6

Phonetics: The Sounds of Language

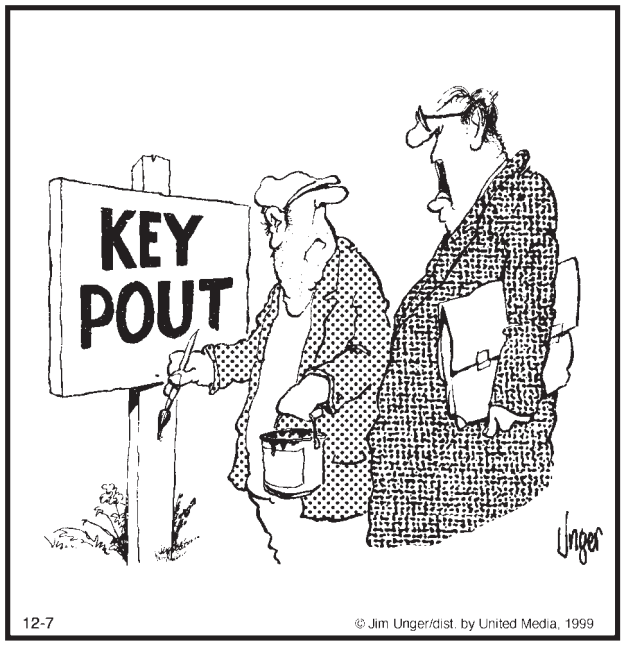
I gradually came to see that Phonetics had an important bearing on human relations—that when people of different nations pronounce each other's languages really well (even if vocabulary & grammar not perfect), it has an astonishing effect of bringing them together, it puts people on terms of equality, a good understanding between them immediately springs up.

FROM THE JOURNAL OF DANIEL JONES

When you know a language you know the *sounds* of that language, and you know how to combine those sounds into words. When you know English you know the sounds represented by the letters *b*, *s*, and *u*, and you are able to combine them to form the words *bus* or *sub*.

Although languages may contain different sounds, the sounds of all the languages of the world together constitute a class of sounds that the human vocal tract is designed to make. This chapter will discuss these speech sounds, how they are produced, and how they may be classified.

Sound Segments



"Keep out! Keep out! K-E-E-P O-U-T."

The study of speech sounds is called **phonetics**. To describe speech sounds, it is necessary to know what an individual sound is, and how each sound differs from all others. This is not as easy as it may seem, for when we speak, the sounds seem to run together and it isn't at all obvious where one sound ends and the next begins. However, when we know the language we hear the individual sounds in our "mind's ear" and are able to make sense of them, unlike the sign painter in the cartoon.

A speaker of English knows that there are three sounds in the word *bus*. Yet, physically the word is just one continuous sound. You can **segment** that one sound into parts because you know English. And you recognize those parts when they occur elsewhere as *b* does in *b*et or ro*b*, as *u* does in *u*p, and as *s* does in *s*ister.

It is not possible to segment the sound of someone clearing her throat into a sequence of discrete units. This is not because throat-clearing is one continuous sound. It is because such sounds are not speech and are therefore not able to be segmented into the sounds of speech.

Speakers of English can separate *keepout* into the two words *keep* and *out* because they know the language. We do not generally pause between words (except to take a breath), even though we may think we do. Children learn-

ing a language reveal this fact. A two-year-old child going down stairs heard his mother say, "hold on." He replied, "I'm holing don, I'm holing don," not knowing where the break between words occurred. In fact, word boundary misperceptions have changed the form of words historically. At an earlier stage of English, the word *apron* was *napron*. However, the phrase *a napron* was so often misperceived as *an apron* that the word lost its initial *n*.

Some phrases and sentences that are clearly distinct when printed may be ambiguous when spoken. Read the following pairs aloud and see why we might misinterpret what we hear:

grade A	gray day
I scream	ice cream
The sun's rays meet	The sons raise meat

The lack of breaks between spoken words and individual sounds often makes us think that speakers of foreign languages run their words together, unaware that we do too. X-ray motion pictures of someone speaking make the absence of breaks very clear. One can see the tongue, jaw, and lips in continuous motion as the individual sounds are produced.

Yet, if you know a language you have no difficulty segmenting the continuous sounds of speech. It doesn't matter if there is an alphabet for the language or whether the listener can read and write. Everyone who knows a language knows how to segment sentences into words, and words into sounds.

Identity of Speech Sounds

> By infinitesimal movements of the tongue countless different vowels can be produced, all of them in use among speakers of English who utter the same vowels no oftener than they make the same fingerprints.
>
> **GEORGE BERNARD SHAW,** 1950

It is truly amazing, given the continuity of the speech signal, that we are able to understand the individual words in an utterance. This ability is more surprising because no two speakers ever say the same word identically. The speech signal produced when one speaker says *cat* is not the same as that of another speaker's *cat*. Even two utterances of *cat* by the same speaker will differ to some degree.

Our knowledge of a language determines when we judge physically different sounds to be the same. We know which aspects of pronunciation are linguistically important and which are not. For example, if someone coughs in the middle of saying "How (cough) are you?" a listener will ignore the cough and interpret this simply as "How are you?" People speak at different pitch levels, at different rates of speed, and even with their heads encased in a helmet, like Darth Vader. However, such personal differences are not linguistically significant.

Our linguistic knowledge makes it possible to ignore nonlinguistic differences in speech. Furthermore, we are capable of making sounds that we know are not speech sounds in our language. Many English speakers can make a clicking

sound of disapproval that writers sometimes represent as *tsk*. This sound never occurs as part of an English word. It is even difficult for many English speakers to combine this clicking sound with other sounds. Yet clicks are speech sounds in Xhosa, Zulu, Sosotho, and Khoikhoi—languages spoken in southern Africa—just like the *k* or *t* in English. Speakers of those languages have no difficulty producing them as parts of words. Thus, *tsk* is a speech sound in Xhosa but not in English. The sound represented by the letters *th* in the word *think* is a speech sound in English but not in French. In general, languages differ to a greater or lesser degree in the inventory of speech sounds that words are built from.

The science of phonetics attempts to describe all of the sounds used in all languages of the world. **Acoustic phonetics** focuses on the physical properties of sounds; **auditory phonetics** is concerned with how listeners perceive these sounds; and **articulatory phonetics**—the primary concern of this chapter—is the study of how the vocal tract produces the sounds of language.

The Phonetic Alphabet

> The English have no respect for their language, and will not teach their children to speak it. They cannot spell it because they have nothing to spell it with but an old foreign alphabet of which only the consonants—and not all of them—have any agreed speech value.
>
> **GEORGE BERNARD SHAW,** Preface to *Pygmalion,* 1912

Orthography, or alphabetic spelling, does not represent the sounds of a language in a consistent way. To be scientific—and phonetics *is* a science—we must devise a way for the same sound to be spelled with the same letter every time, and for any letter to stand for the same sound every time.

To see that ordinary spelling with our Roman alphabet is woefully inadequate for the task, consider sentences such as:

Did he bel**ie**ve that C**ae**sar could s**ee** the p**eo**ple s**ei**ze the s**ea**s?
The sill**y** am**oe**ba stole the k**ey** to the mach**i**ne.

The same sound is represented variously by **e**, **ie**, **ae**, **ee**, **eo**, **ei**, **ea**, **y**, **oe**, **ey**, and **i**.

On the other hand, consider:

My f**a**ther w**a**nted m**a**ny **a** vill**a**ge d**a**me b**a**dly.

Here the letter **a** represents the various sounds in *father*, *wanted*, *many*, and so on.

Making the spelling waters yet muddier, we find that a combination of letters may represent a single sound:

shoot	***ch***aracter	***Th***omas	***ph***ysics
ei***th***er	d***ea***l	rou***gh***	na***ti***on
c***oa***t	gla***ci***al	***th***eater	pl***ai***n

Or, conversely, the single letter **x**, when not pronounced as **z**, usually stands for the *two* sounds **ks** as in sex (you may have to speak aloud to hear that *sex* is pronounced seks).

Some letters have no sound in certain words (so-called *silent* letters):

mnemonic	autum***n***	resi***g***n	g***h***ost
pterodactyl	***w***rite	hol***e***	cor***ps***
psychology	s***w***ord	de***b***t	***g***naw
bou***gh***	lam***b***	i***s***land	***k***not

Or, conversely, there may be no letter to represent sounds that occur. In many words, the letter *u* represents a *y* sound followed by a *u* sound:

c***u***te	(sounds like k**y**ute; compare: c***oo***t)
f***u***me	(sounds like f**y**ume; compare: f***oo***l)
use	(sounds like **y**use; compare: ***U***zbekistan)

Throughout several centuries English scholars have advocated spelling reform. George Bernard Shaw complained that spelling was so inconsistent that *fish* could be spelled *ghoti—gh* as in *tough*, *o* as in *women*, and *ti* as in *nation*. Nonetheless, spelling reformers failed to change our spelling habits, and it took phoneticians to invent an alphabet that absolutely guaranteed a one sound–one symbol correspondence. There could be no other way to study the sounds of all human languages scientifically.

In 1888 members of the International Phonetic Association developed a **phonetic alphabet** to symbolize the sounds of all languages. They utilized both ordinary letters and invented symbols. Each character of the alphabet had exactly one value across all of the world's languages. Someone who knew this alphabet would know how to pronounce a word written in it, and upon hearing a word pronounced, would know how to write it using the alphabetic symbols. The inventors of this **International Phonetic Alphabet**, or **IPA**, knew that a phonetic alphabet should include just enough symbols to represent the fundamental sounds of all languages.

Table 6.1 is a list of the IPA symbols that we will use to represent English speech sounds. The symbols do not tell us everything about the sounds, which may vary from person to person and which may depend on their position in a word. They are not all of the phonetic symbols needed for English, but they will suffice for our purposes. When we discuss the sounds in more detail later in the chapter, we will add appropriate symbols. From now on we will enclose phonetic symbols in square brackets [ ] to distinguish them from ordinary letters.

