PART ONE

PHONETICS AND PHONOLOGY

This book is about sound in language. The first distinction we must draw is between sound as sound ("phonetics") and sound structure ("phonology"). By sound as sound we mean the sound we make with our vocal organs when we speak, an activity equivalent to the playing of the instruments by an orchestra: it is as if we were all carrying an orchestra in us! These sounds have their own physical characteristics, which can be described: here we focus on the description of the movements we make with our organs in order to produce such sounds ("articulatory phonetics"). The sounds made by an orchestra are not random, however, but, rather, the materialization of a symphony. Similarly, the sounds we make when we speak any particular language implement the particular symphony that constitutes the phonic structure of that language ("phonology"). Here we differentiate two levels, which we can illustrate with the two *p*s of the English word *paper*: they are the same "sound", but still sound different. They are the same sound in as much as they are not *b*s, or *t*s, or *k*s, etc. They sound different in as much as you could conceivably blow out a candle with the first *p* of *paper*, but not with the second one. Therefore, the message is that each language possesses an inventory of distinctive sounds ("phonemes" or "lexical segments", depending on the theoretical framework), but that each of these sounds can have a number of different realizations ("allophones" or "surface sounds"), contingent on environmental conditions, a bit like the way we dress up warmly when we climb up a frozen mountain, but undress when we lie in the sun on a beach: one important source of sound alternation thus concerns "contamination" by neighbouring sounds, a process globally known as "assimilation". In order best to understand assimilation, and other alterations of sound, we decompose sounds into atomic units, or "features", to which we grant a certain degree of mutual autonomy: a *p*, therefore, is not a *p*, but a web of interconnected features, just as the hand with which we write is basically a constellation of molecules. The distinctive features of sounds are grounded in the gestures involved in their articulation, and thus in phonetics. Formally, features connect to each other by means of "autosegmental" lines. Sound processes mapping lexical sounds onto surface sounds (equivalently, but not identically, phonemes onto allophones) involve readjustments of such lines, a bit like a game of musical chairs. The linearization of

speech is expressed in a line, or "tier", of abstract timing units, also known as the "skeleton": long sounds, like the *o* in *vote* or the *ee* in *feet*, are associated with two such units, and short sounds like the *o* in *cot* with one. The introduction of the skeleton allows us naturally to differentiate processes involving length changes from processes involving changes in the substance of the segments.

CHAPTER ONE

HOW ARE SOUNDS MADE?

THE PRODUCTION OF OBSTRUENTS

Chapter Objectives

In this chapter you will learn about:

- What is characteristic of speech sounds.
- The organs involved in making speech sounds.
- How we create an airflow from the lungs and then interrupt it to produce a variety of sounds.
- The specific ways in which such an interruption is implemented.
- The parts of the mouth active in the production of speech sounds.
- The role of humming in increasing the number of speech sounds.
- How to write speech sounds down in an unambiguous way.

The primary aim of this book is to present the principles and practice of current phonology in a manner which is both accessible and stimulating to the uninitiated reader. Phonology is the study of linguistically significant sound patterns, that is, of the organization of the sounds of speech. This definition will become clearer as we proceed. In order to study the organization of speech sounds, we must first be able to identify the sounds themselves, and we make a start on this task in the present chapter.

Phonology is the study of linguistically significant sound patterns

1 Speech Sounds

We can compare the act of speaking with the act of playing a recorder, with which many of us are familiar from childhood. You may of course substitute any similar instrument: the analogy will still hold. To start with, when you want the recorder to produce a noise, you have to blow air from your lungs through the mouthpiece. The sounds that we produce when we speak also need to be powered by air from the lungs. In fact, the physical act of speaking can be likened to "playing" our mouths and larynxes with the air coming out of the lungs through the windpipe linking the lungs to the mouth, technically known as the "trachea". The LARYNX is of course the voice box

The act of speaking can usefully be compared with the act of playing a recorder

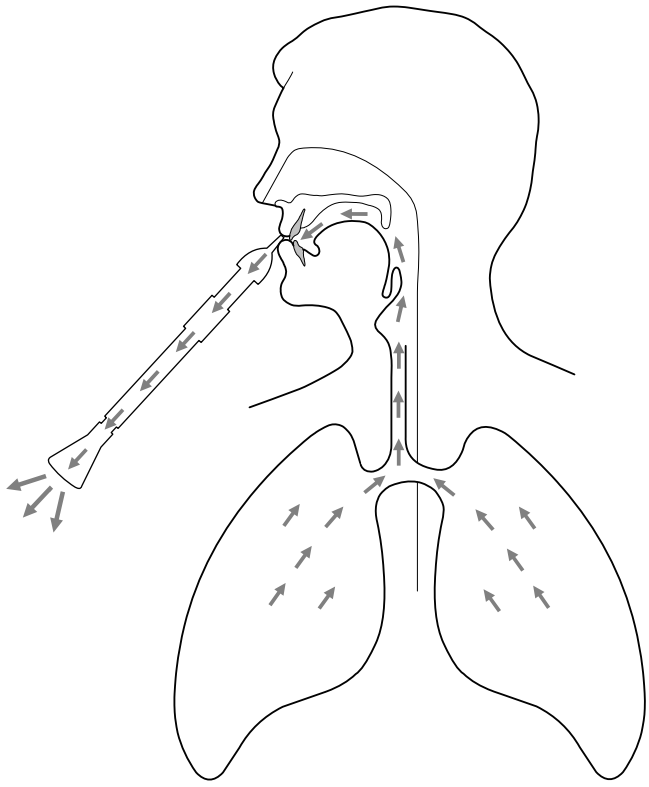

Figure 1.1 Playing a recorder

at the top of the trachea, which in the throat of males protrudes as the Adam's apple. A picture is worth a thousand words, and therefore we will adopt the practice of illustrating many of our statements with drawings (figures 1.1 and 1.2, above and on the next page, respectively).

At this point, a question arises. We take air into our lungs and let it out again every time we breathe. How come then that we are not continuously producing speech sounds? An easy experiment will give the answer. Quite simply, if you pick up a recorder and place the mouthpiece to your lips while breathing normally, you will find that the recorder only makes a faint wheezy sound, and that in order to play the recorder you need to discharge an extra amount of air. In the same way, if you wish to make a speech sound, you must breathe out more air than usual, and, of course, in order to breathe out more air, you must have taken in more air in the first place.

Compare for yourself the difference in the intake of air when you prepare to speak and when you are breathing normally.

