5. Part of linguistic competence involves the ability to recognize whether novel utterances are acceptable. Consider the following sentences and determine which are possible sentences in English. For each unacceptable sentence, change the sentence to make it acceptable, and compare the two.
   a) Jason's mother left himself with nothing to eat.
   b) Miriam is eager to talk to.
   c) This is the man who I took a picture of.
   d) Colin made Jane a sandwich.
   e) Is the dog sleeping the bone again?
   f) Wayne prepared Zena a cake.
   g) Max cleaned the garden up.
   h) Max cleaned up the garden.
   i) Max cleaned up it.
   j) I desire you to leave.
   k) That you likes liver surprises me.

6. Consider the following sentences, each of which is acceptable to some speakers of English. Try to identify the prescriptive rules that are violated in each case.
   a) He don't know about the race.
   b) You was out when I called.
   c) There's twenty horses registered in the show.
   d) That window's broke, so be careful.
   e) Jim and me are gonna go campin' this weekend.
   f) Who did you come with?
   g) I seen the parade last week.
   h) He been lost in the woods for ten days.
   i) My car needs cleaned 'cause of all the rain.
   j) Julie ain't got none.
   k) Somebody left their book on the train.
   l) Murray hurt hisself in the game.

   What is the reaction of linguists to the claim that sentences of this sort are "wrong"?

7. An interesting feature of the variety of English spoken in Hawaii involves the form of the possessive pronoun that shows up in the following context.

   That belongs to me. It's *mines*.

   Make a list of other possessive pronoun forms in standard English by filling in the spaces below.

   That belongs to you. It's _____.
   That belongs to him. It's _____.
   That belongs to her. It's _____.
   That belongs to us. It's _____.
   That belongs to them. It's _____.

   What process in language change appears to be responsible for the form *mines*?

two

Phonetics: The Sounds of Language

Michael Dobrovolsky

Heavenly labials in a world of gutturals

–WALLACE STEVENS

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 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 specialization for it. 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**. 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. Human beings, 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 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

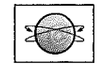
Since the sixteenth century, efforts have been made to devise a universal system for transcribing the sounds of speech. The best-known system, the **International Phonetic Alphabet (IPA)**, has been evolving since 1888. This system of transcription attempts to represent each sound of human speech with 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] (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 Arabic, 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'
Arabic	ذباب	[ðubaːb]	'flies'

To hear audio of the words in Table 2.1, go to **bedfordstmartins.com/linguistics/phonetics** and click on **Audio files**.

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. In North American (NA) usage, though, some phonetic symbols differ from those employed by IPA transcription. For a comparison of North American (NA) symbols with IPA symbols, go to **bedfordstmartins.com/linguistics/phonetics** and click on **NA symbols**. This book employs IPA transcription.



If you wish to start practicing the phonetic transcription of English, turn to Tables 2.16 and 2.17, pages 39–40, for examples.

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*, and *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 underlined segments in the following words:

enough → f
women → i
nation → 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.

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 16, Sections 1.2, 3.2, and 4.2]. In one type of Japanese writing, for example, signs such as か [ka], と [to], and み [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.

1.2 Segments

We have defined the segment as an individual speech sound (phone). There are several kinds of evidence that suggest that speakers are able 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 *Kolacodor* for *Kodacolor* 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.

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 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**.

For more information on the lungs and the larynx, go to **bedfordstmartins.com/linguistics/phonetics** and click on **Lungs and larynx**.

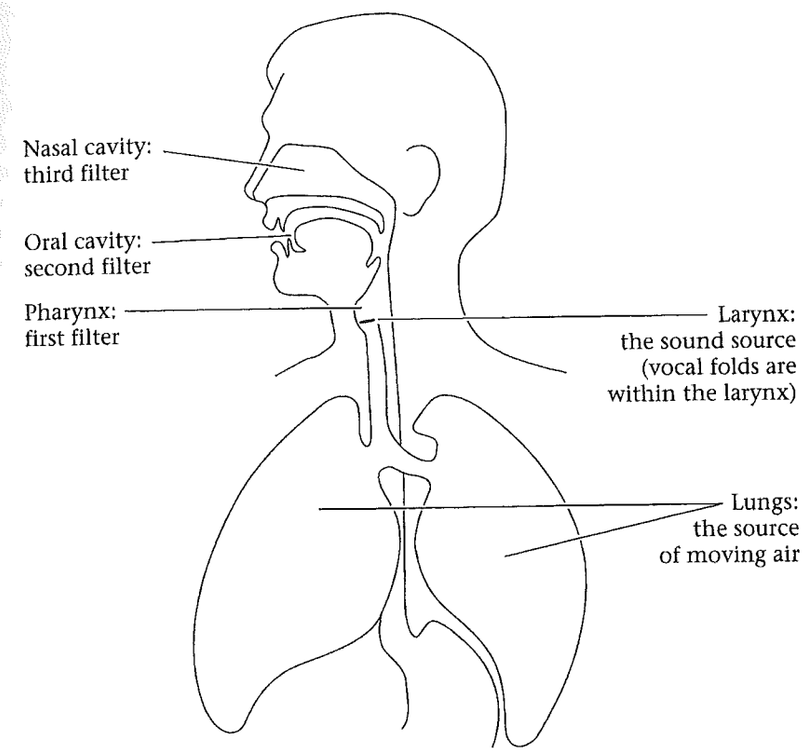


Figure 2.1 The sound-producing system

2.1 Glottal States

The space between the vocal folds is called the **glottis**. The vocal folds may be positioned in a number of ways to produce different glottal states. The two glottal states presented in Figure 2.2 are commonly encountered in most of the world's languages.

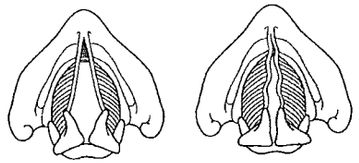


Figure 2.2 Two glottal states: the stylized drawing represents the vocal folds and glottis from above; the anterior portion at the larynx is toward the top. The small triangles represent the arytenoid cartilages, which help spread or close the vocal folds.