TABLE 6.1 | A Phonetic Alphabet for English Pronunciation

Consonants						Vowels			
p	**p**ill	t	**t**ill	k	**k**ill	i	b**ee**t	ɪ	b**i**t
b	**b**ill	d	**d**ill	g	**g**ill	e	b**ai**t	ɛ	b**e**t
m	**m**ill	n	**n**il	ŋ	ri**ng**	u	b**oo**t	ʊ	f**oo**t
f	**f**eel	s	**s**eal	h	**h**eal	o	b**oa**t	ɔ	b**o**re
v	**v**eal	z	**z**eal	l	**l**eaf	æ	b**a**t	a	p**o**t/b**a**r
θ	**th**igh	ʧ	**ch**ill	r	**r**eef	ʌ	b**u**tt	ə	sof**a**
ð	**th**y	ʤ	**g**in	j	**y**ou	aɪ	b**i**te	aʊ	b**ou**t
ʃ	**sh**ill	ʍ	**wh**ich	w	**w**itch	ɔɪ	b**oy**		
ʒ	mea**s**ure								

The symbol [ə] in *sofa* toward the bottom right of the chart is called a *schwa*. We use it to represent vowels in syllables that are not emphasized in speaking and whose duration is very short, such as *general*, *about*, *reader*, etc. The schwa is pronounced with the mouth in a neutral position and is a brief, colorless vowel. The schwa is reserved for the vowel sound in all reduced syllables, even though its pronunciation may vary slightly according to its position in the word and who is speaking. All other vowel symbols in the chart occur in syllables that receive at least some emphasis.

Speakers from different parts of the country may pronounce some words differently. For example, some of you may pronounce the words *which* and *witch* identically. If you do, the initial sound of both words is symbolized by [w] in the chart. If you don't, the breathy *wh* of *which* is represented by [ʍ].

Some speakers of English pronounce *bought* and *pot* with the same vowel; others pronounce them with the vowel sounds in *bore* and *bar*, respectively. We have therefore listed both words in the chart of symbols. It is difficult to include all the phonetic symbols needed to represent all differences in English. There may be sounds in your speech that are not represented, and vice versa, but that's okay. There are many varieties of English. The versions spoken in England, in Australia, in Ireland, and in India, among others, differ in their pronunciations. And even within American English, phonetic differences exist among the many dialects, as we discuss in chapter 10.

The symbols in Table 6.1 are IPA symbols with one small exception. The IPA uses an upside-down "r" (ɹ) for the English sound *r*. We, and many writers, prefer the right side up symbol r for clarity when writing for an English-reading audience. Apart from "r," some writers use different symbols for other sounds that once were traditional for transcribing American English. You may encounter these in other books. Here are some equivalents:

IPA	Alternative
ʃ	š
ʒ	ž
tʃ	č
dʒ	ǰ
ʊ	U

Using the IPA symbols, we can now unambiguously represent the pronunciation of words. For example, in the six words below, *ou* represents six distinct vowel sounds; the *gh* is silent in all but *rough*, where it is pronounced [f]; the *th* represents a single sound, either [Ð] or [ð], and the *l* in *would* is also silent. However, the phonetic transcription gives us the actual pronunciation.

Spelling	Pronunciation
though	[ðo]
thought	[θɔt]
rough	[rʌf]
bough	[baʊ]
through	[θru]
would	[wʊd]

Articulatory Phonetics

> The voice is articulated by the lips and the tongue. . . . Man speaks by means of the air which he inhales into his entire body and particularly into the body cavities. When the air is expelled through the empty space it produces a sound, because of the resonances in the skull. The tongue articulates by its strokes; it gathers the air in the throat and pushes it against the palate and the teeth, thereby giving the sound a definite shape. If the tongue would not articulate each time, by means of its strokes, man would not speak clearly and would only be able to produce a few simple sounds.
>
> **HIPPOCRATES** (460–377 B.C.E.)

The production of any sound involves the movement of air. Most speech sounds are produced by pushing lung air through the *vocal cords*—a pair of thin membranes—up the throat, and into the mouth or nose, and finally out of the body. A brief anatomy lesson is in order. The *opening* between the vocal cords is the **glottis** and is located in the voice box or **larynx**, pronounced "lair rinks." The tubular part of the throat above the larynx is the **pharynx** (rhymes with *larynx*). What sensible people call "the mouth," linguists call the **oral cavity** to distinguish it from the **nasal cavity**, which is the nose and the plumbing that connects it to the throat, plus your sinuses. Finally there are the tongue and the lips, both of which are capable of rapid movement and shape changing. All of these together comprise the **vocal tract**. Differing vocal tract shapes result in the differing sounds of language. Figure 6.1 should make these descriptions clearer. (The vocal cords and larynx are not specifically labeled in the figure.)

Consonants

The sounds of all languages fall into two classes: consonants and vowels. Consonants are produced with some restriction or closure in the vocal tract that impedes the flow of air from the lungs. In phonetics, the terms *consonant* and *vowel* refer to types of *sounds*, not to the letters that represent them. In speaking of the alphabet, we may call "a" a vowel and "c" a consonant, but that means only that we use the letter "a" to represent vowel sounds and the letter "c" to represent consonant sounds.

Place of Articulation

> Lolita, light of my life, fire of my loins. My sin, my soul. Lo-lee-ta: the tip of the tongue taking a trip of three steps down the palate to tap, at three, on the teeth. Lo. Lee. Ta.
>
> **VLADIMIR NABOKOV,** *Lolita*, 1955

We classify consonants according to where in the vocal tract the airflow restriction occurs, called the **place of articulation**. Movement of the tongue and lips creates the constriction, reshaping the oral cavity in various ways to produce the

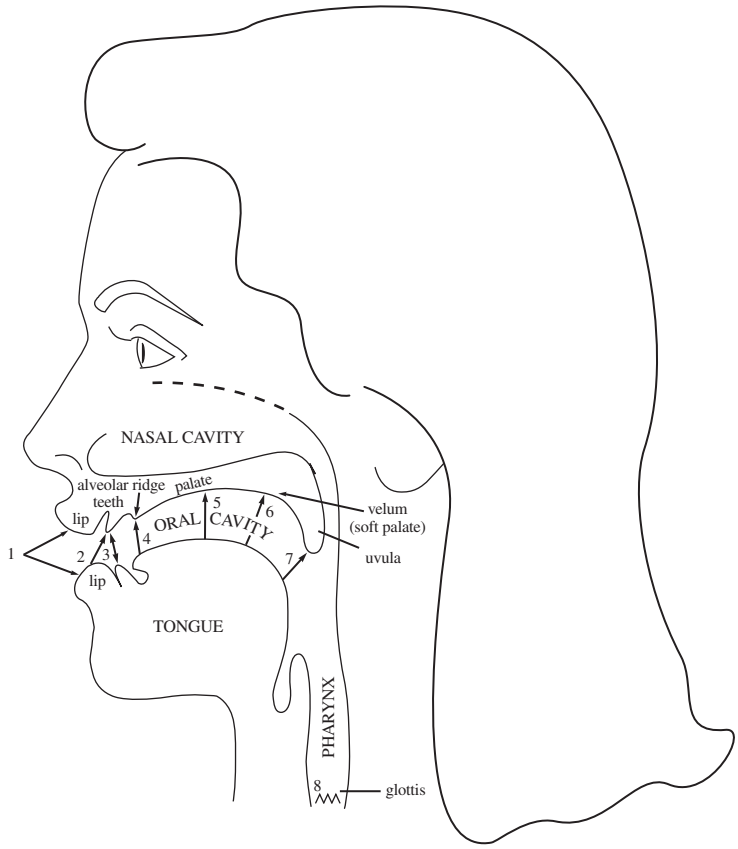


FIGURE 6.1 | The vocal tract. Places of articulation: 1. bilabial; 2. labiodental; 3. interdental; 4. alveolar; 5. (alveo)palatal; 6. velar; 7. uvular; 8. glottal.

various sounds. We are about to discuss the major places of articulation. As you read the description of each sound class, refer to Table 6.1, which provides key words containing the sounds. As you pronounce these words, try to feel which articulators are moving. (Watching yourself in a mirror helps, too.) Look at Figure 6.1 for help with the terminology.

Bilabials [p] [b] [m] When we produce a [p], [b], or [m] we articulate by bringing both lips together.

Labiodentals [f] [v] We also use our lips to form [f] and [v]. We articulate these sounds by touching the bottom lip to the upper teeth.

Interdentals [θ] [ð] These sounds, both spelled *th*, are pronounced by inserting the tip of the tongue between the teeth. However, for some speakers the tongue merely touches behind the teeth, making a sound more correctly called **dental**.

Watch yourself in a mirror and say *think* [θɪŋk] or *these* [ðiz] and see where *your* tongue tip goes.

Alveolars [t] [d] [n] [s] [z] [l] [r] All seven of these sounds are pronounced with the tongue raised in various ways to the **alveolar ridge**.

- For [t,d,n] the tongue tip is raised and touches the ridge, or slightly in front of it.
- For [s,z] the sides of the front of the tongue are raised, but the tip is lowered so that air escapes over it.
- For [l] the tongue tip is raised while the rest of the tongue remains down, permitting air to escape over its *sides*. Hence, [l] is called a **lateral** sound. You can feel this in the "l's" of *Lolita*.
- For [r] [IPA ɹ] most English speakers either curl the tip of the tongue back behind the alveolar ridge, or bunch up the top of the tongue behind the ridge. As opposed to [l], air escapes through the central part of the mouth when [r] is articulated. It is a **central** liquid.

Palatals [ʃ] [ʒ] [tʃ] [dʒ] [j] For these sounds, which occur in *mission* [mɪʃən], *measure* [mɛʒər], *cheap* [tʃip], *judge* [dʒʌdʒ], and *yoyo* [jojo], the constriction occurs by raising the front part of the tongue to the palate.

Velars [k] [g] [ŋ] Another class of sounds is produced by raising the back of the tongue to the soft palate or **velum**. The initial and final sounds of the words *kick* [kɪk] and *gig* [gɪg] and the final sounds of the words *back* [bæk], *bag* [bæg], and *bang* [bæŋ] are all velar sounds.

Uvulars [ʀ] [q] [ɢ] **Uvular** sounds are produced by raising the back of the tongue to the **uvula**, the fleshy protuberance that hangs down in the back of our throats. The *r* in French is often a uvular *trill* symbolized by [ʀ]. The uvular sounds [q] and [ɢ] occur in Arabic. These sounds do not ordinarily occur in English.