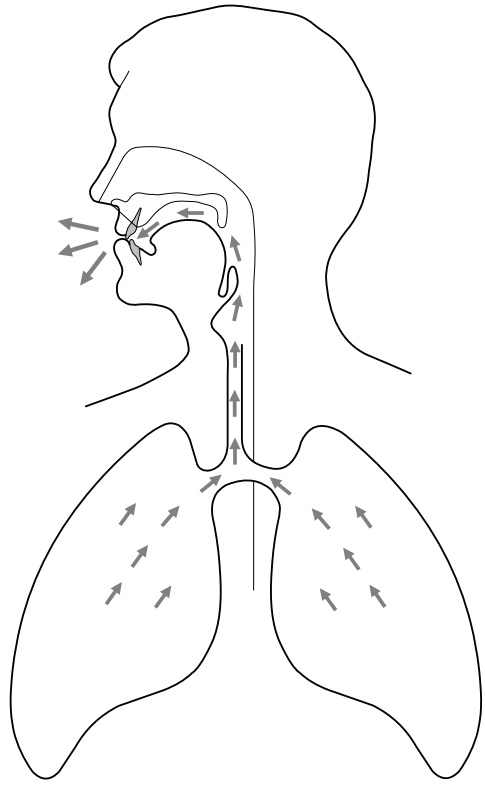

Figure 1.2 Speaking

You have now got the recorder making a noise. In order to play a tune, however, you need to do more than blow extra air through the recorder. Specifically, you need to move your fingers over the different holes on the body of the instrument. Why? Suppose you leave all the holes uncovered. Air will then come out through all the holes simultaneously, and the recorder will play a single note. Covering different holes at successive times will, however, enable you to produce different sounds. By covering (some of) the holes you are effectively putting up obstacles to the exit of the air through those holes. Similarly, in order to make the various speech noises, we have to interfere in various ways with the flow of the air on its way out through the larynx and, especially, the mouth. We will now look at some of the ways in which we "play" our vocal organs, starting off with the mouth.

Think for a minute or two about the analogy between playing the recorder (or any other such instrument) and making speech sounds.

2 Fricatives: Place and Manner of Articulation

Suppose that you place your lower lip loosely on the lower edge of your upper teeth and force air out of the mouth, after having filled your lungs aplenty. The situation is depicted in figure 1.3 (any new technical terminology in the drawings will be explained directly).

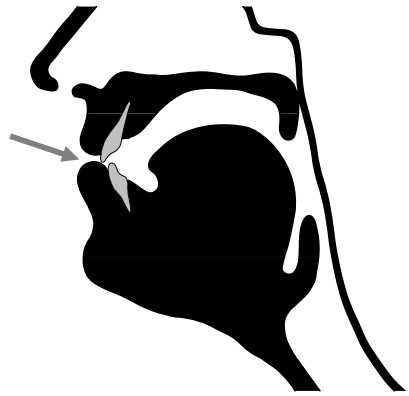

Figure 1.3 Labiodental fricative

What will happen? The obstacle you have created by the loose contact of the lower lip with the upper teeth does not totally block off the air, and therefore air will continue to flow out.

> Test the accuracy of this statement, with the help of a mirror if necessary: notice that the mirror gets misted up if you hold it close enough to your mouth.

Because the teeth and the lip are touching each other, the air rushing past will cause friction, and therefore a noise will be produced.

> Feel this friction and hear the air escape as you repeat the previous experiment.

The noise made by the air escaping between the lower lip and the upper teeth will sound exactly like the *f* at the beginning of *fat*, simply because this is how *f* is made, or "articulated". The ARTICULATORS of *f* are thus

the lower lip and the upper teeth, hence the label LABIODENTAL given to this type of sound: *labial* is a Latin-based adjective meaning 'of the lips', and *dental*, related to *dentist*, means 'of the teeth'. Because the noise made by the air escaping through the obstacle being described is caused by friction, we refer to this type of sound as a FRICATIVE. Accordingly, the sound *f* at the beginning of ***f****at* can be (partially) described as a "labiodental fricative".

> Explain to yourself the meaning of this (composite) label without looking at the text.

"Labiodental" defines the place where the sound is made, its PLACE OF ARTICULATION, and "fricative" defines the manner in which the sound is made, its MANNER OF ARTICULATION.

Where a sound is made is its PLACE OF ARTICULATION. How a sound is made is its MANNER OF ARTICULATION

3 Phonetic Transcription

The labiodental fricative we have just discussed is the first of a range of fricative sounds which we are going to explore. Before we do this, however, it will be useful to introduce a method to write sounds down. An analogy with numbers will make the issue clearer. We call a certain number, say, "one thousand five hundred and sixty-five", but we do not usually write out this lengthy expression; indeed, calculations would be very difficult if we did. Instead, we use a shorthand version with the four digits one-five-six-five: 1565. In a similar way, we can and shall use a single symbol as a shorthand for the phrase "labiodental fricative".

How are we going to write down speech sounds? At first sight, this looks like a rather silly question – surely we already have a method of writing down speech sounds: we call it a "spelling system", the very one we are using right now to put our thoughts on paper. So, you may think, of course we are going to write the first sound of *fat* as *f*, the second sound as *a*, and the third sound as *t* – what else is the spelling there for? Well, there is actually something rather unsound about this line of reasoning. One example will bring out the problem. If indeed we are going to write the first sound of ***f****at* as *f* because that's the way it's spelled, are we also going to write the last sound of *lau****gh*** as *gh* because that's the way it is spelled, and the first and the penultimate sounds of ***ph****iloso****ph****y* as *ph*? The point is that the first sound of ***f****at* and the last sound of *lau****gh*** are identical, but their spellings are not. This is a bit like writing the number one sometimes as "1", and other times as "4", "23", etc.: clearly confusing! In fact, of course, there is no

reason not to write "one" with the same symbol every time, say, as "1". The reasoning carries over to sounds. The best system of representation is thus one where the same symbol is always and only used for the same sound. This way there will be a one-to-one correspondence between each sound and each symbol, and we will be able to work out what sound we are referring to just by looking at the symbol – always assuming familiarity with the table of sound-symbol correspondences, which we will be supplying as we go along.

Ordinary English spelling is very far from being an adequate system for transcribing sound

Clearly, ordinary English spelling is very far from being an adequate system for transcribing sound. In fact, no conventional spelling of any living language is, but English orthography is notoriously further removed from the ideal than average, as highlighted by Bernard Shaw's famous witticism that the word *fish* could equally well have been written *ghoti*: *gh* as in *lau**gh***, *o* as in *w**o**men*, and *ti* as in *na**ti**on*.

