This book contains all the material on phonetics. The paragraphs in small typeface contain information which is not required for exam purposes. But much of it is either important for the pronunciation of particular languages or is followed up in later years of the course, so these paragraphs are at least worth noting.

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1. INTRODUCTION.

1.01 What is Phonetics?

Languages can basically be thought of as systems - highly complicated ones - which enable us to express our thoughts by means of “vocal noises”, and to extract meaning from the “noises” (speech sounds from now on!) that are made by other people. Linguistics is the study of the nature and properties of these systems, and its various branches focus on different aspects of the communication process.

Phonetics is the branch concerned with human speech sounds, and itself has three different aspects:

- Articulatory Phonetics (the most anatomical and physiological division) describes how vowels and consonants are produced or “articulated” in various parts of the mouth and throat.
- Acoustic Phonetics (the branch that has the closest affinities with physics) studies the sound waves that transmit the vowels and consonants through the air from the speaker to the hearer.
- Auditory Phonetics (the branch of most interest to psychologists) looks at the way in which the hearer’s brain decodes the sound waves back into the vowels and consonants originally intended by the speaker.

Closely associated with Phonetics is another branch of linguistics known as Phonology. This focuses on the way languages use differences between sounds in order to convey differences of meaning between words, and how each language has its own unique sound pattern. Phonology is really the link between Phonetics and the rest of Linguistics.

In the Phonetics component of ML109 you’ll be concentrating on Articulatory Phonetics, and thinking about the physical basis of speech sounds. This is a necessary first step: units available later in your course will enable you to study the uses to which sounds are put, their acoustic effects, and the way in which they are perceived by hearers.

Warning. The word phonetics is often incorrectly used to refer to the symbols of the International Phonetic Alphabet (the IPA). So people say: “How is this written in phonetics?”, “It was all in phonetics, so I couldn’t understand it”, or “Dictionaries use phonetics to show pronunciation”. This isn’t how the term should be used. As has been explained, Phonetics is a branch of Linguistics, not an alphabet. So the right thing to say is: “How is this written in phonetic script?”, “It was all in phonetic transcription”, or “Dictionaries show pronunciation by using
the phonetic alphabet”. You will of course be introduced to the IPA as you work through this book. Its symbols are identified by square brackets: [p], [u], [ʊ], etc. Ordinary letters and spellings, on the other hand, will always be given in italics. As you see, some of the phonetic symbols are the same as ordinary letters, but others will be new to you.

1.02 Why study Phonetics?

Obviously it’s a fundamental part of Linguistics, so no-one studying this subject can ignore it. But for students of languages, there are also practical advantages to be gained from knowing some basic Phonetics.

Firstly, you should be able to improve your pronunciation of foreign languages if you have a clearer idea of how the sounds are actually produced. Troublesome sounds like French r, German ü or Spanish j lose their mystery and become less daunting once you know how they relate to other more familiar sounds. And there are various general features of the “British accent” which can be characterized by phonetic analysis: when you know what it is that makes British accents so British, you’ll be well on the way to getting rid of yours (if you have one: most people do to some extent at least). What’s more, you’ll be able to look up the pronunciation of words in the dictionary once you’re familiar with the phonetic alphabet.

Secondly, many of you will at some stage or other find yourselves teaching a language to other people: either French, German, Spanish, etc. if you make a career of teaching, or English if you are involved in ESOL (English as a Second Language, also known as EFL: English as a Foreign Language). ESOL is not just a useful source of vac jobs: it is a serious career in itself. And many students spend year 3 of their degree course working abroad as English language teachers.

In all such cases, you are likely to have to help learners to improve their accents. If someone is having difficulty with English th, it’s not much help just to tell them “don’t say it like that, say it like I do”. (Unless they’re natural mimics, in which case they won’t need instruction from you anyway.) Much better if you can guide them to make the appropriate tongue movements, on a basis of your knowledge of phonetics.

In short, Phonetics always looks good on a language teacher’s cv.
1.03 Working through this book.

It contains a chapter describing the organs of speech, a chapter on vowels, a chapter on consonants, and a concluding chapter on phonetic transcription, together with a few suggestions for optional further reading.