Glottals [h] [ʔ] The sound of [h] is from the flow of air through the open *glottis*, and past the tongue and lips as they prepare to pronounce a vowel sound, which always follows [h].

If the air is stopped completely at the glottis by tightly closed vocal cords, the sound upon release of the cords is a **glottal stop [ʔ]**. The interjection *uh-oh*, that you hope never to hear your dentist utter, has two glottal stops and is spelled phonetically [ʔʌʔo].

Table 6.2 summarizes the classification of these English consonants by their place of articulation.

Manner of Articulation

We have described several classes of consonants according to their *place of articulation*, yet we are still unable to distinguish the sounds in each class from one another. What distinguishes [p] from [b] or [b] from [m]? All are bilabial sounds. What is the difference between [t], [d], and [n], which are all alveolar sounds?

TABLE 6.2 | Place of Articulation of English Consonants

Bilabial	p	b	m				
Labiodental	f	v					
Interdental	θ	ð					
Alveolar	t	d	n	s	z	l	r
Palatal	ʃ	ʒ	tʃ	dʒ			
Velar	k	g	ŋ				
Glottal	h	ʔ					

Speech sounds also vary in the way the airstream is affected as it flows from the lungs up and out of the mouth and nose. It may be blocked or partially blocked; the vocal cords may vibrate or not vibrate. We refer to this as the **manner of articulation**.

Voiced and Voiceless Sounds

Sounds are **voiceless** when the vocal cords are apart so that air flows freely through the glottis into the oral cavity. [p] and [s] in *super* [supər] are two of the several voiceless sounds of English.

If the vocal cords are together, the airstream forces its way through and causes them to vibrate. Such sounds are **voiced**. [b] and [z] in *buzz* [bʌz] are two of the many voiced sounds of English. To get a sense of voicing, try putting a finger in each ear and say the voiced "z-z-z-z-z." You can feel the vibrations of the vocal cords. If you now say the voiceless "s-s-s-s-s," you will not sense these vibrations (although you might hear a hissing sound). When you whisper, you are making all the speech sounds voiceless. Try it! Whisper "Sue" and "zoo." No difference, right?

The voiced/voiceless distinction is very important in English. This phonetic property distinguishes the words in word pairs like the following:

ro**p**e/ro**b**e	fa**t**e/fa**d**e	ra**c**k/ra**g**	wrea**th**/wrea**th**e
[ro**p**]/[ro**b**]	[fe**t**]/[fe**d**]	[ræ**k**]/[ræ**g**]	[ri**θ**]/[ri**ð**]

The first word of each pair ends with a voiceless sound and the second word with a voiced sound. All other aspects of the sounds in each word pair are identical; the position of the lips and tongue is the same.

The voiced/voiceless distinction also occurs in the following pairs, where the first word begins with a voiceless sound and the second with a voiced sound:

fine/**v**ine	**s**eal/**z**eal	**ch**oke/**j**oke
[**f**aɪn]/[**v**aɪn]	[**s**il/**z**il]	[**tʃ**ok]/[**dʒ**ok]
peat/**b**eat	**t**ote/**d**ote	**k**ale/**g**ale
[**p**it]/[**b**it]	[**t**ot]/[**d**ot]	[**k**el]/[**g**el]

In our discussion of [p], we did not distinguish the initial sound in the word *pit* from the second sound in the word *spit*. There is, however, a phonetic differ-

ence in these two voiceless stops. During the production of voiceless sounds, the glottis is open and the air flows freely between the vocal cords. When a voiceless sound is followed by a voiced sound such as a vowel, the vocal cords must close so they can vibrate.

Voiceless sounds fall into two classes depending on the timing of the vocal cord closure. When we say *pit*, the vocal cords remain open for a very short time after the lips come apart to release the *p*. We call this *p* **aspirated** because a brief puff of air escapes before the glottis closes.

When we pronounce the *p* in *spit*, however, the vocal cords start vibrating as soon as the lips open. That *p* is **unaspirated**. Hold your palm about two inches in front of your lips and say *pit*. You will feel a puff of air, which you will not feel when you say *spit*. The *t* in *tick* and the *k* in *kin* are also aspirated voiceless stops, while the *t* in *stick* and the *k* in *skin* are unaspirated.

Finally, in the production of the voiced [b] (and [d] and [g]), the vocal cords are vibrating throughout the closure of the lips, and continue to vibrate during the vowel sound that follows after the lips part.

We indicate aspirated sounds by writing the phonetic symbol with a raised *h*, as in the following examples:

pool	[p^{h}ul]	spool	[spul]
tale	[t^{h}el]	stale	[stel]
kale	[k^{h}el]	scale	[skel]

Figure 6.2 shows in diagrammatic form the timing of lip closure in relation to the state of the vocal cords.

Nasal and Oral Sounds

The voiced/voiceless distinction differentiates the bilabials [b] and [p]. The sound [m] is also a bilabial, and it is voiced. What distinguishes it from [b]?

Figure 6.1 shows the roof of the mouth divided into the (hard) palate and the soft palate (or velum). The palate is a hard bony structure at the front of the mouth. You can feel it with your thumb. First, wash your hands. Now, slide your thumb along the hard palate back toward the throat; you will feel the velum, which is where the flesh becomes soft and pliable. The velum terminates in the uvula, which you can see in a mirror if you open your mouth wide and say "aaah." The velum is movable, and when it is raised all the way to touch the back of the throat, the passage through the nose is cut off and air can escape only through the mouth.

Sounds produced with the velum up, blocking the air from escaping through the nose, are **oral sounds**, because the air can escape only through the oral cavity. Most sounds in all languages are oral sounds. When the velum is not in its raised position, air escapes through both the nose and the mouth. Sounds produced this way are **nasal sounds**. The sound [m] is a nasal consonant. Thus [m] is distinguished from [b] because it is a nasal sound, whereas [b] is an oral sound.

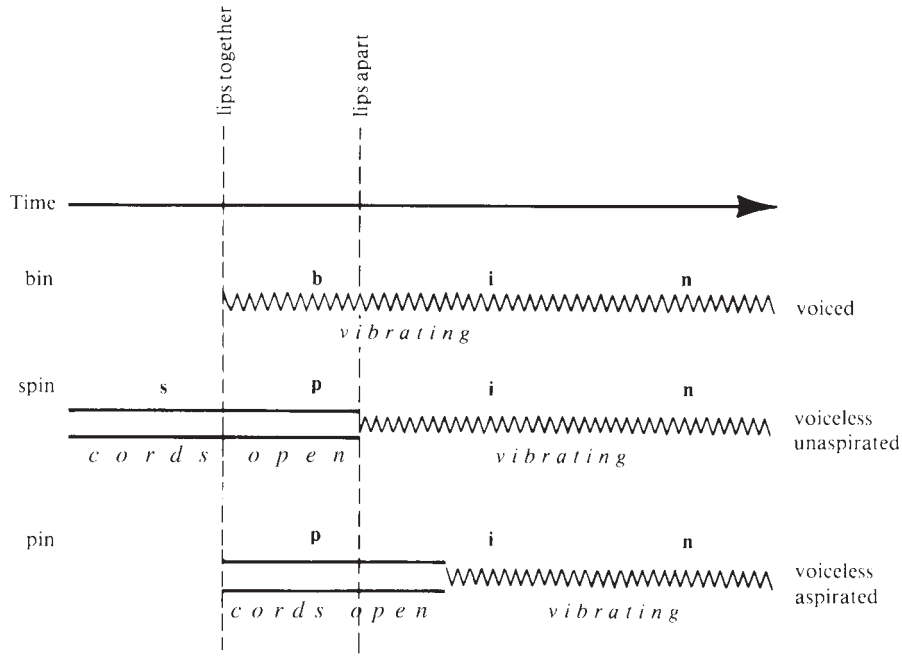


FIGURE 6.2 | Timing of lip closure and vocal-cord vibrations for voiced, voiceless unaspirated, and voiceless aspirated bilabial stops [b], [p], [p^h].

The diagrams in Figure 6.3 show the position of the lips and the velum when [m], [b], and [p] are articulated. The sounds [p], [b], and [m] are produced by stopping the airflow at the lips; [m] and [b] differ from [p] by being voiced; [m] differs from [b] by being nasal. (If you ever wondered why people sound

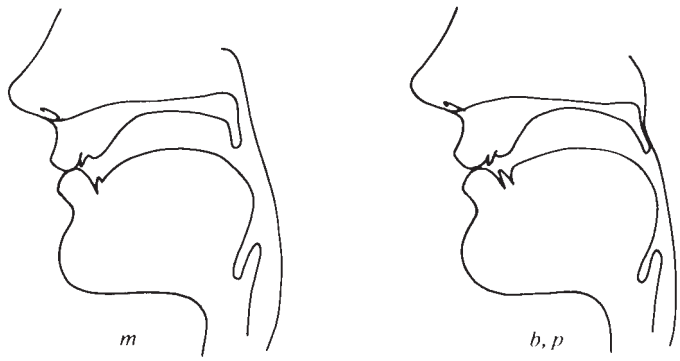


FIGURE 6.3 | Position of lips and velum for *m* (lips together, velum down) and *b*, *p* (lips together, velum up).

TABLE 6.3 | Four Classes of Speech Sounds

	Oral	Nasal
Voiced	b d g	m n ŋ
Voiceless	p t k	*

*Nasal consonants in English are usually voiced. Both voiced and voiceless nasal sounds occur in other languages.

"nasally" when they have a cold, it's because excessive mucous production prevents the velum from closing properly during speech.)

The same oral/nasal difference occurs in *raid* [re**d**] and *rain* [re**n**], *rug* [rʌ**g**] and *rung* [rʌ**ŋ**]. The velum is raised in the production of [d] and [g], preventing the air from flowing through the nose, whereas for [n] and [ŋ] the velum is down, allowing the air out through both the nose and the mouth when the closure is released. The sounds [m], [n], and [ŋ] are therefore nasal sounds, and [b], [d], and [g] are oral sounds.

The presence or absence of these **phonetic features**—nasal and voiced—permit the division of all speech sounds into four classes: voiced, voiceless, nasal, and oral, as shown in Table 6.3.

We now have three ways of classifying consonants: by voicing, by place of articulation, and by nasalization. For example, [p] is a voiceless, bilabial, oral sound; [n] is a voiced, alveolar, nasal sound, and so on.

