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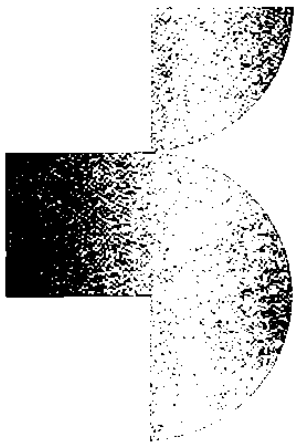

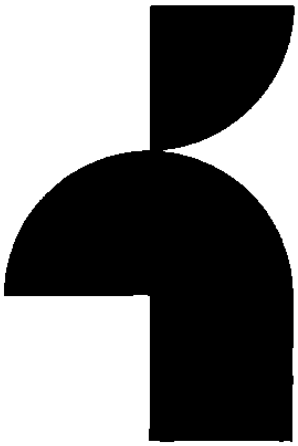

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Phonetics: The Sounds of Language

Michael Dobrovolsky

I shall whisper
Heavenly labials in a world of gutturals.
–Wallace Stevens, *"The Plot against the Giant"* (1917)

Objectives

In this chapter, you will learn:

- how we use special symbols to represent all the different sounds in human languages, beginning with English
- how to write down your own speech using these symbols
- how we use articulators in the vocal tract to produce specific sounds
- how we can group language sounds into classes
- how human languages use tone, intonation, and sound length to create meaning
- how language sounds in context can be modified by neighboring sounds

We do not need to speak in order to use language. Language can be written, manually signed, mechanically reproduced, and even synthesized by computers with considerable success. Nevertheless, speech remains the primary way in which humans express themselves through language. Our species spoke long before we began to write, and this long history of spoken language is reflected in our anatomical specialization for speech. Humans also appear to have specialized 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 *phōnē* 'sound, voice') or **speech sounds**. 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 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 while breathing out. Any human, child or adult, can learn to produce any human speech sound.

Linguists undertake the study of phonetics in two ways. One approach involves analyzing the physiological mechanisms of speech production. This is known as **articulatory phonetics**. The other approach, **acoustic phonetics**, is concerned with measuring and analyzing 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.

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] (the symbol is called *eth*, as in *weather*). The IPA uses this symbol to represent that sound in whichever language it is heard, whether it is English, Spanish, or Arabic, as shown in Table 2.1.

Table 2.1 Use of [ð] in transcribing speech phonetically

Language	*Spelling*	*IPA*	*Meaning*
English	this	[ðis]	'this'
Spanish	boda	[boða]	'wedding'
Arabic	ذباب	[ðuba:b]	'flies'

The use of a standardized phonetic alphabet with a one-to-one correspondence between sound and symbol enables linguists to transcribe languages consistently and accurately. Although we use the IPA in this book, it is not the only system of phonetic transcription; there is also a North American system, in which some symbols are different. You can see a comparison of the North American system and IPA at **launchpadworks.com**.

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 *ough,* but the letters represent different sounds in each word—and sometimes even a different number of sounds. In the word *rough,* they represent two sounds, while in *through,* they represent only one. The absence of a one-to-one correspondence between a symbol and a sound in English spelling is also evident when we look at the letter *o,* which is pronounced differently in *go, hot, women, more,* and *mutton.*

George Bernard Shaw, the famous playwright who described a character in his play *Pygmalion* as an "energetic phonetic enthusiast" (a description that we think could just as easily be applied to Shaw himself), illustrated the problem in the following anecdote. Imagine a new word coming 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 underlined segments in the following words:

enou*gh* → f

w*o*men → i

na*ti*on → sh

Shaw felt that any writing system that could possibly represent "fish" with the string of letters *ghoti* was in desperate need of reform.

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

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.

The IPA represents speech in the form of **segments**—individual phones like [p], [s], or [m]. Segments are produced by coordinating a number of individual articulatory gestures including jaw movement, lip shape, and tongue placement.

1.2 Segments

We have defined the segment as an individual speech sound (phone). The analysis of speech in terms of sound segments, or phones, is supported by several kinds of evidence.

LANGUAGE MATTERS The Muscles of Speech

The bundle of nerves controlling the vocal folds is among the densest in the entire body. There are about forty different muscles in the vocal tract. Although they aren't all used for all sounds, coordinating those that are used at any particular moment requires exquisite timing. In fact, it's been estimated that 225 muscle activations are needed to produce just one second of speech.

Information from: Peter F. MacNielage, *The Origin of Speech* (New York: Oxford University Press, 2008), p. 4.

Errors in speech production provide one kind of evidence for the existence of segments. Slips of the tongue such as *renumeration* for *remuneration* 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 that should 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. 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 while 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.