> Provide a few other alternative (perhaps facetious) spellings for a handful of English words. Explain their rationale.

English spelling is based on the late medieval pronunciation of English, and is indeed grossly inadequate for representing the way the modern language sounds. Awareness of spelling shortcomings spurred on the birth of systems of phonetic transcription in Britain and other European countries from at least the sixteenth century. At the end of the nineteenth century, a group of language teachers and phoneticians led by the Frenchman Paul Passy set up the International Phonetic Association and devised one such transcription system – soon to join was the British phonetician Henry Sweet, traditionally thought to have inspired the character of Professor Higgins in *Pygmalion*/*My Fair Lady*. The transcription system of the International Phonetic Association was gradually enriched to make it applicable to all languages, and it has by now been adopted by most practising phoneticians the world over. The system is known as the "alphabet of the International Phonetic Association", "IPA alphabet" for short. It is called an alphabet because it is based on letters – in fact, as we will see, essentially the letters English is spelled with, the Roman alphabet. The chief remit of the International Phonetic Association is to ensure the well-being of the international phonetic alphabet, which it regularly updates and publicizes.

The goal of the IPA alphabet is to have each symbol always stand for the same sound, and only for that sound, and, conversely, to have each sound always represented by the same symbol

From now on, when we describe a sound, we will also give its IPA symbol. Remember that the goal of the IPA alphabet is to have each symbol always stand for the same sound, and only for that sound, and, conversely, to have each sound always represented by the same symbol. You will be pleased to learn that the IPA symbol for the first sound in ***f**at* that we have been describing is [f]: conventionally, phonetic symbols are enclosed in square brackets.

You should equally not be surprised to hear that [f] also represents the last sound in *lau**gh***, and the first and penultimate sounds in ***ph**ilosо**ph**y*.

Square brackets are conventionally used to enclose phonetic symbols

Why are we saying that you should not be surprised at the identity of phonetic symbol for *f*, *gh* and *ph* in the given words?

4 A Hissing Fricative

We now proceed to the description of other fricative sounds. How does the articulation of the sound at the beginning of ***s**ip* differ from the articulation of [f]?

Explore ffff and ssss for yourself before reading on (it is good practice to read out phonetic symbols as the sound they represent, rather than in the way letters are usually read out in English).

When we pronounce *s*, as in ***s**ip*, we place either the "blade" or the "tip" of the tongue close to the ridge out of which the top teeth grow. The BLADE is easily recognizable as the most mobile and versatile part of the tongue, located behind the front point, itself known as the TIP (many non-specialist people actually call the whole blade of the tongue the "tip"). The blade is in fact the part of the tongue that sticks out most easily (figures 1.4 and 1.5).

The BLADE is easily recognizable as the most mobile and versatile part of the tongue, located behind the TIP

Figure 1.4 The tip and blade of the tongue

Figure 1.5 Alveolar fricative

If you blow air through the narrow gap between the blade of the tongue and the upper tooth ridge, in the manner you did through the gap between the lower lip and the upper teeth for [f], a hissing noise will be produced, which we transcribe as [s].

> Pronounce the two sounds [f] and [s] in succession, paying close attention to the different positions of the vocal organs. A useful technique to help awareness of precisely what bits of the vocal anatomy are involved in making a particular fricative sound consists in pronouncing that sound and then, without changing the position of the articulators, inverting the direction of the airflow, that is, breathing in, instead of breathing out: you will feel distinctly cold at the site of the friction.

Now some terminology in connection with [s]. Because [s] is articulated on the (upper) tooth ridge, it is given the label ALVEOLAR: *alveolus* is the Latin word for 'socket', and the teeth obviously grow out of "sockets", hence the expression "alveolar ridge". We can therefore describe [s] more fully (but still partially) as an "alveolar fricative".

> Say which of the two words making up the expression "alveolar fricative" describes the manner of articulation, and which the place of articulation.

Note that, strictly speaking, we ought to use the label "linguoalveolar": both the alveoli and the tongue, *lingua* in Latin, contribute to the articulation of [s]. The prefix *linguo-* is omitted on the grounds that the tongue is the organ most commonly involved in sound articulation, its intervention therefore being taken for granted in the absence of information to the contrary.

5 A Fricative in the Back of the Mouth

We have now described the articulation of two fricative sounds pronounced in the front region of the mouth: [f] (labiodental) and [s] (alveolar). The mouth is quite a big cavity, and other parts of it can also be used in sound production. In fact, there are so many locations available that typically languages do not make use of all of them.

The tongue is the most important articulator, and is almost exclusively composed of muscles, eight in all, some of them quite long – surprisingly so when you consider we can comfortably tuck the whole lot into the mouth. In addition, the wealth of innervations and the complex arrangements of the fibres of its muscles give the tongue a remarkable degree of versatility, which makes it particularly apt for the articulation of speech sounds. Consequently, there are many sections of the tongue available for contact with the structures that lie above it from the teeth to the pharynx. Note that, contrary to popular belief, the PHARYNX is the backmost part of the mouth, above the larynx, rather than the uppermost part of the throat (pharyngitis is therefore an inflamed back mouth, rather than a sore throat). See figure 1.6.

There are many sections of the tongue available for contact with the structures that lie above it from the teeth to the pharynx

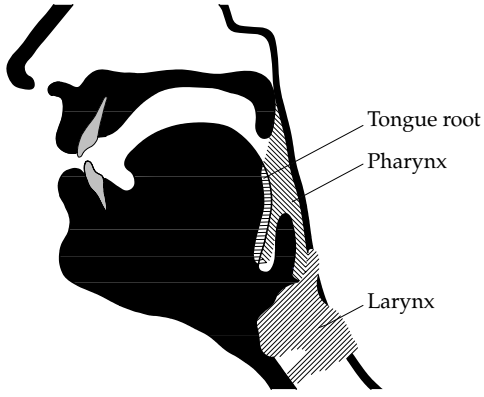

Figure 1.6 The pharynx, larynx and tongue root

We have explained that [s] is made by positioning the blade of the tongue in the vicinity of the alveolar ridge. Suppose, instead, that you make the constriction at the back of the palate, that is, in the soft palate region. The PALATE is commonly referred to as the "roof of the mouth", and the SOFT PALATE is the soft area of the palate at the back. The technical term for the sounds made at the soft palate is VELAR, from VELUM, the anatomical word for the soft palate, derived from the Latin word *velum* 'veil' (figure 1.7).

Identify the soft palate by curling back your tongue tip and feeling the palate as you move the tongue backwards: you will notice that the front and middle areas of the palate are hard, but the back area is soft, since it is not supported by bone, hence the label "*soft* palate".