Stops [p] [b] [m] [t] [d] [n] [k] [g] [ŋ] [tʃ] [dʒ] [ʔ] We are seeing finer and finer distinctions of speech sounds. However, both [t] and [s] are voiceless, alveolar, oral sounds. What distinguishes them? After all, *tack* and *sack* are different words.

Stops are consonants in which the airstream is completely blocked in the *oral* cavity for a short period (tens of milliseconds). All other sounds are **continuants**. The sound [t] is a stop, but the sound [s] is not, and that is what makes them different speech sounds.

- [p], [b], and [m] are *bilabial stops*, with the airstream stopped at the mouth by the complete closure of the lips.
- [t], [d], and [n] are *alveolar stops*; the airstream is stopped by the tongue, making a complete closure at the alveolar ridge.
- [k], [g], and [ŋ] are *velar stops*, with the complete closure at the velum.
- [tʃ] and [dʒ] are *palatal affricates* with complete stop closures. They will be further classified later.
- [ʔ] is a *glottal stop*; the air is completely stopped at the glottis.

We have been discussing the sounds that occur in English. A variety of stop consonants occur in other languages but not in English. For example, in Quechua, spoken in Bolivia and Peru, uvular stops occur, where the back of the tongue is raised and moved rearward to form a complete closure with the uvula. The phonetic symbol [q] denotes the voiceless version of this stop, which is the

initial sound in the name of the language "Quechua." The voiced uvular stop [ɢ] also occurs in Quechua.

Fricatives [f] [v] [θ] [ð] [s] [z] [ʃ] [ʒ] [x] [ɣ] [h] In the production of some continuants, the airflow is so severely obstructed that it causes friction, and the sounds are therefore called **fricatives**. The first of the following pairs of fricatives are voiceless; the second voiced.

- [f] and [v] are *labiodental fricatives*; the friction is created at the lips and teeth, where a narrow passage permits the air to escape.
- [θ] and [ð] are *interdental fricatives*, represented by *th* in *thin* and *then*. The friction occurs at the opening between the tongue and teeth.
- [s] and [z] are *alveolar fricatives*, with the friction created at the alveolar ridge.
- [ʃ] and [ʒ] are *palatal fricatives*, and contrast in such pairs as *mission* [mɪʃən] and *measure* [mɛʒər]. They are produced with friction created as the air passes between the tongue and the part of the palate behind the alveolar ridge. In English, the voiced palatal fricative never begins words except for foreign words such as *genre*. The voiceless palatal fricative begins the words *shoe* [ʃu] and *sure* [ʃur] and ends the words *rush* [rʌʃ] and *push* [pʊʃ].
- [x] and [ɣ] denote *velar fricatives*. They are produced by raising the back of the tongue toward, but not quite touching, the velum. The friction is created as air passes through that narrow passage, and the sound is not unlike clearing your throat. These sounds do not commonly occur in English, though in some forms of Scottish English the final sound of *loch* meaning "lake" is [x]. In rapid speech the *g* in *wagon* may be pronounced [ɣ]. The final sound of the composer J. S. Bach's name is also pronounced [x], which is a common sound in German.
- [h] is a glottal fricative. Its relatively weak sound comes from air passing through the open glottis and pharynx.

All fricatives are continuants. Although the airstream is obstructed as it passes through the oral cavity, it is not completely stopped.

Affricates [tʃ] [dʒ] These sounds are produced by a stop closure followed immediately by a gradual release of the closure that produces an effect characteristic of a fricative. The palatal sounds that begin and end the words *church* and *judge* are voiceless and voiced affricates, respectively. Affricates are not continuants because of the initial stop closure.

Liquids [l] [r] In the production of the sounds [l] and [r], there is some obstruction of the airstream in the mouth, but not enough to cause any real constriction or friction. These sounds are **liquids**. They are articulated differently, as described in the earlier alveolar section, but are grouped as a class because they are acoustically similar. Due to that similarity, foreign speakers of English may confuse the two sounds and substitute one for the other. It also accounts for Dennis's confusion in the cartoon.

"Dennis the Menace" © Hank Ketcham. Reprinted with permission of North America Syndicate.

Glides [j] [w] The sounds [j] and [w], the initial sounds of *you* [ju] and *we* [wi], are produced with little obstruction of the airstream. They are always followed directly by a vowel and do not occur at the end of words (don't be fooled by spelling; words ending in *y* or *w* like *say* and *saw* end in a vowel sound). After articulating [j] or [w], the tongue glides quickly into place for pronouncing the next vowel, hence the term **glide**.

The glide [j] is a palatal sound; the blade of the tongue (the front part minus the tip) is raised toward the hard palate in a position almost identical to that in producing the vowel sound [i] in the word *beat* [bit]. The glide [w] is produced by both rounding the lips and simultaneously raising the back of the tongue toward the velum. It is thus a **labio-velar** glide. Where speakers of English have different pronunciations for the words *which* and *witch*, the labio-velar glide in the first word is voiceless, symbolized as [ʍ] (an upside-down *w*). The position of the tongue and the lips for [w] is similar to that for producing the vowel sound [u] in *suit* [sut].

Approximants In some books the sounds [w], [j], [r], and [l] are alternatively called approximants because the articulators approximate a frictional closeness, but no actual friction occurs. The first three are central approximants, whereas [l] is a lateral approximant.

Although in this chapter we focus on the sounds of English, the IPA has symbols and classifications for all the sounds of the world's languages. For example, many languages have sounds that are referred to as trills, and others have clicks. These are described in the following sections.

Trills and flaps The "*r*"-sound of many languages may be different from the English [r]. A trilled "*r*" is produced by rapid vibrations of an articulator. An alveolar **trill**, as in the Spanish word for dog, *perro*, is produced by vibrating the tongue tip against the alveolar ridge. Its IPA symbol is [r], strictly speaking, though we have co-opted [r] for the English "r." Many French speakers articulate the initial sound of *rouge* as a uvular trill, produced by vibrating the uvula. Its IPA symbol is [ʀ].

Another "*r*"-sound is called a **flap** and is produced by a flick of the tongue against the alveolar ridge. It sounds like a very fast *d*. It occurs in Spanish in words like *pero* meaning "but." It may also occur in British English in words such as *very*. Its IPA symbol is [ɾ]. Most American speakers produce a flap instead of a [t] or [d] in words like *writer* and *rider*, which then sound identical and are spelled phonetically as [raɪɾər].

Clicks These "exotic" sounds are made by moving air in the mouth between various articulators. The sound of disapproval often spelled *tsk* is an alveolar **click** that occurs in several languages of southern Africa such as Zulu. A lateral click, which is like the sound one makes to encourage a horse, occurs in Xhosa. In fact, the 'X' in Xhosa stands for that particular speech sound.

Phonetic Symbols for American English Consonants

We are now capable of distinguishing all of the consonant sounds of English via the properties of voicing, nasality, and place and manner of articulation. For example, [f] is a voiceless, (oral), labiodental fricative; [n] is a (voiced), nasal, alveolar stop. The parenthesized features are usually not mentioned because they are redundant; all sounds are oral unless nasal is specifically mentioned, and all nasals are voiced in English.

Table 6.4 lists the consonants by their phonetic features. The rows stand for manner of articulation and the columns for place of articulation. The entries are sufficient to distinguish all words in English from one another. For example, using [p] for both aspirated and unaspirated voiceless bilabial stops, and [b] for the voiced bilabial stop, suffices to differentiate the words *pit*, *spit*, and *bit*. If a narrower phonetic transcription of these words is desired, the symbol [p^h] can be used to indicate aspiration giving us [p^hɪt], [spɪt], [bɪt]. By "narrow transcription" we mean one that indicates all the phonetic details of a sound, even those that do not affect the word.

Examples of words in which these sounds occur are given in Table 6.5.

TABLE 6.4 | Some Phonetic Symbols for American English Consonants

	Bilabial	Labiodental	Interdental	Alveolar	Palatal	Velar	Glottal
Stop (oral)							
voiceless	p			t		k	ʔ
voiced	b			d		g	
Nasal (voiced)	m			n		ŋ	
Fricative							
voiceless		f	θ	s	ʃ		h
voiced		v	ð	z	ʒ		
Affricate							
voiceless					tʃ		
voiced					dʒ		
Glide							
voiceless	ʍ					ʍ	
voiced	w				j	w	
Liquid (voiced)							
(central)				r			
(lateral)				l			

TABLE 6.5 | Examples of Consonants in English Words

	Bilabial	Labiodental	Interdental	Alveolar	Palatal	Velar	Glottal
Stop (oral)							
voiceless	***p***ie			***t***ie		***k***ite	(ʔ)uh-(ʔ)oh
voiced	***b***uy			***d***ie		***g***uy	
Nasal (voiced)	***m***y			***n***ight		si***ng***	
Fricative							
voiceless		***f***ine	***th***igh	***s***ue	***sh***oe		***h***igh
voiced		***v***ine	***th***y	***z***oo	mea***s***ure		
Affricate							
voiceless					***ch***eese		
voiced					***j***ump		
Glide							
voiceless	***wh***ich					***wh***ich	
voiced	***w***ipe				***y***ou	***w***ipe	
Liquid (voiced)							
(central)				***r***ye			
(lateral)				***l***ye			

Vowels

HIGGINS: Tired of listening to sounds?
PICKERING: Yes. It's a fearful strain. I rather fancied myself because I can pronounce twenty-four distinct vowel sounds, but your hundred and thirty beat me. I can't hear a bit of difference between most of them.
HIGGINS: Oh, that comes with practice. You hear no difference at first, but you keep on listening and presently you find they're all as different as A from B.

GEORGE BERNARD SHAW, *Pygmalion,* 1912

Vowels are produced with little restriction of the airflow from the lungs out the mouth and/or the nose. The quality of a vowel depends on the shape of the vocal tract as the air passes through. Different parts of the tongue may be high or low in the mouth; the lips may be spread or pursed; the velum may be raised or lowered.

Vowel sounds carry pitch and loudness; you can sing vowels or shout vowels. They may be longer or shorter in duration. Vowels can stand alone—they can be produced without consonants before or after them. You can say the vowels of *beat* [bit], *bit* [bɪt], or *boot* [but], for example, without the initial [b] or the final [t], but you cannot say a [b] or a [t] alone without at least a little bit of vowel sound.