When we use the same symbol to represent two sounds that are not exactly the same phonetically, we are making a **broad transcription**. A broad transcription uses a relatively simple set of symbols to represent contrasting segments but does not show all phonetic detail. If we wish to show more phonetic detail, we can use a more elaborate set of symbols and **diacritics**. In this case, we are making a **narrow transcription**. The terms *broad* and *narrow* are relative, not absolute: the less phonetic detail we show, the broader the transcription; the more phonetic detail, the narrower the transcription.

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 modify 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 passages above the larynx, collectively known as the **vocal tract**: the tube of the throat between the larynx and the oral cavity, which is called the **pharynx**; the oral cavity; and the nasal cavity.

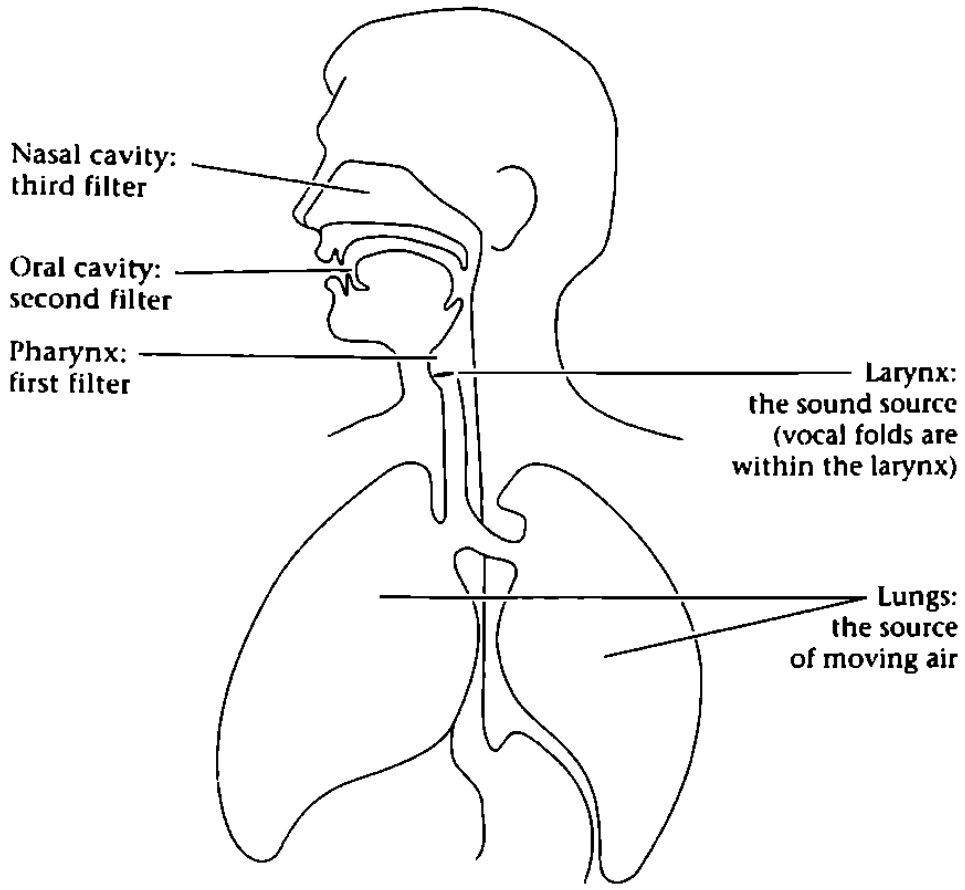

Figure 2.1 The sound-producing system

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.)

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 primary muscles are 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 control the release of air during exhalation for speech so that we can speak for a reasonable period of time between breaths.

2.2 The Larynx

As air flows out of the lungs up the **trachea** (windpipe), it passes through a boxlike 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 plow. 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. 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.

