2 Phonetics: The Sounds of Language

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Heavenly labials in a world of gutturals.

Wallace Stevens, *The Plot against the Giant*

We do not need to speak in order to use language. Language can be written, manually signed, mechanically reproduced and even synthesised by computers with considerable success. Nevertheless, speech remains the primary way humans express themselves through language. Our species spoke long before we began to write and, as we saw in the first chapter of this book, this long history of spoken language is reflected in our anatomical specialisation for it. Humans also appear to have specialised neural mechanisms for the perception of speech sounds. Because language and speech are so closely linked, we begin our study of language by examining the inventory and structure of the sounds of speech. This branch of linguistics is called **phonetics**.

Human languages display a wide variety of sounds, called **phones** (from Greek *ph*ōnē 'sound, voice') or **speech sounds**. There are a great many speech sounds, but not an infinite number of them. The class of possible speech sounds is finite, and a portion of the total set will be found in the inventory of any human language. Humans can also make sounds with the vocal tract that do not occur in speech, such as the sound made by inhaling through one corner of the mouth, or the 'raspberry' produced by sticking out the tongue and blowing hard across it. Nonetheless, a very wide range of sounds is found in human language (600 consonants and 200 vowels, according to one estimate), including such sounds as the click made by drawing the tongue hard away from the upper molars on one side of the mouth (imagine making a sound to get a horse to move), or the sound made by constricting the upper part of the throat as we breathe out. Any human, child or adult, can learn to produce any human speech sound.

There are two ways of approaching phonetics. One approach studies the physiological mechanisms of speech production. This is known as **articulatory phonetics**. The other, known as **acoustic phonetics**, is concerned with measuring and analysing the physical properties of the sound waves we produce when we speak. Both approaches are indispensable to an understanding of speech. This chapter focuses on articulatory phonetics, but also makes some reference to the acoustic properties of sounds and to acoustic analysis.

2.1 Phonetic transcription

Since the sixteenth century, efforts have been made to devise a universal system for transcribing the sounds of speech. The best-known system, the **International Phonetic Alphabet (IPA)**, has been evolving since 1888. This system of transcription attempts to represent each sound of human speech with a single symbol. These symbols are enclosed in brackets [ ] to indicate that the transcription is phonetic and does not represent the spelling system of a particular language. For example, the sound spelled *th* in English *this* is transcribed as [ð] (pronounced *eth*, as in *weather*). The IPA uses this symbol to represent the sound in whichever language it is heard, whether it is English, Spanish, or Turkmen (a Turkic language spoken in Central Asia and written with the Cyrillic alphabet) as shown in Table 2.1.

Table 2.1 Use of [ð] in the International Phonetic Alphabet

Language	*Spelling*	*IPA*	*Meaning*
English	this	[ðɪS]	'this'
Spanish	boda	[bɔða]	'wedding'
Turkmen	адак	[aðak]	'foot'

Language Matters Sounds and spelling

Although the relationship between sound and symbol in IPA is one to one, things are very different in the writing system of English – as a quick look at the words *rough*, *through*, *bough*, *though*, and *cough* illustrates. All these words contain the sequence of symbols *ough* and yet we note two things: (1) the written symbols represent different sounds, and (2) the same four symbols may represent different numbers of sounds. In *rough* it represents two sounds, while in *through* it represents only one. There is no one-to-one correspondence between a symbol and a sound in English. This is also evident when we look at the pronunciation of a single symbol 'o', which is pronounced differently in *go*, *hot*, *women*, *more*, *mutton*. Again, there is no one-to-one correspondence of sound and symbol in the English writing system.

George Bernard Shaw, the famous playwright who described himself as an 'energetic, phonetic enthusiast', illustrated the problem in the following anecdote. Imagine a new word comes into the English language that is spelled *ghoti*. How would this word be pronounced? In an attempt to demonstrate what he felt were the inadequacies of the English spelling system, Shaw argued that the word could be pronounced as 'fish'. How so? Note the pronunciations of the italicised segments in the following words:

enou*gh* ___f
women ___i
na*t*ion ___sh

Shaw felt that any writing system that could possibly pronounce the string of letters *ghoti* as 'fish' was in desperate need of spelling reform. (See Chapter 15, section 15.5.)

The use of a standardised phonetic alphabet with a one-to-one correspondence between sound and symbol enables linguists to transcribe languages consistently and accurately. In North American (NA) usage, though, some phonetic symbols differ from those employed by

IPA transcription. For example, the sound heard at the beginning of the English word *shark* is transcribed as [ʃ] in IPA, but usually as [š] in North America. This book employs IPA transcription, but notes common North American symbols where relevant.

If you wish to start practising the phonetic transcription of English, turn to Tables 2.16 and 2.17 for examples.

2.1.1 Units of representation

Anyone who hears a language spoken for the first time finds it hard to break up the flow of speech into individual units. Even when hearing our own language spoken, we do not focus attention on individual sounds as much as we do on the meanings of words, phrases and sentences. Many alphabets, including the IPA, represent speech in the form of **segments** – individual phones like [p], [s] or [m]. Using segments, however, is only one way to represent speech. The **syllable**, presented in Chapter 3, is also represented in some writing systems (see Chapter 15, sections 15.1.2, 15.3.2 and 15.4.2). In one type of Japanese writing, for example, signs such as:

 [ka],  [to], and  [mi]

represent syllables without recourse to segmental transcription.

Segments are produced by coordinating a number of individual articulatory gestures including jaw movement, lip shape and tongue placement. Many of these individual activities are represented as smaller subunits called **features** that segments are made up of. Even though features are almost never represented in writing systems, they are important elements of linguistic representation. Features reflect individual aspects of articulatory control or acoustic effects produced by articulation. This chapter presents segmental transcription, since it is the most widely used way of representing speech. Features and syllables are introduced in the following chapter.

2.1.2 Segments

We have defined the **segment** as an individual speech sound (phone). There are several kinds of evidence that suggest that speakers have the linguistic knowledge that makes it possible to break down a stream of speech into sound segments.

Errors in speech production provide one kind of evidence for the existence of segments. Slips of the tongue such as *Kolacodour* for *Kodacolour* and *melcome wat* for *welcome mat* show segments shifting and reversing position within and across words. This suggests that segments are individual units of linguistic structure and can be represented individually in a system of transcription.

The relative invariance of speech sounds in human language also suggests that segmental phonetic transcription is a well-motivated way of transcribing speech. It is impossible to represent all variants of human speech sounds, since no one says the same sound in exactly the same way twice. Nonetheless, the sounds of speech remain invariant enough from language to language for us to transcribe them consistently. A *p* sound is much the same in English, Russian or Uzbek. The fact that when producing a *p* sound, English speakers press their lips together but Russian speakers draw theirs slightly inward does not make the sounds different enough to warrant separate symbols. But the sounds *p* and *t* are distinct enough from each other in languages the world over to be consistently transcribed with separate symbols.

Language Matters **An interesting phonetic fact**

Words of two syllables are not necessarily longer than words of one syllable. If we measure the amount of time it takes us to say a word like *dad* we come up with a length of 520 milliseconds. The word *daddy*, though, which is two syllables long, takes only 420 milliseconds. Try it and see if you agree.

2.2 The sound-producing system

Sound is produced when air is set in motion. Think of the speech production mechanism as consisting of an air supply, a sound source that sets the air in motion in ways specifically relevant to speech production and a set of filters that modifies the sound in various ways (see Figure 2.1). The air supply is provided by the lungs. The sound source is in the larynx, where a set of muscles called the **vocal folds** (or **vocal cords** [not ***chords***]) is located. The filters are the organs above the larynx: the tube of the throat between the larynx and the oral cavity, which is called the **pharynx**, the oral cavity, and the nasal cavity. These passages are collectively known as the **vocal tract**.

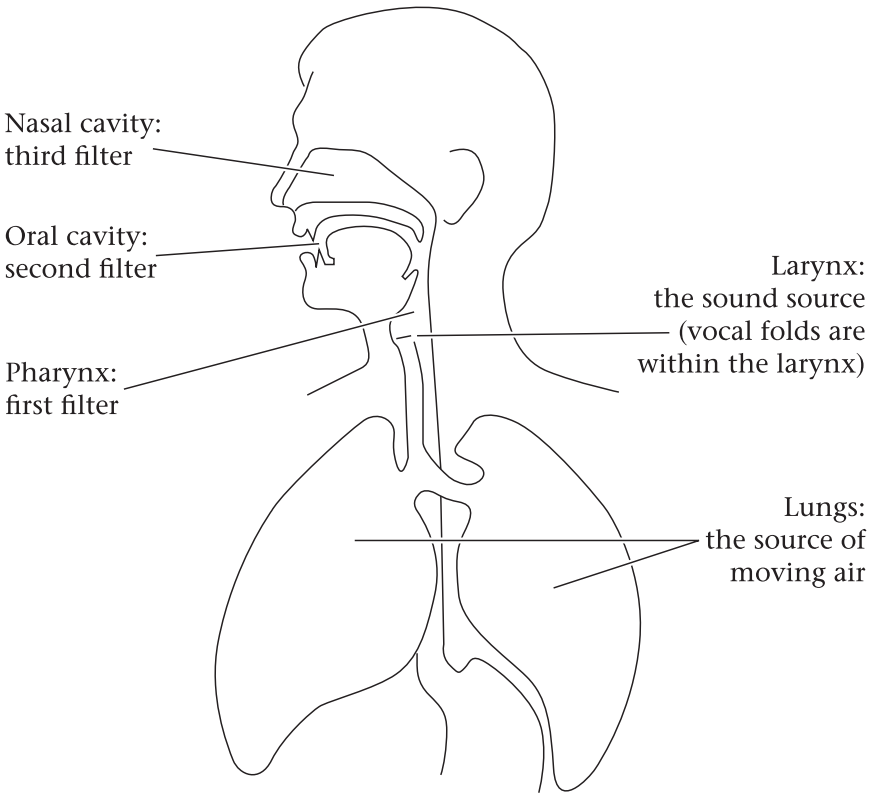


Figure 2.1 The sound-producing system

2.2.1 The lungs

In order to produce the majority of sounds in the world's languages, we take air into the lungs and expel it during speech. (A small number of phones are made with air as it flows

into the vocal tract. Samples of these and other sounds can be heard on the website at www.pearsoned.co.uk/ogrady.) A certain level of air pressure is needed to keep the speech mechanism functioning steadily. The pressure is maintained by the action of various sets of muscles coming into play during the course of an utterance. The muscles are primarily the **intercostals** (the muscles between the ribs) and the **diaphragm** (the large sheet of muscle separating the chest cavity from the abdomen). The intercostals raise the ribcage to allow air to flow into the lungs during inhalation, while the diaphragm helps to control the release of air during exhalation for speech so that we can speak for a reasonable period of time between breaths.

2.2.2 The larynx

As air flows out of the lungs up the **trachea** (windpipe), it passes through a box-like structure made of cartilage and muscle; this is the **larynx** (commonly known as the voice box or Adam's apple), as shown in Figure 2.2. The main portion of the larynx is formed by the **thyroid cartilage**, which spreads outward at its front like the head of a plough. The thyroid cartilage rests on the ring-shaped **cricoid cartilage**. Fine sheets of muscle flare from the inner sides of the thyroid cartilage, forming the paired vocal folds (vocal cords). The inner edges of the vocal folds are attached to the vocal ligaments. The vocal folds can be pulled apart or drawn closer together, especially at their back or posterior ends, where each is attached to one of two small cartilages, the **arytenoids**. The arytenoids are opened, closed and rotated by several pairs of small muscles (not shown in Figure 2.2). As air passes through the space between the vocal folds, which is called the **glottis**, different glottal states are produced, depending on the positioning of the vocal folds.

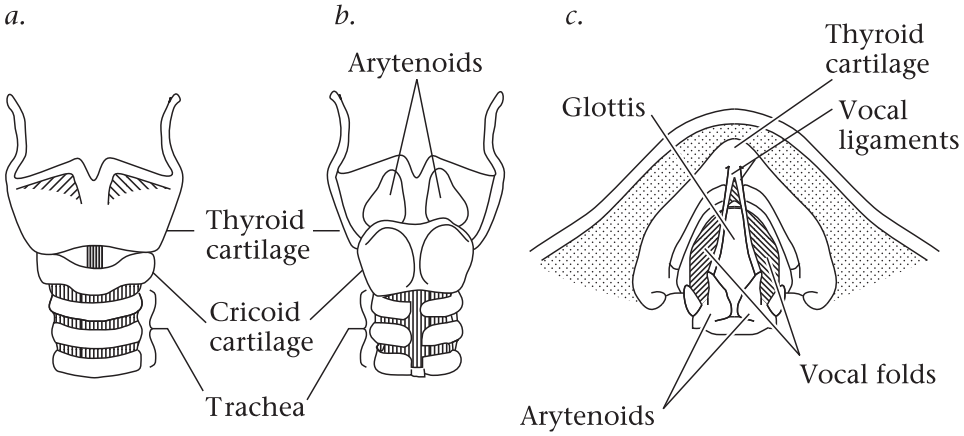


Figure 2.2 The larynx: *a.* from the front; *b.* from the back; *c.* from above, with the vocal folds in open position. The striated lines in *c.* indicate muscles, a number of which have been eliminated from the drawings in order to show the cartilages more clearly.

2.2.3 Glottal states

The vocal folds may be positioned in a number of ways to produce different glottal states. The first two glottal states presented in Figure 2.3 are commonly encountered in most of the world's languages. The third diagram describes the glottal state that underlies a common

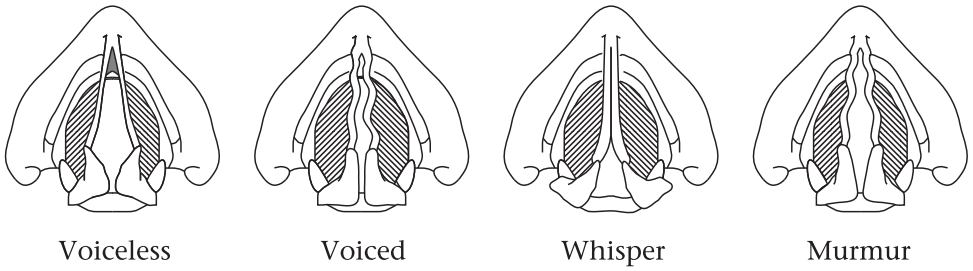


Figure 2.3 Four glottal states: the stylised drawing represents the vocal folds and glottis from above; the anterior portion at the larynx is towards the top. The small triangles represent the arytenoid cartilages, which help spread or close the vocal folds.

speech phenomenon, and the fourth illustrates one of a number of glottal states not encountered in English.

