



INTRODUCTION TO

Phonetics and Phonology

(Compilation 1)

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Phonetics and Phonology

1. Introduction

Out of the seven fundamental levels of linguistic analysis, the role and importance of Phonetics and Phonology is worth discussing. Had it been neglected, Linguistics would have been left behind with merely the crude and boring structures of vocabulary and grammar. Modern Linguistics has rightly adopted the study of human speech sounds (in both general and particular language contexts) as the staple of Linguistics. The emergence of English as a global language and lingua franca brought new challenges for the linguists at the end of the colonization period. The biggest such challenge was the spoken discourse wherein most of the colonized nations mispronouncing the written language under any influence was the common practice. 1986 saw a big development towards taking some concrete steps in addressing the problem on futuristic grounds. It was the establishment of International Phonetic Association under the leadership of Henry Sweet. The Association came up with a brilliant idea of International Phonetic Alphabets.

Phonetics is the field of language study concerned with the physical properties of sounds, and it has three subfields. Articulatory phonetics explores how the human vocal apparatus produces sounds. Acoustic phonetics studies the sound waves produced by the human vocal apparatus. Auditory phonetics examines how speech sounds are perceived by the human ear. Phonology, in contrast, is concerned not with the physical properties of sounds, but rather with how they function in a particular language.

This article covers in detail the definition, examples and types of both Phonetics and Phonology. International Phonetic Alphabets (IPA) transcription with forty four symbols for forty four phonemes of English has been laid down on the next pages.

2. Phonetics and its Branches

Phonetics, branch of linguistics concerned with the production, physical nature, and perception of speech sounds. The main fields of study are experimental phonetics, articulatory phonetics, phonemics, acoustical phonetics, and auditory phonetics. Auditory phonetics is the field involved in determining how speech sounds are perceived by the human ear.

David Crystal defines Phonetics in such words:

“Phonetics is the science of human speech; it studies the defining characteristics of all human vocal noise and concentrates the attention on those sounds which occur in the world’s languages.”



In simple words it is defined as:

“Phonetics is the scientific study of human speech sounds. How speech sounds are made, described, classified, and transcribed.”

2.1. Diachronic Development of Phonetics

The earliest contributions to phonetics were made more than 2000 years ago by Sanskrit scholars such as the grammarian Panini in the 400s who dealt with articulation to keep the pronunciation of ancient rituals unchanged.

- The first phonetician of the modern world was the Dane J. Matthias, author of *De Litteris* (1586).
- English mathematician John Wallis, who instructed deaf-mutes, was the first to classify vowels, in 1653, according to their place of articulation.
- The vowel triangle was invented in 1781 by C. F. Hellwag from Germany.
- Ten years later, Austrian mechanic Wolfgang von Kempelen invented a machine that produced speech sounds.
- German physicist Hermann Helmholtz, who wrote *Sensations of Tone* (1863), inaugurated the study of acoustical phonetics.
- Frenchman Abbé Jean Pierre Rousset pioneered in experimental phonetics.
- Late in the 19th century, the theory of the phoneme was advanced by Jan Baudouin de Courtenay from Poland and Ferdinand de Saussure from Switzerland.
- In the United States, linguist Leonard Bloomfield and anthropologist and linguist Edward Sapir contributed greatly to phonetic theory.
- Linguist Roman Jakobson developed a theory of the universal characteristics of all phonemic systems.

2.2. Branches of Phonetics

Phonetics has three core areas of human speech sound analysis. Each one would be discussed in detail.

2.2.1. Articulatory Phonetics

This describes speech sounds genetically—that is, with respect to the ways by which the vocal organs modify the air stream in the mouth, nose, and throat in order to

produce a sound. All the vocal activities involved in a sound need not be described, but only a selection of them, such as the place and manner of articulation. Phonetic symbols and their articulatory definitions are abbreviated descriptions of these selected activities. The symbols most commonly used are those adopted by the International Phonetic Association (IPA).

Producing speech sounds means employing ones vocal organs to modify an egressive airstream created by the lungs. In normal breathing, there are no restrictions to this air flow. However, the organs that form part of the vocal tract, most notably the larynx (vocal cords), Velum (Uvula), tongue and lips are subject to conscious muscular activity which modifies their positions and thereby the shape of the cavities through which the air needs to pass.