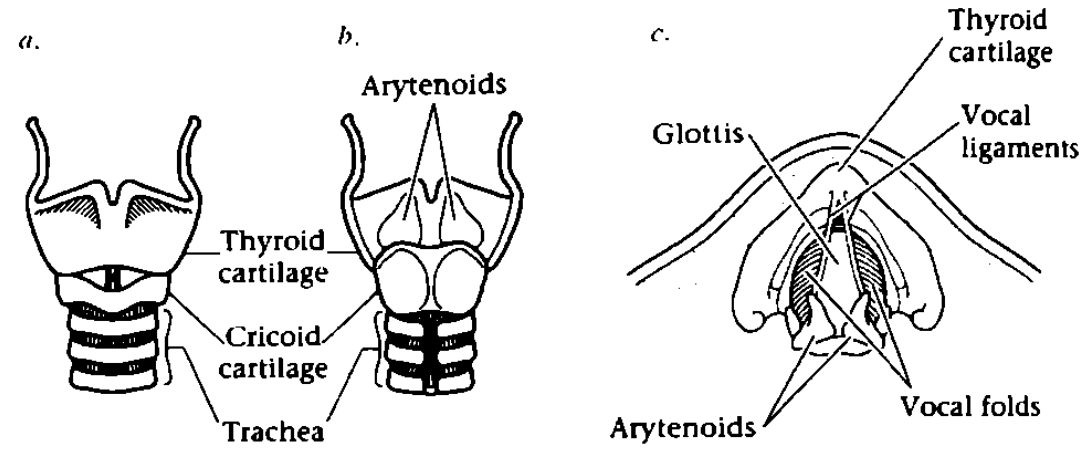

Figure 2.2 The larynx: *a.* from the front; *b.* from the back; *c.* from above, with the vocal folds in open position. The striated lines in *c.* indicate muscles, a number of which have been eliminated from the drawings in order to show the cartilages more clearly.

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

Voiceless

When the vocal folds are pulled apart as illustrated in the first drawing 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**. The initial sounds of *fish*, *sing*, and *house* are all voiceless. You can confirm a sound's voicelessness by touching your fingers to your larynx as you produce it. You will not feel any vibration from the vocal folds being transmitted to your fingertips. 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.

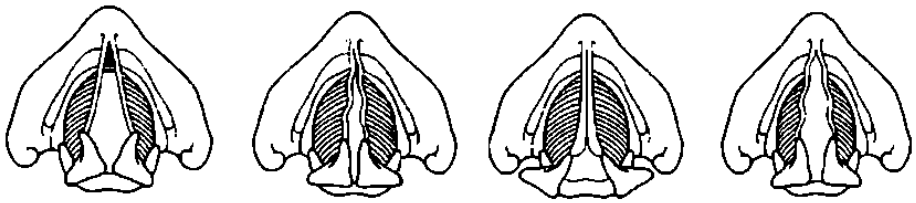

Figure 2.3 Four glottal states: the drawings represent the vocal folds and glottis from above; the anterior (front) portion of the larynx is at the top. The small triangles represent the arytenoid cartilages, which help spread or close the vocal folds.

Voiced

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 the second illustration in Figure 2.3.) You can determine whether a sound is voiced in the same way you determined voicelessness. By lightly touching your fingers to your 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.

[fffffffffffffffffffffffvvvvvvvvvvvvvvvvvvvvv]
[sssssssssssssssssssssssszzzzzzzzzzzzzzzzzzzzzzzz]

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 with the sounds that 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 generalize, 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 consider the three major classes of speech sound.

3 Sound Classes

The sounds of language can be grouped into **sound 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.

3.1 Vowels and Consonants

Vowels and consonants 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 **nonsyllabic** elements.

The Articulatory Difference

Consonantal sounds, which may be voiced (e.g., [v]) or voiceless (e.g., [f]), are made with either a complete closure (e.g., [p]) or a narrowing (e.g., [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, which are usually voiced, 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).

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 Nonsyllabic 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 5.7, 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 nonsyllabic elements

Vowels (and other syllabic elements)	*Consonants (nonsyllabic 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

3.2 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* ([i]) and then make the glide in the word *you* ([j]). Now go back and forth from [i] 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* ([u]) and the glide in *would* ([w]).

Even though they are vowel-like in articulation, glides pattern as consonants. For example, glides do not 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*.

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 of articulation**. The major 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.

4.1 The Tongue

The primary articulating organ is the tongue. It can be raised, lowered, thrust forward or retracted, and even rolled back. The sides of the tongue can also be raised or lowered.

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 (versus the throat) 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).