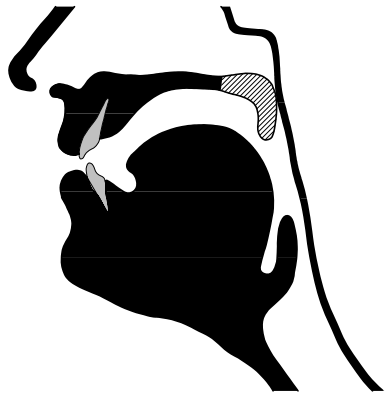

Figure 1.7 The soft palate

Clearly, the quickest and most comfortable way of creating a velar stricture will not be with the blade of the tongue, as the feeling exercise just suggested is likely to have revealed. Instead, it will be more convenient to use the part of the tongue which normally lies under the soft palate: the back part of the body of the tongue. The BODY is the section of the tongue behind the blade, more massive and less mobile than the blade (figure 1.8).

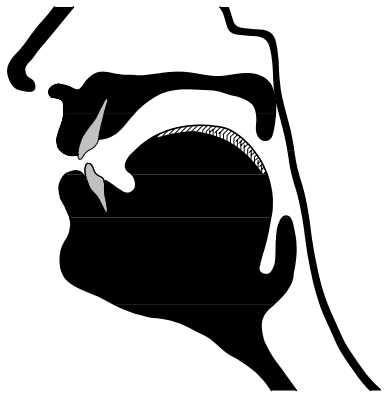

Figure 1.8 The body of the tongue

Indeed, the ACTIVE and PASSIVE ARTICULATORS involved in the production of a sound, that is, the articulator that moves and the inert articulator, more often than not lie directly opposite each other. Suppose now that you move the back of the body of the tongue up towards the soft palate, to create the same sort of narrow gap as for [f] and [s] (figure 1.9).

ACTIVE and PASSIVE ARTICULATORS more often than not lie directly opposite each other

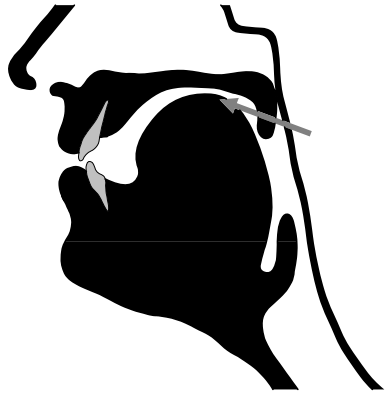

Figure 1.9 Velar fricative

The air rushing through will produce the sound that occurs at the end of *lo**ch*** as this word is pronounced in Scotland, and also the sound in such German words as *a**ch**t* ('eight') or *Ba**ch*** (the composer).

> Try this sound making sure that the airflow is not completely blocked, or else you will produce a sound more like the sound that corresponds to *k*, which we shall discuss below.

The phonetic symbol for this sound is [x]. You must of course not confuse this symbol with the letter *x*, which in English corresponds to two successive sounds.

> Work out what the two sequential sounds spelled as *x* are by pronouncing such words as *exam* and *box* (we will provide the answer in due course).

On the other hand, [x] is spelled *ch* in both Scots and German, therefore with two letters, despite being a simple sound. The spelling of [x] in other languages confirms the arbitrariness of spelling conventions: as either *g* or *j* in Spanish (depending on the vowel that follows), and as *h*, as well as *ch*, in

Polish. In the face of this diversity, the usefulness of a truly international standard for the representation of language sounds should be becoming obvious.

6 A Laryngeal Fricative

We shall now present another fricative sound which is pronounced even further back than [x]. In fact, it is articulated so far back that it is not articulated in the mouth at all, but rather in the larynx – as we said above, the larynx, or voice box, is the part of the throat that can stick out as the Adam's apple: we give cross-sections of the larynx in figure 1.10 below. The sound we are now introducing occurs at the beginning of the word ***h****igh*.

The larynx is the part of the throat that can stick out as the Adam's apple

Pronounce this sound by itself: you should get something like a strong exaggerated puff, the noise you make when you blow condensation onto a pane of glass.

Clearly, there is no obstacle to the airflow in the mouth here, and yet one can distinctly hear friction. What is happening, then?

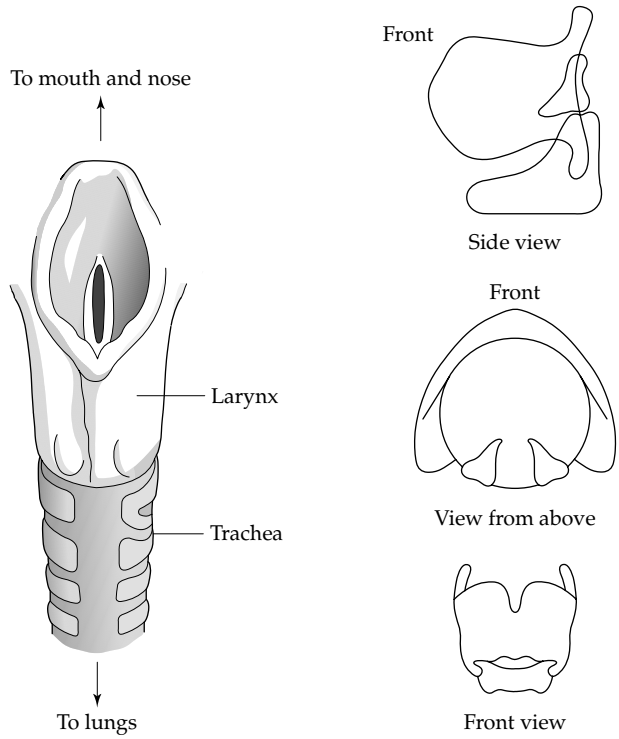

Figure 1.10 The larynx

When the air comes up the windpipe, it obviously has to pass through the larynx before reaching the mouth. Anatomically, the larynx is a cylindrical frame made up of cartilage, across which stretch two folds of muscle, called the VOCAL FOLDS – also, and perhaps more commonly in a non-linguistic context, VOCAL CORDS, a somewhat misleading term anatomically. The vocal folds are shaped like a pair of small lips and are highly mobile – they are responsible for the sudden reflex movement that prevents us from choking when a foreign body threatens to make its way into the windpipe (figure 1.11).