The organs of articulation are either movable or stationary. Movable organs such as lips, jaws, tongue, or vocal chords are called articulators. By means of them a speaker modifies the surge of air from the lungs. Stationary parts include the teeth, the alveolar arch behind them, the hard palate, and the softer velum behind it. In the production of consonants, four things matter.

- a. **Voiced or Voiceless**
- b. **Nasal or Oral**
- c. **Place/Point of Articulation**
- d. **Manner of Articulation**

Not only do speech sounds differ from each other in their place of articulation but they also differ in the manner of articulation. Sounds made by touching two articulators—for example, the bilabial *p*, which requires both lips—or those made by an articulator and a stationary part of the vocal apparatus are named from the organs that make the juncture, which is called the **place/point of articulation**. Reference to the tongue, when it is an articulator, is not expressed—for example, the *t* sound, which is produced by the alveolar arch touched by the tongue, is called alveolar.

The **manner of articulation** is determined by the way in which the speaker affects the air stream with the movable organs. This action may consist of stopping the air completely (plosive); leaving the nasal passage open during the stopping (nasal); making contact with the tongue but leaving space on either side of it (lateral); making merely a momentary light contact (flap); leaving just enough space to allow a continuing stream of air to produce friction as it passes through (fricative); or permitting the air stream to pass over the center of the tongue without oral friction (vocal).

On the other hand all the vowels are **voiced** and **oral**. In the production of vowels, three things matter.

- a. **Height of the Tongue**
- b. **Part of the Tongue Raised**
- c. **Roundedness of the Lips**



The speaker produces vowels of different quality by varying the position of his or her tongue on its **vertical axis** (high, mid, low) and on its **horizontal axis** (front, central, back). For example, a speaker moves the tongue from low to high in pronouncing the first two vowels of *Aida*, and from back to front in pronouncing successively the vowel sounds in *who* and *he*. The tongue positions for the vowels /u/, /i/, and /a/ are the cardinal points on the so-called vowel triangle $u_i a$. The vowel /e/ has the most neutral position. The quality of a vowel also depends on whether the speaker keeps the lips **rounded or unrounded**, keeps the jaws close together or open, or holds the tip of the tongue flat or curled up (retroflex). At the same time the speaker may move the tongue gradually upward and to the front, or upward and to the back, making diphthongal off-glides.

The quality of certain sounds is also affected by whether the speaker keeps the speech organs **tense or lax**. The vocal cords are vibrated to produce sounds that are voiced. Vowels are voiced, and in English, lax consonants are more or less voiced. When the speaker gives a strong puff of air after the contact, this is called **aspiration**. If the hand is placed before the lips, aspiration may be observed in the p^h sound produced at the beginning of the word *pie*.

a. The Organs of Speech

(A detailed Catalogue in series)

For the production of speech sounds, there must be some disturbance in the air passage. The required disturbance is provided by the movement of certain organs of the body such as the muscles of the chest, the vocal cords, soft palate, tongue, teeth and lips. The knowledge of the organs of speech, their relation to each other, and the way in which they are used while speaking, provides a sound basis for the classification of the sounds making up human languages.

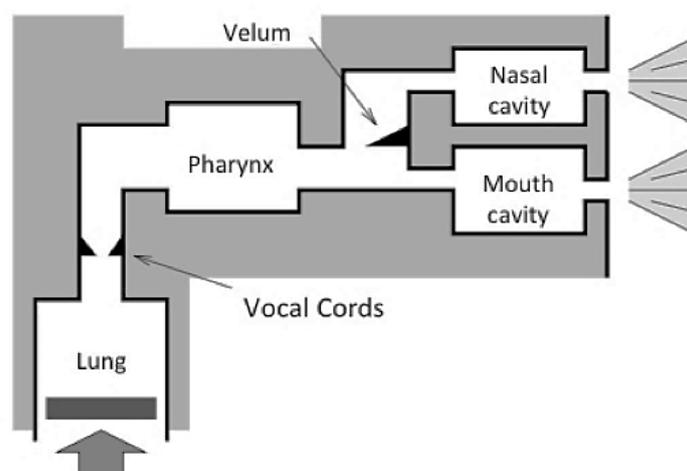


Fig 1

Any of the organs involved in speech production is known as speech organ. We have a number of them generally discussed in two categories.

