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## CHAPTER 1

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## Introduction to phonetics

### 1.1 Introduction

The purpose of this book is to introduce you to the study of PHONOLOGY. Phonology is the branch of linguistics which investigates the ways in which sounds are used systematically in different languages to form words and utterances.

In order to understand phonology, one must have a grasp of the basic concepts of PHONETICS, the study of the inventory of all SPEECH SOUNDS which humans are capable of producing. The term speech sound has been used advisedly since not all noises which we are capable of producing with our vocal apparatus are employed in speech: we can all snore; we can all cough and hiccup; we can all sneeze and we can all gnash our teeth. However, no linguist, has yet discovered a community that has a language in which noises produced by any one of these mechanisms are used to form words. It is almost certain that no such speech community exists. One reason for this is the fact that there are obvious disadvantages in letting communication depend on involuntary noises like hiccups which speakers cannot start and stop at will. Other methods like the gnashing of teeth may be easy to control, but have their drawbacks – the wear and tear which gnashing of teeth would entail must have ruled out that method. I am using these examples to underscore the point that speech sounds form a small subset of all the noises which humans can produce with their vocal apparatus. It is this subset that phoneticians focus on.

The study of speech sounds can be approached from

various angles. These are reflected by the three major branches of phonetics:

- (a) **ACOUSTIC PHONETICS**: the study of the physical properties of speech sounds using laboratory instruments;
- (b) **AUDITORY PHONETICS**: the study of speech perception;
- (c) **ARTICULATORY PHONETICS**: the study of speech production.

## 1.2 The production of speech

It is articulatory phonetics that we shall concentrate on here because it is the branch of phonetics on which most phonological theories have been based in the past.

### 1.2.1 The production of consonants

Speech sounds are produced by interfering in some way with a body of moving air. Phoneticians use the term **AIR-STREAM MECHANISM** to describe a body of moving air used in speech production. It is important to describe how the air is set in motion and the direction in which it travels because that makes a difference in the sound produced. The commonest airstream mechanism used in the world's languages (and the only one found in English) is the **PULMONIC EGRESSIVE** mechanism. When this mechanism is employed, air is expelled from the lungs, up the windpipe and gets out through the mouth, or through the nose, or through both.

There exist other airstream mechanisms, but we shall postpone discussion of these until Chapter 3. We shall provisionally assume that all speech sounds are made with air pushed from the lungs up the **WIND PIPE** (also called the **TRACHEA**, more technically). Continuing its outward journey, the air reaches the **LARYNX** (or voice box – that cartilaginous membrane at the top of the windpipe which is called the Adam's apple in everyday language). Once in the larynx, the air must pass through the **GLOTTIS**. This is the space between the vocal cords. If the vocal cords are apart, i.e. if the glottis is open, the air escapes unimpeded. Sounds produced in this way are said to be **VOICELESS**.

If, on the other hand, the vocal cords are very close together, the air will blow them apart as it forces its way through. In doing so, it will make them vibrate, producing a **VOICED** sound.

You can perform a little experiment to determine for yourself whether a given sound is voiced or voiceless. Say [mm] and then [vvvv] with two fingers held firmly on your larynx. Repeat this four times. What do you observe?

Now say [ffffvvvvffffvvvv] this time with your index fingers in your ears. What do you observe?

In the first experiment, you should be able to feel your fingers vibrating slightly when you say [vvvv] but not when you say [ffff]. And in the second experiment, you should be able to hear a low buzzing noise in your head when you produce [vvvv], but not when you produce [ffff]. The noise that causes the vibration in your larynx which you feel with your fingers as well as the low buzzing sound which you feel when you have fingers in your ears is called **VOICING**.

Voicing is linguistically important. The difference between voiced and voiceless sounds is functional. In many languages, English included, as you can see in [1.1], there are many consonants which come in pairs, with the two sounds in question differing in voicing:

[1.1]	A	B
	pull	bull
	ten	den
	cot	got
	fast	vast
	sink	zinc
	chew	Jew

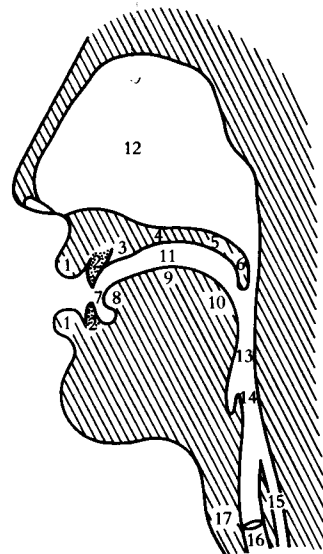
The initial consonant of the words in column A is **voiceless** while the initial consonant of the words in column B is **voiced**.