The larynx is a cylindrical frame made up of cartilage, across which stretch two folds of muscle, called the VOCAL FOLDS

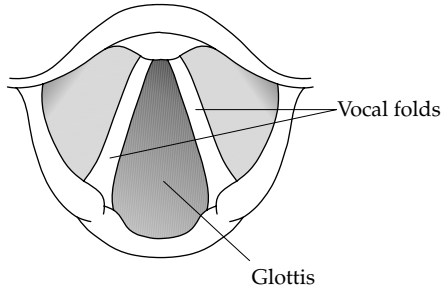

Figure 1.11 The vocal folds

In order to create the necessary friction for [h], the sound under observation, we position the vocal folds near each other to create turbulence in the airflow, but not so close together that they vibrate, as they do when we hum (figure 1.12).

Try making a longish [h]. Now hum. Alternate between [h] and humming, trying to get a feel for the respective states of the vocal folds.

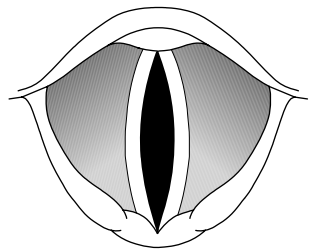

Figure 1.12 Glottal friction

The space surrounded by the vocal folds is known as the GLOTTIS, and therefore [h] is said to be a GLOTTAL fricative.

7 Voice

We have just mentioned humming, and a sort of humming plays a very important role in the production of many of the sounds of speech.

If you bring the vocal folds together closer than for the fricative sound [h], and tighten them somewhat, although not so much as simply to stop the airflow, the air passing through will cause them to vibrate, giving a humming effect (figure 1.13).

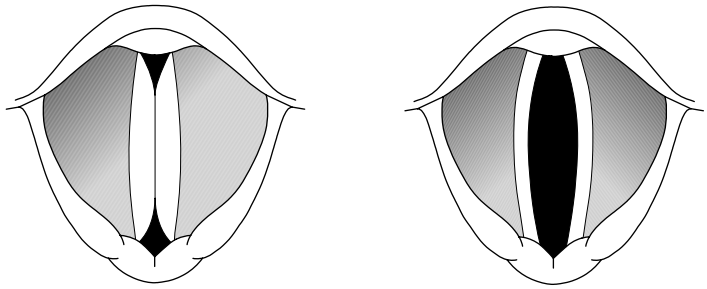

Figure 1.13 Positions of the vocal folds during voicing (initial and widest aperture)

You will feel the vibration of the vocal folds for yourself if you put your index finger and thumb on either side of the larynx and hum. Also, if you hum with covered ears, you will hear the hum as a buzz.

When the vocal cords are brought close together and tightened somewhat, the air passing through causes them to vibrate, giving a humming effect known technically as VOICE

This humming effect is known technically as VOICE. Voice can be superimposed on any of the sounds that we have already practised, just as we could get the combined sounds of a trumpet and a clarinet by playing the two instruments plugged into one another, with the same airstream powering both instruments: the mouth "instrument", which gives us the majority of the fricative sounds we have examined, is in effect permanently plugged into the larynx "instrument", with which we obtain voice. Clearly, this new set of sounds, composed of oral friction (that is, friction at some place in the mouth) and voice (that is, vibration of the vocal folds) will sound different from the simple set of voiceless sounds we have been reviewing so far: in this way, we will effectively double the inventory of speech sounds.

If you repeat the action by which you produced [f] in *fat* and superimpose voicing, the result will be a different sound: instead of *fat*, you will get *vat*. The two articulators, the teeth and the lower lip, are in the same position for both sounds (see figure 1.3 above), which are only differentiated with regard to voicing. The phonetic symbol for this new sound is, unexcitingly, [v].

> Place your finger tips on either side of the larynx, and pronounce [fffvvv]: as before, you will be able to feel the voicing as tickling. Now alternate the sounds [fvfvfvf] to gain further control over voice production.

The two other oral fricative sounds we described above also have voiced analogues. If you add vocal fold vibration to the [s] in *sip*, you will hear *zip*. Therefore, the only difference between [s] (as in *sip*) and [z] (as in *zip*) is again voicing: [s] is voiceless, and [z] voiced.

> Repeat the experiment you just carried out substituting [sz . . .].

Adding voicing to the sound at the end of *lo**ch*** does not give us a common sound of English. This is not terribly surprising, since [x] itself is not a sound of modern English either – *loch* is originally a Gaelic word, and most non-Scottish speakers of English pronounce it like *lo**ck***. The voiced velar fricative [ɣ] (a phonetic symbol resembling the Greek letter gamma) is found in Greek and Arabic, among other languages.

> Assuming you are not familiar with either language, try to pronounce [ɣ] by composing it out of the more familiar [x] and (crucially, simultaneous) voicing.

We have now presented four voiceless fricatives ([f], [s], [x] and [h]), and three voiced ones ([v], [z] and [ɣ]). Voicing of [h] may appear impossible, since the organ responsible for the friction of [h], the vocal folds, is also the organ responsible for voice: it would seem out of the question to have one and the same instrument execute two apparently incompatible actions simultaneously. Surprising though it may seem, we can indeed perform this feat, given a bit of vocal fold gymnastics: the vocal folds must be placed

close together at one end whilst held a little further apart at the other end. The closed end vibrates, while at the more open end there is air friction (figure 1.14).

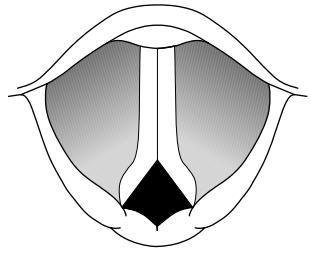

Figure 1.14 The position of the vocal folds for voiced *h*

In order to identify the new sound, you can compare the *h* of ***h****ead* with the *h* of *a****h****ead*. In ***h****ead*, there is no vocal fold vibration on the *h*, whereas in *a****h****ead* voice runs through the entire word.

> Pronounce both tokens in succession, paying attention to the noted voice difference in the *h*. You can also try a phrase like "He arrived *ahead* of me because he had *a head* start".

We must of course differentiate graphically between the two types of *h*, and accordingly we use the phonetic symbol [ɦ] for the voiced *h*. This sound completes our initial survey of fricative sounds, which we now tabulate (table 1.1). Notice that the two relevant criteria for the classification are place of articulation and voicing.

Table 1.1 Fricatives (first inventory)

	Place of articulation			
	Labiodental	*Alveolar*	*Velar*	*Glottal*
Voiceless	f	s	x	h
Voiced	v	z	ɣ	ɦ

8 The Stop Gesture

We now know that the common denominator for fricatives is the gesture with which these sounds are produced: the two articulators are held close together, but not so close that the air is prevented from getting through and causing friction. Obviously, if the contact is tightened up, the airflow will be interrupted. Surprising though it may seem, momentarily stopping the airflow is another common method of producing speech sounds: another "manner of articulation". We shall now examine exactly how this is done.