There are also a large number of exercises. Some of these are to enable you to check that you’ve absorbed and understood the material covered, others encourage you to think more about the languages you are studying and more particularly to draw on your experience and knowledge of English.

Each week your group tutor will set you some reading and some written exercises to hand in, and will ask you to prepare other exercises for class discussion. It’s important that you should complete all the assignments set: in particular a record will be kept of all your written work, and missing items will be penalized.
2. THE VOCAL TRACT

2.01 Speaking and breathing

All speech sounds in all languages are produced by modifying ordinary respiration. In quiet breathing, air enters and leaves the lungs without any obstruction, passing freely through the throat and mouth (or nose). If, however, the tongue or some other organ is placed in the path of the airstream, this free passage of air is disturbed; the air from the lungs may be set into vibration or the flow momentarily interrupted. For example, the lips close and briefly cut off the airstream for [p] and [b]. Any such disturbance generates a sound wave - a ripple effect that travels through the air between speaker and hearer(s) and is then interpreted as a particular speech sound. Articulatory phonetics studies the various ways in which airstreams can be “interfered with”.

2.02 The source of air for speech sounds

The LUNGS (Fig. 1) are basically sponge-like in design, except that they hold air (in a myriad of tiny airsacs), not water.

When we breathe in, we enlarge the chest cavity (in part by lowering the diaphragm). This in turn expands the lungs, and air rushes in to fill the vacuum. Breathing out involves the opposite procedure. The chest is contracted and air is squeezed out of the lungs, passing through the two BRONCHI (or bronchial tubes), then through the windpipe (more technically the TRACHEA), and finally emerging in the throat.
One or two refinements on this simple picture might be noted in passing (you can study some of them in more detail in later years of the course).

First, we normally speak only while breathing out. It’s also quite possible to speak while breathing in (for example when counting and not wishing to pause to draw breath), but this is an inefficient, awkward way of making sounds and therefore not a regular feature of any language. In some speech-communities, though, people use “ingressive air” as a conventional means of disguising their voices.

Second, there are various ways of making speech sounds with air that doesn’t originate in the lungs. The disapproving noise conventionally represented as tut tut! is an example. Some languages make regular use of “click” sounds like this one, as well as other “non-pulmonic” sounds that from our point of view seem even more exotic.

Third, if we used the same breathing rhythm for talking as for just breathing quietly, we’d have to pause for breath every couple of words. (Try it and see.) In speech, quite complex adjustments of the chest muscles and diaphragm are constantly being made in order to slow down the airstream and hold it back as it leaves the lungs.

2.03 The larynx

The statement above that the airstream “emerges from the trachea (windpipe) into the throat” is actually an over-simplification. Before the air reaches the “throat”, it has to pass through one of the most important speech organs, the LARYNX. It’s at this point that the first possibilities occur of modifying the airstream and generating sound.

The larynx can conveniently be thought of as an irregularly-shaped, hollow box made of cartilage, which sits on top of the trachea. (This is reflected in the non-technical name for it: the “voice-box”.) The front of the larynx can easily be seen and touched: it forms the projection an inch or two below the chin, known as the “Adam’s apple” (more prominent in males than in females - hence presumably the name).

Across the interior of the larynx are stretched two horizontal sheets of muscle tissue. When these are relaxed and wide apart, then the air is free to pass between them. This is how they are held for normal respiration (Fig. 2). But if they are brought together with their inner edges in close contact, then air is prevented from entering or leaving the lungs.
only way in or out is through the larynx cavity, which is now sealed off (Fig. 3). This is the configuration for swallowing: it prevents not only air but, more importantly, foreign bodies from getting into the lungs.

A third possibility is shown in Fig. 4. The sheets of muscle are again in contact, but very loosely this time, instead of being pressed firmly together as they were in Fig. 3. As a result, air is able to pass through, but not freely: it has to force its way, so to speak. This sets the inner edges of the muscles into vibration, and this vibration causes a disturbance in the airstream - i.e. a sound wave. The sound is greatly amplified by the resonance of the mouth and throat cavities, and the result is: the human voice. As a consequence, the inner edges of the muscles stretched across the larynx are known as the vocal folds (alternatively vocal cords or, occasionally, vocal lips). Say aaah, for instance: the sound you’re producing is amplified vocal fold vibration. In essence, the vibration is similar to the effect which you get by folding over a piece of thin paper and blowing between the edges.