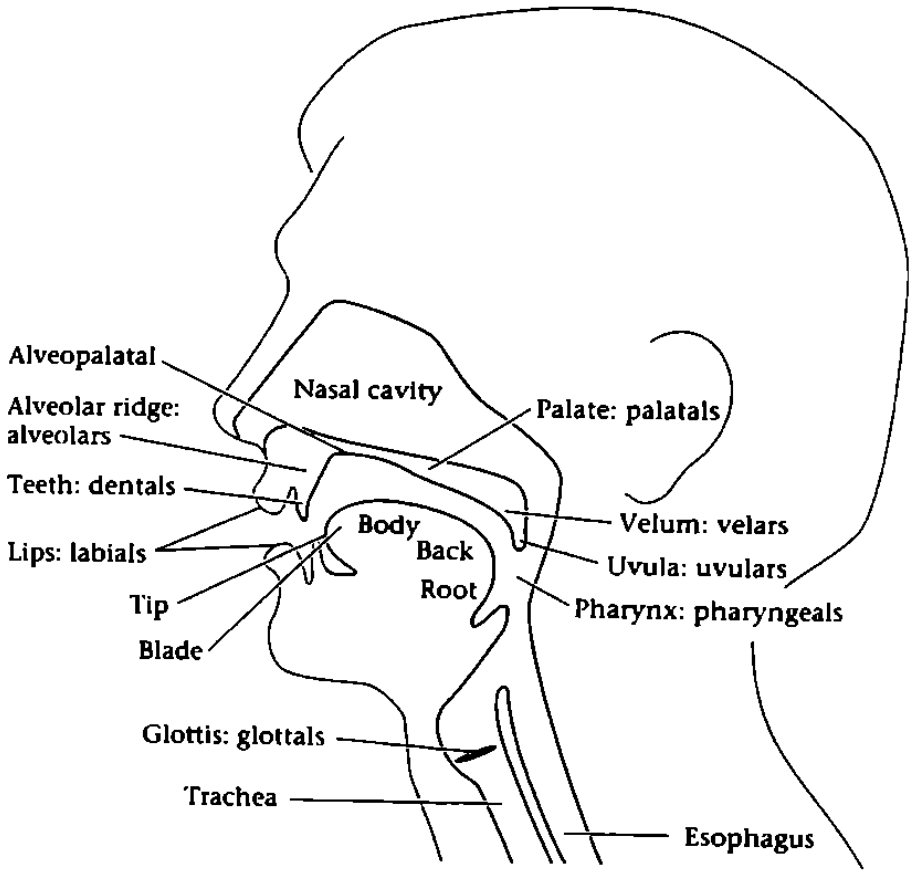

Figure 2.4 The vocal tract and places of articulation

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 (see Figure 2.5 *a–f*).