Linguists can describe vowels acoustically or electronically. We will discuss that topic in chapter 9. In this chapter we describe vowels by their articulatory features as we did with consonants. Just as we say a [d] is pronounced by raising the tongue tip to the alveolar ridge, we say an [i] is pronounced by raising the body of the tongue toward the palate. With a [b], the lips come together; for an [æ] (the vowel in *cat*) the tongue is low in the mouth with the tongue tip forward, behind the front teeth.

If you watch a side view of an X-ray (that's *-ray*, not *-rated*!) video of someone's tongue moving during speech, you will see various parts of the tongue rise up high and fall down low; at the same time you will see it move forward and backward in the mouth. These are the dimensions over which vowels are produced. We classify vowels according to three questions:

1. How high or low in the mouth is the tongue?
2. How forward or backward in the mouth is the tongue?
3. Are the lips rounded (pursed) or spread?

Tongue Position

The upper two diagrams in Figure 6.4 show that the tongue is high in the mouth in the production of the vowels [i] and [u] in the words *he* [hi] and *who* [hu]. In *he* the front part (but not the tip) of the tongue is raised; in *who* it is the back of the tongue. (Prolong the vowels of these words and try to feel the raised part of your tongue.) These are both *high* vowels, and the [i] is a *high front* vowel while the [u] is a *high back* vowel.

To produce the vowel sound [a] of *hah* [ha], the back of the tongue is low in the mouth, as the lower diagram in Figure 6.4 shows. (The reason a doctor

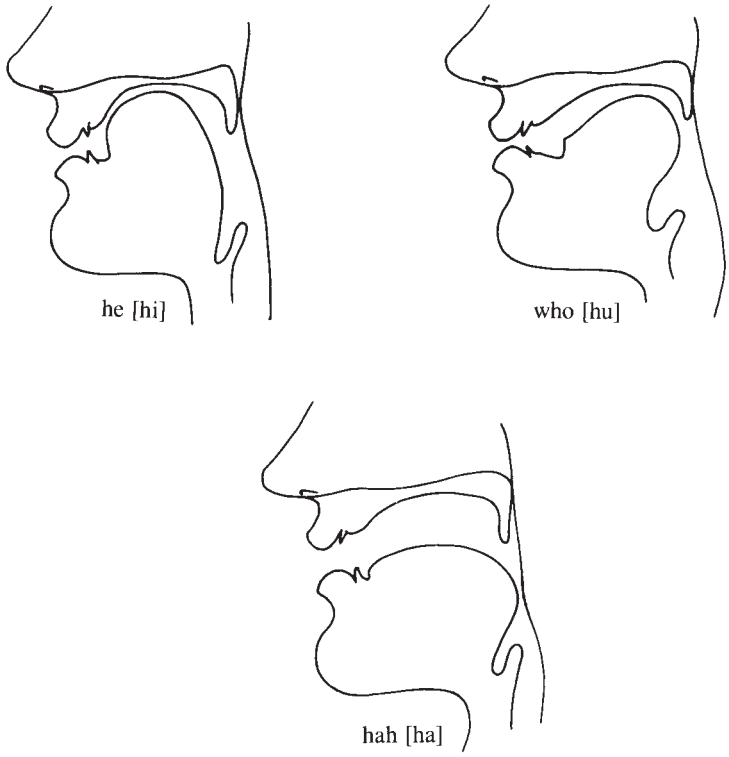


FIGURE 6.4 | Position of the tongue in producing the vowels in he, who, and hah.

examining your throat may ask you to say "ah" is that the tongue is low and easy to see over.) This vowel is therefore a *low back* vowel.

The vowels [ɪ] and [ʊ] in the words *hit* [hɪt] and *put* [p^{h}ʊt] are similar to those in *heat* [hit] and *hoot* [hut] with slightly lowered tongue positions.

The vowel [æ] in *hack* [hæk] is produced with the front part of the tongue low in the mouth, similar to the low vowel [a], but with the front rather than the back part of the tongue lowered. Say "hack, hah, hack, hah, hack, hah . . ." and you should feel your tongue moving forward and back in the low part of your mouth. Thus [æ] is a *low front* vowel.

The vowels [e] and [o] in *bait* [bet] and *boat* [bot] are *mid vowels*, produced by raising the tongue to a position midway between the high and low vowels just discussed. [ɛ] and [ɔ] in the words *bet* [bɛt] and *bore* [bɔr] are also mid vowels, produced with a slightly lower tongue position than [e] and [o], respectively. Here, [e] and [ɛ] are *front*; [o] and [ɔ] are *back*.

To produce the vowel [ʌ] in the word *butt* [bʌt], the tongue is not strictly high nor low, front nor back. It is a lower midcentral vowel. The schwa vowel [ə], which occurs as the first sound in *about* [əbaʊt], or the final sound of *sofa* [sofə], is also articulated with the tongue in a more or less neutral position between the extremes of high/low, front/back. The schwa is used mostly to represent unstressed vowels. (We will discuss stress later.)

Lip Rounding

Vowels also differ as to whether the lips are rounded or spread. The back vowels [u], [ʊ], [o], and [ɔ] in *boot*, *put*, *boat*, and *bore* are the only **rounded vowels** in English. They are produced with pursed or rounded lips. You can get a feel for the rounding by prolonging the word *who*, as if you were an owl: *whoooooooooo*. Now pose for the camera and say *cheese*, only say it with a prolonged vowel: *cheeeeeeeeeese*. The high front [i] in *cheese* is unrounded, with the lips in the shape of a smile, and you can feel it or see it in a mirror. The low vowel [a] in the words *bar*, *bah*, and *aha* is the only (American) English back vowel that occurs without lip rounding.

Other languages may differ in whether or not they have rounded vowels. French and Swedish, for example, have *front* rounded vowels, which English lacks. English also lacks a high back *unrounded* vowel, but this sound occurs in Mandarin Chinese, Japanese, and the Cameroonian language Fe?Fe?, among others. The IPA symbol for this vowel is [ɯ], and to show that roundedness is important, we note that in Mandarin Chinese the unrounded [sɯ] means "four," but the round [su] (like *sue*) means "speed."

Figure 6.5 shows the vowels based on tongue "geography." The position of the vowel relative to the horizontal axis is a measure of the vowel's front/back dimension. Its position relative to the vertical axis is a measure of tongue height. For example, we see that [i] is a high front vowel, [o] is a midback (rounded) vowel, and [ʌ] is a lower midcentral vowel, tending toward backness.

Diphthongs

A **diphthong** is a sequence of two vowel sounds. Diphthongs are present in the phonetic inventory of many languages, including English. The vowels we have studied so far are simple vowels, called **monophthongs**. The vowel sound in the word *bite* [baɪt], however, is the [a] vowel sound of *father* followed rapidly by the

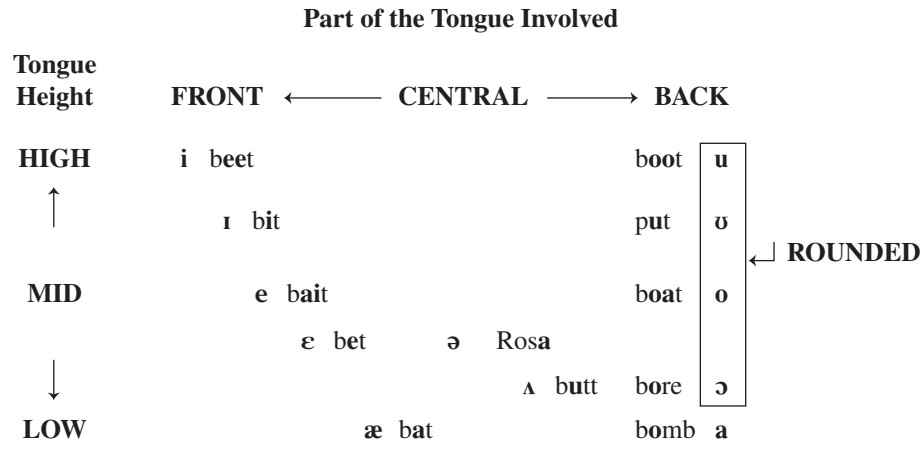


FIGURE 6.5 | Classification of American English vowels.

[ɪ] sound of *fit*, resulting in the diphthong [aɪ]. Similarly, the vowel in *bout* [baʊt] is [a] followed by the [ʊ] sound of *put*, resulting in [aʊ]. Another diphthong that occurs in English is the vowel sound in *boy* [bɔɪ], which is the vowel [ɔ] of *bore* followed by [ɪ], resulting in [ɔɪ]. The pronunciation of any of these diphthongs may vary from our description because of the diversity of English speakers.

To some extent the midvowels [e] and [o] may be diphthongized, especially in American English, though not in other varieties such as Irish English. Many linguists therefore denote these sounds as [eɪ] and [oʊ] as a narrower transcription. In this book we will stay with [e] and [o] for these vowel sounds.

Nasalization of Vowels

Vowels, like consonants, can be produced with a raised velum that prevents the air from escaping through the nose, or with a lowered velum that permits air to pass through the nasal passage. When the nasal passage is blocked, *oral* vowels result; when the nasal passage is open, *nasal* (or *nasalized*) vowels result. In English, nasal vowels occur for the most part before nasal consonants in the same syllable, and oral vowels occur in all other places.

The words *bean*, *bone*, *bingo*, *boom*, *bam*, and *bang* are examples of words that contain nasalized vowels. To show the nasalization of a vowel in a narrow phonetic transcription, an extra mark called a **diacritic**—the symbol ~ (tilde) in this case—is placed over the vowel, as in *bean* [bĩn] and *bone* [bõn].

In languages like French, Polish, and Portuguese, nasalized vowels occur without nasal consonants. The French word meaning "sound" is *son* [sõ]. The *n* in the spelling is not pronounced but indicates that the vowel is nasal.