The space between the vocal folds is known as the GLOTTIS. So Fig. 2 shows an open glottis, Fig. 3 a closed glottis, and Fig. 4 a vibrating glottis.

The vocal folds also control the pitch of the voice. As with the strings of a musical instrument, the greater the tension, the higher the pitch. The larynx is provided with a number of muscles which, together with the vocal fold muscles
themselves, carry out the complex adjustments of vocal fold tension which take place continually during speech.

The larynx and vocal folds of women and children are smaller than those of adult males: hence the difference between soprano and bass voices. When a boy’s voice “breaks” at puberty, this is due to a rapid increase in the size of the larynx. Subtle and complex adjustments of the glottis give rise not just to “normal” voice at a range of pitches, but also to such varied vocal effects as stage whisper, falsetto or so-called “breathy voice”. But it’s worth remembering that voice is a only secondary adaptation of the “vocal” folds, despite the name. (After all, other mammals and even reptiles have a larynx too.) Biologically the primary function of the larynx in general and the vocal folds in particular, is to serve as a valve for the lungs. As has been mentioned already, it’s advisable to close the glottis firmly when swallowing - we all do so instinctively in fact. A second important reason for having a larynx is that the closed vocal folds, by holding back the airstream, can create a firm column of air in the chest, against which we can push during various kind of physical exertion. Weightlifting, defecation and childbirth all involve a tightly closed glottis!

2.04 Voicing

Although it’s merely a biological by-product, the importance of voice for languages can’t be overestimated. All vowel sounds are normally uttered with the vocal folds in vibration (i.e. they are voiced) and so are around half the consonants. Take [s] and [z], for instance. As we’ll see in more detail later, for both these sounds there is a constriction of the airflow just behind the upper front teeth. The difference between them is that [s] is voiceless (vocal folds held apart in the Fig. 2 position and the airstream able to pass between them unhindered) whereas [z] is voiced, with the vocal folds in the Fig. 4 position and consequently in vibration. You should be able to spot the absence or presence of voicing easily enough if you say [s] ... [z] ... [s] ... [z] loudly several times in alternation. The difference becomes even more obvious if you place your fingers firmly over your ears while doing so.

The same relationship exists between the th in thin and the th in this. This time, unfortunately, the spelling doesn’t show any difference. But by repeating these two words in alternation you should be able to tell that in the case of thin we have a voiceless th and in the case of this a voiced one. The phonetic alphabet uses a separate symbol for each: [t] (read “theta”) for the th of thin and [ð] (read “thorn”) for the th of this. (Apologies for the fact that the name “thorn” actually begins with voiceless [t]. Perhaps ill-advisedly, the [ð] symbol is called after a letter of the Old English alphabet.)

Yet another voiceless/voiced pair is [p] and [b]. Try saying [apa] and [aba] in alternation. In both cases there’s a momentary blockage of the airstream between the lips when the consonant is made. What makes the difference between them is voicing (present for [b], absent for [p]). In fact almost all consonants come in voiced and voiceless pairs - an ingenious use of a single feature (voicing) in order
to double, at a stroke, the number of available sounds.

**EXERCISES**

1. Choose an appropriate term from the list, and insert it into one (or more) of the gaps in the paragraph that follows:

   The __________ supply the air for almost all speech sounds. Air passes from them into the __________, one from each of the two ___________, and these two airstreams merge in the trachea, a short tube situated in the lower part of the neck. On top of this is a valve known as the ___________. Here the supply of air to the throat and mouth is controlled by opening or closing the ___________ - the gap between the two ___________. In ordinary quiet breathing the ___________ is open; for swallowing it is closed in order to protect the ___________. A noteworthy evolutionary adaptation in humans allows voice to be produced by positioning the ___________ in such a way that passage of air between them causes them to vibrate.

2. Say whether the following consonants are voiced or voiceless. The first group have already been mentioned - see if you can answer without looking at the text. For the second group the decision is up to you.

   (a) [z], [t], [b], [p], [ð], [s].