Voicelessness

When the vocal folds are pulled apart as illustrated in Figure 2.3, air passes directly through the glottis without much interference. Any sound made with the vocal folds in this position is said to be **voiceless**. You can confirm a sound's voicelessness by touching your fingers to the larynx as you produce it. You will not feel any vibration from the vocal folds being transmitted to your fingertips. The initial sounds of *fish*, *sing*, and *house* are all voiceless. Voicelessness is a true speech state distinct from breathing; the vocal folds are not as far apart during speech voicelessness as they are in silent breathing.

Voicing

When the vocal folds are brought close together, but not tightly closed, air passing between them causes them to vibrate, producing sounds that are said to be **voiced**. (See Figure 2.3, where the movement of the vocal folds during voicing is indicated by the wavy lines.) You can determine whether a sound is voiced in the same way you determined voicelessness. By lightly touching the fingers to the larynx as you produce an extended version of the initial sounds of the words *zip* or *vow*, or any vowel, you can sense the vibration of the vocal folds within the larynx. It can be helpful to contrast voiced versus voiceless sounds while resting your hand on your throat. Produce the following pairs of sounds and decide which are voiced and which are voiceless.

[fffffffffffffffffffffffvvvvvvvvvvvvvvvvvvvvvv]
[sssssssssssssssssssssssszzzzzzzzzzzzzzzzzzzzzzzzzz]

On which sounds did you feel vibration? Some people find it easier to hear this distinction in another way. Perform the same exercise as given above but this time with your fingers in your ears. You will feel much greater resonance on the sounds which are voiced. These techniques can be helpful as you try to hear which phones are voiced and which are voiceless.

Whisper

Another glottal state produces a **whisper**. Whispering is voiceless, but, as shown in Figure 2.3, the vocal folds are adjusted so that the anterior (front) portions are pulled close together, while the posterior (back) portions are apart.

Murmur

Yet another glottal state produces a **murmur**, also known as **breathy voice**. Sounds produced with this glottal configuration are voiced, but the vocal folds are relaxed to allow enough air to escape to produce a simultaneous breathy effect. There are languages in the world that use breathy voice as an integral part of the sound system. Although it is difficult to generalise, sometimes when you see words or place names that have been borrowed into English with spellings such as 'bh' as in *Bhagavad-Gita*, 'dh' as in *dharma* or *dhal*, or 'gh' as in *ghee* they can represent murmured sounds.

These four glottal states represent only some of the possibilities of sound production at the glottis. The total number of glottal states is still undecided, but there are more than a dozen. Combined with various articulations made above the larynx, they produce a wide range of phones. Before examining phones in more detail, we will first consider the three major classes of speech sound.

2.3 Sound classes

The sounds of language can be grouped into **classes** based on the phonetic properties that they share. You have already seen what some of these properties can be. All voiced sounds, for example, form a class, as do all voiceless sounds. The most basic division among sounds is into two major classes, **vowels** and **consonants**. Another class of sounds, the **glides**, shares properties of both vowels and consonants. Each class of sounds has a number of distinguishing features.

2.3.1 Vowels, consonants and glides (syllabic and non-syllabic elements)

Vowels, consonants and glides can be distinguished on the basis of differences in articulation, or by their acoustic properties. We can also distinguish among these elements with respect to whether they function as syllabic or non-syllabic elements.

The articulatory difference

Consonantal sounds, which may be voiced ([v]) or voiceless ([f]), are made with either a complete closure ([p]) or a narrowing ([f]) of the vocal tract. The airflow is either blocked momentarily or restricted so much that noise is produced as air flows past the constriction. In contrast, vowels are produced with little obstruction in the vocal tract (you will note that for all vowels the tip of your tongue stays down by your lower front teeth) and are usually voiced.

The acoustic difference

As a result of the difference in articulation, consonants and vowels differ in the way they sound. Vowels are more sonorous (acoustically powerful) than consonants, and so we perceive them as louder and longer lasting.

Syllabic and non-syllabic sounds

The greater sonority of vowels allows them to form the basis of **syllables**. A syllable can be defined as a peak of sonority surrounded by less sonorous segments. For example, the words *a* and *go* each contain one syllable, the word *laughing* two syllables, and the word *telephone*

three syllables. In counting the syllables in these words, we are in effect counting the vowels. A vowel is thus said to form the **nucleus** of a syllable. In section 2.5.6, we will see that certain types of consonants can form syllabic nuclei as well. It is a good idea, therefore, to think of vowels and consonants not simply as types of articulations, but as elements that may or may not be syllabic. In (1), the initial sounds of the words in the left column are all consonants; those on the right are all vowels.

(**1**) take above
cart at
feel eel
jump it
think ugly
bell open

Table 2.2 sums up the differences between consonants and vowels.

Table 2.2 Major differences between syllabic and non-syllabic elements

Vowels (and other syllabic elements)	*Consonants (non-syllabic elements)*
■ are produced with relatively little obstruction in the vocal tract	■ are produced with a complete closure or narrowing of the vocal tract
■ are more sonorous	■ are less sonorous

Glides

A type of sound that shows properties of both consonants and vowels is called a glide. Glides may be thought of as rapidly articulated vowels – this is the auditory impression they produce. Glides are produced with an articulation like that of a vowel. However, they move quickly to another articulation, as do the initial glides in *yet* or *wet*, or quickly terminate, as do the word-final glides in *boy* and *now*. You can feel how little movement is necessary to move from a vowel articulation to a glide articulation when you pronounce the following phrases:

see you later
who would do that

Make the vowel sound in the word *see* ([iː]) and then make the glide in the word *you* ([j]). Now go back and forth from [iː] to [j] and note that the small articulatory movement can cause us to perceive one sound as a vowel and the other as a glide. The same pattern emerges when you produce the vowel in who ([uː]) and the glide in would ([w]).

Even though they are vowel-like in articulation, glides pattern as consonants. For example, glides can never form the nucleus of a syllable. Since glides show properties of both consonants and vowels, the terms *semivowel* and *semiconsonant* may be used interchangeably with the term *glide*.

2.4 Consonant articulation

Airflow is modified in the vocal tract by the placement of the tongue and the positioning of the lips. These modifications occur at specific **places** or **points of articulation**. The major

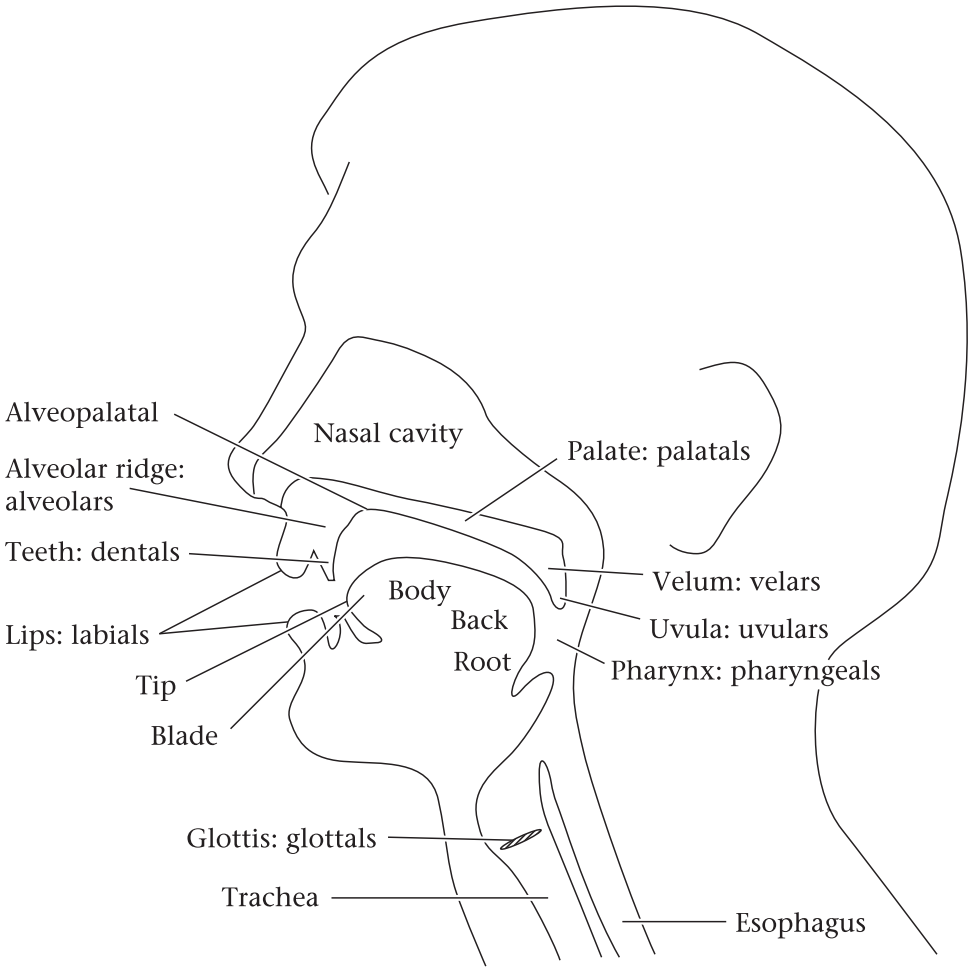


Figure 2.4 The vocal tract

places of articulation used in speech production are outlined in this section. Figure 2.4 provides a midsagittal section, or cutaway view, of the vocal tract on which each place of articulation has been indicated.

2.4.1 The tongue

The primary articulating organ is the tongue. It is an agile thing. It can be raised, lowered, thrust forward or retracted, and even rolled back. The sides of the tongue can also be raised or lowered. For most sounds, the tongue is the **active articulator** (i.e. the articulator that moves) and the upper part of the vocal tract, normally the roof of the mouth or the teeth, serves as the **passive articulator** (i.e. the static target). In some cases, the active articulator makes firm contact with the target, e.g. in [k], the first sound of *cow,* the back of the tongue presses firmly against the **velum** (see Figure 2.4). But in some other instances, the active articulator gets close to the passive articulator but falls short of making firm contact. That is the case in the [z], the first sound in *zoo*.

Phonetic description refers to five areas of the tongue. The **tip** is the narrow area at the front. Just behind the tip lies the **blade**. The main mass of the tongue is called the **body**, and the hindmost part of the tongue that lies in the mouth is called the **back**. The body

and back of the tongue can also be referred to jointly as the **dorsum**. The **root** of the tongue is contained in the upper part of the throat (pharynx).

2.4.2 Places of articulation

Each point at which the airstream can be modified to produce a different sound is called a place of articulation. Places of articulation are found at the lips, within the oral cavity, in the pharynx and at the glottis.

Labial

Any sound made with closure or near-closure of the lips is said to be **labial**. Sounds involving both lips are termed *bilabial*; sounds involving the lower lip and upper teeth are called **labiodentals**. English includes the bilabials heard word-initially in *peer*, *bin* and *month*, and the labiodentals heard initially in *fire* and *vow*.

Dental and interdental

Some phones are produced with the tongue placed against or near the teeth. Sounds made in this way are called **dentals**. European French has dental sounds at the beginning of the words *temps*, *dire*, *sept* and *zizi*.

If the tongue is placed between the teeth, the sound is said to be **interdental**. Interdentals in English include the initial consonants of the words *this* and *thing*. (Some English speakers produce *s* and *z* as dentals; see section 2.5.3 for more details.)

Alveolar

Within the oral cavity, a small ridge protrudes from just behind the upper front teeth. This is called the **alveolar ridge**. The tongue may touch or be brought near this ridge. Alveolar sounds are heard at the beginning of the English words *top*, *deer*, *soap*, *zip*, *lip* and *neck*. Some languages, such as Spanish, have two alveolar *r* sounds. One is made by tapping the alveolar ridge once with the tongue, as in *caro* 'dear, expensive' and the other by repeatedly hitting the tongue against the alveolar ridge, as in *roca* 'rock'.

Alveopalatal and palatal

Just behind the alveolar ridge, the roof of the mouth rises sharply. This area is known as the **alveopalatal** area (**palatoalveolar** in some books). Alveopalatal consonants are heard in the English words *show*, *measure*, *chip* and *judge*.

The highest part of the roof of the mouth is called the **palate**, and sounds produced with the tongue on or near this area are called **palatals**. The word-initial phone in *yes* is a palatal glide.

Velar

The soft area towards the rear of the roof of the mouth is called the **velum** (or **soft palate**). Sounds made with the tongue touching or near this position are called **velars**. Velars are heard in English at the beginning of the words *call* and *guy*, and at the end of the word *hang*. The glide heard word-initially in *wet* is called a **labiovelar**, since the tongue is raised near the velum and the lips are rounded at the same time. We refer to the velar aspect of the sound as its *primary* place of articulation while the labial aspect is a *secondary* place of articulation.

Uvular

The small fleshy flap of tissue known as the **uvula** hangs down from the velum. Sounds made with the tongue near or touching this area are called **uvulars**. The *r* sound of Standard European French found in words like *ma<u>r</u>i* 'husband' and *<u>r</u>iz* 'rice', etc. is uvular. Uvulars are rare, but not unknown, in English. Uvular *r* is manifested by what is popularly known as the 'Northumberland burr' – the guttural pronunciation of *r* in the traditional accent of the north-east corner of England. The same sound also occurs in some varieties of lowland Scottish English as well as in the Welsh English dialects of Gwynedd and Dyfed.

Pharyngeal

The area of the throat between the uvula and the larynx is known as the pharynx. Sounds made through the modification of airflow in this region by retracting the tongue or constricting the pharynx are called **pharyngeals**. Pharyngeals can be found in many dialects of Arabic

Language Matters **Pharyngeals in English**

In English, pharyngeals are extremely rare. But they are not entirely absent. They occur in the traditional English dialect spoken in north Wales. In this dialect there is a general tendency to pharyngealise speech sounds. Pharyngeals are also found in urban Scottish English dialects as a result of recent innovations. Nowadays vowels may be pharyngealised in words like *work* and *third,* if the *r* following the vowel of the syllable is dropped. In addition, *l* may be pharyngealised if it follows a vowel belonging to the same syllable, as in *melt* or *call*.