- a. **Active Articulators**
- b. **Passive/ Stationary Articulators**

The active articulator does all or most of the movement when a speech sound is made. It is usually the lower lip or a part of the tongue, because the tongue and lower jaw are free moving.

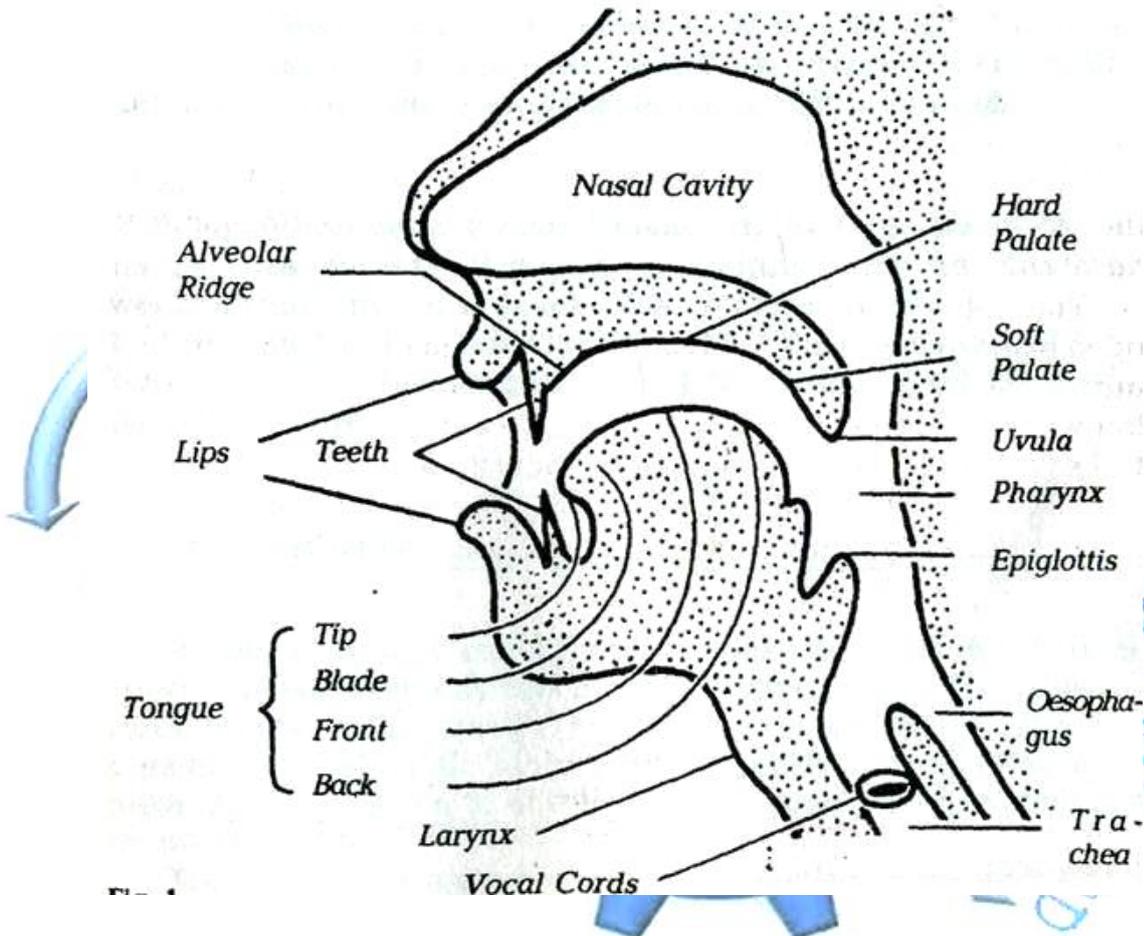


Fig 2

The passive articulator does little or no movement. It is the part of the place of articulation where the active articulator presses against: usually the upper jaw, upper teeth, roof of the mouth, or back of the throat (pharynx).

i. Lungs

Lungs provide the airstream pressure that is utilized and maneuvered by the speech organs. The pressure is of two types:

- a. Pulmonic Egressive (Exhaling)
- b. Pulmonic Ingressive (Inhaling)

ii. Vocal Cords

The air stream released by the lungs goes through the windpipe and comes to the larynx, which contains the vocal cords. The vocal cords are 2 elastic folds which may be kept apart or brought together. The opening between them is called the **glottis**. This is the usual state of the vocal cords. If the tense vocal cords are brought



together, the air stream forcing an opening makes them vibrate and we hear some voice. Such sounds are called voiced, if there is no vibration, no voice is heard. Such sounds are called voiceless. There is one more state of the vocal cords which results in the glottal stop. When the vocal cords are brought close together and then opened suddenly by the air stream there comes a sort of coughing noise, this sound is called the glottal stop.

iii. Pharynx

On coming out of the larynx the air stream passes through the pharynx. The pharyngeal cavity extends from the top of the larynx to the **soft palate**, which directs the air stream either to the mouth or nasal cavities.

The soft palate can be easily seen in a hand mirror. The very end of the soft palate is called **uvula**. The soft palate can easily move. When the soft palate is in its lowered position the air goes up into the nasal cavity and then out through the nose. When the soft palate is raised the uvula forms a full contact with the back wall of the pharynx and the air stream goes through the oral cavity.

iv. Palate

Most of the palate is hard. This hard and fixed part of the palate is divided into 2 sections: **the hard palate and the alveolar ridge** (or the teeth ridge). The alveolar ridge is very important in English.

v. Tongue

The most important organ of speech is **the tongue**.

It has 4 sections:

The back part of the tongue (the part, which lies opposite the soft palate)

The front part of the tongue (the part facing the hard palate)

The blade of the tongue

The tip (the one lying under the alveolar ridge),

vi. Lips

The lips can take up various positions as well. They can be: brought firmly together, kept apart, neutral, or rounded.

2.2.2 Acoustic Phonetics

Acoustic Phonetics is the study of the physical properties of speech sound such as frequency and amplitude in their transmission. Acoustic Phoneticians analyze the speech waves with the help of instruments, they attempt to describe the physical properties of the stream of sound that issues forth from the mouth of a speaker. It is in the field of acoustic phonetics that the most striking developments have taken place since the Second World War. complex sound waves produced in speech can be analyzed into their components frequencies and relative amplitudes.

Sound waves are closer than articulations to the essence of communication, because the same auditory impression can be produced by a normal articulation and by an entirely different sound apparatus, like that of parrots. A spectrograph may be used to record significant characteristics of speech waves and to determine the effect of articulatory activities. Parts of this record of speech waves can be cut out experimentally and the rest played back as sound in order to determine which features serve to identify the sounds of a language.

2.2.3 Auditory Phonetics

If articulatory phonetics studies the way in which speech sounds are produced, auditory phonetics focuses on the perception of sounds or the way in which sounds are heard and interpreted. Remembering our conventional division of linguistic communication into several stages of a process unfolding between two parties, the sender of the message and its addressee, we may say that while articulatory phonetics is mainly concerned with the speaker, auditory phonetics deals with the other important participant in verbal communication, the listener. It is again, obviously, a field of linguistic study which has to rely heavily on biology and more specifically on anatomy and physiology.

Before the sounds we perceive are processed and interpreted by the brain, the first anatomical organ they encounter is the ear. The ear has a complex structure and its basic auditory functions include the perception of auditory stimuli, their analysis and their transmission further on to the brain. We can identify three components: the outer, the middle and the inner ear.

Auditory Phonetics is the study of hearing and the perception of speech sounds. It studies different auditory impression of quality, pitch and loudness of sounds. The auditory classification of speech sound has yet been carried to a decisive phase. At the present time phonetics can be regarded as being made up of two main branches; Articulatory phonetic and Acoustic phonetics.

3. International Phonetic Association (IPA)

The International Phonetic Association was established in 1886 as a forum for the teachers who were inspired by the idea of using phonetics to improve the teaching of spoken language to the foreign learners. It also laid the foundations for the modern science of phonetics. The Association had a revolutionary impact on the language classroom in the early decades of its existence, where previously the concentration had been on proficiency in the written form of language. The association's mission is to "promote the scientific study of phonetics".

The general fact is that there is no One-to-One correspondence between the spelling and the sound of words. For example 'BOUGH' and 'TROUGH' do not rhyme in English, even though their spelling might suggest they do. There are many other problems that a non-native speaker of English has to face.

i: Some letters stand for more than one sound

ii: Different combinations of letters yield the same sound

To overcome these issues, a need was felt to evolve a spoken alphabet system in which words of any language could be written unambiguously. One such alphabet which is used now extensively around the globe is "International Phonetic Alphabet (IPA)"

"One sound, one symbol" was the fundamental principle behind all International Phonetic Alphabet compiled first time in 1888 in the first publication by International Phonetic Association.