Voicelessness

When the vocal folds are pulled apart as illustrated in Figure 2.2, 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 2.2, 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]
[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 on the sounds which are voiced. These techniques can be helpful as you try to hear which phones are voiced and which are voiceless.

Other glottal states include whisper and murmur, which you can read about on the Web site. Go to **bedfordstmartins.com/linguistics/phonetics** and click on **Whisper/murmur**.

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, Consonants, and Glides (Syllabic and Nonsyllabic 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 **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 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 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 more sonorous	• are produced with a complete closure or narrowing of the vocal tract • 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* ([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 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*.

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 places of articulation used in speech production are outlined in this section. Figure 2.3 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.

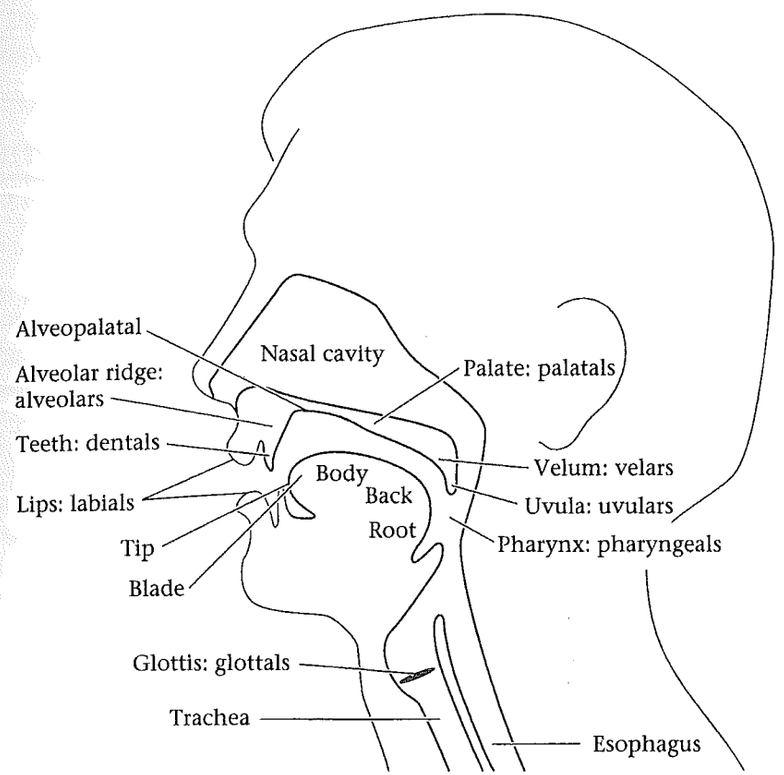


Figure 2.3 The vocal tract

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).

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 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 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 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 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 *sun, sum,* and *sung* are nasal. For many speakers of English, the vowels of words such as *bank* and *wink* are also slightly nasal due to 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, palatal, velar, uvular, and glottal points of articulation.

Oral Stops

Oral stops are articulated by a complete closure of articulators in the oral cavity, and the airflow is stopped completely. In English, bilabial, alveolar, and velar oral stops occur in the words shown in Table 2.3.

The Glottal Stop

The glottal stop is commonly heard in English in the expression *uh-oh* [ʔʌʔow]. The two vowels in this expression are 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*. This glottal stop is often spelled with an apostrophe <bo'l>.

Nasal Stops

Nasal stops are articulated with a complete closure in the oral cavity. However, the airflow is not stopped but continues through the nasal passages, making nasal consonants sonorous. Because they are sonorous, in contrast with other stops, nasal consonants are usually treated separately from other stops. (This will be explained in more detail in Chapter 3.)

The nasal stops in English are articulated with a closure of articulators at the bilabial, alveolar, and velar points of articulation, as shown in the words in Table 2.3. Note that [ŋ] does not occur word-initially in English.

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 according to point of articulation. As you can see, each nonnasal 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; since no air can pass through the glottis, the vocal folds cannot be set in motion. The nasal stops, on the other hand, are all voiced in English.

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 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.

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 point of articulation. However, some noncontinuant 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.

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 **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]
	[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 2.4 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.

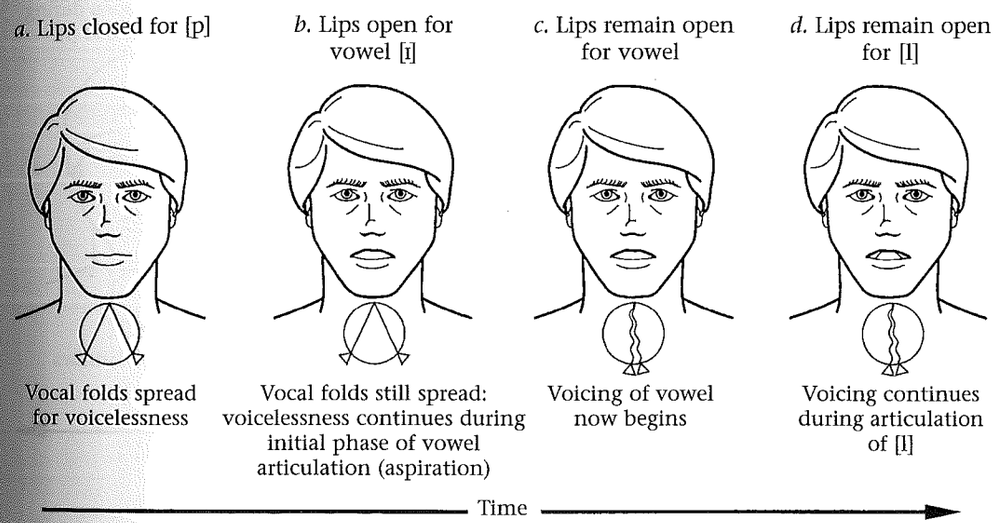


Figure 2.4 Aspirated consonant production (English *pill*)

Figures 2.5 and 2.6 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 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 2.6, note how voicing precedes the release of the labial articulators.