Glottal

Sounds produced using the vocal folds as primary articulators are called **glottals**. The sound at the beginning of the English words *<u>h</u>eave* and *<u>h</u>og* is made at the glottis. You can also hear a glottal sound in the Cockney accent, and indeed, in most other popular accents of British English, in the pronunciation of the *t* in words like *put* or *waiter* and of *tt* in *better* or *bottle*.

2.5 Manners of articulation

The lips, tongue, velum and glottis can be positioned in different ways to produce different sound types. These various configurations are called the **manners of articulation**.

2.5.1 Oral versus nasal phones

A basic distinction in manner of articulation is between **oral** and **nasal** phones. When the velum is raised, cutting off the airflow through the nasal passages, oral sounds are produced. The velum can also be lowered to allow air to pass through the nasal passages, producing a sound that is nasal. Both consonants and vowels can be nasal, in which case they are generally voiced. (Unless otherwise noted, all nasals represented in this chapter are voiced.) The consonants at the end of the English words *su<u>n</u>*, *su<u>m</u>* and *su<u>ng</u>* are nasal. For many speakers of English, the vowels of words such as *b<u>a</u>nk* and *w<u>i</u>nk* are also slightly nasal due to their proximity to nasal consonants.

2.5.2 Stops

Stops are made with a complete closure either in the oral cavity or at the glottis. In the world's languages, stops are found at bilabial, dental, alveolar, palatal, velar, uvular and glottal points of articulation.

In English, bilabial, alveolar, and velar oral and nasal stops occur in the words shown in Table 2.3. Note that [ŋ] does not occur word-initially in English though it can in other languages.

Table 2.3 English stops and their transcription

Bilabial		*Transcription*
Voiceless	s̲pan	[p]
Voiced	b̲an	[b]
Nasal	m̲an	[m]
Alveolar		
Voiceless	s̲tun	[t]
Voiced	d̲ot	[d]
Velar		
Voiceless	s̲car	[k]
Voiced	g̲ap	[g]
Glottal		
Voiceless	(see Table 2.4)	[ʔ]

The glottal stop is commonly heard in English in the expression *uh-uh* [ʔʌʔʌ], meaning 'no'. The two vowels in this utterance are each preceded by a momentary closing of the airstream at the glottis. In some British dialects, the glottal stop is commonly heard in place of the [t] in a word like *bottle*. You may see this glottal stop spelled with an apostrophe *(bo'l)*.

A grid for stops

Table 2.4 presents a grid on which the stop consonants of English are arranged horizontally according to point of articulation. As you can see, each stop, with one exception, has voiced and voiceless counterparts. The glottal stop is always voiceless. It is produced with the vocal folds drawn firmly together and the arytenoids drawn forward; since no air can pass through the glottis, the vocal folds cannot be set in motion.

Table 2.4 English stop consonants

	Bilabial	*Alveolar*	*Velar*	*Glottal*
Voiceless	[p]	[t]	[k]	[ʔ]
Voiced	[b]	[d]	[g]	

2.5.3 Fricatives

Fricatives are consonants produced with a continuous airflow through the mouth. They belong to a large class of sounds called **continuants** (a class that also includes vowels and

glides), all of which share this property. The fricatives form a special class of continuants; during their production, they are accompanied by a continuous audible noise because the air used in their production passes through a very narrow opening either at the glottis or in the vocal tract.

English fricatives

English has voiceless and voiced labiodental fricatives at the beginning of the words *fat* and *vat*, voiceless and voiced interdental fricatives word-initially in the words *thin* and *those*, alveolar fricatives word-initially in *sing* and *zip*, and a voiceless alveopalatal fricative word-initially in *ship*. The voiced alveopalatal fricative is rare in English. It is the first consonant in the word *azure*, and is also heard in the words *pleasure* and *rouge*. The voiceless glottal fricative of English is heard in *hotel* and *hat*. See the transcription of English fricatives in Table 2.5.

Table 2.5 The transcription of English fricatives

Glottal state	*Point of articulation*	*Transcription*
	Labiodental	
Voiceless	fan	[f]
Voiced	van	[v]
	Interdental	
Voiceless	thin	[θ]
Voiced	then	[ð]
	Alveolar	
Voiceless	sun	[s]
Voiced	zip	[z]
	Alveopalatal	
Voiceless	ship	[ʃ]
Voiced	azure	[ʒ]
	Glottal	
Voiceless	hat	[h]

Special note must be taken of the alveolar fricatives [s] and [z]. There are two ways that English speakers commonly produce these sounds. Some speakers raise the tongue tip to the alveolar ridge (or to just behind the upper front teeth) and allow the air to pass through a grooved channel in the tongue. Other speakers form this same channel using the blade of the tongue; the tip is placed behind the lower front teeth.

A grid for fricatives

Table 2.6 presents a grid on which the fricative consonants of English are arranged according to point of articulation. As in Table 2.5, dentals are not distinguished from alveolars, since most languages have sounds with either one or the other point of articulation, but not both. Note that IPA [ʃ] and [ʒ] correspond to North American [š] and [ž], respectively.

Table 2.6 English fricatives

	Labiodental	*Interdental*	*Alveolar*	*Alveopalatal*	*Glottal*
Voiceless	[f]	[θ]	[s]	[ʃ]	[h]
Voiced	[v]	[ð]	[z]	[ʒ]	

2.5.4 Affricates

When a stop articulation is released, the tongue moves rapidly away from the point of articulation. However, some non-continuant consonants show a slow release of the closure; these sounds are called **affricates**. English has only two affricates, both of which are alveopalatal. They are heard word-initially in *church* and *jump*, and are transcribed as [tʃ] and [dʒ], respectively.

A grid for affricates

Table 2.7 presents a grid showing the two English affricates. Note that IPA [tʃ] and [dʒ] correspond to North American [č] and [ǰ], respectively.

Table 2.7 English affricates

	Alveopalatal (= IPA Palatoalveolar)
Voiceless	[tʃ]
Voiced	[dʒ]

Stridents and sibilants

At the beginning of this chapter, it was noted that acoustic as well as articulatory criteria are sometimes used in describing speech sounds. An acoustic criterion comes into play to describe fricatives and affricates, which are subdivided into two types based on their relative loudness. The noisier fricatives and affricates are called **stridents** (see Table 2.8). Their quieter counterparts, such as [θ] or [ð], which have the same or nearly the same place of articulation, are considered non-strident. Stridents are also known as **sibilants**.

Table 2.8 Strident fricatives and affricates in English

Place of articulation	*Strident*	
	Voiceless	*Voiced*
Alveolar	[s]	[z]
Alveopalatal	[ʃ]	[ʒ]
	[tʃ]	[dʒ]

2.5.5 Voice lag and aspiration

After the release of certain voiceless stops in English, you can hear a lag or brief delay before the voicing of a following vowel. Since the lag in the onset of vocalic voicing is accompanied by the release of air, the traditional term for this phenomenon is **aspiration**. It is transcribed with a small raised [^{h}] after the aspirated consonant. Table 2.9 provides some examples of aspirated and unaspirated consonants in English (some vowel symbols are introduced here as well). Notice that the sounds that have both aspirated and unaspirated

Table 2.9 Aspirated and unaspirated consonants in English

Aspirated		*Unaspirated*	
[p^{h}æt]	pat	[spæt]	spat
[t^{h}ʌb]	tub	[stʌb]	stub
[k^{h}ɪd]	kid	[skɪd]	skid

varieties are all voiceless stops. In other languages, voiceless fricatives and affricates may also be aspirated or unaspirated.

Figure 2.5 shows how aspiration of a voiceless consonant takes place, using the aspirated consonant [p^{h}] as an example. Though the sequence of articulations takes place continuously, the figure illustrates only certain moments.

Figures 2.6 and 2.7 show the relation between articulation and voicing for unaspirated and voiced consonants. The unaspirated consonant, such as the [p] of English *spill*, shows

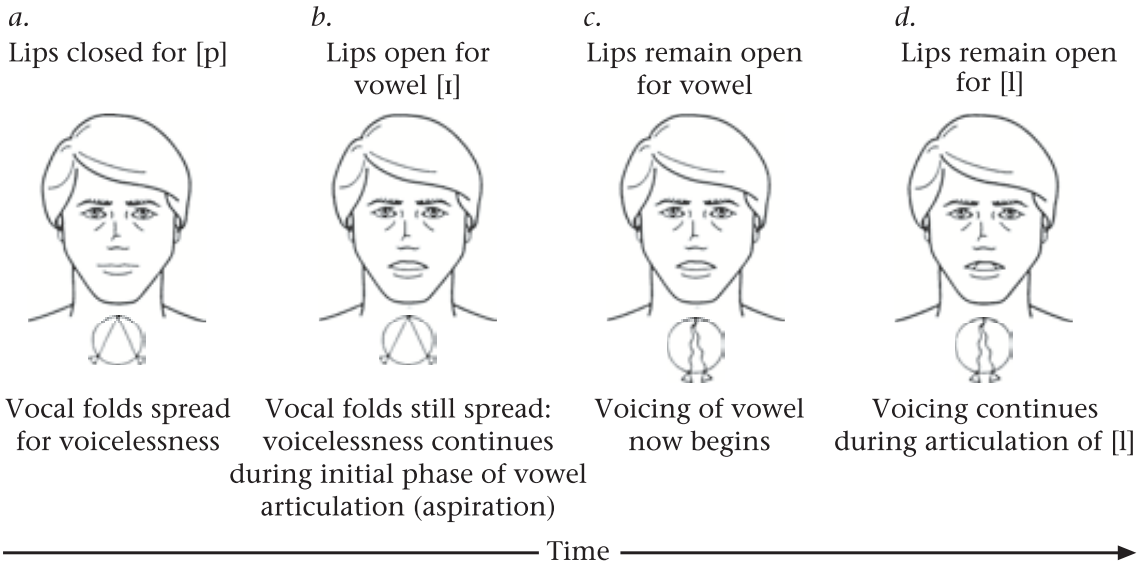


Figure 2.5 Aspirated consonant production (English *pill*)

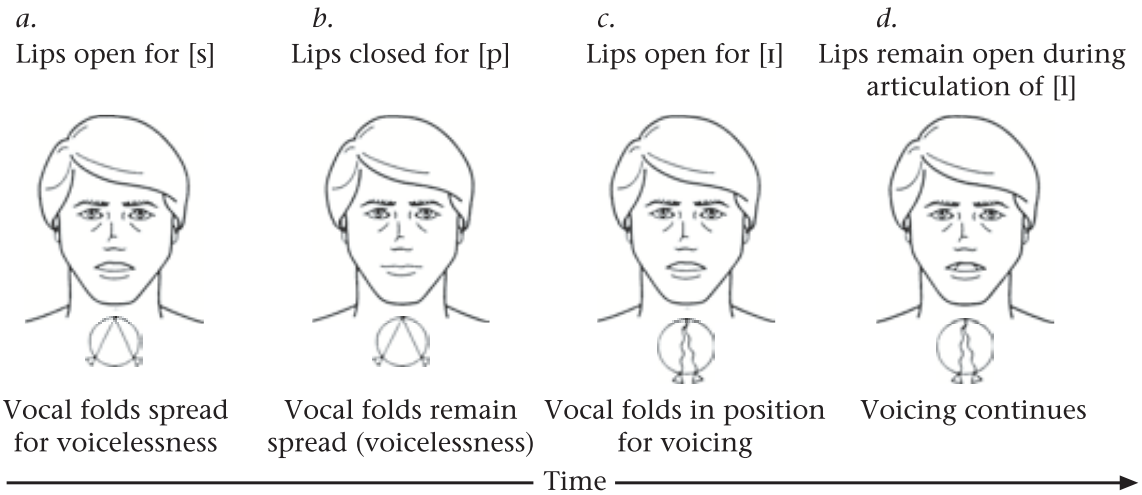


Figure 2.6 Unaspirated consonant production (English *spill*)

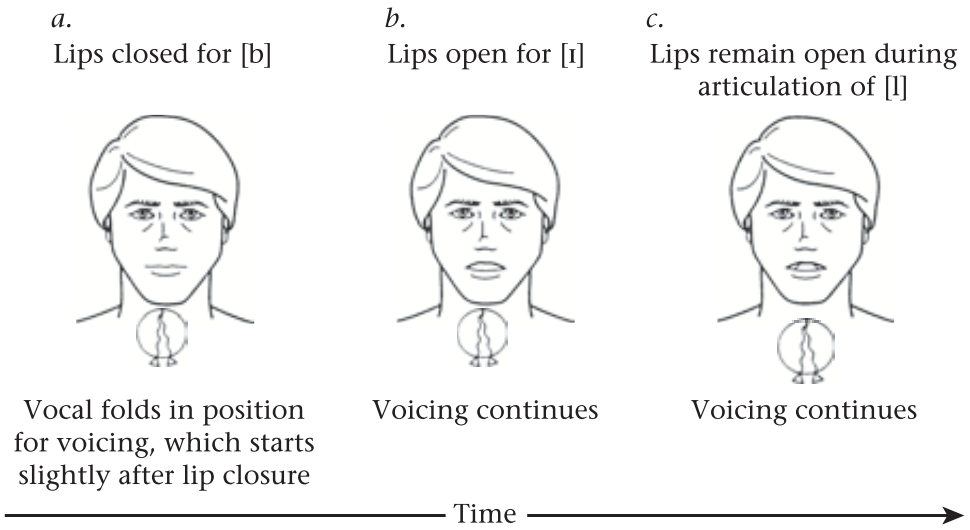


Figure 2.7 Voiced consonant release (English *bill*)

voicing of the vowel starting very soon after release of the consonant closure. The voiced initial [b] of English *bill* shows voicing starting just before the release of the bilabial closure. In Figure 2.7, note how voicing precedes the release of the labial articulators

Unreleased stops

Up to now in the chapter, we have described how stops may be either aspirated or unaspirated. Here we introduce a third variant: the *unreleased* stop. Pronounce the words in the following lists:

p̲ave	cap̲
T̲om	pot̲
k̲ing	back̲

The words in the first column have the stops ([p^h], [t^h], and [k^h]) released into the following vowel. However, in the second column, it is quite common not to release these stops at all. When you pronounce the word *cap* you may well end with your lips closed. Likewise, in *pot* the [t] is often not audibly released; and again in *back* your tongue may stay on the roof of your mouth, trapping the air. The phonetic symbol for this is a raised [˺] as in [p˺] .