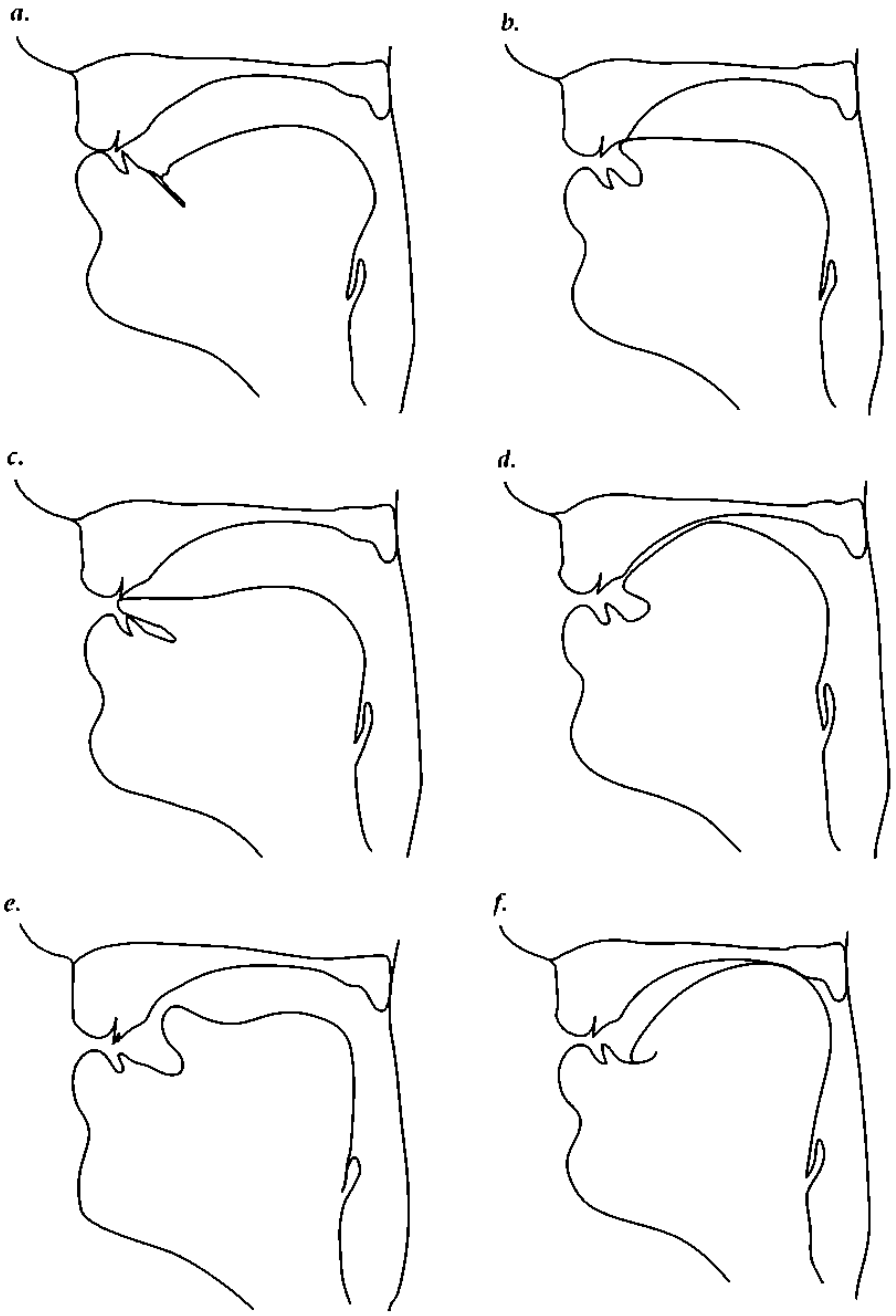

Figure 2.5 Places of articulation: *a.* the labial sound at the beginning of *peer*; *b.* the alveolar sound at the beginning of *top*; *c.* the interdental sound at the beginning of *this*; *d.* the alveopalatal sound at the beginning of *show*; *e.* the retroflex sound at the beginning of *red*; *f.* the velar sound at the beginning of *call*.

Labial

Any sound made with closure or near-closure of the lips is said to be **labial**. Sounds involving both lips are termed **bilabials**; 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**. English has two interdentals, corresponding to the initial consonants of the words *this* and *thing*. (If you have difficulty distinguishing these two sounds, try the voicing test described in Section 2.3 above.)

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 an *r* that is made by touching the tongue to the alveolar ridge.

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 toward the rear of the roof of the mouth is called the **velum**. 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 body 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**. English has no uvulars, but the *r* sound of standard European French is uvular.

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, but not in English.

Glottal

Sounds produced using the vocal folds as primary articulators are called **glottals**. The sound at the beginning of the English words *heave* and *hog* is made at the glottis. You can also hear a glottal sound in the Cockney English pronunciation of the *tt* in words like *better* or *bottle*.

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 **manners of articulation**.

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 cavity, oral sounds are produced. The velum can also be lowered to allow air to pass through the nasal cavity, producing a sound that is nasal. Both consonants and vowels can be nasal, in which case they are generally voiced. (All nasals represented in this chapter are voiced.) The consonants at the end of the English words *sun*, *sum*, and *sung* are nasal. For many speakers of English, the vowels of words such as *bank* and *wink* are also slightly nasal because of their proximity to nasal consonants.

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, alveopalatal, palatal, velar, uvular, and glottal places 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.

The glottal stop is commonly heard in English in the expression *unh-unh* [ʔʌ̃ʔʌ̃], 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*).

Table 2.3 English stops and their transcription

Place of articulation			*Transcription*
Bilabial			
Oral	Voiceless	span	[p]
	Voiced	ban	[b]
Nasal	(Voiced)	man	[m]
Alveolar			
Oral	Voiceless	stun	[t]
	Voiced	done	[d]
Nasal	(Voiced)	none	[n]
Velar			
Oral	Voiceless	scold	[k]
	Voiced	gold	[g]
Nasal	(Voiced)	long	[ŋ]
Glottal			
	Voiceless	_uh-oh	[ʔ]

A Grid for Stops

Table 2.4 presents a grid on which the stop consonants of English are arranged horizontally according to place of articulation. As you can see, each oral stop, with one exception, has voiced and voiceless counterparts. The nasal stops are always voiced in English. 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*
Nonnasal	Voiceless	[p]	[t]	[k]	[ʔ]
	Voiced	[b]	[d]	[g]	
Nasal	(Voiced)	[m]	[n]	[ŋ]	

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 passes through a very narrow opening either at the glottis or at some point higher 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*, voiceless and voiced 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.

Special note must be taken of the alveolar fricatives [s] and [z]. English speakers commonly produce these sounds in two ways. 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.

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]

A Grid for Fricatives

Table 2.6 presents a grid on which the fricative consonants of English are arranged according to place of articulation. As in Table 2.5, dentals are not distinguished from alveolars, since most languages have sounds with either one place of articulation or the other, but not both.

Table 2.6 English fricatives

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

5.4 Affricates

When a stop articulation is released, the tongue moves rapidly away from the place of articulation. However, some noncontinuant consonants show a slow (or delayed) 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.