Clearly, if you simply block the air, no sound will be made.

> Demonstrate this to yourself by trying to blow air out with closed lips. As long as the lips remain closed (and no air comes out through the nose) there will be no sound: all that will happen is that your cheeks will quickly fill with air.

However, if after blocking the airflow for a fraction of a second, you abruptly release the closure to allow the air to rush out, a sound will be produced. For instance, if you close both lips tightly and then open them suddenly, you will hear the sound [p], corresponding to the spelling *p* in the word *spy* – do bear in mind, however, that you need to have built up sufficient air pressure in the lungs for the "vocal instrument" to "sound" at all. The type of sound we are now introducing is obviously not a fricative, because the main phase of its realization does not involve the slow friction that characterizes fricatives. Instead, the articulation of [p] involves air stoppage, hence the generic name STOPS given to these sounds (figure 1.15).

If, after blocking the airflow for a fraction of a second, you abruptly release the closure and allow the air to rush out, a STOP sound will be produced

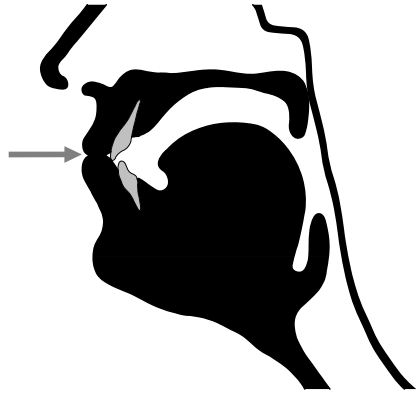

Figure 1.15 Bilabial stop

Practise the bilabial stop [p] comparing it with the labiodental fricative [f]. You will notice that during the production of the fricative there is sound all the way through, even though the vocal folds are not vibrating. When you switch to the stop, however, there is no sound until the air is released.

If you vibrate the vocal folds during the closure phase of the lips, you will hear the sound [b] of the word *obey*.

Repeat the previous exercise with the words *sober* and *over*. Notice how both [b] and [v] involve vocal fold vibration.

The sounds [p] and [b] share both manner of articulation and place: they are stops and BILABIAL, since they are articulated with both lips. Therefore, [p] and [b] only differ with regard to voice.

9 More Stops

We shall now describe the stop correlates of the rest of our by now familiar fricatives. If you place the blade of the tongue roughly in the same position as for [s], but this time interrupt the airflow by tightening up the contact, you will get the [t] of the word *sty* (figure 1.16).

Figure 1.16 Alveolar stop

If you increment [t] with voicing, the result will be the [d] of *a**d**orn*. What will happen if you stop the air by placing the back of the tongue against the soft palate, in approximately the same position as for the fricatives [x] and [ɣ]? The respective stop sounds will now be [k], without voicing, as in *s**k**y*, and [g], with voicing, as in *a**g**ain* (figure 1.17).

Figure 1.17 Velar stop

> Compare *loch* with *lock* and notice that in the latter word the last sound involves a complete blockage of the air-passage by the tongue, whereas in the Scottish pronunciation of the former no such stoppage occurs.

We now have all the information we need in order to give the promised phonetic interpretation to the English letter *x*: the *x* of *bo**x*** corresponds to the sound sequence [ks] (notice that *bo**x*** rhymes with *so**cks***), and the *x* of *e**x**am* to [gz] (compare *e**ggs***).

The remaining fricatives in the inventory in table 1.1 are [h] and its voiced counterpart [ɦ]. They are both glottal, as their production involves air friction in the glottis – remember: the space surrounded by the vocal folds. Does either of these fricatives have a stop counterpart? If you say *ah* (as when asked to do so by the doctor), then close the vocal folds, and then open them again with another *ah*, the result will be the sound that is thought of as a "dropped *t*", heard in words like *butter* or *bottle* in many British accents (in *bottle* also in some American accents).

> Pronounce a few such dropped *t*s to become aware of the mechanics of this sound.

The technical name for this "dropped *t*" is, unsurprisingly, GLOTTAL STOP (figure 1.18).

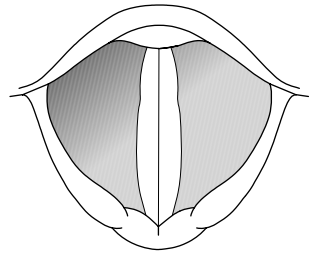

Figure 1.18 Glottal stop

In order to pronounce a glottal stop, the vocal folds come together to close the glottis, causing a momentary break in the airstream. This closure is then released suddenly, exactly as with the remainder of the stops. The gesture involved in making the glottal stop is in fact similar to the gesture involved in coughing. Glottal stops do have to be voiceless, since it is not possible for the vocal folds to vibrate if no air is passing through, just as it is impossible for a flag to flap in the absence of wind. The phonetic symbol for the glottal stop looks like a question mark without the dot: [ʔ].

The addition of [p], [b], [t], [d], [k], [g] and [ʔ] notably enlarges our inventory of speech sounds, as we now encode in table 1.2, which obviously supersedes table 1.1 above.

Table 1.2 Stops and fricatives (second inventory)

			Place of articulation				
			Mouth				*Larynx*
			Bilabial	*Labiodental*	*Alveolar*	*Velar*	*Glottal*
M		*Voiceless*	p		t	k	ʔ
a	*Stops*						
n		*Voiced*	b		d	g	
n		*Voiceless*		f	s	x	h
e	*Fricatives*						
r		*Voiced*		v	z	ɣ	ɦ

Try out the articulation of each of the sounds represented by each of the symbols in this table.

10 Still More Fricatives

Fricatives and stops made in the mouth are known as OBSTRUENTS

Fricative and stop sounds with the obstruction to the airstream in the mouth are known as OBSTRUENTS: the glottal sounds [h], [ɦ] and [ʔ] are therefore not considered obstruents. In stops, the obstruction takes the form of a total blocking of the air, while in fricatives the air forces its way through the obstruction. You may well think that the list in table 1.2 exhausts the inventory of obstruents. In fact, there are quite a few more in store, even if we don't look beyond English.

The sounds we will now examine also come in voiced–voiceless pairs. If you place the blade of the tongue on either the inside or the edge of the upper teeth, allowing the appropriate narrow gap for friction, you will get the sound at the beginning of ***th****igh* if you don't voice, and the sound at the beginning of ***th****y* if you superimpose vocal fold vibration (figure 1.19).