2.5.6 Liquids

Among the sounds commonly found in the world's languages are *l* and *r* and their numerous variants. They form a special class of consonants known as *liquids*. Although there is a great deal of variation in the production of *l*s and *r*s in the languages of the world, they are grouped together in a single category because they often pattern together in phonology (more will be said about this in Chapter 3).

Laterals

Varieties of *l* are called **laterals**. As laterals are articulated, air escapes through the mouth along the lowered sides of the tongue. When the tongue tip is raised to the dental or alveolar position, the dental or alveolar laterals are produced. Both may be transcribed as [l].

Because laterals are generally voiced, the term *lateral* used alone usually means 'voiced lateral'. Still, there are instances of voiceless laterals in speech. The voiceless dental or alveolar lateral is written with an additional phonetic symbol, called a **diacritic**. In this case, the diacritic is a circle beneath the symbol: [l̥]. Voiceless laterals can be heard in the pronunciation of the English words *pl̥ease* and *cl̥ear* and also in the Welsh pronunciation of *'ll'* in names such as *Llanelli* and *Llywelyn*.

Language Matters **Another kind of *l***

Pronounce the words in the following two lists:

leaf	fall
lie	milk
lawn	steal

Notice that the *l* sounds are not pronounced in the same way. In the first column, the *l* is made with the tongue tip touching the alveolar ridge (as described in Table 2.10). In the second column, however, you will notice that the *l* sound is made with additional constriction further back in the mouth (at the velum). This type of *l* is known technically as a *velarised l* and more casually as a *dark l*. The phonetic symbol is [ɬ].

English *r*s

Numerous varieties of *r* are also heard in the world's languages. This section describes some of the types found in English. In **received pronunciation** (**RP** for short, see also pp. 486–90), the generally accepted variety of spoken standard southern British English, *r* is a **postalveolar approximant**. The term **approximant** (or **frictionless continuant**) describes a consonant with a manner of articulation that involves bringing the articulators quite close together while at the same time leaving a sufficiently large gap between them for air to escape without causing audible turbulence. Typically, in the RP articulation of *r* (as in *reed* and *raw),* the tip of the tongue is brought close to the area just past the alveolar ridge (hence the label postalveolar) without making firm contact with the roof of the mouth. The IPA symbol for this sound is [ɹ], but for convenience the symbol [r] is normally used.

The *r* of English as it is spoken in Canada and the United States is also normally a postalveolar approximant ([ɹ]). But for some American speakers its place of articulation is slightly farther back than it is in RP. The same is true also of the *r* in the accent of the south-west of England. An even more strikingly retracted *r* is found in Indian English where *r* (symbolised by [ɽ] in IPA) is a flap made by curling the tongue tip back so that the underside of the tongue tip taps the alveolar ridge (or by bunching the tongue upwards and back in the mouth in order to get the tongue tip to tap the back of the alveolar ridge). This sound is known as a **retroflex** *r*. It is also often transcribed as [r] (following a common convention of using non-Roman alphabet symbols like [r] sparingly).

Another sound commonly identified with *r* is the **flap**. The flap is produced when the tongue tip strikes the alveolar ridge as it passes across it. It is heard in the North American English pronunciation of *bi*t̲t̲*er* and *la*d̲d̲*er*. This flap is also found in some British pronunciations of *r* when it occurs between vowels, as in *ca*r̲*ry* and *ve*r̲*y*. That is the case sometimes in RP, and more typically in Scouse, the dialect of Liverpool. It is commonly transcribed as [ɾ] and is voiced.

Yet another type of *r* found in English is the **trill** (or **roll**). In a trill the **active articulator** hits repeatedly against part of the roof of the mouth. Highly stylised RP used in declamations may exhibit rolled alveolar *rs*. An alveolar trill realisation of *r* is also found in Afrikaans-influenced South African English. But the trill is not limited to the alveolar place of articulation. The uvular *r* mentioned above (which is found in the north-east of England, the Scottish lowlands and in parts of Wales) may also be realised as a trill (symbolised in IPA as [ʀ]) or as a fricative (represented by [ʁ]).

Table 2.10 which lists liquids omits [ʁ] since this sound is a fricative and not a liquid.

Table 2.10 English liquids

			Alveolar	*Postalveolar*	*Retroflex*	*Uvular*
Laterals		Voiced	[l]			
		Voiceless	[l̥]			
rs	Approximant	Voiced		[ɹ]		
		Voiceless		[ɹ̥]		
	Flap	Voiced	[ɾ]		[ɽ]	
		Voiceless	[ɾ̥]		[ɽ̥]	
	Trill	Voiced				[ʀ]
		Voiceless				[ʀ̥]

Syllabic liquids and nasals

Liquids and nasals are more sonorous than other consonants and in this respect are more like vowels than are the other consonants. In fact, they are so sonorous that they may function as syllabic nuclei. When they do so, they are called **syllabic liquids** and **syllabic nasals** (see Table 2.11). Syllabic liquids and nasals are found in many of the world's languages, including English. In transcription, they are usually marked with a short diacritic line underneath.

Table 2.11 Syllabic liquids and nasals in English

Syllabic		*Non-syllabic*	
bottle	[bɒt]	lift	[lɪft]
funnel	[fʌn]	pill	[pʰɪl]
sudden	[sʌd]	net	[net]
button	[bʌt]	tent	[tʰent]
'm-m'	[ʔm̩ʔm̩] (meaning 'no')	mat	[mæt]
bird	[bərd], [bɚd], or [b d] (North American English)	cat	[kʰæt]
her	[hər], [hɚ], or [h] (North American English)	now	[naʊ]

To be clear then, the [n] in a word like *no* is not syllabic because it does not form the nucleus of the syllable. *No* is a one-syllable word and has one vowel. However, the [n] in a two-syllable word like *button* is syllabic. The second syllable has [n] as its nucleus. Therefore,

whether a segment is syllabic or not is directly related to how it functions in the syllable. We will discuss this further in section 3.4 of Chapter 3 on the syllable.

There is an important difference between North American English and most other varieties of English with respect to the behaviour of *r*. In most North American dialects, *r* is pronounced when it follows a vowel in the same syllable in words like *bi*r*d* and *he*r. But in most other dialects, *r* is normally dropped in this position. In fact, frequently Americans and Canadians will drop the vowel itself, leaving behind the *r,* which then becomes the syllable nucleus, and hence is syllabic.

Unfortunately for beginning linguistics students, North American transcription is not always consistent here. The syllabic *r* sound heard in words like *bi*r*d* and *he*r is often transcribed in North America as a vowel-r sequence: [ər]. (The vowel symbol is presented in section 2.6.2 of this chapter.) The IPA symbol for this sound is [ɚ]. For many linguists, the following transcriptions would be taken as notationally equivalent variants:

[bʌtən]	and	[bʌt]
[bʌtər]	and	[bʌt]

See section 3.2.3 of the next chapter for further discussion of the sound *r* in English.

2.5.7 Glides

Recall that a glide is a very rapidly articulated non-syllabic segment. The two RP English glides are the yod [jɒd] (NA 'y-glide') [j] of *y*es and *boy*, and the w-glide [w] of *w*et and *sow*er. The [j] in IPA transcription corresponds to the [y] of North American transcription.

The [j] is a palatal glide (sometimes described as alveopalatal or palate-alveolar as well) whose articulation is virtually identical to that of the vowel [iː] of *see*. You can verify this by pronouncing a [j] in an extended manner; it will sound very close to an [iː].

The glide [w] is made with the tongue raised and pulled back near the velum and with the lips protruding, or **rounded**. For this reason, it is sometimes called a **labiovelar**. The [w] corresponds closely in articulation to the vowel [uː] of *who*. This can be verified by extending the pronunciation of a [w]. We will consider [w] a rounded velar glide for purposes of description.

Some speakers of English also have a voiceless (labio)velar glide, transcribed [ʍ], in the words *wh*en, *wh*ere and *wh*ich (but not in *witch*). The [ʍ] pronunciation is common in Scotland and North America, but it is increasingly rare elsewhere (except in contexts where [w] is preceded by a voiceless stop as in Table 2.16 on page 41). In word-initial position it derives from a historical [hw] consonant cluster which has been simplified to [w] by dropping [h] in most dialects.

Language Matters **An investigation: which witch is which?**

Do you make a distinction in your pronunciation of the following pairs of words?

weather	whether
witch	which
wither	whither
wear	where
Wales	whales

Ask some of your friends (of different ages and geographical origins) to pronounce these words. Do they make a distinction?

Table 2.12 provides a summary of the places and manners of articulation of English consonants.

Table 2.12 English consonants: places and manners of articulation

Manner of articulation		*Places of articulation*								
		Labial	*Labiodental*	*Interdental*	*alveolar*	*Postalveolar*	*Retroflex*	*Alveopalatal*	*Velar*	*Glottal*
Stop	Voiceless	p			t				k	ʔ
	Voiced	b			d				g	
Nasal	Voiced	m			n				ŋ	
Fricative	Voiceless		f	θ	s			ʃ		h
	Voiced		v	ð	z			ʒ		
Affricate	Voiceless							tʃ		
	Voiced							dʒ		
Liquid	Voiced Lateral				l					
	Voiced Approximant				ɹ					
	Voiced Trill				r					
	Voiced Flap				ɾ		ɽ			
Glide	Voiceless								(ʍ)	
	Voiced							j	w	

Language Matters **What s the world s most unusual speech sound?**

Pirahã, a language with a couple of hundred speakers in Brazil, has a sound that is produced as follows: the tongue tip first touches the alveolar ridge and then comes out of the mouth, almost touching the upper chin as the underblade of the tongue touches the lower lip.

Technically speaking, this is known as a 'voiced, lateralised apical-alveolar/sublaminal-labial double flap with egressive lung air'. (Fortunately, for all concerned, the sound is only used in 'certain special types of speech performance'.) Try it. Impress your friends.

Source: Ladefoged, P. and I. Maddieson. *The Sounds of the World's Languages*. Malden, MA: Blackwell, 1996.

2.6 Vowels

Vowels are sonorous, syllabic sounds made with the vocal tract more open than it is for consonant and glide articulations. Different vowel sounds (also called vowel *qualities*) are produced by varying the placement of the body of the tongue (remember that for vowels

your tongue tip is behind your lower, front teeth) and shaping the lips. The shape of the vocal tract can be further altered by protruding the lips to produce rounded vowels, or by lowering the velum to produce a nasal vowel. Finally, vowels may be tense or lax, depending on the degree of vocal tract constriction during their articulation.

The following section on vowels introduces most of the basic vowels of English. Some phonetic detail is omitted that will be introduced in the following chapter.

2.6.1 Simple vowels and diphthongs

English vowels are divided into two major types, **simple vowels** (also called **pure vowels** or **monophthongs)** and **diphthongs** (Table 2.13). Simple vowels do not show a noticeable change in quality. The vowels of *pit*, *set*, *cat*, *dog*, *but*, *put* and the first vowel of *suppose* are all simple vowels.

Diphthongs are vowels that exhibit a change in quality within a single syllable. English diphthongs show changes in quality that are due to tongue movement away from the initial vowel articulation towards another vowel position. This change in vowel quality is clearly perceptible in words such as *say*, *buy*, *cow*, *ice*, *lout*, *go* and *boy*. The first part of a diphthong is much longer and perceptually more salient than the second.

In standard British English, there are nine diphthongs and they fall into two classes: **centring diphthongs** and **closing diphthongs.** In a centring diphthong, during the final phase of the vowel articulation, the highest point of the tongue moves quickly towards the centre of the mouth – the typical position it assumes for the articulation of schwa ([ə]), the vowel at the beginning of the word *aloud*. There are four centring diphthongs, namely [ɪə], as in *dear*, *cheer* and *clear;* [eə] as in *rare*, *wear* and *air;* [ʊə] as *boor*, *sure* and *dour;* and [ɔə] as in *oar*, *shore* and *roar*. Nowadays, [ʊə] and [ɔə] are disappearing from RP and many other varieties of British English. They are being replaced by [ɔ:]. As a result, words like *paw*, *pore* and *poor* rhyme with each other. They all come out as [pɔ:].

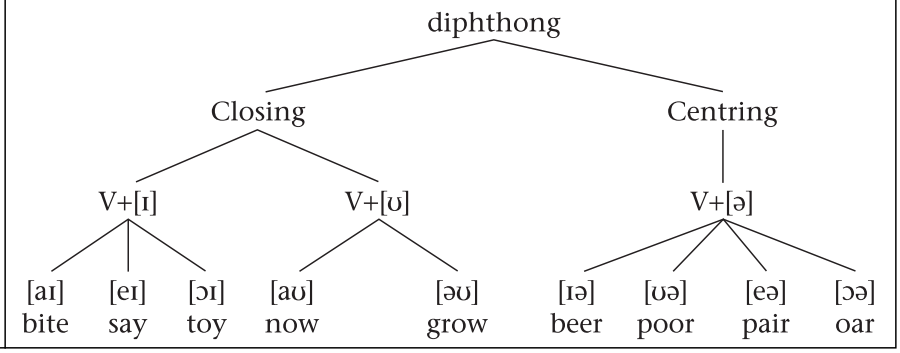
In closing diphthongs, the tongue starts in a relatively low position and ends up in a high position either in the palatal area at the front of the mouth in the region where the glide [j] is articulated, or at the back of the mouth in the velar area where the glide [w] is produced. There are three closing diphthongs that end in [ɪ]. They are [eɪ] which is found in *way*, *weight* and *tail;* [aɪ] which is found in *tie*, *buy* and *my;* and [ɔɪ] which is found in *oil*, *boy* and *coin*. There are only two diphthongs rising to [ʊ], namely [əu] as in *no*, *go* and *slow* and [aʊ] which occurs in *proud*, *town* and *round*. Observe also that in all cases, the diphthongs are somewhat longer than the short simple vowels.[1]

Language Matters **Cross-dialectal variation**

One of the best ways to learn to appreciate some of these fine differences in vowel articulation is to think of some cross-dialectal variation in English. Let us consider the question of the closing diphthongs [eɪ] and [əʊ]. In RP, these sounds are diphthongs (as reflected in our transcription) but this is not the case in *all* dialects of English. In many dialects, e.g. northern English (the varieties of English spoken in the northern counties of England) and in Jamaican English, words like *say* and *go* have simple, long vowels and would be transcribed as [se:] and [go:] respectively.