3. The following pairs of words are distinguished in pronunciation partly or solely according to whether they contain a voiced or a voiceless consonant. Say which is the crucial consonant in each case, and specify its voicing status.

   - pin, bin
   - fail, veil
   - toll, dole
   - gin, chin
   - zoo, sue
   - wreath, wreathe ("in smiles")
   - either, ether (a kind of gas)
   - Aleutian, allusion

4. Changing the voicing of a single consonant in each of the following results in a different word. Which consonant and which word? (Sometimes there’s more than one possibility. Concentrate on the pronunciation, not on the spelling.)

   - seal, bicker
   - razor, lunge
   - ice, Jews
   - scarce, choke
   - ankle, thigh
   - dug, Confucian

**2.05 The upper vocal tract.**
The next thing you need to get a clear idea about is the configuration of the cavities through which the air passes once its has left the larynx. These are referred to collectively as the UPPER VOCAL TRACT - “upper” because the vocal tract as a whole includes the larynx as well. You can call it the supra-glottal tract if you prefer (supra is a Latin word meaning “above”). Fig. 5 gives the overall picture:

![Vocal Tract Diagram](image)


You can see from this that the upper vocal tract consists of the mouth and throat cavities (together referred to as the oral tract) and the nasal cavity (or nasal tract). The oral tract has a part to play in all speech sounds. Sounds like [n] or [m] or the nasal vowels of French or Portuguese involve the nasal tract as well, as will be seen later.

Let’s go through the various parts of the oral tract, drawing attention to those that are directly involved in the production (or articulation) of speech sounds, and are therefore known as articulators. A number of consonant sounds will be mentioned in passing in order to illustrate the part played by different articulators, but there’s no need to concentrate too much on individual sounds at this stage: they will be presented in more detail in later chapters.

For the moment you should aim at understanding the location and names of the various “organs of speech” labelled in
Fig. 6. The oral tract from lips to uvula.

2.06 The oral tract from lips to uvula.

a. THE LIPS. These are too familiar to need further comment, and the involvement of the upper and lower lip in sounds like [p] and [b] is also very obvious. (Details about exactly what happens will be provided later.)

b. THE UPPER FRONT TEETH. These are involved for example in the production of [t] and [ð] (as in thin and this), for which the tongue comes into contact with the back of the teeth. As the tongue is the moveable organ which initiates the contact, it is said to be an active articulator, and the teeth, which don't move, are a passive articulator. The lower teeth and the remaining upper teeth don't appear to have any role in language.

c. THE ALVEOLAR RIDGE. Place the tip of your tongue against the rear of your upper front teeth. Then draw it slowly backwards along the roof of the mouth. You'll notice that there is a bulge or ridge just behind the teeth, after which the roof of the mouth rises in quite a steep, domelike way. This bulge is the teethridge - in phonetics more
commonly called the alveolar ridge or alveolum. It’s an important passive articulator for sounds like [t], [d], [s] or [z].
Again the tongue is the active articulator.

d. THE HARD PALATE. This is the steeply rising section of the roof of the mouth behind the alveolar ridge. It serves as a passive articulator in sounds like the h of huge.

e. THE SOFT PALATE or VELUM. If you continue to run your tongue backward along the roof of the mouth (as far back as it can go) you will come to a point where the hard bone of the palate gives way to soft tissue. This section of the roof of the mouth is accordingly known as the soft palate, or, more commonly, the velum. The back of the tongue comes into contact with the velum for consonants like [k] and [g].

The velum is an important organ of speech because it’s moveable and its movement controls the entrance to the nasal cavity. (That’s why it’s soft not hard: it consists of muscle tissue.) Raising the velum so that it’s pressed against the rear wall of the throat has the effect of closing off the nasal tract, so that air is diverted into the mouth (dotted line in Fig. 6). If you want to breathe through your nose, you have to lower the velum (solid line in Fig. 6).
Nasal consonants like [m] or [n] and nasalized vowels are articulated with the velum lowered. For non-nasal sounds (that’s the vast majority), the velum must be in the raised position, so that the airstream passes into the mouth. Note that the velum can’t block the entrance to the oral cavity, even when it’s lowered. So even for nasal sounds, some air enters the mouth. More about this point in 3.08 and 4.09.

f. THE UVULA. This is the extreme tip of the velum, and isn’t directly involved in the closure of the nasal cavity: you can see from Fig. 6 and several of the other figures how it dangles down instead of being pressed against the rear wall. Some r sounds in French and German are made by vibrating the uvula. More about these in 4.11.