It is based upon the Latin alphabet but since the 26 letters of Roman alphabet are grossly insufficient to represent all the sounds that exist in all the languages. Therefore, many English alphabet were also incorporated as symbols of the



sounds uttered by the humans. Writing one's speech through these IPA alphabet is known as **Phonetic Transcription**.

SOUNDS AND PHONEMES

Speech sounds are grouped into language units called **phonemes**. They are the smallest contrastive language units which exist in the speech of all people belonging to the same language community. The phoneme is a functional unit. That means that being opposed to other phonemes in the same phonetic context it is capable of differentiating the meaning.

e.g. Are you fond of this **cut**? - Are you fond of this **cart**?

The phoneme is realized in speech in the material form of speech sounds of different type.

There are 2 types of speech sounds: vowels and consonants.

Vowels are voiced sounds produced without any obstruction.

Consonants are made with air stream that meets an obstruction in the mouth or nasal cavities.

Phonetic Transcription of English Consonants:

Consonants			
f	f at, co ff ee, rou gh , ph oto	d	d ay, la dd er, od d
v	v iew, hea vy , mo v e	k	k ey, clo ck , sch ool
θ	th ing, au th or, pa th	g	g et, g iggle, g host
ð	th is, o th er , smoo th	tʃ	ch urch, ma ch , na t ure
s	s oon, cea s e, s ister	dʒ	j udge, a g e, sol d ier
z	z ero, mu s ic, ro s es, bu zz	m	m ore, ha mm er, su m
ʃ	sh ip, s ure, na ti onal	n	n ice, k n ow, fu nn y, su n
ʒ	plea s ure, vi s ion	ŋ	ri ng, a ng er, su ng , br ing
h	h ot, wh ole, a h ead	l	l ight, va ll ey, fee l
p	p en, co pp y, ha pp en	r	r ight, w rr ong, so rr y, a rr ange
b	b ack, b aby, jo b	j	y et, u se, bea u ty, fe w
t	t ea, t ight, bu tt on	w	w et, o ne, w hen, w ingle

Phonetic Transcription of English Vowels:

Vowels			
i:	fleece, sea, machine	u:	goose, two, blue, shook
ɪ	kit, bid, hymn, minute	eɪ	face, day, break
e	dress, bed, head, many	aɪ	price, high, try
æ	trap, bad	ɔɪ	choice, boy
ʌ	strut, mud, love, blood	əʊ	goat, show, no
ɑ:	start, father	aʊ	mouth, now
ɒ	lot, odd, wash	ɪə	near, here, weary
ɔ:	thought, law, north, war	eə	Square, fair, various
ɜ:	nurse, learn, refer	ʊə	poor, jury, cure
ʊ	foot, good, put, took		
ə	Against, Above	i	happy, radiate, glorious

4. Phonology and its types

Phonology includes from ancient Greek: which means Phones, "voice sounds", and Logos, "word speech, subject of discussion". This is broadly speaking the sub-discipline of linguistics concerned with the sounds of a language.

Definitions

- Phonology is a branch of linguistics which studies the sound system of a language. It studies the sounds which have distinctive features.
- Phonology is concerned with the patterns and organization of a language in terms of the phonetic al features and categories involved.
- Phonology is the study of speech sounds and their organization in a particular language. For example: the speech sounds in the English language. How sounds, the elements of speech, are organized in English language to form an integrated system.
- English Phonology is the study of the sound system of the English language. It studies the sounds with distinctive features. The sounds are organized into a system of contrasts which are analyzed in terms of phonemes.

Phonology as the Subfield of Linguistics

Phonology is viewed as the subfield of linguistics that deals with the sound system of a language. It should be carefully distinguished from phonetics whereas phonetics concerns the physical production, acoustic transmission and perception of the sounds of speech. Phonology describes the way sounds function within a given language or across languages to encode meaning. In other words, phonetics is a type of descriptive linguistics whereas phonology is a type of theoretical linguistics.