Find five more words which begin with voiceless and voiced consonants respectively.

## [1.2]

## The Organs of Speech

- 1 lips
- 2 teeth
- 3 alveolar ridge
- 4 (hard) palate
- 5 velum
- 6 uvula
- 7 tongue tip
- 8 tongue blade
- 9 front of the tongue
- 10 back of the tongue
- 11 mouth cavity
- 12 nose cavity
- 13 pharynx
- 14 epiglottis
- 15 oesophagus
- 16 glottis
- 17 larynx



The term **VOCAL TRACT** is used to refer to the air passages which the air enters on leaving the larynx. As you can see in the figure in [1.2], the vocal tract has two parts: the **ORAL TRACT**, which is the air passage offered by the mouth and the **NASAL TRACT**, which is the air passage provided by the nose.

Consonants are produced by obstructing in some way the flow of air through the vocal tract. We can identify the **PLACE** (or **POINT**) where the obstruction takes place, and the organs involved. The parts of the oral tract such as the tongue and lips which can be used to form speech sounds are called **ARTICULATORS**. A list of places of articulation is given in [1.3] together with the phonetic symbols representing some of the sounds made at each place.

As you read through [1.3] you should say aloud the words in the illustrative examples and observe how you use the articulators to produce each sound. Next, you should find examples of your own of each sound. The examples can come from any language you know. If you are uncertain about the terminology, consult [1.2].

## [1.3] Places of articulation

place	articulators	examples
<b>BILABIAL</b>	both lips	[p] <i>peat</i> [b] <i>beat</i> [m] <i>meat</i>
<b>LABIO-DENTAL</b>	lower lip and upper front teeth	[f] <i>fine</i> [v] <i>vine</i>
<b>DENTAL</b>	tongue tip and upper front teeth	[θ] <i>thigh</i> [ð] <i>thy</i>
<b>ALVEOLAR</b>	tongue tip or blade and the alveolar ridge	[t] <i>tip</i> [d] <i>dip</i> [s] <i>sip</i> [z] <i>zip</i> [l] <i>lip</i> [r] <i>rip</i> [n] <i>nip</i>
<b>RETRO-FLEX</b>	tongue tip curled back past the alveolar ridge	[ɽ] <i>raft</i> (in American English) [ɳ] <i>pina</i> 'lake' (in Wangkatja (Australia))
<b>PALATO-ALVEOLAR</b>	blade of the tongue rising towards the alveolar ridge and the front of the hard palate	[ʃ] <i>sheep</i> [ʒ] <i>genre</i> [tʃ] <i>cheap</i> [dʒ] <i>jeep</i>
<b>PALATAL</b>	front of the tongue and the hard palate	[j] <i>yes</i> [ç] <i>ich</i> 'I' (German) [ɲ] <i>agneau</i> 'lamb' (French)
<b>VELAR</b>	back of the tongue and the velum	[g] <i>got</i> [k] <i>cot</i> [ŋ] <i>song</i>
<b>LABIO-VELAR</b>	simultaneously using both lips and raising the back of the tongue towards the velum	[w] <i>win</i> [kp] <i>kpakpa</i> 'field' (Yoruba (Nigeria))
<b>GLOTTAL</b>	vocal cords	[h] <i>hot</i> [ʔ] <i>better</i> (in many varieties of nonstandard British English, e.g. Cockney)

Besides describing the place where the obstruction occurs in the production of a consonant, it is also essential

to consider the MANNER OF ARTICULATION, i.e. the nature and extent of the obstruction involved because sounds made at the same place of articulation – and which are both voiced or voiceless, as the case may be – can still differ depending on the manner in which the airstream is modified. Take these words, which all begin with VOICED ALVEOLAR consonants: *dine*, *nine*, *line* and *Rhine*. Not only do they sound different, they also mean different things. The difference lies in the manner of articulation of their initial consonants.

In [1.4] below a brief survey of manners of articulation is given, together with English examples.

[1.4] STOP: The articulators come together and completely cut off the flow of air momentarily, then they separate abruptly. Examples: *pin bin tin din kilt gilt*.

Stops like [p b t d k g] which are made with the pulmonic egressive airstream mechanism (as the speaker breathes out through the mouth) are called PLOSIVES. Sounds like [m n], as we shall see presently, are also stops but they are not plosives; they differ from plosives in that they are formed by completely blocking off the airstream in the mouth while at the same time allowing it to escape through the nose.