To listen to the sounds of various English accents and dialects go to The British Library website at www.bl.uk/learning/langlit/sounds/.

Table 2.13 Some simple vowels and diphthongs of British (RP) English

Simple vowels		*Diphthongs*
pit	[ɪ]	
pet	[e]	
port	[ɔː]	
pot	[ɒ]	
pat	[æ]	
putt	[ʌ]	
part	[ɑː]	

Note: The colon indicates length. (See section 2.6.2 below.)

Vowel articulations are not as easy to feel at first as consonant articulations because the vocal tract is not narrowed as much. To become acquainted with vowel articulation, alternately pronounce the vowels of *he* and *art*. You will feel the tongue move from a **high** front to a **low** back position. Once you feel this tongue movement, alternate between the vowels of *part* and *pat*. You will feel the tongue moving from the low **back** to low **front** position. Finally, alternate between the vowels of *he* and *who*. You will notice that in addition to a tongue movement between the high front and high back position, you are also rounding your lips for the [uː]. Figure 2.8 shows a midsagittal view of the tongue position for the vowels [iː], [ɑː] and [uː] based on X-ray studies of speech.

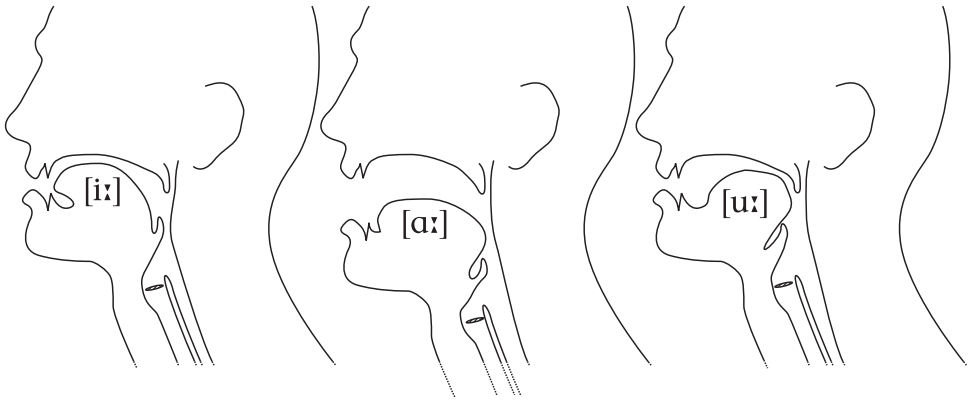


Figure 2.8 Tongue position and transcription for three English vowels

Vowels for which the tongue is neither raised nor lowered are called **mid vowels**. In some cases, the relative height of the tongue in the general mid zone results in vowels that are perceptibly different. So, it may be necessary to distinguish between **mid**, **mid-high** and **mid-low** vowels. Thus, in RP, [e] the front vowel of *set* is said to be mid-high, front and unrounded while [ɔː], the vowel of *storm*, is mid-low, back and rounded. Schwa ([ə]), the first and the last vowels of *Madonna* is a mid, central vowel. Similar to schwa is the long unrounded central vowel [ɜː] found in words like *bird* and *word*. (See section 2.6.2 for further discussion.)

Unfortunately, there are no clear cutoff points between various tongue height positions. Hence it is not always obvious whether a sound should be classified, say, as mid-high rather than mid, or as mid rather than mid-low. That is why there is some variation in the symbols

chosen by phoneticians to represent the vowel sound in words like *pet* and *tell* in RP. Those in whose judgment the tongue is in a relatively high position use the symbol [e], which represents a fairly mid-high articulation, while those who think the tongue is relatively low use the symbol [ɛ], which represents a more open, mid-lowish vowel.

The motivation for the distinction between mid-high and mid-low vowels is much clearer in Scottish English where a contrast normally exists between the mid-high front unrounded vowel [e] of *tail* and the mid-low front unrounded vowel [ɛ] found in *tell*. A similar contrast exists between the mid-high back rounded vowel [o] of *boat* and the mid-low back rounded vowel [ɔ] found in *bought*.

The RP vowels presented so far in this section are summed up in Table 2.14. Note that in describing the vowels, the articulatory parameters are presented in the order *height*, *backness*, *rounding*.

Table 2.14 Basic phonetic parameters for describing RP English vowels

sheet	[iː]	high front unrounded
set	[e]	mid-high front unrounded
shoot	[uː]	high back rounded
mad	[æ]	low front unrounded
purr	[ɜː]	central (i.e., mid and neither front nor back) unrounded
caught	[ɔː]	mid-low back rounded
cot	[ɒ]	low back rounded
cart	[ɑː]	low back unrounded[2]

Before leaving this section, there is a lack of terminological uniformity about which you should be warned. The terms high, high-mid, low-mid and low used in this book correspond respectively to **close**, **close-mid**, **open-mid** and **open** which are used by some other linguists. (See the IPA vowel chart on the inside back cover.)

2.6.2 Tense and lax vowels

All of the vowels illustrated in Figure 2.9, except [e], [æ], [ʌ] and [ɒ] are tense. They are produced with a placement of the tongue that results in greater vocal tract constriction than that of

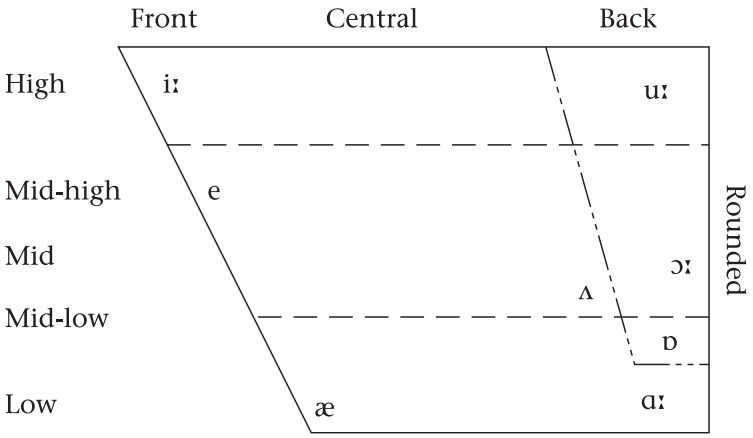


Figure 2.9 Basic positions for RP vowels

non-tense vowels; in addition, tense vowels are longer than non-tense vowels. Some vowels of English are made with roughly the same tongue position as the tense vowels, but with a less constricted articulation. They are called **lax** vowels. Table 2.15 provides examples from RP comparing tense and lax simple vowels. Note that not all the vowels come in tense/lax pairs.

Table 2.15 Tense and lax vowels in RP

Tense		*Lax*	
(a) Pure vowels			
f<u>ee</u>t	[iː]	f<u>i</u>t	[ɪ]
–	–	m<u>e</u>t	[e]
–	–	m<u>a</u>t	[æ]
f<u>a</u>rm	[ɑː]	–	–
p<u>oo</u>l	[uː]	pull	[ʊ]
c<u>au</u>ght	[ɔː]	–	–
–	–	c<u>o</u>t	[ɒ]
w<u>o</u>rd	[ɜː]	cobra	[ə]
(b) diphthongs			
m<u>a</u>ke	[eɪ]		
b<u>i</u>ke	[aɪ]		
b<u>oi</u>l	[ɔɪ]		
n<u>o</u>te	[əʊ]		
sh<u>ou</u>t	[aʊ]		
r<u>a</u>re	[eə]		
d<u>ee</u>r	[ɪə]		
p<u>oo</u>r	[ʊə]		
r<u>oa</u>r	[ɔə] (marginal)		

The difference between two of the vowels illustrated in Table 2.15 is often not easy to hear at first. The vowel [ʌ] in *c<u>u</u>t*, *d<u>u</u>d*, *pl<u>u</u>ck* and *r<u>u</u>n* is back, unrounded, mid-low and lax while the vowel [ə] of *b<u>a</u>nan<u>a</u>*, *<u>a</u>bout*, *tom<u>a</u>hawk* and *sofa* is mid, central, unrounded and lax. The vowel of the second set of examples, labelled **schwa**, is called a **reduced** vowel. In addition to being lax, it is characterised by very brief duration.

Language Matters **Linguistic conservatism and dialectal variation**

Linguistic conservatism is one of the factors responsible for dialectal variation. Language change does not proceed at the same pace in all dialects. When innovative dialects introduce new forms, speakers of conservative dialects are often slow to jump on the bandwagon. That is certainly true of northern English, which is generally conservative. For instance, the vowel [ʌ], spelt with the letter <u> which is found in RP and most other varieties of English is derived historically from [ʊ]. The change of [ʊ] to [ʌ] in London and the south of England affected some words e.g., *cut, dud, pluck* and *run,* which have the [ʌ] vowel, but not others like *pull, push, butcher* and *bull* which retained the original [ʊ] pronunciation. By contrast, in all cases the conservative northern dialects have kept the earlier pronunciation of [kʊt] *cut,* [dʊl] *dull* and [plʊk] *pluck*. (See Chapter 14, Section 14.2.1.)

In English, the tense vowels tend to be longer than their lax counterparts. For this reason, some phoneticians refer to them as **long** and short vowels respectively. As we saw above, diphthongs are longer than simple vowels. In many cases they display the same behaviour as tense simple vowels. So, they are also classified as tense. Indeed, in some dialects, the same vowel may be realised as a tense simple vowel or as a diphthong in different contexts. For instance, in RP, when tense [iː] and [uː] occur at the end of a word they are often pronounced not as pure vowels, but as the diphthongs [ij] and [uw].

The vowel [ɜː] of *word*, *bird*, *nerve, church* and *journal* is mid, central, unrounded and tense. In other words, it is just like schwa in all things but tenseness (or length). The spelling gives a clue to its origins. In most cases [ɜː] is derived from a vowel followed by [r]. In most varieties of British English the [r] following a vowel was lost, leaving behind a lengthened, tense vowel. In Scotland, North America, the south-west of England and parts of Lancashire in the north-west of England the [r] was not entirely lost. There is still a residual [r] which 'colours' the preceding vowel. The r-colouring of a vowel is referred to as **rhotacisation**. A rhotacised schwa is represented by the symbol [ɚ] in IPA. (See also the discussion of centring diphthongs in section 2.6.1 above.)

There is a simple test that helps determine whether vowels are tense or lax. In English, monosyllabic words spoken in isolation do not end in lax vowels. We find *see* [siː], *say* [seɪ], *Sue* [suː], *so* [səʊ] and *saw* [sɔː], but not [sɪ], *[se], *[sæ], *[sʊ], *[sɒ] or *[sʌ]. Schwa, however, frequently appears in unstressed position in polysyllabic words like *sof[ə]* and *Canad[ə].* It should be pointed out – especially for those who think their ears are deceiving them – that many speakers produce the final vowel in the last two examples not as [ʌ] but as [ə].

The representation of vowels and their articulatory positions (Figure 2.9) is expanded in Figure 2.10 to include more tense and lax vowels. This rather formidable crowd of vowels should not intimidate you. If you are a native speaker of RP, you have been using these vowels (and others, some of which you will be introduced to in the next chapter) most of your life. Learning to hear them consciously and transcribe them is not a difficult task. The next section provides more examples of the transcription of English consonants and vowels.

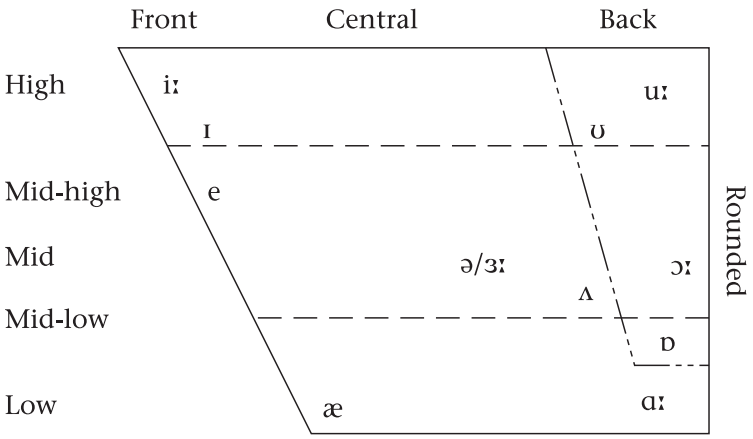


Figure 2.10 Basic positions for RP vowels (expanded)

2.7 Phonetic transcription of English consonants and vowels

Tables 2.16 and 2.17 present the phonetic symbols for consonants and vowels commonly used to transcribe RP. To illustrate how each symbol is used, one word is transcribed completely,