Tense and Lax Vowels

Figure 6.5 shows that the vowel [i] has a slightly higher tongue position than [ɪ]. This is also true for [e] and [ɛ], [u] and [ʊ], and [o] and [ɔ]. The first vowel in each pair is generally produced with greater tension of the tongue muscles than its counterpart, and they are often a little longer in duration. These vowels can be distinguished by the features **tense** and **lax**, as shown in the first four rows of the following:

Tense		Lax	
i	beat	ɪ	bit
e	bait	ɛ	bet
u	boot	ʊ	put
o	boat	ɔ	bore
a	hah	ɔɪ	boy
aɪ	high	æ	hat
aʊ	how	ʌ	hut
		ə	about

Additionally, [a] is a tense vowel as are the diphthongs [aɪ] and [aʊ], but the diphthong [ɔɪ] is lax as are [æ], [ʌ], and of course [ə]. Tense vowels may occur at the ends of words: [si], [se], [su], [so], [pa], [saɪ], and [haʊ] represent the English words *see*, *say*, *sue*, *sew*, *pa*, *sigh*, and *how*. Lax vowels mostly do not occur

at the ends of words; [sɪ], [sɛ], [sʊ], [sæ], [sʌ], and [sə] are not possible words in English. (The one exception to this generalization is lax [ɔ] and its diphthong [ɔɪ], which occur in words such as [sɔ] (*saw*) and [sɔɪ] (*soy*).)

Different (Tongue) Strokes for Different Folks

The vowels in Figure 6.5 do not represent all the vowels of all English speakers. They may not represent your particular vowel set. If you speak British English, there's a good chance that you have a low, back, rounded vowel in the word *hot* that the vowel chart lacks. Canadian English speakers pronounce the vowel in words like *bite* as [ʌɪ] rather than [aɪ]. Consonants, too, vary from region to region, if not from person to person. One person's "alveolar" stops may technically be dental stops, with the tongue hard behind the upper front teeth. In Britain, the substitution of the glottal stop where an American might use a [t] or [d] is common. It's very much the case throughout the English-speaking world that, as the old song goes, "I say '*tomayto*' [təmeto], you say '*tomahto*' [təmato]," and we lovers of language say "vive la différence."

Major Phonetic Classes

Biologists divide life forms into larger and smaller classes. They may distinguish between animals and plants; or within animals, between vertebrates and invertebrates; and within vertebrates, between mammals and reptiles, and so on.

Linguists describe speech sounds similarly. All sounds are consonant sounds or vowel sounds. Within consonants, all are voiced or unvoiced, and so on. All the classes of sounds described so far in this chapter combine to form larger, more general classes that are important in the patterning of sounds in the world's languages.

Noncontinuants and Continuants

Stops and affricates belong to the class of **noncontinuants**. There is a total obstruction of the airstream in the *oral cavity*. Nasal stops are included although air does flow continuously out the nose. All other consonants, and all vowels, are continuants, in which the stream of air flows continuously out of the mouth.

Obstruents and Sonorants

The non-nasal stops, the fricatives, and the affricates form a major class of sounds called **obstruents**. The airstream may be fully obstructed, as in non-nasal stops and affricates, or nearly fully obstructed, as in the production of fricatives.

Sounds that are not obstruents are **sonorants**. Vowels, nasal stops [m,n,ŋ], liquids [l,r], and glides [j,w] are all sonorants. They are produced with much less obstruction to the flow of air than the obstruents, which permits the air to resonate. Nasal stops are sonorants because, although the air is blocked in the mouth, it continues to resonate in the nasal cavity.

Consonantal

Obstruents, nasal stops, liquids, and glides are all consonants. There is some degree of restriction to the airflow in articulating these sounds. With glides ([j,w]), however, the restriction is minimal, and they are the most vowel-like, and the least consonant-like, of the consonants. Glides are even referred to as "semivowels" or "semi-consonants" in some books. In recognition of this fact linguists place the obstruents, nasal stops, and liquids in a subclass of consonants called **consonantal**, from which the glides are excluded.

Here are some other terms used to form subclasses of consonantal sounds. These are not exhaustive, nor are they mutually exclusive (e.g., the interdentals belong to two subclasses). A full course in phonetics would note further classes that we omit.

Labials [p] [b] [m] [f] [v] [w] [ʍ] Labial sounds are those articulated with the involvement of the lips. They include the class of *bilabial* sounds [p] [b] and [m], the *labiodentals* [f] and [v], and the *labiovelars* [w] and [ʍ].

Coronals [θ] [ð] [t] [d] [n] [s] [z] [ʃ] [ʒ] [tʃ] [dʒ] [l] [r] Coronal sounds are articulated by raising the tongue blade. Coronals include the *interdentals* [θ] [ð], the *alveolars* [t] [d] [n] [s] [z], the *palatals* [ʃ] [ʒ], the *affricates* [tʃ] [dʒ], and the *liquids* [l] [r].

Anteriors [p] [b] [m] [f] [v] [θ] [ð] [t] [d] [n] [s] [z] Anterior sounds are consonants produced in the front part of the mouth, that is, from the alveolar area forward. They include the labials, the interdentals, and the alveolars.

Sibilants [s] [z] [ʃ] [ʒ] [tʃ] [dʒ] Another class of consonantal sounds is characterized by an acoustic rather than an articulatory property of its members. The friction created by sibilants produces a hissing sound, which is a mixture of high-frequency sounds.

Syllabic Sounds

Sounds that may function as the core of a syllable possess the feature **syllabic**. Clearly vowels are syllabic, but they are not the only sound class that anchors syllables.

Liquids and nasals can also be syllabic, as shown by the words *dazzle* [dæzl̩], *faker* [fekr̩], *rhythm* [rɪðm̩], and *button* [bʌtn̩]. (The diacritic mark under the [l̩], [r̩], [m̩], and [n̩] is the notation for syllabic.) Placing a schwa [ə] before the syllabic liquid or nasal also shows that these are separate syllables. The four words could be written as [dæzəl], [fekər], [rɪðəm], and [bʌtən]. We will use this transcription. Similarly, the vowel sound in words like *bird* and *verb* are sometimes written as a syllabic *r*, [bṛd] and [vṛb]. For consistency we shall transcribe these words using the schwa—[bərd] and [vərb]—the only instances where a schwa represents a stressed vowel.

Obstruents and glides are never syllabic sounds because they are always accompanied by a vowel, and that vowel functions as the syllabic core.

Prosodic Features

Length, *pitch*, and *stress* (or "accent") are **prosodic**, or **suprasegmental**, features. They are features *over and above* the segmental values such as place or manner of articulation, thus the "supra" in *suprasegmental*. The term *prosodic* comes from poetry, where it refers to the metrical structure of verse. One of the essential characteristics of poetry is the placement of stress on particular syllables, which defines the versification of the poem.

Speech sounds that are identical in their place or manner features may differ in length (duration). Tense vowels are slightly longer than lax vowels, but only by a few milliseconds. However, in some languages when a vowel is prolonged to around twice its normal length, it can make a difference between words. In Japanese the word *biru* [biru] with a regular *i* means "building," but with the *i* doubled in length as in *biiru*, spelled phonetically as [bi:ru], the meaning is "beer." (The colon-like : is the IPA symbol for segment length or doubling.) In Japanese vowel length can make the difference between two words.

Japanese, and many other languages such as Finnish and Italian, have long consonants that may contrast words. When a consonant is long, or doubled, either the closure or obstruction is prolonged. Pronounced with a short *k*, the word *saki* [saki] means "ahead" in Japanese; pronounced with a long *k*—prolonging the velar closure—the word *sakki* [sak:i] means "before." In effect, the extended silence of the prolonged closure is meaningful in these languages.

English is not a language in which vowel or consonant length can change a word. You might say "puleeeeeze" to emphasize your request, but the word is still *please*. You may also say in English "Whatttttt a dump!" to express your dismay at a hotel room, prolonging the *t*-closure, but the word *what* is not changed.

When we speak, we also change the **pitch** of our voice. The pitch depends on how fast the vocal cords vibrate; the faster they vibrate, the higher the pitch. If the larynx is small, as in women and children, the shorter vocal cords vibrate faster and the pitch is higher, all other things being equal. That is why women and children have higher-pitched voices than men, in general. When we discuss tone languages in the next section, we will see that pitch may affect the meaning of a word.

In many languages, certain syllables in a word are louder, slightly higher in pitch, and somewhat longer in duration than other syllables in the word. They are **stressed** syllables. For example, the first syllable of *digest*, the noun meaning "summation of articles," is stressed, whereas in *digest*, the verb meaning "to absorb food," the second syllable receives greater stress. Stress can be marked in several ways: for example, by putting an accent mark over the stressed vowel in the syllable, as in *dígest* versus *digést*.

English is a "stress-timed" language. In general, at least one syllable is stressed in an English word. French is not a stress-timed language. The syllables have approximately the same loudness, length, and pitch. It is a "syllable-timed" language. When native English speakers attempt to speak French, they often stress syllables, so that native French speakers hear French with "an English

accent." When French speakers speak English, they fail to put stress where a native English speaker would, and that contributes to what English speakers call a "French accent."

Tone and Intonation

We have already seen how length and stress can make sounds with the same segmental properties different. In some languages, these differences make different words, such as the two *digests*. Pitch, too, can make a difference in certain languages.

Speakers of all languages vary the pitch of their voices when they talk. The effect of pitch on a syllable differs from language to language. In English, it doesn't matter whether you say *cat* with a high pitch or a low pitch. It will still mean "cat." But if you say [ba] with a high pitch in Nupe (a language spoken in Nigeria), it will mean "to be sour," whereas if you say [ba] with a low pitch, it will mean "to count." Languages that use the pitch of individual vowels or syllables to contrast meanings of words are called **tone languages**.

More than half the world's languages are tone languages. There are more than one thousand tone languages spoken in Africa alone. Many languages of Asia, such as Mandarin Chinese, Burmese, and Thai, are tone languages. In Thai, for example, the same string of segmental sounds represented by [na:] will mean different things if one says the sounds with a low pitch, a midpitch, a high pitch, a falling pitch from high to low, or a rising pitch from low to high. Thai therefore has five linguistic tones, as illustrated as follows:

(Diacritics are used to represent distinctive tones in the phonetic transcriptions.)