Phonology is concerned not with the physical properties of sounds, but rather with how they function in a particular language. The following example illustrates the difference between phonetics and phonology. In the English language, when the sound *k* (usually spelled *c*) occurs at the beginning of a word, as in the word *cut*, it is pronounced with *aspiration* (a puff of breath). However, when this sound occurs at the end of a word, as in *tuck*, there is no aspiration. Phonetically, the aspirated *k* and unaspirated *k* are different sounds, but in English these different sounds never distinguish one word from another, and English speakers are usually unaware of the phonetic difference until it is pointed out to them. Thus English makes no phonological distinction between the aspirated and unaspirated *k*. The Hindi language, on the other hand, uses this sound difference to distinguish words such as *ka* (time), which has an unaspirated *k*, and *kha* (skin), in which *kh* represents the aspirated *k*. Therefore, in Hindi the distinction between the aspirated and unaspirated *k* is both phonetic and phonological.

English has wide variation in pronunciation, both historically and from dialect to dialect.

Branches of English Phonology

- **Segmental Phonology**
- **Supra-segmental Phonology**

4.1 Segmental Phonology

Definition

Segmental phonology is the study of sounds. This is about the study of phonemes, signs and symbols. In other words, when we study the segments of sounds of a particular language or phonemes of a particular language, we are actually involved in the segmental phonology.

Segmental Phonology is everyday English. Because in this we study about sounds that how they are produced and what voice they have. In English, there are forty four (44) traditional sounds which are actually forty four (44) phonemes as well. They are divided into two parts: one is consonants and other is vowel. There are twenty four (24) consonant sounds and twenty (20) vowel sounds. Actually, they are forty four (44) different segments as well as forty four (44) phonemes.

4.1.1 Phoneme

Most linguists regard phoneme as one of the basic units of a language. But they have not yet defined this term in its absolute terms.

According to Bloomfield:

The phoneme is the minimal unit of distinctive sound feature.

In Webster's Third New International:

The phoneme is defined as the smallest unit of speech distinguishing one unit from another. In all the variation, it displays in the speech of one person, or in one dialect as a result of modifying influences, such as neighboring sounds or stress.

In Dorfman's:

A phoneme is a single speech sound or group of similar or related speech sounds functioning analogously in a language, and usually represented in writing by the same letter, with or without diacritic marks.

According to Contemporary Linguists:

The phoneme is a minimal bundle of relevant sound features. A phoneme is not a sound; it can be realized only through one of its allophones. It is a class of sounds, actualized or realized in a different way in any given position by its representative the allophone. It is an ideal towards which the speaker strives, while the allophones are the performance he achieves. It occupies an area within which the various allophones move and operate. Its quiter limits may approach but not overlap those of other phonemes and it cannot invade the territory of another phoneme without loss of phonemic distinction.

Classification Theory of Phoneme

The first is the **Classification Theory**, developed by **Danial Jones**, considers the phoneme to be a group or family of related sounds, e.g. /p/ in English consisting of [p], [p^h] etc. or /u/ consisting of (u:) , (u) etc.

Distinctive Feature Theory of Phoneme

The second or **Distinctive Feature Theory**, developed by **N.S. Turbetzkoy** and the **Prague School**, considers a phoneme to be a bundle of distinctive feature, e.g. /p/ in English is considered to be made up of bilabial + stop + voiceless. Aspiration is therefore not distinctive and thus the allophones (p^h) and (p) above are allowed for.

Explanation

Depending upon a point of view taken, a phoneme can be defined as "a unit, a rubric, a bundle of sound feature" or "the smallest contrastive linguistic unit which may bring about a change of meaning". Hence, it is a minimum distinct functional unit.

Phonemes of a language may be discovered by forming minimal pairs, i.e. pairs of words are different in respect of only one sound segment.

The series of words **pat, bat, cat, hat, sat, that, mat**, supplies us with seven words which are distinguished simply by a change in the first **Consonantal Element** of sound sequence. These elements of contrastive significance are phonemes and be symbolized as /p,b,k,h,s,ð,m/. Similarly, in the series of words **hat, hit, heat, hot, heart**, the elements of contrastive significance are /æ, I, i:, O, a:/.
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Allophone:

Allophones are phoneme variants. Some sounds, the native speaker thinks are the same, while others are different. The linguist has to figure out what sounds are grouped together as the same, what it is that they all have in common among themselves and how dissimilar are they to other groups of sounds in the informant's speech and what criteria the native speaker uses to tell sounds apart.