AFFRICATE: In the production of an affricate, first the articulators come together and completely cut off the flow of air, just as they do in a stop; then they separate gradually.

Examples: *chain Jane*  
[tʃ] [dʒ]

Say the following words very carefully

*char jar*

Describe as accurately as you can the ways in which the articulators are used to obstruct the flow of air in the first sound of each word. Which one of the affricates is voiced?

FRICATIVE: the articulators are brought very close together leaving only a very narrow channel through which the air squeezes on its way out, producing turbulence in the process.

Examples: [f v θ ð s z ʃ ʒ]

Say the following words and listen for the turbulence of the initial consonant:

*fan van thin then sink zinc shrill genre*

APPROXIMANT: the articulators are brought near each other but a large enough gap is left between them for air to escape without causing turbulence.

Examples: [r l w j] as in *read lead weed* and *yield* respectively.

NASAL: Nasal sounds are produced with air escaping through the nose; the velum is lowered to allow access to the nasal tract.

Examples [m n ŋ]

The final sounds in all these words are nasal:  
*sum sun sung*.

On the other hand, to produce ORAL sounds like [p t k b d g s z] the VELUM is raised right up against the back wall of the PHARYNX, cutting off access to the nasal cavity and making air escape through the mouth only (see [1.2]).

LATERAL: to produce a lateral, the air is obstructed by the tongue at a point along the centre of the mouth but the sides of the tongue are left low so that air is allowed to escape over one or both sides of the tongue.

Example: [l]

If you say the following words slowly and carefully, you will be able to observe how the air escapes over the sides of the tongue in the last [l] sound:

*peddle paddle huddle*  
*kettle battle cattle*

Examine the examples in [1.4] above once again. State the place of articulation of each consonant and also determine whether it is voiced or voiceless.

Next find three more words exemplifying each manner of articulation that has been described. Take your examples from any language which you know.

### Summary

The production of consonants involves four major parameters which can be varied independently of each other to create different kinds of consonant. The four parameters are:

- (a) **THE AIRSTREAM MECHANISM**  
This refers to the way in which the moving body of air that provides the power for speech production is generated and the direction in which it moves.
- (b) **THE STATE OF THE GLOTTIS**  
Voiceless sounds are produced when there is a wide open glottis, with a big space between the vocal cords; voiced sounds are produced when the vocal cords are close together so that the air has to force its way through them, making them vibrate in the process.
- (c) **THE PLACE OF ARTICULATION**  
This refers to the place in the vocal tract where the airstream is obstructed in the production of a consonant.
- (d) **THE MANNER OF ARTICULATION**  
This refers to the way in which the airstream is interfered with in producing a consonant.

## 1.3 The production of vowels

Vowels are more difficult to describe accurately than consonants. This is largely because there is no noticeable obstruction in the vocal tract during their production. It is not easy to feel exactly where vowels are made. Moreover, in many cases, sounds perceived by hearers as the 'same vowel' may be produced using a number of substantially different articulatory gestures. The only reliable way of

observing vowel production is using x-ray photography. But this is not only expensive, it is also dangerous and could not be carried out each time one wanted to describe a particular vowel (even if willing subjects eager to allow themselves to be exposed to radiation in the noble cause of phonetic inquiry could be found).

The account in this chapter will be restricted to vowels which occur in English but much of what is said is generalizable to many other languages. As we noted above, many of the parameters described above which are used in the description of consonants have not been found applicable to vowels. Vowels are typically voiced, but they have no place or manner of articulation. Traditionally, for the description of vowels a different set of concepts has been found necessary.

Say the words in [1.5] carefully. Observe in a mirror the position of the highest point of your tongue and your lower jaw.

[1.5]	[i]	seek	[u]	pool
	[ɪ]	sick	[ʊ]	pull
	[e]	set	[ɒ]	pot
	[æ]	sat	[ɑ]	part

Now repeat the exercise, just uttering the vowel sounds on their own. Again observe the position of your tongue and jaw.

In each column your tongue is high when you say the vowel in the first word on the list and gets progressively lower as you work your way through the list. If you watch yourself in a mirror, you will observe that there is a correlation between tongue height and jaw opening: when the tongue is high, the jaw is not lowered but when the tongue is low the jaw is also low and your mouth is wide open.

Vowels produced with the highest point of the hump in the tongue close to the roof of the mouth are said to be HIGH and those produced with the highest point of the hump in the tongue barely rising above the floor of the mouth are said to be LOW; the intermediate position is referred to as MID.