[ˋ]	L	low tone	[nà:]	"a nickname"
[ˉ]	M	mid tone	[nā:]	"rice paddy"
[ˊ]	H	high tone	[ná:]	"young maternal uncle or aunt"
[ˆ]	HL	falling tone	[nâ:]	"face"
[ˇ]	LH	rising tone	[nă:]	"thick"

There are two kinds of tones. If the pitch is level across the syllable, we have a **register tone**. If the pitch changes across the syllable, whether from high to low or vice versa, we have a **contour tone**. Thai has three level and two contour tones. Commonly, tone languages will have two or three register tones and possibly one or two contour tones.

In a tone language it is not the absolute pitch of the syllables that is important but the relations among the pitches of different syllables. Thus men, women, and children with differently pitched voices can still communicate in a tone language.

Tones generally have a *lexical* function, that is, they make a difference between words. But in some languages tones may also have a *grammatical* function, as in Edo spoken in midwestern Nigeria. The tone on monosyllabic verbs followed by a direct object indicates the tense and transitivity of the verb. Low

tone means present tense, transitive; high tone means past tense, transitive, as illustrated here:

òtà gbɛ̏	èbé
Ota write+PRES+TRANS	book
Ota writes a book.	
òtà gbɛ̋	èbé
Ota write+PAST+TRANS	book
Ota wrote a book.	

In many tone languages we find a continual lowering of the absolute pitch on the tones throughout an utterance. The *relative* pitches remain the same, however. In the following sentence in Twi, spoken in Ghana, the relative pitch rather than the absolute pitch is important.

"Kofi searches for a little food for his friend's child."

```
Kòfí   hwèhwɛ́   áduàŋ   kàkrá  mà   ǹ'  ádàmfò    bá
 | |    |   |    |  |    |  |   |    |  | |  |     |
 L H    L   H    H  L    L  H   L    L  H L  L     H
```

The actual pitches of these syllables would be rather different from each other, as shown in the following musical staff-like figure (the higher the number, the higher the pitch):

7		fí											
6				hwɛ́	á								
5	Kò							krá					
4			hwè								á		
3						duàŋ	kà						bá
2									mà	ǹ'			
1												dàmfò	

The lowering of the pitch is called **downdrift**. In languages with downdrift, a high tone that occurs after a low tone, or a low tone after a high tone, is lower in pitch than the preceding similarly marked tone. Notice that the first high tone in the sentence is given the pitch value 7. The next high tone (which occurs after an intervening low tone) is 6; that is, it is lower in pitch than the first high tone.

This example shows that in analyzing tones, just as in analyzing segments, all the physical properties need not be considered. Only essential features are important in language—in this case, whether the tone is high or low *in relation to the other pitches*. The absolute pitch is inessential. Speakers of tone languages are able to ignore the linguistically irrelevant absolute pitch differences between individual speakers and attend to the linguistically relevant relative pitch differences, much like speakers of non-tone languages ignore pitch altogether.

Languages that are not tone languages, such as English, are called **intonation** languages. The **pitch contour** of the utterance varies, but in an intonation language as opposed to a tone language, pitch is not used to distinguish words

from each other. Intonation may affect the meaning of whole sentences, so that *John is here* spoken with falling pitch at the end is interpreted as a statement, but with rising pitch at the end, a question. We'll have more to say about intonation in the next chapter.

Phonetic Symbols and Spelling Correspondences

"Why do I have to keep writin' in these K's when they don't make any noise anyway?"

"Family Circus" © Bil Keane, Inc. Reprinted with permission of King Features Syndicate.

Table 6.6 shows the sound/spelling correspondences for American English consonants and vowels. (We have not given all possible spellings for every sound; however, these examples should help you relate English orthography to the English sound system.) We have included the symbols for the voiceless aspirated stops to illustrate that what speakers usually consider one sound—for example *p*—may occur phonetically as two sounds, [p], [p^h].

Some of these pronunciations may differ from your own. For example, you may (or may not) pronounce the words *cot* and *caught* identically. In the form of English described here, *cot* and *caught* are pronounced differently, so *cot* is one

of the examples of the vowel sound [a] as in *car*. *Caught* illustrates the vowel [ɔ] as in *core*.

There will be other differences, too, because English is a worldwide language and is spoken in many forms in many countries. The English examples used in this book are a compromise among several varieties of American English, but this should not deter you. Our purpose is to teach phonetics in general, and to show you how phonetics might describe the speech sounds of any of the world's languages with the proper symbols and diacritics. We merely use American English for illustration, and we provide the major phonetic symbols for American English to show you how such symbols may be used to describe the phonetics of any of the world's languages.

TABLE 6.6 | Phonetic Symbol/English Spelling Correspondences

Consonants	
Symbol	**Examples**
p	s**p**it ti**p** La**pp**
p^h	**p**it **p**rick **p**laque a**pp**ear
b	**b**it ta**b** **b**rat **b**u**bb**le
m	**m**itt ta**m** s**m**ack E**mm**y ca**m**p co**mb**
t	s**t**ick pi**t** kiss**ed** wri**t**e
t^h	**t**ick in**t**end **pt**erodactyl a**tt**ack
d	**D**ick ca**d** **d**rip love**d** ri**d**e
n	**n**ick ki**n** s**n**ow **mn**emonic **Gn**ostic **pn**eumatic **kn**ow
k	s**k**in sti**ck** s**c**at criti**que** el**k**
k^h	**c**url **k**in **ch**arisma **c**ritic me**ch**anic **c**lose
g	**g**irl bur**g** lon**g**er Pittsbur**gh**
ŋ	si**ng** thi**n**k fi**n**ger
f	**f**at **ph**ilosop**h**y **f**lat **ph**logiston co**ff**ee ree**f** cou**gh**
v	**v**at do**ve** gra**v**el
s	**s**ip **s**kip **ps**ychology pa**ss** pat**s** democra**c**y **sc**issors fa**s**ten de**c**eive de**sc**ent
z	**z**ip ja**zz** ra**z**or pad**s** kisse**s** **X**erox de**s**ign la**z**y sci**ss**ors mai**ze**
θ	**th**igh **th**rough wra**th** e**th**er Ma**tth**ew
ð	**th**y **th**eir wea**th**er la**the** ei**th**er
ʃ	**sh**oe mu**sh** mi**ss**ion na**ti**on fi**sh** gla**ci**al **s**ure
ʒ	mea**s**ure vi**s**ion a**z**ure ca**s**ual deci**s**ion rou**g**e
tʃ	ma**tch** ri**ch** right**e**ous
$tʃ^h$	**ch**oke **Tch**aikovsky dis**ch**arge
dʒ	**j**u**dg**e mi**dg**et **G**eor**g**e ma**g**istrate resi**d**ual
l	**l**eaf fee**l** ca**ll** sing**l**e
r	**r**eef fea**r** Pa**r**is singe**r**
j	**y**ou **y**es f**eu**d **u**se
w	**w**itch s**w**im q**u**een
ʍ	**wh**ich **wh**ere **wh**ale (for speakers who pronounce *which* differently than *witch*)
h	**h**at **wh**o **wh**ole re**h**ash
ʔ	bo**tt**le bu**tt**on glo**tt**al (for some speakers), (**ʔ**)uh-(**ʔ**)oh
ɾ	wri**t**er, ri**d**er, la**tt**er, la**dd**er

TABLE 6.6 | (Continued)

	Vowels
i	b**ee**t b**ea**t b**e** rec**ei**ve k**e**y bel**ie**ve am**oe**ba p**eo**ple C**ae**sar Vasel**i**ne ser**e**ne
ɪ	b**i**t cons**i**st **i**njury b**i**n w**o**men
e	g**a**te b**ai**t r**ay** gr**ea**t **ei**ght g**au**ge gr**ey**hound
ɛ	b**e**t ser**e**nity s**ay**s g**ue**st d**ea**d s**ai**d
æ	p**a**n **a**ct l**au**gh comr**a**de
u	b**oo**t l**u**te wh**o** s**ew**er thr**ough** t**o** t**oo** t**wo** m**o**ve L**ou** tr**ue** s**ui**t
ʊ	p**u**t f**oo**t b**u**tcher c**ou**ld
ʌ	c**u**t t**ou**gh am**o**ng **o**ven d**oe**s c**o**ver fl**oo**d
o	c**oa**t g**o** b**eau** gr**ow** th**ough** t**oe** **ow**n s**ew**
ɔ	c**augh**t st**a**lk c**o**re s**aw** b**a**ll **aw**e **au**to
a	c**o**t f**a**ther p**a**lm s**e**rgeant **ho**nor h**o**spital mel**o**dic
ə	sof**a** **a**lone symph**o**ny s**u**ppose mel**o**dy b**i**rd v**e**rb th**e**
aɪ	b**i**te s**igh**t b**y** b**uy** d**ie** d**ye** **ai**sle ch**oi**r l**i**ar **is**land h**ei**ght s**ig**n
aʊ	ab**ou**t br**ow**n d**ou**bt c**ow**ard s**au**erkraut
ɔɪ	b**oy** **oi**l

The "Phonetics" of Signed Languages

Earlier we noted that signed languages, like all other human languages, are governed by a grammatical system that includes syntactic and morphological rules. Signed languages are like spoken languages in another respect; signs can be broken down into smaller units analogous to the phonetic features discussed in this chapter. Just as spoken languages distinguish sounds according to place and manner of articulation, so signed languages distinguish signs according to the place and manner in which the signs are articulated by the hands. The signs of ASL, for example, are formed by three major features:

1. *The **configuration** of the hand (handshape)*
2. *The **movement** of the hand and arms toward or away from the body*
3. *The **location** of the hands in signing space*

To illustrate how these features define a sign, the ASL sign meaning "arm" is a flat hand, moving to touch the upper arm. It has three features: *flat hand*, *motion upward*, *upper arm*.

ASL has over 30 handshapes. But not all signed languages share the same handshapes, just as not all spoken languages share the same places of articulation (French lacks interdental stops; English lacks the uvular trill of French). For example, the T handshape of ASL does not occur in the European signed languages. Similarly, Chinese Sign Language has a handshape formed with an open hand with all fingers extended except the ring finger. ASL does not have this handshape.