Table 2.7 English affricates

	Alveopalatal (= 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], are considered **nonstrident.** 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]
Alveopalatal	[tʃ]	[dʒ]

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

Table 2.9 Aspirated and unaspirated consonants in English

Aspirated		*Unaspirated*	
[pʰæt]	pat	[spæt]	spat
[tʰʌb]	tub	[stʌb]	stub
[kʰowp]	cope	[skowp]	scope

Figure 2.6 shows how aspiration of a voiceless consonant takes place, using the aspirated consonant [pʰ] as an example. Though the sequence of articulations takes place continuously, the figure illustrates only certain moments.

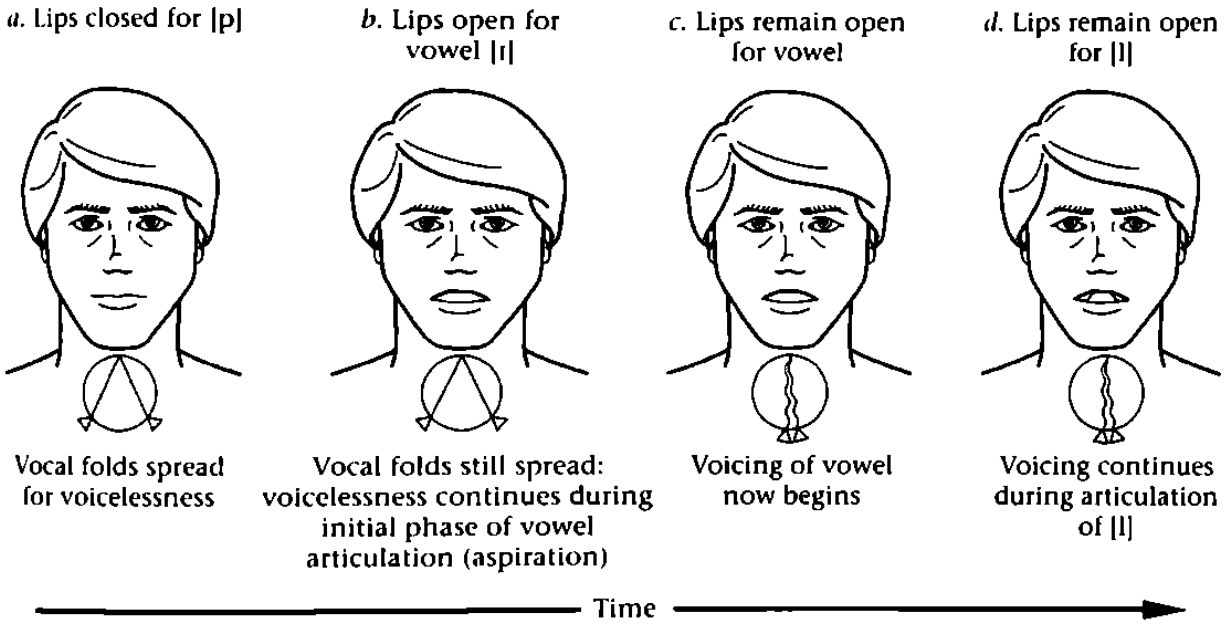

Figure 2.6 Aspirated consonant production (English *pill*)

Figures 2.7 and 2.8 show the relation between articulation and voicing for unaspirated and voiced consonants. The unaspirated consonant, such as the [p] of English *spill*, shows voicing of the vowel very soon after release of the consonant closure. The voiced initial [b] of English *bill* shows voicing just before the release of the bilabial closure. In Figure 2.8, note how voicing precedes the release of the labial articulators.