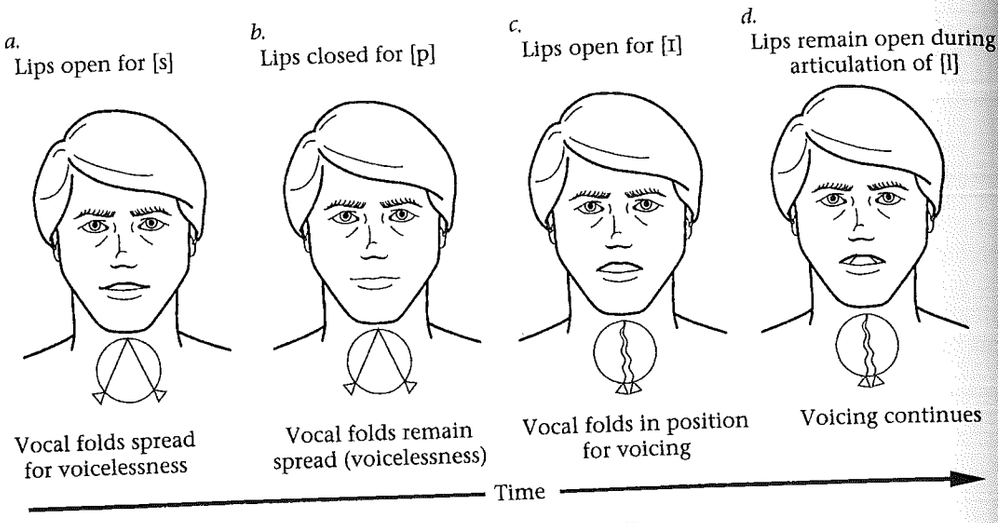


Figure 2.5 Unaspirated consonant production (English *spill*)

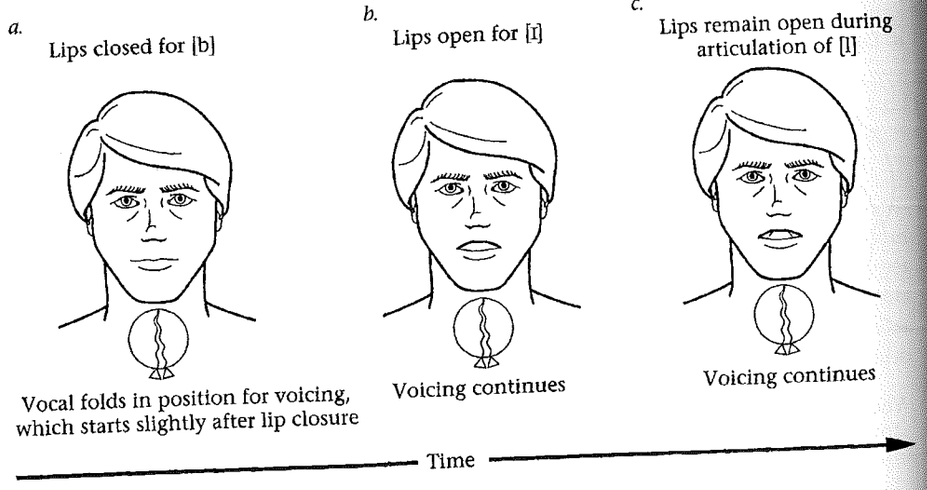


Figure 2.6 Voiced consonant release (English *bill*)

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 ([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. In *pot* and *back* your tongue stays on the roof of your mouth. The phonetic symbol for this is a raised [˺] as in [p˺].

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 *please* and *clear*.

English *r*s

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 either by curling the tongue tip back into the mouth or by bunching the tongue upward and back in the mouth. 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 *r*s 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*.

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). 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*. The phonetic symbol is [ɬ].

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 laterals *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	[bɻd]	rat	[ɹæt]
her	[hɻ]	car	[kʰɑɹ]
button	[bʌtn̩]	now	[naw]
'm-m'	[ʔm̩ʔm̩] (meaning 'no')	mat	[mæt]

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 Chapter 3, Section 4, on 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 also use the syllabic *r* [ɻ] in words like *bird, earth,* and *girl.*

For other ways of transcribing these sounds and others, go to **bedfordstmartins.com/linguistics/phonetics** and click on **Transcription**.

5.8 Glides

Recall that a glide is a very rapidly articulated nonsyllabic segment. The two glides of American English are the jod [jɑd] [j] of *yes* and *boy,* and the w-glide [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 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 *when, where,* and *which* (but not in *witch*).

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

		Place of articulation							
Manner 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 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 at **http://www.ling.upenn.edu/phono_atlas/maps/Map8.html.**

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, 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.")

Source: *The Sounds of the World's Languages* by Peter Ladefoged and Ian Maddieson. Maldon, MA: Blackwell, 1996.

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.

Note that vowels are particularly subject to dialectal variation. For examples of how American dialects vary, go to **bedfordstmartins.com/linguistics/phonetics** and click on **American dialects** and the **interactive map of American dialects.**

6.1 Simple Vowels and Diphthongs

English vowels are divided into two major types, **simple vowels** and **diphthongs.** Simple vowels do not show a noticeable change in quality during their articulation. 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 a glide position. In the diphthongs classified as **major diphthongs**, the change in articulation is quite extreme and, hence, easy to hear. Listen to the change in articulation in the following words: *buy* ([aj]), *boy* ([ɔj]), and *now* ([aw]). Each of these diphthongs starts in one position (e.g., [a]) and ends up in another position (e.g., [w]). There are also **minor**

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 first consider the question of the minor diphthongs in [ej] and [ow]. In most dialects of American English, these sounds are diphthongs (as reflected in our transcription) but this is not the case in *all* dialects of English. In Jamaican English words like *go* and *say* have simple vowels and would be transcribed as [go] and [se].