Table 2.16 Transcribing English consonants

Symbol	*Word*	*Transcription*	*More examples*
[pʰ]	pit	[pʰɪt]	pain, upon, apart
[p]	spit	[spɪt]	spar, crispy, up, culprit, bumper
[tʰ]	tick	[tʰɪk]	tell, attire, terror, tutu
[t]	stuck	[stʌk]	stem, hunt, nasty, mostly
[kʰ]	keep	[kʰiːp]	cow, kernel, echo
[k]	skip	[skɪp]	scatter, uncle, blacklist, likely
[ʔ]	atlas	[æʔtləs]	witness, top, rich (glottal reinforcement of a following stop or affricate)
[tʃ]	chip	[tʃɪp]	lunch, lecher, ditch, belch
[dʒ]	judge	[dʒʌdʒ]	germ, journal, budgie, wedge
[b]	bib	[bɪb]	boat, liberate, rob, blast
[d]	dip	[dɪp]	dust, adder, red
[ɾ]	very	[veɾɪ]	merry, curry, serial (for some RP speakers); madder, matter, hitting, writer, rider (in North American English)
[g]	get	[get]	gape, mugger, twig, gleam
[f]	fit	[fɪt]	flash, coughing, proof, phlegmatic, gopher, office
[v]	vat	[væt]	vote, oven, prove
[θ]	thick	[θɪk]	thought, ether, teeth, three, bathroom
[ð]	though	[ðəʊ]	then, bother, teethe, bathe
[s]	sip	[sɪp]	psychology, fasten, fancy, bass, curse, science
[z]	zap	[zæp]	Xerox, scissors, desire, zipper, fuzzy
[ʃ]	ship	[ʃip]	shock, nation, mission, vicious, wish, chivalry
[ʒ]	azure	[eɪʒə]	measure, rouge, visual, garage (for some speakers), Taj Mahal
[h]	hat	[hæt]	who, ahoy, forehead, behind
[j]	yet	[jet]	use, few, yes
[w]	witch	[wɪtʃ]	wait, weird, when
[ʍ]	which	[ʍɪtʃ]	what, where, when (for some speakers)
[l]	leaf	[liːf]	loose, lock, alive, blue
[ ]	huddle	[hʌd]	bottle, needle, medal (for many speakers)
[r]	reef	[riːf]	prod, arrive, tomorrow
[m]	moat	[məʊt]	mind, humour, shimmer, sum, thumb, lamb, atom, random, Adam, rhythm, anthem
[m̩]	'm-m'	[ʔm̩ʔm̩]	bottom, random, Adam, rhythm, anthem
[n]	net	[net]	now, winner, angel, sign, wind
[ ]	button	[bʌt]	cotton, mutton, happen, sudden, Jordan
[ŋ]	sing	[sɪŋ]	singer, longer, bank, twinkle

Table 2.17 Transcribing English vowels

TENSE PURE VOWELS			
Symbol	*Word*	*Transcription*	*More examples*
[iː]	fee	[fiːt]	she, cream, believe, receive, serene, amoeba, ski
[uː]	boot	[buːt]	too, two, loose, brew, Louise, Lucy, through, Peru
[ɑː]	cart	[kɑːt]	card, guard, master, laugh, aunt, heart, sergeant
[ɜː]	firm	[fɜːm]	herd, prefer, Hurd, err, heard, worm, connoisseur, myrrh, colonel
[ɔː]	saw	[sɔː]	saw, court, caught, port, walk, decor, dinosaur, Auckland
(TENSE) DIPHTHONGS			
Symbol	*Word*	*Transcription*	*More examples*
[eɪ]	fate	[feɪt]	they, clay, grain, gauge, escape, way, engage, great, sleigh
[aɪ]	rice	[raɪs]	I, eye, my, try, tide, thigh, byte, buy, dye, die
[ɔɪ]	boy	[bɔɪ]	voice, boil, toy, royal
[əʊ]	note	[nəʊt]	no, toe, sumo, throat, though, slow, oaf, Toronto, O'Connor
[aʊ]	crowd	[kraʊd]	out, house, plough, town, now, glaucoma, Faust
[ɪə]	cheer	[tʃɪə]	clear, idea, criteria, weird, here, mere
[eə]	chair	[tʃeə]	flare, flair, parent, where , heir, mayor
[ʊə]	poor	[pʊə]	sure, moor, tour, velour, paramour
[ɔə]	oar	[ɔə]	door, ore, roar, shore, more, pour
LAX VOWELS			
Symbol	*Word*	*Transcription*	*More examples*
[ɪ]	fit	[fɪt]	hit, income, definition, pity (for some speakers)
[e]	let	[let]	led, head, says, said, sever, guest, friend, ate
[æ]	bat	[bæt]	panic, van, marry, racket, gas, planet, plastic
[ɒ]	cod	[kɒd]	dog, rock, holly, yacht, watch, what, cough
[ʊ]	put	[pʊt]	bush, hook, foot, book, hood, woman, wolf
[ʌ]	shut	[ʃʌt]	cut, putt, other, udder, lucky, son, tough, flood, supper
[ə]	letter	[letə]	about, abbot, woman, splendor, Canberra, canary, support, colour

and then some other words in which the same sound is found are given. You will notice that in the example words, the spelling of the sound may vary. Be careful of this when you transcribe words phonetically – the sound of a word, not its spelling, is what is transcribed!

2.8 Suprasegmentals

All phones have certain inherent **suprasegmental** or **prosodic** properties that form part of their makeup no matter what their place or manner of articulation. These properties are **pitch**, **loudness** and **length**.

All sounds give us a subjective impression of being relatively higher or lower in pitch. Pitch is the auditory property of a sound that enables us to place it on a scale that ranges from low to high. Pitch is especially noticeable in sonorous sounds like vowels, glides, liquids and nasals. Even stop and fricative consonants convey different pitches. This is particularly noticeable among the fricatives, as you can hear by extending the pronunciation of [s] and then of [ʃ]; the [s] is clearly higher pitched. All sounds have some degree of intrinsic loudness as well or they could not be heard. Moreover, all sounds occupy a certain stretch of time – they give the subjective impression of length.

2.8.1 Pitch: tone and intonation

Speakers of any language have the ability to control the level of pitch in their speech. This is accomplished by controlling the tension of the vocal folds and the amount of air that passes through the glottis. The combination of tensed vocal folds and greater air pressure results in higher pitch on vowels and sonorant consonants, whereas less tense vocal folds and lower air pressure result in lower pitch. Two kinds of controlled pitch movement found in human language are called **tone** and **intonation**.

Tone

A language is said to have tone or be a **tone language** when differences in word meaning are signalled by differences in pitch. Pitch on forms in tone languages functions very differently from the movement of pitch in a non-tone language. When a speaker of English says *a car?* with a rising pitch, the word *car* does not mean anything different from the same form pronounced on a different pitch level or with a different pitch contour. In contrast, when a speaker of a tone language such as Mandarin pronounces the form *ma [mà]* with a falling pitch, it means 'scold', but when the same form (*ma*) is pronounced with a rising pitch, as [má] the meaning is 'hemp' (see Figure 2.13). There is no parallel to anything like this in non-tone languages such as English and French.

Unlike the preceding Mandarin falling or rising tone examples, some languages show only what are known as level tones. Tsúut'ína (or Sarcee), an Athabaskan language spoken in Alberta, has high, mid and low pitch level tones. In Figure 2.11, the uppercase letters H, M and L stand for high, mid and low tones, respectively. An **association line** drawn from the letters to the vowel links the segments with their respective tones.

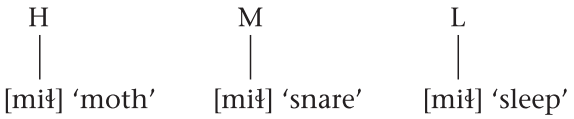


Figure 2.11 Tsúut'ína level tones ([ɬ] is a voiceless **lateral fricative**)

Level tones that signal meaning differences are called **register tones**: two or three register tones are the norm in most of the world's register tone languages, though four have been reported for Mazatec, a language spoken in Mexico.

A single tone may be associated with more than one syllabic element. In Mende, spoken in West Africa, certain polysyllabic forms show the same tone on each syllable (in Table 2.18, the diacritic [´] indicates a high tone and the diacritic [`] indicates a low tone).

Table 2.18 High-tone and low-tone words in Mende

pɛ́lɛ́	'banana'
háwámá	'waistline'
kpàkàlì	'tripod chair'

This formalism, which is an an example of **autosegmental notation**, allows us to represent the tone as characteristic of an entire form. The single underlying tone unit is associated with all vowels. (Figure 2.12.)

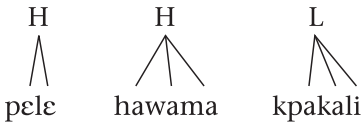


Figure 2.12 Tone as a word feature

In some languages, tones can change pitch within a single syllabic element. Moving pitches that signal meaning differences are called **contour tones**. In Mandarin, both register and contour tones are heard. Contour tones are shown by pitch level notation lines that converge above the vowel, as shown in Figure 2.13.

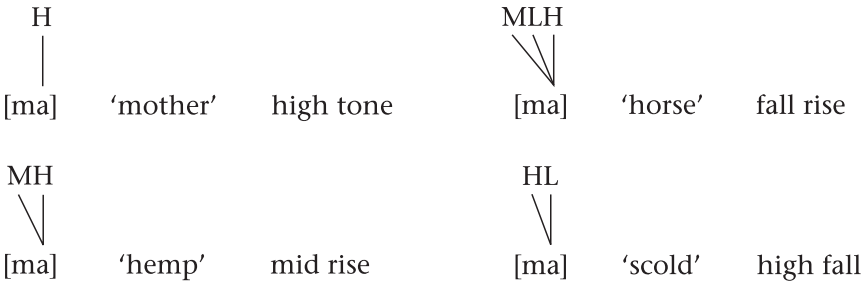


Figure 2.13 Register and contour tones in Mandarin

In Figure 2.13, there is one (high) register tone. The other tones are all contour tones.

In other languages, tone can have a grammatical function. In Bini, a language spoken in Nigeria, tone can signal differences in the tense of a verb (such as past versus present), as Figure 2.14 shows.

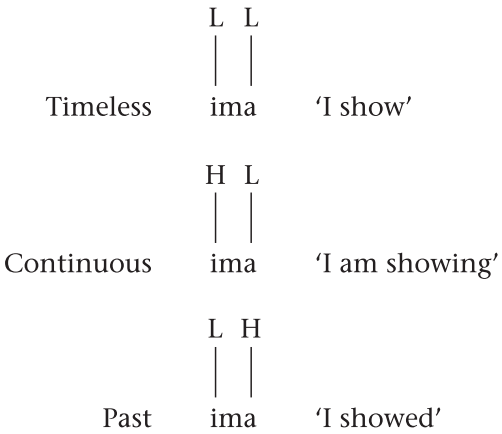


Figure 2.14 Tense and tone in Bini

Although tones may seem exotic to native speakers of Western European languages, they are very widespread. Tone languages are found throughout North and South America, sub-Saharan Africa and East Asia.

Intonation

Pitch movement in spoken utterances that is not related to differences in word meaning is called intonation. It makes no difference to the meaning of the word *seven*, for example, whether it is pronounced with a rising pitch or a falling pitch.

Intonation often does serve to convey information of a broadly meaningful nature, however. For example, the falling pitch we hear at the end of a statement in English such as *Fred parked the car* signals that the utterance is complete. For this reason, falling intonation at the end of an utterance is called a **terminal (intonation) contour**. Conversely, a rising or level intonation, called a **non-terminal (intonation) contour**, often signals incompleteness. Non-terminal contours are often heard in the non-final forms found in lists and telephone numbers.

Language Matters Who eats, shoots & leaves?

In English orthography punctuation marks often serve to indicate syntactic units and to suggest intonation patterns. If you read an unpunctuated string of words such as *Dave said Jane is brilliant* you will observe that there are two possible interpretations, depending on the pitch modulation and groupings of words that is chosen.

Failure to punctuate appropriately is the basis of a lot of humour, some of it unintended, as in this sentence that appeared in a student composition:

> *When we finished eating Sam his Chihuahua barked.*

But inappropriate punctuation is also the basis of many intended jokes, such as the one below that was published in a popular punctuation manual:

> A panda walks into a bar. He orders a sandwich, eats it, then draws a gun and fires two shots in the air.
>
> 'Why? Why are you behaving in this strange, un-panda-like fashion?' asks the confused waiter, as the panda walks towards the exit. The panda produces a badly punctuated wildlife manual and tosses it over his shoulder.
>
> 'I'm a panda,' he says, at the door. 'Look it up.'
>
> The waiter turns to the relevant entry and, sure enough, finds an explanation.
>
> 'Panda. Large black-and-white bear-like mammal, native to China. Eats, shoots and leaves.'

Source: Truss, L. *Eats, Shoots & Leaves*. London: Profile Books, 2003.

In questions, final rising intonations also signal a kind of incompleteness in that they indicate that a conversational exchange is not finished. *Are you hungry?* However, English sentences that contain question words like *who*, *what*, *when* and *how* (for example, *What did you buy?*) ordinarily do not have rising intonation. It is as if the question word itself is enough to indicate that an answer is expected.

Although intonation can be represented graphically as in Figures 2.15 and 2.16, a more formal way of representing intonation is shown in Figure 2.17. Here, as in tonal representation, L and H are relative terms for differences in pitch. The letters HL are placed above

Sally Fred Helen and Joe

two eight four two five one three

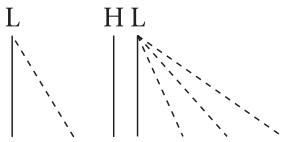
Figure 2.15 Rising non-terminal intonations in a list and a telephone number

Did you have a nice time

Figure 2.16 Non-terminal intonation in a question

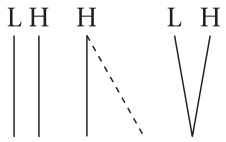
the syllabic elements on which the pitch change occurs. The dotted lines indicate that the lowering pitch spreads across the remaining pitch-bearing elements.

The complex use of intonation has just been touched on here. For example, rising intonation is often used to express politeness, as in *Please sit down*. Some linguists think that this is an extension of the 'open-ended mode' of intonation, and that since a rising intonation indicates that further response is expected (but not demanded) of the addressee, a sentence uttered with a rising intonation sounds less like an order and so is more polite (Figure 2.18).



There's an elephant in here.

Figure 2.17 A terminal contour

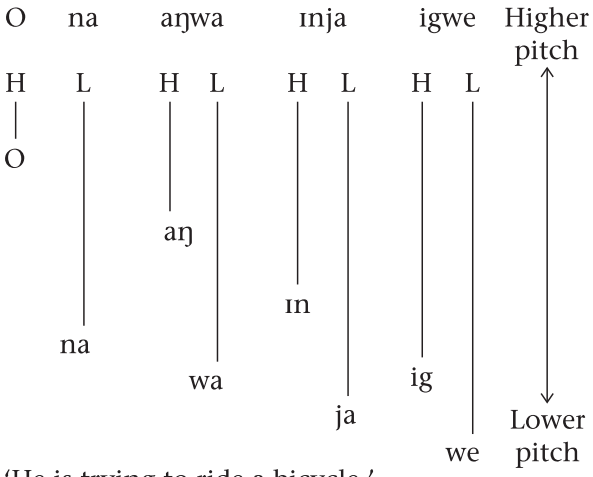


Margo? Is that you?