Not  
Right  
v  
A vowel

Up to now, we have considered the vertical axis in locating the highest point of the tongue. That is not enough. It is also necessary to determine the location of the highest point on the horizontal axis: the highest point of the tongue may be at the front, in the centre or at the back of the mouth. Depending on the location of the highest point of the tongue, vowels may be regarded as FRONT, CENTRAL or BACK.

Say the words in [1.6] slowly a number of times and observe the position of your tongue in each case:

[1.6] [e] shed      [ə] should<sup>1</sup>      [ʊ] shod

When you say the vowel [e] your tongue is in the front, palatal region; when you say [ə] your tongue is in the centre of the mouth; when you say [ʊ] your tongue shifts to the back of the mouth. That this is the case will be clear if you utter the vowels on their own one after the other.

Finally, the quality of a vowel is affected by the shape of the lips. For simplicity's sake, phoneticians assume that lips can assume only two positions: they are either **ROUNDED** or **UNROUNDED** – intermediate positions are ignored. Lip rounding results in an elongated resonating chamber while lip **SPREADING** or **UNROUNDING** (the position the lips assume if you put on that fixed grin when the voice behind the camera tells you to smile or say 'cheese') does not. Just as the notes which can be produced by different wind instruments partly depend on the shape of the instrument, the **QUALITY** of a vowel sound partly depends on the shape of the resonating chamber in the vocal tract resulting from adjustments in lip position.

Get a mirror and once again observe your lips as you say the words in [1.7]. You will be able to verify that in each case the first word in each pair is said with spread (unrounded) lips while the second is produced with the lips rounded:

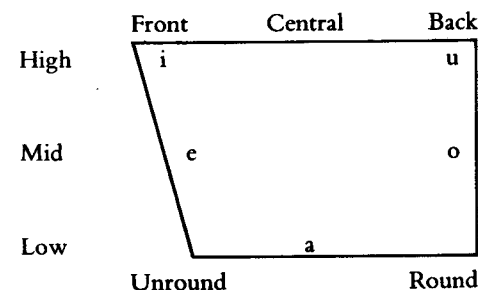
[1.7] [i] see      [u] sue  
[ɪ] tea      [ʊ] two

[e] fen      [ɔ] fought  
[æ] lag      [ʊ] log

The various articulatory parameters are not entirely independent of each other. Note, for instance, that there is a systematic correlation between lip rounding and tongue height. For a rounded vowel, the higher the tongue is, the greater the degree of lip rounding.

The phonetic properties of vowels surveyed in this section are conventionally represented in this diagram:

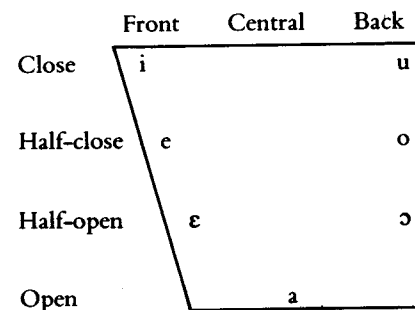
[1.8]



As [1.8] shows, typically front vowels are unrounded and back vowels are rounded.

The parameters high, mid and low enable one to distinguish three degrees of vowel height as you can see in [1.8]. But this is not always sufficient. There are languages which make a four way distinction on this parameter. Many phoneticians use the terms **CLOSE**, **HALF-CLOSE**, **HALF-OPEN** and **OPEN** to reflect this:

[1.9]



All the vowels which have been described so far are **MONOPHTHONGS** i.e. vowels whose quality remains virtually unchanged throughout their duration. In addition to such vowels some languages (English included) also have **DIPHTHONGS**, i.e. vowels whose quality changes during their production.

Say the following words, concentrating on the vowel sound:

[1.10] pie    buy    my    guy    cry    tie  
die    sigh    shy    high    lie    five

Identify the shifting positions which your tongue occupies as you produce the vowel.

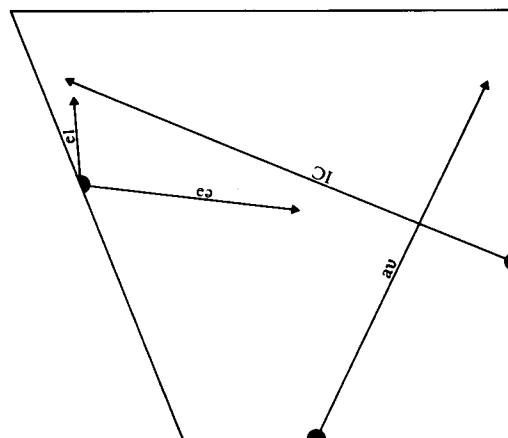
Initially the tongue is low and front but it finishes up in a high, front position. The symbol for this vowel is [aɪ].