Comparison across dialects can also help us to understand why we have used the [a] symbol in the major diphthongs. In articulatory terms, the [a] sound is made at the front of the mouth a bit lower than [æ]. You can hear this sound in many Romance languages (like French or Spanish) in words like *la* or *gato*. This [a] vowel is, in fact, where we start articulating our diphthongs. If you try to say words like *right* and *round* with an [ɑ] sound rather than an [a] you will find yourself speaking with one variety of a British accent.

diphthongs in which the change in position of the articulators is less dramatic. If you listen carefully and note the change in your lip position as you pronounce the words *play* ([ej]) and *go* [ow]), you will realize that in each of these diphthongs, too, the starting position is different from the ending position. The change is less easy to hear, and in fact is not made by all English speakers, in the vowels of words like *heed* and *lose,* and we will not transcribe these as diphthongs. Some instructors, however, may ask that you transcribe them in the diphthongized form. Table 2.13 presents the simple vowels and diphthongs of American English. The diphthongs are transcribed as vowel-glide sequences. Although diphthongs are complex in an articulatory sense (in that they are transcribed as a vowel plus a glide), they still act as a single vowel in some respects. Our judgments tell us that both *pin* (simple vowel) and *pint* (diphthong) are single-syllable words. Having a diphthong doesn't add a syllable to a word.

Table 2.13 Some simple vowels and diphthongs of American English

Simple vowels		*Major diphthongs*		*Minor diphthongs*	
pit	[ɪ]	my	[aj]	say	[ej]
set	[ɛ]	now	[aw]	grow	[ow]
put	[ʊ]	boy	[ɔj]		
bought	[ɔ]				
cut	[ʌ]				
mat	[æ]				
pot	[ɑ]				
heat	[i]				
lose	[u]				

6.2 Basic Parameters for Describing Vowels

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 *ah*. 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 *ah* and *at*. 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 positions, you are also **rounding** your lips for the [u]. Figure 2.7 shows a midsagittal view of the tongue position for the vowels [i], [ɑ], and [u] based on X-ray studies of speech.

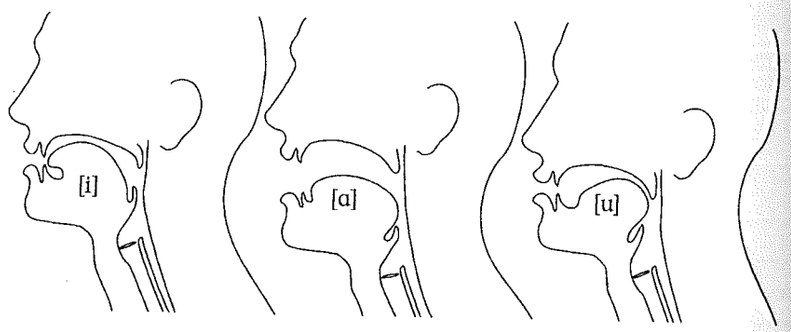


Figure 2.7 Tongue position and transcription for three English vowels

Vowels for which the tongue is neither raised nor lowered are called **mid vowels**. The front vowel of English *made* or *fame* is mid, front, and unrounded. The vowel of *code* and *soak* is mid, back, and rounded. In the case of diphthongs, the articulatory descriptions refer to the tongue position of the vowel nucleus, not the following glide. The 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 American English vowels

heat	[i]	high front unrounded
fate	[ej]	mid front unrounded
mad	[æ]	low front unrounded
Sue	[u]	high back rounded
boat	[ow]	mid back rounded
caught	[ɔ]	mid back rounded
sun	[ʌ]	mid back (central) unrounded
cot	[ɑ]	low back unrounded

As Table 2.14 shows, the vowel of *caught* (and certain other words such as *law*) is the mid back rounded lax vowel [ɔ] in many dialects of English, both in the United States and worldwide. However, in some dialects of North American English, the

vowel [ɔ] has merged with the vowel [ɑ], and there is, therefore, no difference between *cot* and *caught;* the vowel in both words is [ɑ].

Tongue positions for these vowels are illustrated in Figure 2.8. The trapezoid corresponds roughly to the space within which the tongue moves, which is wider at the top of the oral cavity and more restricted at the bottom. Nonfront vowels are traditionally divided into central and back vowels (see Figures 2.8 and 2.9); often the term *back* alone is used for all nonfront vowels.

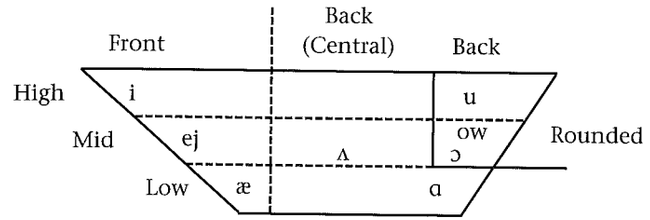


Figure 2.8 Basic tongue positions for English vowels

6.3 Tense and Lax Vowels

All the vowels illustrated in Figure 2.8 except [æ] and [ʌ] are **tense vowels**; they are produced with a placement of the tongue that results in greater vocal tract constriction than that of nontense vowels; in addition, tense vowels are longer than nontense 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**. The representation of vowels and their articulatory positions (Figure 2.8) is expanded in Figure 2.9 to include both tense and lax vowels.

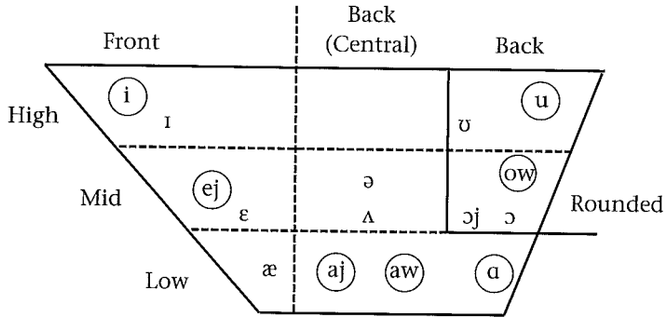


Figure 2.9 American English vowels (tense vowels are circled)

Table 2.15 provides examples from English comparing tense and lax vowels. Note that not all the vowels come in tense/lax pairs. The difference between two of the vowels illustrated in Table 2.15 is often not easy to hear at first. Both the vowel [ʌ] in *cut, dud, pluck,* and *Hun,* and the vowel [ə] of *Canada, about, tomahawk,* and *sofa* are mid, back, unrounded, and lax. The vowel of the second set of examples,

Table 2.15 Tense and lax vowels in American English

Tense		*Lax*	
heat	[i]	hit	[ɪ]
mate	[ej]	met	[ɛ]
—	—	mat	[æ]
shoot	[u]	should	[ʊ]
coat	[ow]	ought	[ɔ] (in some dialects)
—	—	cut	[ʌ]
—	—	Canada	[ə]
lock	[ɑ]	—	—
lies	[aj]		
loud	[aw]		
boy	[ɔj]		

called **schwa**, is referred to as a **reduced vowel**. In addition to being lax, it has a very brief duration (briefer than that of any of the other vowels).