Figure 2.18 Two non-terminal contours

Intonation and tone

Tone and intonation are not mutually exclusive. Tone languages show intonation of all types. This is possible since tones are not absolute but relative pitches. For example, a tone is perceived as high if it is high relative to the pitches around it. As long as this relative difference is maintained, the pitch distinctions will also be maintained. This is shown graphically in Figure 2.19, which represents the overall pitch of a declarative sentence in Igbo, a West African language with register tones. Note how an Igbo speaker clearly maintains the distinction among the pitch registers even as the overall pitch of the utterance falls. Each high tone is always lower than the preceding high tone, but higher than the low tone that immediately precedes it. This phenomenon is known as **downdrift**.



'He is trying to ride a bicycle.'

Figure 2.19 Tone and intonation: downdrift in Igbo

2.8.2 Length

In many languages there are both vowels and consonants whose articulation takes longer relative to that of other vowels and consonants. This phenomenon, known as length, is widespread in the world's languages. Length is indicated in phonetic transcription by the use of an IPA-style colon [ː] (or simply a colon [:] in North American transcription) placed after the segment in question.

Hungarian, German, Cree and Finnish are a few of the many languages that have long and short vowels. Yapese, a language spoken on the island of Yap in the Western Pacific, shows short and long vowels in pairs of words such as in Table 2.19.

Table 2.19 Short and long vowels in Yapese

[θɪs]	'to topple'	[θɪːs]	'(a) post'
[pul]	'to gather'	[puːl]	'moon'
[ʔer]	'near you'	[ʔeːr]	'part of a lagoon'

Italian has short and long consonants in pairs of words such as those shown in Table 2.20. Long and short consonants are also found in many other languages, including Finnish, Turkish and Hungarian.

Table 2.20 Short and long consonants in Italian

fato	[fatɔ]	'fate'	fatto	[fatːɔ]	'fact'
fano	[fanɔ]	'grove'	fanno	[fanːɔ]	'they do'
casa	[kasa]	'house'	cassa	[kasːa]	'box'

2.8.3 Stress

In any utterance, some vowels are perceived as more prominent than others. In a word such as *banana* the second syllable is more prominent than the other two. In a word such as *telegraphic* [tʰèləgrĩ fɪk], the two vowel nuclei that are more prominent than the others are [e] and [æ]. Syllabic segments perceived as relatively more prominent are stressed. Stress is a cover term for the combined effects of pitch, loudness, and length – the result of which is perceived prominence. In each language, the effect of these prosodic features varies. In general, English **stressed vowels** are higher in pitch, longer and louder than unstressed ones. In some languages, the impression of vowel prominence results from a different interaction of the prosodic parameters than is found in English. In Modern Greek, for example, syllables tend to be of equal length. Stress, therefore, is manifested by a change only in pitch and loudness and not in syllable length. Tone languages do not change the pitch level or contour of tones to mark stress. In many of these languages, relative prominence is marked by exaggerating the vowel length or pitch contour.

There are various ways to mark stress in phonetic transcription. North American transcription commonly uses an acute accent [ˊ] placed over the vowel nucleus in question to mark the most prominent or **primary** stress, and a grave accent [ˋ] to mark the second most prominent or **secondary** stress or stresses. (This should not be confused with the use of the same diacritics to mark tone in tone languages.) Stress can also be marked by placing

numbers above the stressed vowels, usually [1] for a primary stress and [2] for a secondary stress. The word *telegraphic* can therefore be transcribed in either of the following ways:

(2) [tʰèləgrĩ fɪk] or [$^{2}\,^{1}$tʰeləgræfɪk]

The examples in Table 2.21 illustrate some differences in English stress placement. In the last four examples, you can also see that the quality of certain vowels varies depending on whether they are stressed or unstressed. This phenomenon is common in English, Russian, Palauan and many other languages, but is not universal.

Table 2.21 Differing stress placement in English

(an) éxport	[ékspɔːt]
(a) présent	[prézənt]
télegràph	[tʰéləgræf]
telégraphy	[tʰəlégrəfi]
tèlegráphic	[tʰèləgrĩ fɪk]
(to) expórt	[ekspɔ́ːt]
(to) presént	[prəzént]

2.9 Speech production

Up to this point, we have, for the most part, been describing phonetic segments as if they existed in isolation, and did not affect one another. However, speech production is not a series of isolated events. The phenomenon is a complex one, as the articulatory organs operate independently of each other (as we saw in section 2.5.5) and many fine adjustments are carried out very rapidly as we speak. As a consequence, speech production often results in the articulation of one sound affecting that of another sound.

2.9.1 Coarticulation

In order to articulate a sequence of phonetic segments, we have to plan a complex series of muscular movements. Due to the rapidity of speech (we can produce many segments in a second) and the design of the vocal tract, if our goal is to produce a [pl] sequence, we cannot first make the [p] and then make the [l]. Indeed, early speech synthesisers that produced speech in this way were practically unintelligible. Rather, as the sequence [pl] is produced, the tongue tip will start to move towards the alveolar ridge *before* the lips separate. The term **coarticulation** is used for situations such as this in which more than one articulator (here the lips and the tongue tip) is active. For more detailed information on this phenomenon, please see the website at www.pearsoned.co.uk/ogrady.

2.9.2 Processes

Articulatory adjustments that occur during the production of connected speech are called **processes**. Processes change the nature of the individual segment. Their cumulative effect

often results in making words easier to articulate, and in this sense they are said to make speech more efficient. For example, when speakers of English nasalise the vowel of *bank*, they do not delay lowering the velum until the exact moment the nasal consonant articulation is reached. Instead, most English speakers begin lowering the velum for a nasal consonant almost as soon as they articulate the vowel that precedes it.

In a parallel manner, when speakers pronounce [k̟] as more palatal in a word such as *key*, they are speaking more efficiently from the point of view of articulation since they are making a less drastic adjustment in moving from the articulation of a more palatal [k̟] to that of a high front vowel than they would make in moving from a velar [k] to a high front vowel. Even more drastically, a speaker of English who says [p̥rejd] for *parade* is making a major adjustment that results in a more efficient articulation: the two syllables of a careful pronunciation of *parade* are reduced to one by dropping the unstressed vowel of the first syllable; the tongue position for [r] can be anticipated during pronunciation of the [p]; and the voicelessness of the initial stop is carried on through the [r̥].

Some processes appear to make articulation less, not more, efficient. For example, English speakers often lengthen consonants and vowels when they are asked to repeat a word that someone has not heard clearly. The following kind of exchange is typical.

(3) 'It's Fred.'
'Did you say, "It's red"?'
'No, I said, "Fffreeed!" '

Lengthening segments results in a greater articulatory effort, but the process results in a more distinct form that is easier to perceive.

Another process that results in more easily perceivable speech adds a segment under certain conditions. When speaking slowly and carefully in a noisy environment, for example, English speakers often insert a vowel inside a group of consonants. This breaks up the sequence of consonants into separate syllables. To judge from the use people often make of this process when they wish to be clearly understood, it may well make words easier to perceive.

(4) 'Stop screaming!'
'What? Stop dreaming?'
'I said, "Stop sc[ə]reaming!" '

These examples show that there are two basic reasons for the existence of articulatory processes. Some processes result in a *more efficient articulation* of a series of sounds in that the precise timing and coordination of speech is relaxed to various degrees. Other processes result in a *more distinct output*, which is easier to perceive than fluent or rapid everyday speech. Although these two types of processes might at first appear to be contradictory, each serves a particular end in speech production.

2.9.3 Some common articulatory processes

Only a finite number of processes operate in language, though their end result is a great deal of linguistic variability. In this section, we survey some of the most common of these processes.

Assimilation

A number of different processes, collectively known as **assimilation**, result from the influence of one segment on another. Assimilation always results from a sound becoming more like another nearby sound in terms of one or more of its phonetic characteristics.

Nasalisation of a vowel before a nasal consonant is caused by speakers anticipating the lowering of the velum in advance of a nasal segment. The result is that the preceding segment takes on the nasality of the following consonant as in [kʰɑ̃nt] 'can't'. This type of assimilation is known as **regressive assimilation**, since the nasalisation is, in effect, moving *backwards* to a preceding segment.

The nasalisation of vowels following nasal consonants in Scots Gaelic is an example of **progressive assimilation**, since the nasality moves *forward* from the nasal consonant onto the vowel (Table 2.22). It results from not immediately raising the velum after the production of a nasal stop.

Table 2.22 Progressive nasalisation of vowels in Scots Gaelic

[mõːr]	'big'
[n]	'cattle'
[mũ]	'about'
[nẽːl]	'cloud'

Voicing assimilation is also widespread. For many speakers of English, voiceless liquids and glides occur after voiceless stops in words such as *please* [pl̥iːz], *proud* [pr̥aʊd] and *pure* [pj̥ʊə]. These sounds are said to be devoiced in this environment. **Devoicing** is a kind of assimilation since the vocal folds are not set in motion immediately after the release of the voiceless consonant closure. The opposite of devoicing is **voicing**. In Dutch, voiceless fricatives assimilate to the voicing of the stops that follow them, in anticipation of the voiced consonant. For example, the word *af* [ɑf] 'off, over' is pronounced with a [v] in the words *afbellen* 'to cancel' and *afdekken* 'to cover'.

Assimilation for place of articulation is also widespread in the world's languages. Nasal consonants are very likely to undergo this type of assimilation, as shown in Table 2.23.

Table 2.23 Assimilation for place of articulation in English

possible	i<u>mp</u>ossible
potent	i<u>mp</u>otent
tolerable	i<u>nt</u>olerable
tangible	i<u>nt</u>angible

The negative form of each of these words is made with either *im* or *in*. In both cases, the form shows a nasal consonant that has the same place of articulation as the stop consonant that follows it: labial in the case of *possible* and *potent*, and alveolar in the case of *tolerable* and *tangible*. In informal speech, many English speakers pronounce words like *inconsequential* and *inconsiderate* with an [ŋ] where the spelling shows *n*. Assimilation can also be heard in pronunciations such as *Va*[ŋ]*couver* and *Ba*[ɱ]*ff* (the symbol [ɱ] represents a labiodental nasal). Assimilation may even cross the boundary between words. In rapid speech, it is not uncommon to hear people pronounce phrases such as *in code* as [Iŋ kəʊd].

The English example in Table 2.23 shows regressive assimilation for place of articulation. The example in Table 2.24, taken from German, shows progressive assimilation that again affects nasal consonants. In careful speech, certain German verb forms are pronounced with a final [ən], as in *laden* 'to load', *loben* 'to praise' and *backen* 'to bake'. In informal speech,

Table 2.24 Progressive assimilation in German

laden	[la:dən]	[laːd ̩]	'to load'
loben	[lo:bən]	[loːbm̩]	'to praise'
backen	[bakən]	[bakŋ̩]	'to bake'

the final [ən] is reduced to a syllabic nasal, which takes on the point of articulation of the preceding consonant. (Recall that the little diacritic line under the phonetically transcribed nasals indicates that they are syllabic.) (Table 2.24.)

Flapping is a process in which a dental or alveolar stop articulation changes to a flap [ɾ] articulation. In Canadian and American English, this process applies to both [t] and [d] that occur between vowels, the first of which is generally stressed. Flaps are heard in the casual speech pronunciation of words such as *butter*, *writer*, *fatter*, *wader* and *waiter* and even in phrases such as *I bought it* [aɪ bɑ́ɾɪt]. The alveolar flap is always voiced. Flapping is considered a type of assimilation because it changes a non-continuant segment (a stop) to a continuant segment (flaps are classified as continuants) in the environment of other continuants (vowels). In addition, note that voicing assimilation also occurs in the change of the voiceless [t] to the voiced [ɾ].

Dissimilation

Dissimilation, the opposite of assimilation, results in two sounds becoming less alike in articulatory or acoustic terms. The resulting sequence of sounds is easier to articulate and distinguish. It is a much rarer process than assimilation. One commonly heard example of dissimilation in English occurs in words ending with three consecutive fricatives, such as *fifths*. Many speakers dissimilate the final [fθs] sequence to [fts], apparently to break up the sequence of three fricatives with a stop.

Deletion

Deletion is a process that removes a segment from certain phonetic contexts. Deletion occurs in everyday rapid speech in many languages. In English, a schwa [ə] is often deleted when the next vowel in the word is stressed, as shown in Table 2.25.

Table 2.25 Deletion of [ə] in English

[pʰəréɪd]	[pʰr̥éɪd]	'parade'
[kʰərə́ʊd]	[kʰr̥ə́ʊd]	'corrode'
[səpʰə́ʊz]	[spʰə́ʊz]	'suppose'

Deletion also occurs as an alternative to dissimilation in words such as *fifths*. Many speakers delete the [θ] of the final consonant cluster and say [fɪfs]. In very rapid speech, both the second [f] and the [θ] are sometimes deleted, resulting in [fɪs].

Epenthesis

Epenthesis is a process that inserts a syllabic or a non-syllabic segment within an existing string of segments. For example, in careful speech, the words *warmth* and *something* are pronounced [wɔːmθ] and [sʌmθɪŋ] (see Table 2.26). It is common in casual speech for speakers

Table 2.26 Some examples of English consonant epenthesis

something	[sʌmθɪŋ]	[sʌmpθɪŋ]
warmth	[wɔːmθ]	[wɔːmpθ]
length	[leŋθ]	[leŋkθ]
prince	[prɪns]	[prɪnts]
tenth	[tenθ]	[tentθ]

to insert a [p] between the *m* and the *th* and pronounce the words [wɔːmpθ] and [sʌmpθɪŋ]. Consonant epenthesis of this type is another example of a coarticulation phenomenon. In English, the articulatory transition from a sonorant consonant to a non-sonorant appears to be eased by the insertion of a consonant that shares properties of both segments. Notice that the epenthesised consonants are all non-sonorant, have the same place of articulation as the sonorant consonant to their left and have the same voicing as the non-sonorant consonant to their right.