Now say the words in [1.11] and again observe the shifting quality of each vowel:

[1.11] a. cow now shout out [aʊ]  
b. toy boy boil coin [ɔɪ]  
c. wait pay weight hay [eɪ]  
d. air fare wear chair [eə]

In [1.12] you can see the changing quality of the diphthongs exemplified above:

[1.12]



The primary aim of this chapter has been to introduce you to the basic concepts of articulatory phonetics so that you can understand the nature of speech production. The secondary aim is to introduce standard symbols for phonetic transcription largely through familiar English data.

For a complete list of phonetic symbols see the **International Phonetic Alphabet** in the chart in [1.13]. You do not need to learn all the symbols in the chart right away. The chart is provided so that you can refer back to it whenever you encounter unfamiliar phonetic symbols in the course of reading this book.

[1.13]

Consonants	Bilabial.	Labiodental.	Dental and Alveolar.	Retroflex.	Palato-alveolar.	Alveolo-palatal.	Palatal.	Velar.	Uvular.	Pharyngeal.	Glottal.
Plosive . . .	p b		t d	ʈ ɖ			c ɟ	k ɡ	q ɢ		ʔ
Nasal . . .	m	ɱ	n	ɳ			ɲ	ŋ	ɴ		
Lateral . . .			l	ɭ			ʎ				
„ fricative .			f ɸ								
Rolled . . .			r						ʀ		
Flapped . . .			ɾ	ɽ					ʀ		
Rolled fricative .			ɽ								
Fricative . . .	ɸ β	f v	θ ð   s z   ʃ ʒ	ʂ ʐ	ʃ ʒ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ	
Frictionless Continuants and Semi-vowels . . .	w   ɥ	ʋ	ɹ			j (ɥ)	(w) ɰ	ʁ			
Vowels	Rounded						Front	Centr.	Back		
Close . . .	(y ɯ u)						i y	ɨ ʉ	ɯ u		
Half-close . . .	(ø ɔ)						e ø		ɤ ɔ		
Half-open . . .	(œ ɔ̃)						ə		ɛ œ	ʌ ɔ̃	
							ɐ		æ		
Open . . .	(ɒ)						ɑ		ɑ ɒ		

## Exercises

1. Write a one-page summary of this chapter. Your summary should include the following points:

- (a) the domain of phonetics
- (b) the three main branches of phonetics
- (c) the description of speech sounds
  - (i) The four parameters used to describe consonants are:
    - (a)
    - (b)
    - (c)
    - (d)
  - (ii) The three parameters used to describe vowels are:
    - (a)
    - (b)
    - (c)
  - (iii) The two major types of vowel sounds are:
    - (a)
    - (b)

2.(a) Write down the appropriate phonetic symbol for each one of the sounds described below.

(b) Give an example of a word containing the sound you have written down. Use examples from any language which you know. Underline the relevant sound.

- (i) alveolar lateral
- (ii) voiceless alveolar fricative
- (iii) alveolar nasal
- (iv) voiceless glottal fricative
- (v) voiced bilabial stop
- (vi) voiceless bilabial stop
- (vii) velar nasal
- (viii) voiced dental fricative
- (ix) voiceless alveo-palatal fricative
- (x) voiced alveo-palatal affricate

3. Circle each sound in the following words which matches the description given. Follow the example given in (i).

- (i) a high front vowel  
f æ t fell pat wet full p æ t
- (ii) a low front vowel  
what bad cat saw these eggs

- (iii) a high back vowel  
women suit pool fool blood flood
- (iv) a front vowel  
weed word when hat card hit
- (v) a back vowel  
hut call guard sell soot mist
- (vi) a central vowel  
skin her winter pertain doctor sir
- (vii) a rounded vowel  
her good dumb ball pod cart
- (viii) a high vowel  
we do see ten pan bin
- (ix) a mid vowel  
send card keys school hall you
- (x) a low vowel  
man moon art cup knot teeth
- (xi) a diphthong  
why he may boy tar house bird

## Notes

1. Say 'should' as you would in a casual conversation when uttering a sentence like 'John should go' where there is no emphasis on *should*.
2. For a general introduction to phonetics I refer you to one of a number of textbooks such as Abercrombie (1967), Ladefoged (1982) or Knowles (1987).