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 (except for [ɔ]). We find *see* [si], *say* [sej], *Sue* [su], *so* [sow], and *spa* [spɑ] in English, but not *s[ɪ], *s[ɛ], *s[æ], *s[ʊ], or *s[ʌ]. Schwa, however, frequently appears in unstressed position in polysyllabic words like *sof* [ə] and *Can*[ə]*d*[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 as [ʌ], and not as [ə].

This rather formidable crowd of vowels should not intimidate you. If you are a native speaker of English, 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. If you are a non-native speaker of English, you have access to the sound files on our Web site to practice listening to these sounds. The next section provides more examples of the transcription of English consonants and vowels.

7 Phonetic Transcription of American English Consonants and Vowels

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

Table 2.16 Transcribing English consonants

	Symbol	*Word*	*Transcription*	*More examples*
Stops	[p]	spit	[spɪt]	spar, crispy, upper, culprit, bumper
	[b]	bib	[bɪb]	boat, liberate, rob, blast
	[t]	stuck	[stʌk]	stem, hunter, nasty, mostly
	[d]	dip	[dɪp]	dust, sled, draft
	[k]	skip	[skɪp]	scatter, uncle, blacklist, likely
	[g]	get	[gɛt]	gape, mugger, twig, gleam
Aspirated Stops	[pʰ]	pit	[pʰɪt]	pain, upon, apart
	[tʰ]	tick	[tʰɪk]	tell, attire, terror, tutu
	[kʰ]	keep	[kʰip]	cow, kernel, recur
Affricates	[tʃ]	chip	[tʃɪp]	lunch, lecher, ditch, belch
	[dʒ]	judge	[dʒʌdʒ]	germ, journal, budge, wedge
Fricatives	[f]	fit	[fɪt]	flash, coughing, proof, phlegmatic, gopher
	[v]	vat	[væt]	vote, oven, prove
	[θ]	thick	[θɪk]	thought, ether, teeth, three, bathroom
	[ð]	though	[ðow]	then, bother, teethe, bathe
	[s]	sip	[sɪp]	psychology, fasten, lunacy, bass, curse, science
	[z]	zap	[zæp]	Xerox, scissors, desire, zipper, fuzzy
	[ʃ]	ship	[ʃɪp]	shock, nation, mission, glacier, wish
	[ʒ]	rouge	[ruʒ]	measure, azure, visual, garage (for some speakers)
	[h]	hat	[hæt]	who, ahoy, forehead, behind
Nasals	[m]	moat	[mowt]	mind, humor, shimmer, sum, thumb
	[n]	note	[nowt]	now, winner, angel, sign, wind
	[ŋ]	sang	[sæŋ]	singer, longer, bank, twinkle, speaking
Syllabic Nasals	[m̩]	m-m	[ʔm̩ʔm̩]	bottom, prism
	[n̩]	button	[bʌtn̩]	Jordan, fatten
Liquids	[l]	leaf	[lif]	loose, lock, alive, hail
	[ɹ]	reef	[ɹif]	rod, arrive, tear
Flap	[ɾ]	hitting	[hɪɾɪŋ]	butter, madder, writer, rider, pretty, amity
Syllabic Liquids	[l̩]	huddle	[hʌdl̩]	bottle, needle (for many speakers)
	[ɹ̩]	bird	[bɹ̩d]	early, hurt, stir, purr, doctor, leader
Glides	[j]	yet	[jɛt]	_use, c_ute, yes
	[w]	witch	[wɪtʃ]	wait, weird, queen, now
	[ʍ]	which	[ʍɪtʃ]	what, where, when (only for some speakers)

Table 2.17 Transcribing English vowels

Symbol	*Word*	*Transcription*	*More examples*
[i]	fee	[fi]	she, cream, believe, receive, serene, amoeba, highly
[ɪ]	fit	[fɪt]	hit, income, definition, been (for some speakers)
[ej]	fate	[fejt]	they, clay, grain, gauge, engage, great, sleigh
[ɛ]	let	[lɛt]	led, head, says, said, sever, guest
[æ]	bat	[bæt]	panic, racket, laugh, Nantucket
[u]	boot	[but]	do, two, loose, brew, Louise, Lucy, through
[ʊ]	book	[bʊk]	should, put, hood
[ow]	note	[nowt]	no, throat, though, slow, toe, oaf, O'Conner
[ɔ]	fought	[fɔt]	caught, normal, all
[ɔj]	boy	[bɔj]	voice, boil, toy
[ɑ]	rob	[ɹɑb]	cot, father, body
[ʌ]	shut	[ʃʌt]	other, udder, tough, lucky, what, flood
[ə]	suppose	[səpʰowz]	collide, hinted, telegraph, about
[aw]	crowd	[kɹawd]	(to) house, plow, bough
[aj]	lies	[lajz]	my, tide, thigh, buy

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.

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 signaled by differences in pitch. Pitch on forms in tone languages functions very differently from the movement of pitch in a nontone 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 2.12). There is no parallel to anything like this in nontone 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, Canada, has high, mid, and low pitch level tones. In Figure 2.10, 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.

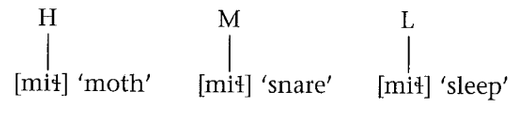


Figure 2.10 Tsúut'ína level tones ([ɬ] is a voiceless lateral fricative)

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 [ˊ] indicates a high tone and the diacritic [ˋ] indicates a low tone).

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

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

To hear audio of the words in Table 2.18, go to **bedfordstmartins.com/linguistics/phonetics** and click on **Audio files**.