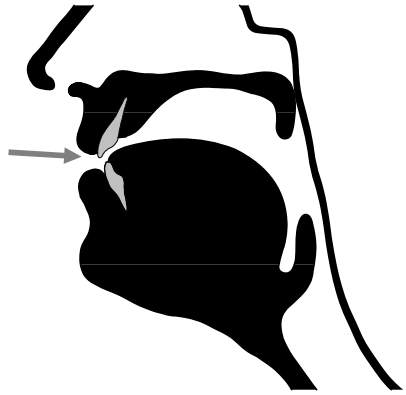

Figure 1.19 Dental fricative

Notice that our spelling system cannot distinguish between these two sounds, but the phonetic alphabet of course must. The respective IPA symbols are [θ] (the Greek letter "theta"), for the voiceless sound in ***th****igh*, and [ð] (the Old English letter "eth"), for the voiced sound in ***th****y*.

Place your fingers on either side of the larynx or cover your ears and feel the difference between these two sounds, [θθðð], as you did in the earlier experiment with [f] and [v].

Note that it is also possible to make stop sounds on the inside of the upper teeth. Indeed, this is the place where speakers of Spanish pronounce their *t*s and *d*s (as also do some speakers of English). This is also the usual rendering by Southern Irish speakers of the common English sounds [θ] and [ð], which thus still remain distinct from the alveolar stops [t] and [d].

Compare the difference in both sound and feel between the *t* and the *d* made by placing the tongue blade against the tooth ridge (as in most accents of English), and the *t* and the *d* made by placing the blade against the back of the upper teeth.

Another fricative we have not yet discussed is the first sound in ***sh****ip*, also used extralinguistically to call for silence (*shhh*!). The phonetic symbol for this sound is [ʃ]. English spelling has some difficulty in representing [ʃ] – normally *sh*; but also, if followed by a vowel, *ti*, as in *ra****ti****on*, or *si*, as in *man****si****on*; and even, if followed by *u*, as a simple *s*, as in ***s****ure*. The articulation of the sound [ʃ] involves drawing the blade of the tongue to the area where the tooth ridge joins the hard palate – the part of the roof of the mouth which feels hard, as we mentioned above.

Practise pronouncing [ʃ] to see exactly how you make it. Pay successive attention to the action of the tongue and to the position of the lips: the gap for [ʃ] is in fact slightly wider than the gap for [s], and there is also a simultaneous slight rounding of the lips.

Because their place of articulation straddles the palate and the alveoli, sounds like [ʃ] are known as PALATOALVEOLARS (figure 1.20 below).

Notice that the composite label "palatoalveolar" defines the passive articulator. Which is the active articulator for these sounds? Why is it not usually included in the descriptive label?

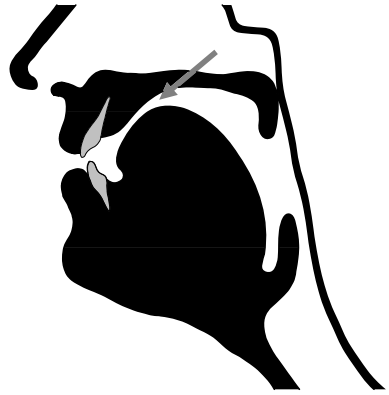

Figure 1.20 Palatoalveolar fricative

If you add vocal cord vibration to [ʃ], you get a sound which, although also used in English, has no specific representation in the English spelling system. This sound is found in the ordinary word *meas**u**re* and in the loanword *rou**g**e*, and its phonetic symbol is [ʒ]. This is also the sound which appears in French at the beginning of ***g**enre* 'class, kind' or ***J**ean*, the French equivalent of *John*.

> Practise the voiceless–voiced pair of sounds [ʃʃʃʒʒʒ]. Now compare [ʒ] with [z] as you did earlier with [ʃ] and [s].

Some authors, particularly in North America, use the symbol [š] for IPA [ʃ], and [ž] for IPA [ʒ].

11 Affricates

There is a third and final type of obstruent which is a composite of a stop and a fricative made in rapid succession, without changing the position of the articulators. These sounds are known as AFFRICATES – the phonetic similarity to *Africa* may be a useful mnemonic for this rather unusual word. The affricates familiar to speakers of English are the sounds found at the beginning and the end of *church* and *judge*.

A third type of obstruent sound is a composite of a stop and a fricative, and is known as an AFFRICATE

In order to produce these sounds, we raise the tongue to the same position as for [ʃ] and [ʒ]. Instead of leaving a gap between the tongue and the roof of the mouth, however, as we do for [ʃ] and [ʒ], we create a total blockage of the air, as for a stop (figure 1.21).

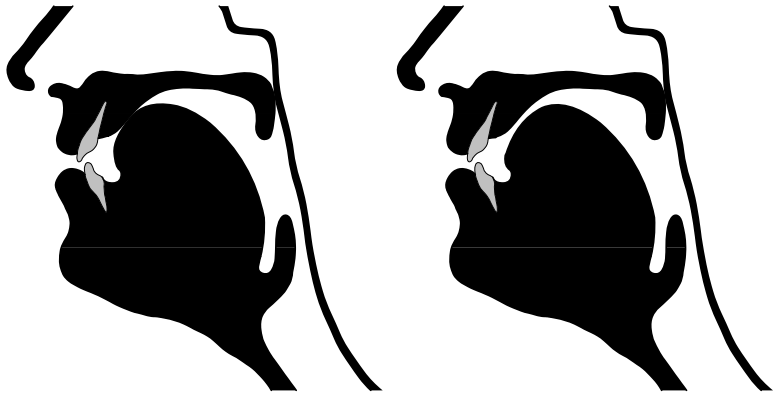

Figure 1.21 Palatoalveolar affricate

Crucially, at the moment of release the articulators do not come apart cleanly, as they do for stops, and therefore the outgoing air causes strong friction.

Observe how this happens as you pronounce *church* or *judge*.

The phonetic symbols for these affricate sounds reflect their compositional nature. The symbols [t] and [ʃ] are combined into [ʧ] to represent the voiceless obstruent in *church* – equivalently, [t͡ʃ], with a TIE BAR linking both symbols to indicate the unitary nature of the affricate. In turn, [d] and [ʒ] are combined into [ʤ] (or [d͡ʒ]) to represent the voiced obstruent in *judge*. Note that the transcription [t] and [d] is strictly speaking inaccurate in this context, since the stop element of these affricates is palatoalveolar, as are [ʃ] and [ʒ], rather than alveolar, like [t] and [d]. An alternative, non-IPA symbol for [ʧ], particularly popular in North America, is [č]. Its equivalent for [ʤ] is [ǰ].