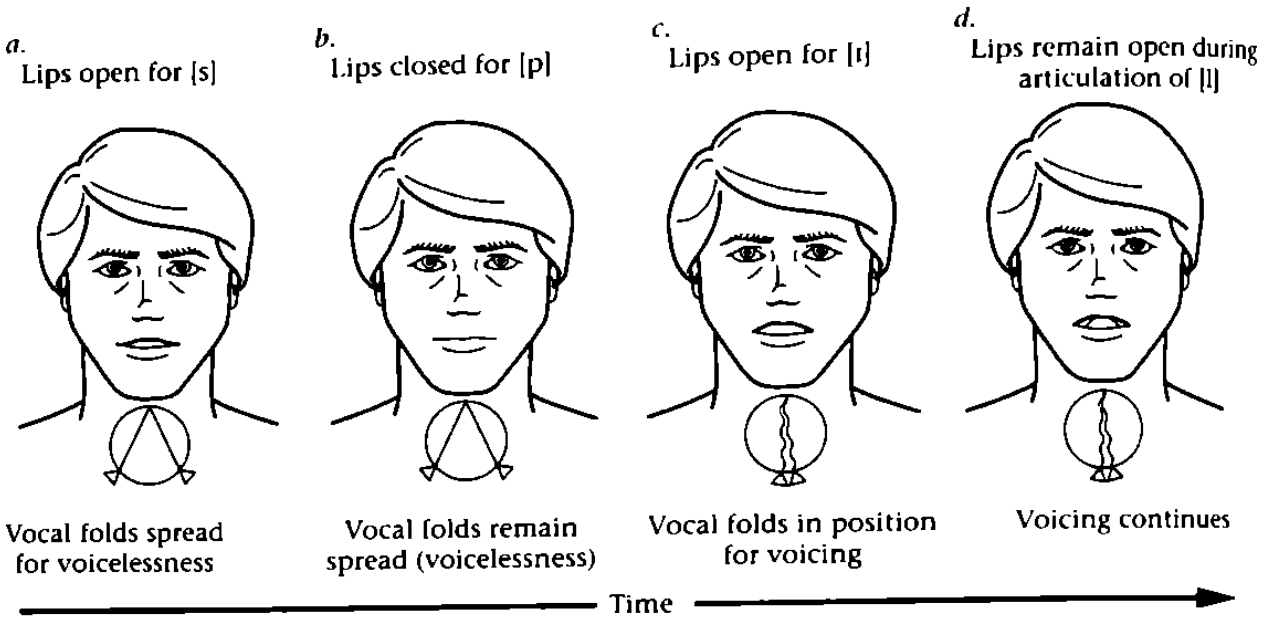

Figure 2.7 Unaspirated consonant production (English *spill*)

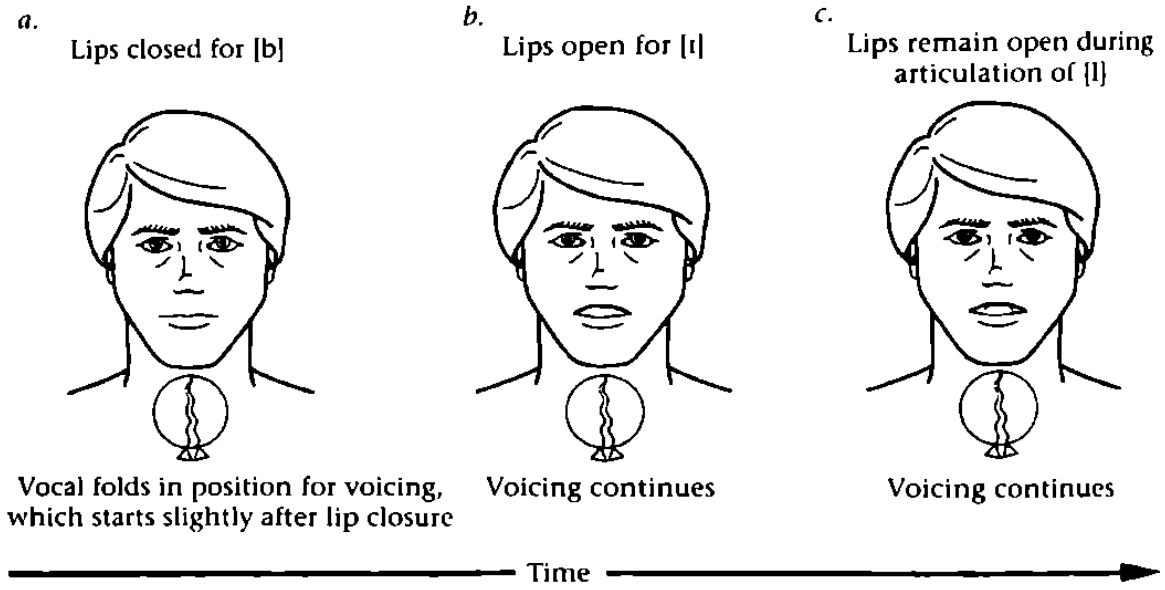

Figure 2.8 Voiced consonant release (English *bill*)

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:

pave	cap
Tom	pot
king	back

The words in the first column have the stops ([pʰ], [tʰ], and [kʰ]) released into the following vowel. However, in the second column, it is quite common not to release word-final stops at all. When you pronounce the word *cap* you may well end with your lips closed, and in *pot* and *back* your tongue can stay on the roof of your mouth. The phonetic symbol for this is a raised [˺] as in [p˺]. In some languages, a word-final stop is always unreleased. This is the case in Korean, where *pap* 'rice' is always pronounced [pap˺]. (Since transcribing all phonetic details can become cumbersome, the symbols indicating aspiration or an unreleased stop are sometimes omitted in the remainder of this chapter when they are not relevant to the point being discussed.)

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 nonetheless similar enough to be grouped together in a single category: they are all oral sonorous consonants.

English Laterals

Varieties of *l* are called **laterals**. The most commonly used lateral liquid in English, transcribed as [l], is articulated with the tip of the tongue touching the alveolar ridge while air escapes through the mouth along the lowered sides of the tongue.