This notation allows us to represent the tone as characteristic of an entire form. The single underlying tone unit is associated with all vowels (see Figure 2.11).

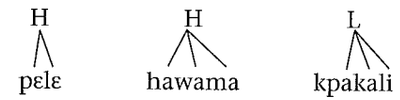


Figure 2.11 Tone as a word feature

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 2.12.

H |			MLH \/		
[ma]	'mother'	high tone	[ma]	'horse'	fall rise
MH \			HL \		
[ma]	'hemp'	mid rise	[ma]	'scold'	high fall

Figure 2.12 Register and contour tones in Mandarin

In Figure 2.12, 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 2.13 shows.

	L L | |	
Timeless	ima	'I show'
	H L | |	
Continuous	ima	'I am showing'
	L H | |	
Past	ima	'I showed'

Figure 2.13 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 the Far East.

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 **nonterminal (intonation) contour**, often signals incompleteness. Nonterminal contours are often heard in the nonfinal forms found in lists and telephone numbers.

LANGUAGE MATTERS Intonation and Punctuation

Punctuation marks in English often serve to indicate intonation patterns. If you just read an unpunctuated sequence such as

John said William is brilliant

you might not recognize the ambiguity of the utterance as shown below:

John said, "William is brilliant."

"John," said William, "is brilliant."

Repeat each of the above sentences and note how your intonation helps to convey the right meaning.

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 2.14 and 2.15, a more formal way of representing intonation is shown in Figure 2.16. Here, as in tonal representation, L and H are relative terms for differences in pitch. The letters HL are placed above the syllabic elements on which the pitch change occurs. The dotted lines indicate that the lowering pitch spreads across the remaining pitch-bearing elements.

Sally Fred Helen and Joe

two eight four two five one three

Figure 2.14 Rising nonterminal intonations in a list and a telephone number

Did you have a nice time?

Figure 2.15 Nonterminal intonation in a question

L H L

There's an elephant in here.

Figure 2.16 A terminal contour

Rising intonation on names or requests is commonly heard in addressing people. Its use indicates that the speaker is opening a conversation or that some further action is expected from the addressee, as shown in Figure 2.17.

L H H LH

Margo? Is that you?

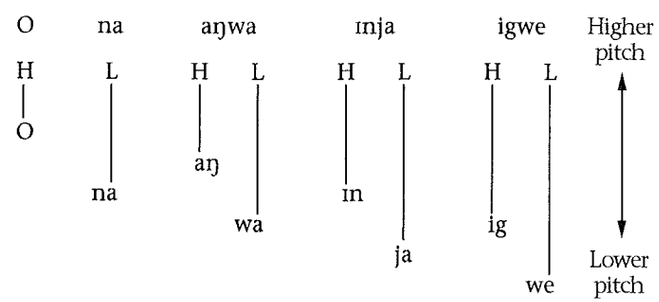
Figure 2.17 Two nonterminal contours

To hear audio files for Figures 2.14 through 2.17, go to **bedfordstmartins.com/linguistics/phonetics** and click on **Intonation**.

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.

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 2.18, 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 2.18 Tone and intonation: downdrift in Igbo

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] 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.

To hear audio of the words in Table 2.19, go to **bedfordstmartins.com/linguistics/phonetics** and click on **Audio files**.

Table 2.19 Short and long vowels in Yapese

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

Italian has short consonants and long consonants (called **geminates**) 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'

To hear audio of the words in Table 2.20, go to **bedfordstmartins.com/linguistics/phonetics** and click on **Audio files**.

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* [tʰɛ̀ləgɪǽfɪk], the two vowel nuclei that are more prominent than the others are [ɛ] 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)

$$[t^{h}\grave{\varepsilon}ləg\imath\acute{æ}f\imath k] \quad \text{or} \quad [t^{h}\overset{2}{\varepsilon}ləg\imath\overset{1}{æ}f\imath k]$$

The examples in Table 2.21 illustrate some differences in English stress placement.

Table 2.21 Differing stress placement in English

(an) éxport	[ék spɔɹt]	(to) expórt	[ɛk spɔ́ɹt]
(a) présent	[pɹéz̩nt]	(to) presént	[pɹə zént]
télegràph	[tʰéləgɹæf]		
telégraphy	[tʰəlégɹəfi]		
tèlegráphic	[tʰèləgɹæfɪk]		

In the last four examples in the table, 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 it is not universal.

To hear audio versions of differing stress placement in English words, go to **bedfordstmartins.com/linguistics/phonetics** and click on **Stress placement**.

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 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.

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 synthesizers that produced speech in this way were practically unintelligible. Rather, as the sequence [pl] is produced, the tongue tip will start to move toward 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 Web site at **bedfordstmartins.com/linguistics/phonetics** and click on **Coarticulation**.

9.2 Articulatory Processes

Articulatory adjustments that occur during the production of connected speech are called **articulatory 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 nasalize 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 [k] as more palatal (represented as [k̟]) 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 [pɹ̟ejd] 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 [ɹ] can be anticipated during pronunciation of the [p]; and the voicelessness of the initial stop is carried on through the [ɹ̥].

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.

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.

Nasalization 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 [kʰæ̃nt] 'can't'.

On the other hand, as the examples of Scots Gaelic show in Table 2.22, nasality can also move *forward* from the nasal consonant onto the vowel. It results from not immediately raising the velum after the production of a nasal stop.

Table 2.22 Nasalization of vowels in Scots Gaelic

[mõːr]	'big'
[nĩ]	'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* [pl̥iz], *proud* [pɹ̥awd], and *pure* [pj̊uɹ]. 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 **place assimilation**, as shown in Table 2.23.

Table 2.23 Assimilation for place of articulation in English

possible	impossible
potent	impotent
tolerable	intolerable
tangible	intangible

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 *A*[ŋ]*chorage* and *sy*[ŋ]*phony* (the symbol [ŋ] 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 [ɪŋkʰowd].