12 Summing Up

We will now bring the chapter to a close. You need, of course, to familiarize yourself with all the aspects of the sounds we are describing until you feel totally comfortable in handling them. Before ending the chapter, we recapitulate our findings in table 1.3.

Table 1.3 Stops, fricatives and affricates (third inventory)

			Place of articulation						
			Mouth						*Larynx*
			Bilabial	*Labiodental*	*Dental*	*Alveolar*	*Palatoalveolar*	*Velar*	*Glottal*
Manner	Stops	Voiceless	p		t̪	t		k	ʔ
		Voiced	b		d̪	d		g	
	Fricatives	Voiceless		f	θ	s	ʃ	x	h
		Voiced		v	ð	z	ʒ	ɣ	ɦ
	Affricates	Voiceless					ʧ		
		Voiced					ʤ		

Two final brief notes about this table. First, as we have hinted, [θ] and [ð] can be pronounced interdentally (that is, between the teeth) instead of dentally – the choice of place of articulation seems to be a matter of individual preference here (figure 1.22).

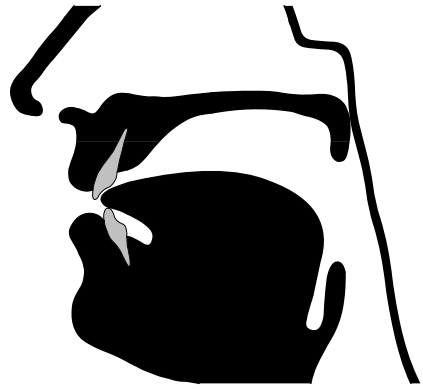

Figure 1.22 Interdental fricative

Second, the dental and alveolar symbols for *t* and *d* in the table are identical except for the extra mark, or DIACRITIC, "̪" under the dentals. Diacritics serve the purpose of increasing the descriptive power of the phonetic alphabet without unduly cluttering up the system with new symbols. Following on from this, we should transcribe the interdental fricatives with a special interdental diacritic. However, no such diacritic is available in the regular IPA alphabet, and therefore we resort to the general diacritic "̟", which simply signals an articulation slightly forward of the point represented by the symbol: [θ̟], [ð̟].

Diacritics serve the purpose of increasing the descriptive power of the phonetic alphabet without unduly cluttering up the system with new symbols

Chapter Summary

This chapter has focused on the physical properties of speech sounds, with particular emphasis on obstruents, those sounds produced by setting up an obstruction in the path of the air from the lungs. Such an obstruction is made by bringing together two articulators, which either totally stop the airflow, then releasing it (a stop), or create a partial closure leading to turbulence of the air particles (a fricative). The third type of obstruent, the affricate, combines these two types of closure. The number and variety of obstruents result directly from the fact that these manners of articulation can be used

at various points in the vocal tract. These points, referred to as places of articulation, are generally described in terms of where in the vocal tract contact is made (the alveolar ridge, the teeth, etc.), rather than in terms of the identity of the active articulator involved. Each of the combinations of manner and place of articulation may also be accompanied by vocal cord vibration or voicing. We showed that the set of (mainly English) obstruents discussed come in voiced and voiceless pairs. The IPA symbols supplied are laid out in table 1.3. Learning the description-to-symbol relationship is an essential part of learning phonology.

Key Questions

1 What is the larynx and what is its role in the production of speech?
2 How is speaking similar to or different from playing the recorder?
3 Discuss the manner of the release of air in the production of the three different types of obstruent.
4 When we talk about "place of articulation", what are we referring to? Enumerate the distinctive places of articulation we have discussed in the text.
5 What does a phonetic symbol represent? What are the advantages of the IPA alphabet?
6 What is the difference between a phonetic symbol and a letter? Why should we never talk about letters when we are doing phonetics (or phonology)?
7 What do the terms "active" and "passive" articulator mean?
8 The set of obstruent sounds available to a language can be doubled by the addition of "voice". What is voice?
9 What is the purpose of a diacritic in phonetic transcription? Illustrate your answer.
10 Define the term "articulation".
11 Enumerate the sounds for which the soft palate is an articulator. Which other articulator would you expect to be involved?

Further Practice

Sound to Spelling

We have pointed out that, as phonologists, we are interested in speech sounds and not in spelling. We also pointed out that there is often, in English as indeed in other languages, more than one way to represent a single sound in the spelling system. We list below the phonetic symbols for a number of obstruent sounds. List as many different words as you can think of containing each sound with a different spelling (under each symbol is a number indicating the number of different spellings we have been able to think of):

[f]	[k]	[s]	[z]	[ʃ]	[ʒ]	[ʧ]	[ʤ]
5	9	5	5	11	5	5	5

Articulation and Phonetic Symbols

a Write down the IPA symbols representing the following descriptions, and illustrate each of the sounds with two English words:

A voiced labiodental fricative
A voiceless alveolar fricative
A voiced palatoalveolar affricate
A voiced glottal fricative
A voiceless bilabial stop
A voiceless dental fricative
A voiced velar stop

b Provide full descriptions of the sounds represented by the following phonetic symbols (you will need to have recourse to the full IPA chart for some of the symbols):

[ɣ] [ç] [d̪] [ʦ] [ʒ] [β] [ð]

c Arrange the sounds below into groups according to the following criteria:

(i) Voicing
(ii) Place of articulation
(iii) Manner of articulation

[x] [k] [b] [ʃ] [ʒ] [z] [d] [p] [f] [g]

Spelling to Sound

Give the phonetic symbols for the sounds represented orthographically by the emboldened letters in the words below:

rou**gh** **Th**omas **th**ink **p**en **ph**ail **f**act stu**ff** **s**eed **c**ede ri**s**e **g**nome a**g**nostic Ste**ph**en **sh**eep **c**a**g**e **j**aw **g**old fi**ssi**on sta**ti**on **ch**ocolate **ch**aos dou**gh** **k**ilt **k**nowledge a**ck**nowledge **qu**es**ti**on freeze bu**s** **th**ere ca**st**le mu**sc**le spa**gh**etti fu**ss**y bu**s**y fu**zz**y ca**s**ual cau**s**al **s**ugar Ru**ssi**a ru**sh**es cu**t**lass **t**able si**g**n fli**gh**t **b**om**b** **v**ani**t**y bom**b**ard **d**u**k**e o**f** o**ff** a**sc**en**si**on e**sc**ape su**cc**eed divi**s**ion