Because laterals are generally voiced, the term *lateral* is usually used to mean '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 *please* and *clear*.

LANGUAGE MATTERS Another Kind of *l*

Pronounce the words in the following two lists:

leaf	fall
lie	milk
lawn	steal

In most dialects of English, the *l* sounds are not pronounced in the same way. For some speakers, the *l* in the first column is made with the tongue tip touching the alveolar ridge (as described in Table 2.10). This *l* sound is known as a **clear l**. In the second column, however, 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 **velarized l** and more casually as a **dark l**. It is represented by the phonetic symbol [ɫ].

English *rs*

Numerous varieties of *r* are also heard in the world's languages. This section describes the types found in English. The *r* of English as it is spoken in the United States and Canada is made by curling the tongue tip back and bunching the tongue upward and back in the mouth, as shown in panel *e* in Figure 2.5 on page 27. This *r*, which is known as a **retroflex** *r*, is heard in *ride* and *car*. In a broad transcription, the symbol [r] can be used for the English *r* as well as *rs* in other languages. However, in narrower IPA transcription, [r] is reserved for a trilled *r*, as in Spanish *perro* 'dog'. The IPA transcription for the retroflex *r* is [ɹ], and that is the symbol we will use in this book for the English *r*.

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 *bitter* and *butter*, and in some British pronunciations of *very*. It is commonly transcribed as [ɾ] and is generally voiced. Table 2.10 presents the liquids *r*, *l*, and the flap of American English.

Table 2.10 English liquids

		Alveolar	
Laterals		voiced	[l]
		voiceless	[l̥]
rs	retroflex	voiced	[ɹ]
		voiceless	[ɹ̥]
	flap		[ɾ]

5.7 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		*Nonsyllabic*	
bottle	[bɑɾl̩]	lift	[lɪft]
funnel	[fʌnl̩]	pill	[pʰɪl]
bird	[bɚd]	rat	[ɹæt]
her	[hɚ]	car	[kʰɑɹ]
teacher	[tiʧɹ̩]	now	[naw]
hidden	[hɪdn̩]	mat	[mæt]
'm-m'	[ʔm̩ʔm̩] (meaning 'no')		

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 some two-syllable words is syllabic. The second syllable in *hidden*, for example, has [n] as its nucleus. Therefore, whether a segment is syllabic or not is directly related to how it functions in the syllable.

Unfortunately for beginning linguistics students, linguists are not always consistent in the transcription of syllabic liquids and nasals, and there is some dialectal variation as well. A broad transcription simply uses schwa plus the liquid or nasal. In this book, we will transcribe a nasal as syllabic in English when it occurs in an unstressed syllable at the end of a word after a stop, affricate, or fricative. We will transcribe a liquid as syllabic in English when it occurs in an unstressed syllable at the end of a word after any consonant. We will use the symbol [ɚ] for *r* in words like *bird*, *earth*, and *girl* and [ɻ̩] for syllabic *r* in unstressed syllables.

5.8 Glides

Recall that a glide is a very rapidly articulated nonsyllabic segment. The two glides of American English are [j] of *yes* and *boy* and [w] of *wet* and *now*.

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

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 [u] of *who*. This can be verified by extending the pronunciation of [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 *when*, *where*, and *which* (but not in *witch*).

LANGUAGE MATTERS Which Witch Is Which?

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

weather	whether
witch	which
wither	whither

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

You can see a dialect map showing where the /w/ versus /ʍ/ distinction is maintained at the Telsur Project site hosted by the University of Pennsylvania (online).

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		*Place of articulation*							
		Bilabial	*Labiodental*	*Interdental*	*Alveolar*	*Alveopalatal*	*Palatal*	*Velar*	*Glottal*
Stop	voiceless	p			t			k	ʔ
	voiced	b			d			g	
Fricative	voiceless		f	θ	s	ʃ			h
	voiced		v	ð	z	ʒ			
Affricate	voiceless					tʃ			
	voiced					dʒ			
Nasal	voiced	m			n			ŋ	
Liquid	voiced lateral				l				
	voiced retroflex				ɹ				
Glide	voiced	w					j	w	
	voiceless	ʍ						ʍ	

LANGUAGE MATTERS What's the World's Most Unusual Speech Sound?

Pirahã, a language with only 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, lateralized 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.")

Information from: Peter Ladefoged and Ian Maddieson, *The Sounds of the World's Languages* (Malden, MA: Blackwell, 1996); Daniel Everett, "Phonetic Rarities in Pirahã," *Journal of the International Phonetic Association* 12, 2 (1982): 94–96.

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