The preceding English example shows assimilation of a nasal for place of articulation. The following example, taken from German, also shows place assimilation that again affects nasal consonants (see Table 2.24). In careful speech, certain German verb forms are pronounced with a final [ən], as in *laden* 'to invite', *loben* 'to praise', and *backen* 'to bake'. In informal speech, the final [ən] is reduced to a syllabic nasal, which takes on the point of articulation of the preceding consonant. (Recall that the diacritic line under the phonetically transcribed nasals indicates that they are syllabic.)

Table 2.24 Place assimilation in German

	Careful speech	*Informal speech*	
laden	[laːdən]	[laːdn̩]	'to invite'
loben	[loːbən]	[loːbm̩]	'to praise'
backen	[bakən]	[bakŋ̍]	'to bake'

Flapping is a process in which a dental or alveolar stop articulation changes to a flap [ɾ] articulation. In 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 such words as *butter*, *writer*, *fatter*, *wader*, and *waiter*, and even in phrases such as *I bought it* [ajbɔ́ɾɪt]. The alveolar flap is always voiced. Flapping is considered a type of assimilation because it changes a noncontinuant 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

Slow speech	*Rapid speech*	
[pʰəɹéjd]	[pɹ̥éjd]	parade
[kʰəɹówd]	[kɹ̥ówd]	corrode
[səpʰówz]	[spówz]	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 nonsyllabic segment within an existing string of segments. For example, in careful speech, the words *warmth* and *something* are pronounced [wɔɹmθ] and [sʌ̃mθĭŋ] (see Table 2.26). It is common in casual speech for speakers to insert a [p] between the *m* and the *th* and pronounce the words [wɔɹmpθ] and [sʌ̃mpθĭŋ]. Consonant epenthesis of this type is another example of a coarticulation phenomenon. In English, the articulatory transition from a sonorant consonant to a nonsonorant appears to be eased by the insertion of a consonant that shares properties of both segments. Notice that the epenthesized consonants are all nonsonorant, have the same place of articulation as the sonorant consonant before them, and have the same voicing as the nonsonorant consonant after them.

Table 2.26 Some examples of English consonant epenthesis

Word	*Nonepenthesized pronunciation*	*Epenthesized pronunciation*
something	[sʌ̃mθĭŋ]	[sʌ̃mpθĭŋ]
warmth	[wɔɹmθ]	[wɔɹmpθ]
length	[lɛ̃ŋθ]	[lɛ̃ŋkθ]
prince	[pɹĭns]	[pɹĭnts]
tenth	[tɛ̃nθ]	[tɛ̃ntθ]

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 10 for further presentation of these and other unfamiliar symbols.)

Table 2.27 Vowel epenthesis in Turkish

Source word	*Turkish form*
train	[tɨ̟ɾen]
club	[kʏlʏp]
sport	[sʉ̟poɾ]

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* [pəskɛɾi]. In this form, the initial sequence [spə], which is often difficult for children to pronounce, is metathesized to [pəs].

The pronunciation of *ask* as a[ks] is an example of metathesis that is common in adult speech. It is interesting that historically in English the word was a[ks] and underwent metathesis in the past to become a[sk].

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* [kʰǽnədə] versus *Canadian* [kʰənéjdiən]. 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 [ej] 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 [ej] are basic to the words in question and are reduced in unstressed position.

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 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 stop [g]). 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 interactive examples of the sounds presented in Tables 2.28 and 2.29, go to the Web site at **bedfordstmartins.com/linguistics/phonetics** and click on **IPA vowels and consonants**.

Table 2.28 Modified IPA chart for vowels, including the vowels of English (shaded) and many of those found in other languages. Where symbols appear in pairs, the phone on the left is unrounded, and the one on the right is rounded.

	Front	*(Central)*	*Back*
High	i y ɪ ʏ	ɨ ʉ	ɯ u ʊ
Mid	e ø ɛ œ	ə	ɤ o ʌ ɔ
Low	æ	a	ɒ ɑ

Table 2.29 Modified IPA chart for consonants, including the sounds of English (shaded) and many of those found in other languages. Where symbols appear in pairs, the phone on the left is voiceless, and the one on the right is voiced. The term *approximant* is used by the IPA to include glides and some liquids, in which there is a relatively free flow of air with no friction.

	Bilabial	*Labiodental*	*Interdental*	*Alveolar*	*Alveopalatal*	*Retroflex*	*Palatal*	*Velar*	*Uvular*	*Pharyngeal*	*Glottal*
Stop	p b			t d		ʈ ɖ	c ɟ	k g	q ɢ		ʔ
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	ɴ		
Trill				r					ʀ		
Flap				ɾ							
Approximant	ʍ w ɥ			ɹ		ɻ	j ɥ	ɰ w			
Lateral Approximant				l̥ l			ʎ̥ ʎ				
Lateral Fricative				ɬ ɮ							

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 nonsyllabic 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**.

Key Terms

General terms

acoustic phonetics
articulatory phonetics
broad transcription
diacritics
features
International Phonetic Alphabet (IPA)
narrow transcription
phones
phonetics
segments
speech sounds
syllable

Parts of the vocal tract below the mouth

glottis
larynx
pharynx
vocal folds (vocal cords)
vocal tract

Terms concerning glottal states

voiced (sounds)
voiceless (sounds)

Terms concerning sound classes

consonants
glides
nonsyllabic
nucleus
sonorous (sounds)
sound classes
syllabic
vowels

Terms concerning the mouth and articulators

alveolar ridge
dorsum
palate
tongue back
tongue blade
tongue body
tongue root
tongue tip
uvula
velum

Types of sounds based on places (points) of articulation

alveolar sounds
alveopalatal (palatoalveolar)
bilabial (sounds)
dentals
glottals
interdental (sounds)
labial (sounds)
labiodentals
labiovelar (sounds)
palatals
pharyngeals
places (points) of articulation
primary place of articulation
secondary place of articulation
uvulars
velars

General terms concerning manners of articulation

manners of articulation
nasal phones
oral phones

Terms for consonant sounds based on manner of articulation

affricates
aspiration
continuants
flap
fricatives
laterals
liquids
nonstrident
retroflex
sibilants
stops
stridents
syllabic liquids
syllabic nasals
unreleased stop

Terms used for vowel sounds

back
diphthongs
front
high
lax vowels
low
major diphthongs
mid vowels
minor diphthongs
reduced vowel
rounding
schwa
simple vowels
tense vowels
vowel qualities

Terms concerning suprasegmental properties

association line
contour tones
downdrift
geminates
intonation
length
long vowels
loudness
nonterminal (intonation) contour
pitch
primary stress
prosodic properties
register tones
secondary stress
stress
suprasegmental properties
terminal (intonation) contour
tone
tone language

Terms concerning sounds in context

articulatory processes
assimilation
coarticulation
deletion

devoicing
dissimilation
epenthesis
flapping
metathesis
nasalization
place assimilation
voicing
voicing assimilation
(vowel) reduction

For information on the sources used in this chapter, see the Sources section at the back of the book, or go to **bedfordstmartins.com/linguistics/phonetics** and click on **Sources**.