Explanation

The **k**-sound in **keel, calm** and **cool**
In **keel**, it is at in front of the mouth. In **calm**, it is a little in the centre and in **cool** further back in the mouth. The native speaker thinks that these sounds are members of the **k**- class or are all **k**. In other words for the phoneme /k/, central -k, retracted -k, fronted -k are all allophones.



Hence, an allophone is a speech sound which is one of the number of variants of a phoneme.

Such a variant can either in complementary variation or in free variation.

Let us discuss separately about consonants and vowels:

Consonants

The consonants are the sounds which are produced with blocking the air passage in some way through the mouth but through nasal cavity. These sounds may be voiced or voiceless. So, there are twenty four (24) consonants symbols given below:

Segmental Phonology

As we all know that there are two types of phonology:

1. **Segmental Phonology**
2. **Supra-segmental Phonology**

But here we are going to discuss about **Segmental Phonology**. The question is what is

Consonant Symbols

p
b
t

d
k
g
tʃ
dʒ
f
v
θ
ð
s
z
ʃ
ʒ
h
m
n
ŋ
l
r
j
w

Sounds used in Eng. words

pad
bat
tea

day
key
get
chain
jam
fast
van
three
this
sing
zero
shine
pleasure
hot
money
night
bring
lay
rat
yes
wet

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Some of them are voiced and some of them are voiceless. The details of voiced and voiceless sounds are given below:

Voiced Sounds: The sounds are voiced when the vocal cords vibrate.

Voiceless Sounds: The sounds are voiceless when the vocal cords do not vibrate.

Voiceless

- /θ/ as in thing
- /p/ as in pen
- /t/ as in tea
- /k/ as in key
- /f/ as in few
- /s/ as in soon
- /ʃ/ as in fishing
- /tʃ/ as in cheer
- /h/ as in hot

Total= 9

Voiced

- /ð/ as in then
- /b/ as in back
- /d/ as in day
- /g/ as in gang
- /v/ as in view
- /ʒ/ as in pleasure
- /dʒ / as in jump
- /m/ as in sum
- /n/ as in sun
- /ŋ/ as in sung
- /l/ as in led
- /r/ as in red
- */j/ as in yet
- */w/ as in wet

Total= 15

Vowels

Vowels are the sounds produced when the vocal cords vibrate and the air passes freely through the mouth without obstruction. There are twenty (20) vowel sounds and they all are voiced.

The Classification of Vowels

There are twelve (12) single vowel sounds out of twenty (20) sounds; five (5) of them are long vowels and seven (7) of them are short vowels. Besides that there are Eight (8) Diphthongs.

Long Vowels

Five long vowels are the following:

- a: as in dark
- i: as in seen
- ɔ: as in born
- ɜ: as in term
- u: as in moon

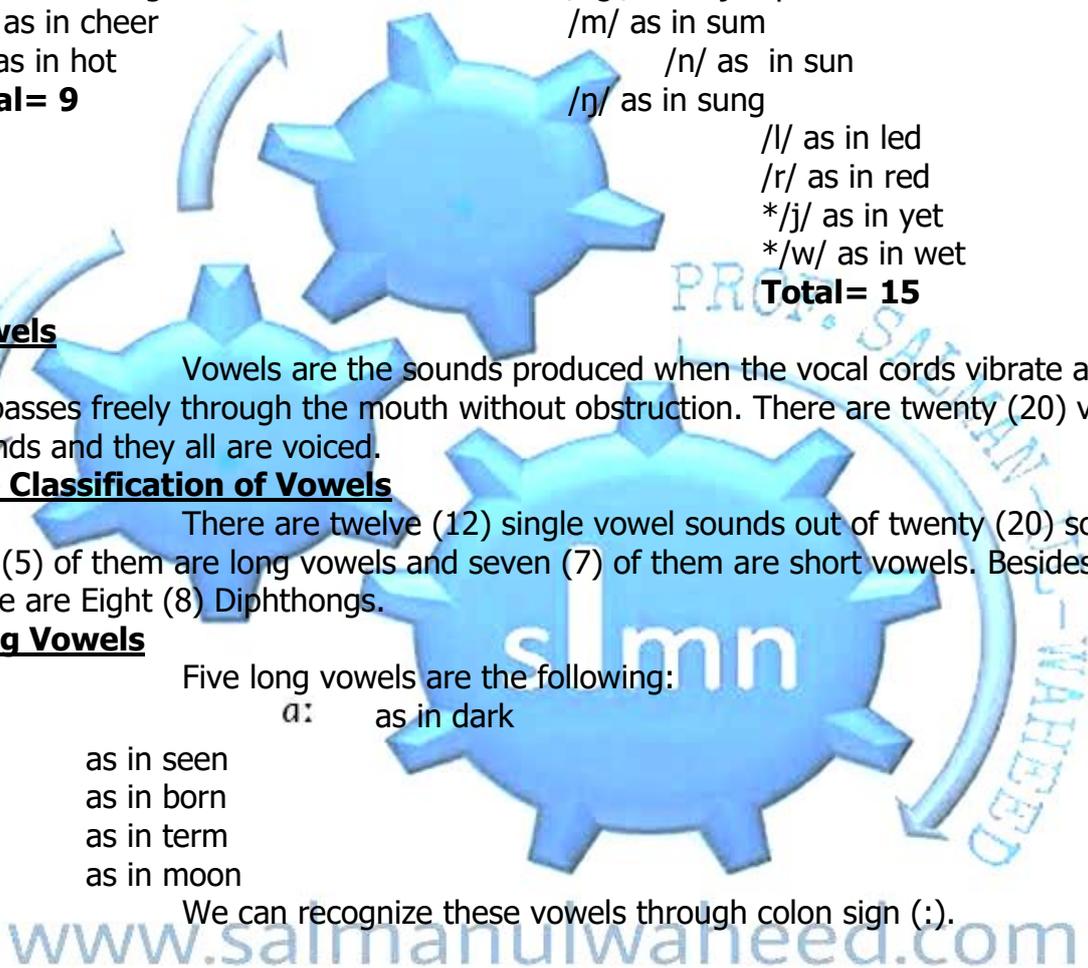
We can recognize these vowels through colon sign (:).

Short vowels

The short vowels are relatively shorter than the long vowels. The shorter vowels are the following:

- æ as in bat
- e as in bet
- ə as in ago
- ɪ as in sit
- ɒ as in top
- ʌ as in but
- ʊ as in put

Diphthongs





In a diphthong, two vowel sounds are joined together. In the diphthongs of the English, the first element is more prominent than the second.

eɪ	As in say
aɪ	As in buy
ɔɪ	As in toy
əʊ	As in so
aʊ	As in now
ɪə	As in mere
eə	As in fair
ʊə	As in poor

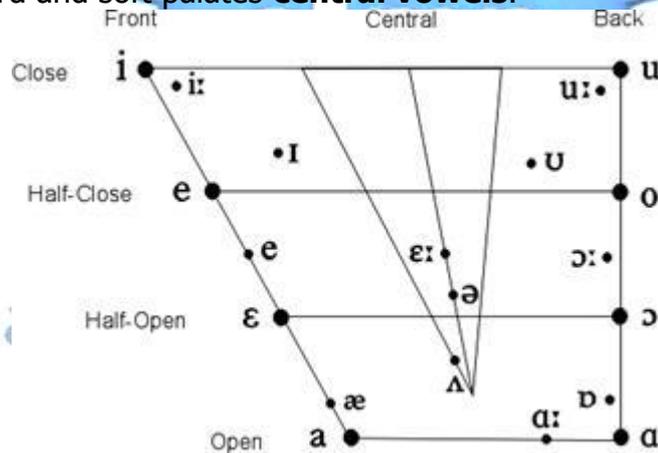
The Cardinal Vowel Scale

The cardinal vowel system was devised by Daniel Jones. The basis of the system is physiological.

A scale of eight primary cardinal vowels was set up, denoted by the following numbers and symbols.

/i/	;	/e/
/ɜ/	;	/a/
/ɒ/	;	/ɔ/
/ʊ/	;	/u/

Now we combine our classificatory chart with the descriptive figure, naming those vowels in which the main raising is made by the front of the tongue towards the hard palate **front vowels**, those in which the back of the tongue is raised towards the soft palate **back vowels**, and those in which the centre is raised towards the juncture of the hard and soft palates **central vowels**.



The Cardinal Vowel Diagram