of front vowels are , , [e], , . These vowels are articulated relatively forward in the mouth. Examples of back vowels are , , , . These vowels are articulated relatively far back in the mouth.. Examples of central vowels are , . These are vowels whose tongue positions are roughly between the front and back vowels.

These classifications, like the tongue heights, are quite relative, as different languages have different canonical tongue backnesses for different classifications.

As illustration of tongue backness, observe the following diagrams for the vowels , .

|  |  |
| --- | --- |
| http://www.ic.arizona.edu/~lsp/Phonetics/Images/Backness1.gif | http://www.ic.arizona.edu/~lsp/Phonetics/Images/Backness2.gif |
| http://www.ic.arizona.edu/~lsp/Features/Data/ibrack.gif | http://www.ic.arizona.edu/~lsp/Features/Data/ubrack.gif |

As you can see from the diagrams, the articulation of the front vowel is much farther forward than that for the back vowel .

In the next section, you will be introduced to the classification of vowels in terms of lip rounding.

***Lip Rounding***

Another aspect of vowel classification is the presence or absence of lip rounding. Some vowels, such as the vowels and , are formed with a high degree of lip rounding. Such vowels are called rounded vowels. Some vowels, such as and , are formed without such rounding, and are called unrounded vowels.

In the next section, you will be introduced to the classification of vowels in terms of tenseness. **tense1**  (tns)

*adj.* **tens·er**, **tens·est**

1. Tightly stretched; taut. See Synonyms at [stiff](http://www.thefreedictionary.com/stiff), [tight](http://www.thefreedictionary.com/tight).



**(i) The Pharynx**: The pharynx lies between the mouth and the food passage, that is, just above the larynx. It is just about 7cm long in the case of women and 8cm long in the case of men.

**(ii) The Roof of the Mouth:** The roof of the mouth is considered as a major speech organ. It is divided into three parts:

a. The Alveolar Ridge/Teeth Ridge: The alveolar ridge is situated immediately after the upper front teeth. The sounds which are produced touching this convex part are called **alveolarsounds**. Some alveolar sounds in English include: /t/d/.

b. The Hard Palate: The hard palate is the concave part of the roof of the mouth. It is situated on the middle part of the roof.

c. The Velum or Soft Palate: The lower part of the roof of the mouth is called soft palate. It could be lowered or raised. When it is lowered, the air stream from the lungs has access to the nasal cavity. When it is raised the passage to the nasal cavity is blocked. The sounds which are produced touching this area with the back of the tongue are called **velarsounds**. For example: /k/g/.

**(iii) The Lips:** The lips also play an important role in the matter of articulation. They can be pressed together or brought into contact with the teeth. The **consonant** **sounds** which are articulated by touching two lips each other are called **bilabial** **sounds**. For example, /p/ and /b/ are bilabial sounds in English. Whereas, the sounds which are produced with lip to teeth contact are called **labiodental** sounds. In English there are two labiodental sounds: /f/ and /v/.

Another important thing about the lips is that they can take different shapes and positions. Therefore, **lip-rounding** is considered as a major criterion for describing **vowel sounds**. The lips may have the following positions:

a. Rounded: When we pronounce a vowel, our lips can be rounded, a position where the corners of the lips are brought towards each other and the lips are pushed forwards. And the resulting vowel from this position is a **rounded** one. For example, /ə ʊ/.

b. Spread: The lips can be spread. In this position the lips are moved away from each other (i.e. when we smile). The vowel that we articulate from this position is an **unrounded** one. For example, in English /i: /is a long vowel with slightly spread lips.

c. Neutral: Again, the lips can be neutral, a position where the lips are not noticeably rounded or spread. And the articulated vowel from this position is referred to as **unrounded vowel**. For example, in English /ɑ: / is a long vowel with neutral lips.



**(iv) The Teeth:** The teeth are also very much helpful in producing various speech sounds. The sounds which are made with the tongue touching the teeth are called **dental** **sounds**. Some examples of dental sounds in English include: /θ/ð/.

**(v) The Tongue:** Thetongue is divided into four parts:

a. The tip: It is the extreme end of the tongue.

b. The blade: It lies opposite to the alveolar ridge.

c. The front: It lies opposite to the hard palate.

d. The back: It lies opposite to the soft palate or velum.

The tongue is responsible for the production of many speech sounds, since it can move very fast to different places and is also capable of assuming different shapes. The shape and the position of the tongue are especially crucial for the production of **vowel sounds**. Thus when we describe the vowel sounds in the context of the function of the tongue, we generally consider the following criteria:

• Tongue Height: It is concerned with the vertical distance between the upper surface of the tongue and the hard palate. From this perspective the vowels can be described as **close** and **open**. For instance, because of the different distance between the surface of the tongue and the roof of the mouth, the vowel /i: /has to be described as a relatively **close** vowel, whereas /æ / has to be described as a relatively **open** vowel.

• Tongue Frontness / Backness: It is concerned with the part of tongue between the front and the back, which is raised high. From this point of view the vowel sounds can be classified as **front vowels** and **back vowels**. By changing the shape of the tongue we can produce vowels in which a different part of the tongue is the highest point. That means, a vowel having the back of the tongue as the highest point is a back vowel, whereas the one having the front of the tongue as the highest point is called a front vowel. For example: during the articulation of the vowel / u: / the back of the tongue is raised high, so it’s a **back** vowel. On the other hand, during the articulation of the vowel / æ / the front of the tongue is raise high, therefore, it’s a **front** vowel.



**(vi) The Jaws:** Some phoneticians consider the jaws as articulators, since we move the lower jaw a lot at the time of speaking. But it should be noted that the jaws are not articulators in the same way as the others. The main reason is that they are incapable of making contact with other articulators by themselves.

**(vii) The Nose and the Nasal Cavity:** The nose and its cavity may also be considered as speech organs. The sounds which are produced with the nose are called **nasal** **sounds**. Some nasal sounds in English include: /m/n/ŋ/.

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