2.07 The tongue.

The tongue has long been thought of the speech organ par excellence, even though its biological role lies in tasting and swallowing, not in vocalizing. In many languages the word for “tongue” and the word for “language” are one and the same (French langue, Spanish lengua, Russian iazyk for instance, or tongue in Biblical and Shakespearean English). In actual fact the larynx is also important, as we have seen - but as people are much less conscious of it, it seems to have
attracted less attention.

Anyway, the tongue is certainly involved in the articulation of a large number of sounds, just a few of which have been mentioned above. Its versatility is due to the fact that it consists entirely of nerve and muscle tissue, so it is highly flexible and mobile. You can see from Fig 6 that the tongue is not thin and flat (even though it may feel that way), but has a considerable amount of depth or body.

It’s convenient to consider the tongue as consisting of a number of different sections (see Fig. 6). As there are no clear cut-off points on the tongue itself, these division are somewhat arbitrary, and can vary from one authority to another. But most phoneticians distinguish between the TIP, the BLADE, the FRONT (not a good name, as it’s more like the middle than the front!), the BACK and the ROOT. These articulate against different parts of the roof of the mouth, giving sounds like the s of so (with the blade), the sh of shall (with the front), and so on.

2.08 The pharynx

Even more so than roof of the mouth and tongue, the term throat is somewhat vague and general. (Should it be taken as including the larynx, for example?) Consequently throat isn’t a word that’s used much by phoneticians, who prefer more specific terms. Larynx is one which you already know, and another - not to be confused with it - is PHARYNX. This designates the tubular cavity bounded by the larynx, the root of the tongue and the soft palate, shown in Fig. 6.

You can see from the figure that the pharynx is a kind of crossroads: air passes through it from the lungs to the nasal cavity; food passes through it from the mouth to the oesophagus or food-pipe.

On the face of it, this mingling of food passage and airway sounds a rather unsatisfactory arrangement. And in fact in animals the larynx is situated higher up, so that it’s linked directly with the nasal cavity: no danger of choking for our dumb friends. But a high larynx is much less efficient for the articulation of speech sounds. It looks as though the “low-slung” human larynx has been favoured by evolution, as it allows better vocal communication. That the occasional unfortunate individual should choke to death is presumably a price well worth paying! Incidentally human babies have a high larynx, which “migrates” downwards during the first months of life: a nice example of “ontogeny recapitulating phylogeny”.

In some non-European languages, the rear wall of pharynx serves as a passive articulator. The root of the tongue is pulled back towards it, causing a constriction used for certain characteristically “guttural” sounds in Arabic or Hebrew (see 4.06).

Remember the difference: the larynx is a cartilaginous box immediately above the trachea; the pharynx is the cavity or “crossroads” above the larynx.

2.09 Pronunciation: an acquired skill
Two points by way of conclusion.

Firstly, the structures described above are universal in humans: whatever the race or speech-community, the speech organs are the same. There are of course differences in the size and even precise shape of particular parts of the vocal tract, but differences between individuals in a given speech-community are greater than the average differences between one community and another.

It follows from this that the pronunciation difficulties experienced by people learning a foreign language are due to psychological factors, not to anatomical ones. After the age of 10 or so, most people find it difficult to break away from their native sound system. So someone who finds French r, German ü or Spanish j troublesome doesn’t have anything wrong with their uvula, tongue or velum (or at least this is highly unlikely): it’s just that their brain is finding it hard to adapt to new articulatory habits. A person’s knowledge of his or her mother tongue is in no way congenital. Had you been kidnapped at the age of six months and brought up in France, Germany or Spain - or China or the Amazon Basin for that matter - you’d be speaking the local language in a totally “native-like” manner ... and no doubt having problems with English.

EXERCISES.

5. Show where the following are situated on this diagram of the upper vocal tract:  
   1. blade of tongue, 2. front of tongue, 3. velum, 4. pharynx, 5. larynx, 6. uvula, 7. alveolum, 8. root of tongue.