Vowels may also be inserted epenthetically. In Turkish, a word may not begin with two consonants. When words are borrowed into Turkish, an epenthetic vowel is inserted between certain sequences of two initial consonants, creating a new and permissible sequence (see Table 2.27). (The reason for the differences among the vowels need not concern us here; note, though, that the vowel is always high; see section 2.10 for further presentation of these and other unfamiliar symbols.)

Table 2.27 Vowel epenthesis in Turkish

Source word	*Turkish form*
train	t̬iren
club	kʏ̬lʏp
sport	sɯ̬por

Metathesis

Metathesis is a process that reorders a sequence of segments. This often results in a sequence of phones that is easier to articulate. It is common to hear metathesis in the speech of children, who often cannot pronounce all the consonant sequences that adults can. For example, some English-speaking children pronounce *spaghetti* as *pesghetti* [pəskɛtiː]. In this form, the initial sequence [spə], which is often difficult for children to pronounce, is metathesised to [pəs].

The pronunciations of *prescribe* and *prescription* as *perscribe* and *perscription* in dialects like American English where *r* is pronounced following a vowel are often-cited as examples of metathesis in adult speech. In these cases, metathesis appears to facilitate the pronunciation of two successive consonant-*r* sequences in each word.

Vowel reduction

In many languages, the articulation of vowels may move to a more central position when the vowels are unstressed. This process is known as **(vowel) reduction**. Typically, the outcome of vowel reduction is a schwa [ə]; this can be observed in pairs of related words that show

different stress placement such as *Canada* [kĩ nədə] versus *Canadian* [kʰənéɪdɪən]. Note that the first vowel of the word *Canada* is [æ] when stressed but schwa when unstressed, whereas the second vowel of the word *Canadian* is [eɪ] when stressed but a schwa when unstressed. Since we cannot predict what vowel a schwa may 'turn into' when it is stressed, we assume that [æ] and [eɪ] are basic to the words in question and are reduced in unstressed position.

2.10 Other vowels and consonants

So far, this chapter has described only the vowels and consonants of English. Many, but not all, of these sounds are found in other languages. Moreover, many of the sounds found in other languages do not occur in English. Tables 2.28 and 2.29 introduce a number of novel

Table 2.28 Modified IPA chart for vowels, including some of the sounds of English and many of those found in other languages (in parentheses). All vowels can be nasalised

	Front		*(Central)*		*Back*		
	Unrounded	*Rounded*	*Unrounded*	*Rounded*	*Unrounded*	*Rounded*	
High	i ɪ	(y) (ʏ)			(ɯ)	u ʊ	Tense Lax
Mid	e ɛ	(ø) (œ)	ɜ ə (reduced) ʌ		(ɤ)	o ɔ	Tense Lax
Low	æ	(Œ)			ɑ		Tense Lax

Notes:
(i) Vowels not found in English are in parentheses.
(ii) The tense vowels are long in English. Hence they are usually written with 'ː' after them e.g. [iː], [uː], [ɜː], etc.
(iii) All vowels can be nasalised.

Table 2.29 Modified IPA chart for consonants. Sounds that are seldom or never found in English are in parentheses. Voiceless phones are always on the left of pairs with the same place of articulation

	Bilabial	*Labiodental*	*Dental*	*Alveolar*	*Alveopalatal*	*Retroflex*	*Palatal*	*Velar*	*Uvular*	*Pharyngeal*	*Glottal*
Stop	p b			t d		( ) (ɖ)	(c) (ɟ)	k g	(q) (ɢ)		ʔ
Fricative	( ) ( )	f v	θ ð	s z	ʃ ʒ	(ʂ) (ʐ)	(ɕ) (ʝ)	(x) ( )	(ʁ)	(ħ) (ʕ)	(h) (ɦ)
Nasal	m	ɱ		n		(ɳ)	(ɲ)	ŋ			
Trill				(r̆)					(ʀ)		
Flap				ɾ		(ɽ)					
Approximant				ɹ		(ɻ)	(ʮ) j	w			
Lateral Approximant				l̥ l			(ʎ̥) (ʎ)				
Lateral Fricative				(ɬ) (ɮ)							

vowels and consonants that are relevant to the discussion and problems throughout this book. Once the basic articulatory parameters have been understood, it's not a big jump to describe and to pronounce new and unfamiliar sounds.

Remember that phonetic descriptions are universal – they apply to the sounds of any human language. If you encounter the description 'voiced velar fricative,' ([ ]) you know that the sound is a voiced continuant consonant made at the velum (i.e., the same place where the stop [g] is made). If you want to make this sound, the articulatory description can guide you: make a near closure at the velum and allow airflow to pass though. If you come across the description 'high front rounded vowel,' and want to produce this sound, make the high front unrounded vowel [i] and then round the lips to produce the high front rounded vowel [y].

For detailed descriptions and examples of the sounds presented in Tables 2.28 and 2.29, go to the website at www.pearsoned.co.uk/ogrady.

For the full IPA chart, see Appendix, p. 670.

Notes

1 There is still a great deal of discussion among linguists on the subject of diphthongs. English vowels that show a change in quality are considered diphthongs as long as the change in quality *follows* the vowel nucleus. Words such as *yes* and *wet* are considered to begin with a glide that is not an integral part of the vocalic nucleus. However, in transcribing other languages (Finnish, for example), sounds like [jɛ] and [wo] are considered to be diphthongs. For now, treat the diphthongs presented in Table 2.13 as unit vowels and the initial two sounds of words like *yes* and *wet* as distinct segments. This approach will be revised somewhat in Chapter 3.

2 In RP as we have seen, as well as in many other dialects of English worldwide, the vowel of *caught* (and certain other words such as *law*) is the mid-low back rounded lax vowel [ɔː], which is distinct from the low back rounded vowel [ɒ] of *pot* and *cot*. However, in standard Canadian English, and in, for example, the Pittsburgh area in the United States, there is no difference between the vowels of a pair of words like *cot* and *caught*, whose vowels are both [A]. For a good exposition of issues in the analysis and transcription of English vowels we recommend that you read especially Chapters 2 and 3 of H.J. Giegerich, *English Phonology: An Introduction*, which is given below.

Summing up

The study of the sounds of human language is called *phonetics*. These sounds are widely transcribed by means of the **International Phonetic Alphabet**.

The sounds of language are commonly described in **articulatory** and **acoustic** terms, and fall into two major types: syllabic sounds (**vowels**, **syllabic liquids** and **syllabic nasals**) and non-syllabic sounds (**consonants** and **glides**). Sounds may be **voiced** or **voiceless**, and **oral** or **nasal**. Consonants are produced at various places of articulation: labial, dental, alveolar, alveopalatal, palatal, velar, uvular, glottal and pharyngeal. At the places of articulation, the airstream is modified by different **manners of articulation** and the resulting sounds are **stops**, **fricatives** or **affricates**. Vowels are produced with less drastic closure and are described with reference to tongue position (**high**, **low**, **back** and **front**), tension (**tense** or **lax**), and lip rounding (**rounded** or **unrounded**). Language also exhibits **suprasegmental** phenomena such as **tone**, **intonation** and **stress**.

Recommended reading

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Note: For ultrasound and X-ray images, go to www.psyc.queensu.ca/~munhallk/05_database.htm.

Exercises

1. In order to become more aware of the differences between spelling and pronunciation, answer the following questions about English spelling.

(a) Find four words that show four alternative spellings of the sound [f].
(b) Find six words that have the letter 'a' pronounced differently.
(c) Find four words in which different groups of letters represent only one sound.
(d) Find two words in which two different sounds are pronounced but not spelled out.

2. How many segments are there in the following words?

(a) at
(b) maths
(c) cure
(d) hopping
(e) psychology
(f) knowledge
(g) mailbox
(h) awesome

3. Is the first sound in each of the following words voiced or voiceless?

(a) though
(b) thought
(c) form
(d) view
(e) zoom
(f) silk
(g) pan
(h) boat
(i) huge
(j) choose
(k) judge
(l) buns
(m) when (*may vary*)
(n) ghetto
(o) pneumatic
(p) winced

4. Using the words presented in question 3, state whether the last sound of each word is voiced or voiceless.

5. For each of the following pairs of sounds, state whether they have the same or a different place of articulation. Then identify the place of articulation for each sound.

(a) [s] : [l]
(b) [k] : [ŋ]
(c) [p] : [g]
(d) [l] : [r]
(e) [m] : [n]
(f) [dʒ] : [ʃ]
(g) [f] : [h]
(h) [w] : [j]
(i) [b] : [f]
(j) [tʃ] : [dʒ]
(k) [s] : [v]
(l) [θ] : [t]

6. For each of the following pairs of sounds, state whether they have the same or different manners of articulation. Then identify the manner of articulation for each sound.

(a) [s] : [θ]
(b) [k] : [g]
(c) [w] : [j]
(d) [f] : [ʃ]
(e) [l] : [t]
(f) [ð] : [v]
(g) [tʃ] : [s]
(h) [m] : [ŋ]
(i) [r] : [w]
(j) [tʃ] : [dʒ]
(k) [h] : [ʔ]
(l) [z] : [dʒ]

7. After each of the following articulatory descriptions, write between square brackets the appropriate IPA symbol for the sound.

(a) voiceless velar stop
(b) voiced labiodental fricative
(c) voiced alveopalatal affricate
(d) voiced palatal glide
(e) voiced velar nasal
(f) voiceless interdental fricative
(g) high back rounded lax vowel
(h) low front unrounded vowel

8. Which of the following pairs of words show the same vowel quality? Mark each pair as *same* or *different*. Then transcribe the vowels of each word.

(a) back sat
(b) cot caught
(c) bid key
(d) luck flick
(e) ooze deuce
(f) cot court
(g) fell fail
(h) hide height
(i) least heed
(j) drug cook
(k) sink fit
(l) oak own
(m) pour port
(n) mouse cow

9. Using descriptive terms like sibilant, fricative, and so on, provide a single phonetic characteristic that all the segments in each group share. Try to avoid over-obvious answers such as 'consonant' or 'vowel'.

Example: [b d g u m j] are all voiced.

(a) [p t k g ʔ]
(b) [i e ɛ æ]
(c) [tʃ ʒ ʃ dʒ]
(d) [p b m f v]
(e) [ʌ ə ʊ a]
(f) [h ʔ]
(g) [u o]
(h) [s z tʃ dʒ ʃ ʒ]
(i) [l r m n ŋ j w]
(j) [t d l r n s z]

10. Transcribe the following sets of words. You may use these words to practise transcribing aspiration.

(a) tog
(b) kid
(c) attain
(d) despise
(e) elbow
(f) haul
(g) juice
(h) thimble
(i) peel
(j) stun
(k) Oscar
(l) cooler
(m) sigh
(n) hulk
(o) explode
(p) tube
(q) spell
(r) cord
(s) accord
(t) astound
(u) pure
(v) wheeze
(w) remove
(x) clinical

11. Using H, L, and association lines, transcribe the intonation of the following English phrases. Compare your results with the transcriptions of several classmates. Are they the same? If they aren't, discuss what aspects of intonation (such as emotion or speech context) might account for the differences in transcription.

(a) 'Hi, Alice.'
(b) 'Three people got off the bus at the last stop.'
(c) 'My uncle likes to mountain climb.'

12. Mark primary and (where present) secondary stresses on the following words. It is not necessary to transcribe them.

(a) sunny
(b) banana
(c) blackboard
(d) Canada
(e) (to) reject
(f) arrive
(g) defy
(h) summary
(i) Canadian
(j) (a) reject
(k) secret
(l) exceed
(m) summery
(n) Canadianise
(o) difficult

13. Find a fluent speaker of a language other than English and transcribe phonetically ten words of that language. If you encounter any sounds for which symbols are not found in this chapter, attempt to describe them in phonetic terms and then invent diacritics to help you transcribe them.

14. Provide coarticulation diagrams (see www.pearsoned.co.uk/ogrady) for the following words. Be sure that your diagrams capture the movement of the lips, tongue, velum and glottis as in the model.

(a) had
(b) snap
(c) please
(d) dome

15. Compare the following careful speech and rapid speech pronunciations of the following words and phrases. Then, name the process or processes that make the rapid speech pronunciation Compare the careful speech and rapid speech pronunciations of the following English different from the careful speech. (Stress is omitted here.)

	Careful speech	*Rapid speech*
(a) in my room	[ɪn maɪ ruːm]	[ɪm maɪ ruːm]
(b) I see them	[aɪ siː ðem]	[aɪ siːəm]
(c) I see him	[aɪ si hɪm]	[aɪ siːəm]
(d) within	[wɪðɪn]	[wðɪn]
(e) balloons	[bəluːnz]	[bluːnz]
(f) popsicle	[pʰɒpsɪkəl]	[pʰɒpskəl]
(g) sit down	[sɪt daʊn]	[sɪraʊn]
(h) my advice	[maɪ ədvaɪs]	[maɪəvɑɪs]
(i) Scotch tape	[skɒtʃ tʰeɪp]	[kʰɒtʃ steɪp]
(j) protection	[pr̥əʊtʰekʃən]	[pərtʰekʃən]
(k) hand me that	[hænd miː ðæt]	[hæ̃ miː ðæt]
(l) Pam will miss you	[pæm wɪl mɪs juː]	[pæmɫmɪʃjə]

16. As we have seen in this chapter, the vowels of different varieties of English vary considerably. Compare your pronunciation of the words below with that of at least two other people who have accents that are radically different from your own.

bun	tough	run	boy	cart	rug	Sam	book
look	dock	nuke	lad	psalm	book	pin	Ruth
chance	duke	nook	pout	soot	suit	stair	stare
duck	dance	grant	fire	aren't	root	route	bad
cute	crook	roof	word	dye	said	shore	beard
newt	shock	joy	grade	root	rough	spore	France
tooth	hook	luck	herd	can't	huff	show	square

(a) Transcribe each word using IPA notation in order to show how it is pronounced by you and by each one of your partners.
(b) Determine which of these words rhyme (a) in your speech and (b) in the speech of each one of your partners.
(c) Attempt to describe the differences that you identify using the technical phonetic terms introduced in this chapter.