Recommended Reading

Catford, J.C. 2001. *A Practical Introduction to Phonetics*. 2nd ed. New York: Oxford University Press.

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Pullum, G.K., and W.A. Ladusaw. 1986. *Phonetic Symbol Guide*. Chicago: University of Chicago Press.

Rogers, H. 1991. *Theoretical and Practical Phonetics*. Toronto: Copp Clark Pitman.

Shearer, William M. 1968. *Illustrated Speech Anatomy*. Springfield, IL: Charles C. Thomas.

For ultrasound and X-ray images of the vocal tract, go to **http://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. (Refer to Section 1.)
   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? (Refer to Section 1.2.)
   a) at
   b) math
   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? (Refer to Section 2.1.)
   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. (Refer to Section 4.)
   a) [s] : [l]
   b) [k] : [ŋ]
   c) [p] : [g]
   d) [l] : [ɹ]
   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. (Refer to Section 5.)
   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) [ɹ] : [w]
   j) [tʃ] : [dʒ]
   k) [h] : [ʔ]
   l) [z] : [dʒ]

7. After each of the following articulatory descriptions, write the sound described in phonetic brackets. (Refer to Sections 4–6.)
   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 sound in your dialect? Mark each pair as *same* or *different*. Then transcribe the vowels of each word. (Refer to Section 6.)
   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 obvious answers such as "consonant" or "vowel." (Refer to Sections 4–6.) *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 ɹ m n ŋ j w]
   j) [t d l ɹ n s z]

10. Transcribe the following sets of words. You may use these words to practice transcribing aspiration. (Refer to Sections 5.5 and 7.)
    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. (Refer to Section 8.1.)
    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. (Refer to Section 8.3.)
    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) Canadianize
    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. (See Tables 2.28 and 2.29.)

14. Name the articulatory process responsible for the change from standard Spanish to the dialectal variant in each item below. (See Section 9.3.)
    a) [poβɾe] → [pɾoβe] (U.S. southwestern Spanish) 'poor'
    b) [grasjas] → [grasja] (Caribbean Spanish) 'thank you'
    c) [gatito] → [gatiko] (Costa Rican Spanish) 'kitty'
    d) [kaɾne] → [kanne] (Cuban Spanish) 'meat'
    e) [pesos] → [pesọs] (Mexican Spanish) 'pesos'
    f) [estomaɣo] → [estoɣamo] (U.S. southwestern Spanish) 'stomach'
    g) [alβɾisjas] → [aβɾisjas] (U.S. southwestern Spanish) 'gift, reward'

15. Compare the careful speech and rapid speech pronunciations of the following English words and phrases. Then name the process or processes that make the rapid speech pronunciation different from the careful speech. Stress is omitted here. (Refer to Section 9.)

	Careful speech	*Rapid speech*
a) in my room	[ɪn maj ɹum]	[ɪm maj ɹum]
b) I see them	[aj si ðɛm]	[aj siəm]

c)	I see him	[aj si hɪm]	[aj siəm]
d)	within	[wɪθɪn]	[wɪðɪn]
e)	balloons	[bəlunz]	[blunz]
f)	careful	[kʰɛɹfʊl]	[kʰɛɹf̩]
g)	sit down	[sɪt dawn]	[sɪɾawn]
h)	my advice	[maj ədvajs]	[maj əvajs]
i)	Scotch tape	[skɑtʃ tʰejp]	[kʰɑtʃstejp]
j)	protection	[pr̥owtʰɛkʃn̩]	[pɹ̩tʰɛkʃn̩]
k)	hand me that	[hænd mi ðæt]	[hæ̃miðæt]
l)	Pam will miss you	[pæm wɪl mɪs ju]	[pæmɫ̩mɪʃjə]

To try more advanced exercises, go to **bedfordstmartins.com/linguistics/phonetics** and click on **Exercises.**

For the Student Linguist

For more food for thought on phonetics, go to **bedfordstmartins.com/linguistics/phonetics** and click on **For the Student Linguist.**

three

Phonology: The Function and Patterning of Sounds

Ewa Czaykowska-Higgins
Michael Dobrovolsky

A person's tongue is a twisty thing, there are plenty of words there of every kind, and the range of words is wide, and their variation.
– HOMER, *The Iliad*, 20

OBJECTIVES

In this chapter, you will learn:

- how we know which language sounds are distinctive in a particular language
- how distinctive sounds in a particular language can vary systematically according to the context in which they occur
- how we use transcription to represent distinctive sounds and systematic variations of these sounds
- how syllables are constructed and the influence of language-specific syllable structure
- how individual sounds can be broken down further, according to specific features
- how we can construct rules to explain systematic variations in the production of sounds

We saw in Chapter 2 that human beings can produce and perceive a large number of speech sounds. No human language exploits *all* of these phonetic possibilities. Instead, every language makes its own particular selection from the range of all possible speech sounds and organizes them into a system. The component of grammar that determines the selection of speech sounds and that governs both the sound patterns and the systematic phonetic variation found in language is known as **phonology**. While phonetics is primarily concerned with the concrete physical properties of language sounds, phonology investigates how sound and meaning are connected.

Speakers have some subconscious knowledge of the phonetic patterns that make up phonological systems. For example, as we saw in Chapter 1, speakers of English