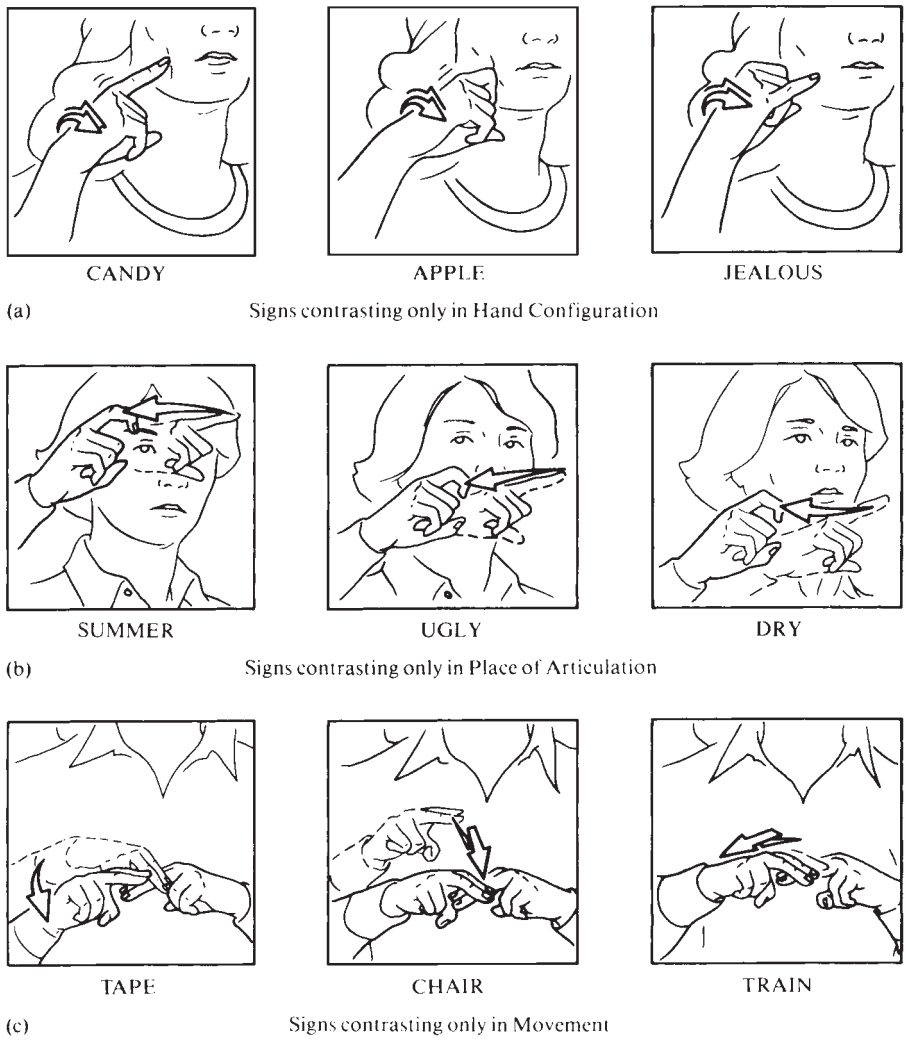


FIGURE 6.6 | Minimal contrasts illustrating major formational parameters.

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Movement can be either straight or in an arc. Secondary movements include wiggling or hooking fingers. Signs can also be unidirectional (moving in one direction) or bidirectional (moving in one direction and then back again). The location of signs is defined relative to the body or face and by whether the sign involves vertical movement, horizontal movement, or movement to or away from the body.

As in spoken language, a change along one of these parameters can result in different words. Just as a difference in voicing or tone can result in different words in a spoken language, a change in location, handshape, or movement can

result in different signs with different meanings. For example, the sign meaning "father" differs from the sign meaning "fine" only in the place of articulation. Both signs are formed with a spread five-finger handshape, but the thumb touches the signer's forehead in "father" and it touches his chest in "fine."

Figure 6.6 illustrates several sets of words that differ from each other along one or another of the phonetic parameters of ASL.

There are two-handed and one-handed signs. One-handed signs are formed with the speaker's dominant hand, whether left or right. Just as spoken languages have features that do not distinguish different words (e.g., consonant length in English), in ASL (and probably all signed languages), a difference in handedness does not affect the meaning of the sign.

The parallels that exist in the organization of sounds and signs are not surprising when we consider that similar cognitive systems underlie both spoken and signed languages.

Summary

The science of speech sounds is called **phonetics**. It aims to provide the set of properties necessary to describe and distinguish all the sounds in human languages throughout the world.

When we speak, the physical sounds we produce are continuous stretches of sound, which are the physical representations of strings of discrete linguistic **segments**. Knowledge of a language permits one to separate continuous speech into individual sounds and words.

The discrepancy between spelling and sounds in English and other languages motivated the development of phonetic alphabets in which one letter corresponds to one sound. The major **phonetic alphabet** in use is the **International Phonetic Alphabet (IPA)**, which includes modified Roman letters and **diacritics**, by means of which the sounds of all human languages can be represented. To distinguish between **orthography** (spelling) and **phonetic transcriptions**, we write the latter between square brackets, as in [fə̃nɛrɪk] for *phonetic*.

All English speech sounds come from the movement of lung air through the vocal tract. The air moves through the **glottis** (i.e., between the vocal cords), up the pharynx, through the oral (and possibly the nasal) cavity, and out the mouth or nose.

Human speech sounds fall into classes according to their phonetic properties. All speech sounds are either **consonants** or **vowels**, and all consonants are either **obstruents** or **sonorants**. Consonants have some obstruction of the airstream in the vocal tract, and the location of the obstruction defines their **place of articulation**, some of which are **bilabial**, **labiodental**, **alveolar**, **palatal**, **velar**, **uvular**, and **glottal**.

Consonants are further classified according to their **manner of articulation**. They may be **voiced** or **voiceless**, **oral** or **nasal**, long or short. They may be **stops**, **fricatives**, **affricates**, **liquids**, or **glides**. During the production of voiced sounds, the vocal cords are together and vibrating, whereas in voiceless sounds they are apart and not vibrating. Voiceless sounds may also be **aspirated** or **unaspirated**. In the production of aspirated sounds, the vocal cords remain apart for a brief time after the stop closure is released, resulting in a puff of air at the time of the

release. Consonants may be grouped according to certain features to form larger classes such as **labials**, **coronals**, **anteriors**, and **sibilants**.

Vowels form the nucleus of syllables. They differ according to the position of the tongue and lips: high, mid, or low tongue; front, central, or back of the tongue; rounded or unrounded lips. The vowels in English may be **tense** or **lax**. Tense vowels are slightly longer in duration than lax vowels. Vowels may also be **stressed** (longer, higher in pitch, and louder) or **unstressed**. Vowels, like consonants, may be nasal or oral, although most vowels in all languages are oral.

Length, pitch, loudness, and stress are **prosodic**, or **suprasegmental**, features. They are imposed over and above the segmental values of the sounds in a syllable. In many languages, the pitch of the vowel in the syllable is linguistically significant. For example, two words with identical segments may contrast in meaning if one has a high pitch and another a low pitch. Such languages are **tone languages**. There are also **intonation** languages in which the rise and fall of pitch may contrast meanings of sentences. In English the statement *Mary is a teacher* will end with a fall in pitch, but in the question *Mary is a teacher?* the pitch will rise.

English and other languages use stress to distinguish different words, such as *cóntent* and *contént*. In some languages, long vowels and long consonants contrast with their shorter counterparts. Thus *biru* [biru] and *biiru* [biːru], *saki* [saki] and *sakki* [sakːi] are different words in Japanese.

Diacritics to specify such properties as nasalization, length, stress, and tone may be combined with the phonetic symbols for more detailed phonetic transcriptions. A phonetic transcription of *men* would use a tilde diacritic to indicate the nasalization of the vowel: [mɛ̃n].

In sign languages there are "phonetic" features analogous to those of spoken languages. In ASL these are handshape, movement, and location. As in spoken languages, changes along one of these parameters can result in a new word. In the following chapter, we discuss this meaning-changing property of features in much greater detail.

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Exercises

1. Write the phonetic symbol for the first sound in each of the following words according to the way you pronounce it.

Examples: ooze [u] psycho [s]

a. judge	[ ]	**f.** thought	[ ]
b. Thomas	[ ]	**g.** contact	[ ]
c. though	[ ]	**h.** phone	[ ]
d. easy	[ ]	**i.** civic	[ ]
e. pneumonia	[ ]	**j.** usual	[ ]

2. Write the phonetic symbol for the *last* sound in each of the following words.

Example: boy [ɔɪ] (Diphthongs should be treated as one sound.)

a. fleece	[ ]	**f.** cow	[ ]
b. neigh	[ ]	**g.** rough	[ ]
c. long	[ ]	**h.** cheese	[ ]
d. health	[ ]	**i.** bleached	[ ]
e. watch	[ ]	**j.** rags	[ ]

3. Write the following words in phonetic transcription, according to your pronunciation.

Examples: *knot* [nat]; *delightful* [dilaɪtfəl] or [dəlaɪtfəl]. Some of you may pronounce some of these words the same.

a. physics	**h.** Fromkin	**o.** touch
b. merry	**i.** tease	**p.** cough
c. marry	**j.** weather	**q.** larynx
d. Mary	**k.** coat	**r.** through
e. yellow	**l.** Rodman	**s.** beautiful
f. sticky	**m.** heath	**t.** honest
g. transcription	**n.** "your name"	**u.** president

4. Following is a phonetic transcription of a verse in the poem "The Walrus and the Carpenter" by Lewis Carroll. The speaker who transcribed it may not have exactly the same pronunciation as you; there are many correct versions. However, there is *one major error* in each line that is an impossible pronunciation for any American English speaker. The error may consist of an extra symbol, a missing symbol, or a wrong symbol in the word. Note that the phonetic transcription that is given is a **narrow** transcription; aspiration is marked, as is the nasalization of vowels. This is to illustrate a detailed transcription. However, none of the errors involve aspiration or nasalization of vowels.

Write the word in which the error occurs in the correct phonetic transcription.

	Corrected Word
a. ðə tʰãɪm hæz cʌ̃m	[kʰʌ̃m]
b. ðə wɔlrəs sed	

c. tʰu tʰɔlk əv mɛ̃ni θĩŋz
d. əv ʃuz ãnd ʃɪps
e. æ̃nd silĩŋ wæx
f. əv kʰæbəgəz æ̃nd kʰĩŋz
g. æ̃nd waɪ ðə si ɪs bɔɪlĩŋ hat
h. æ̃nd wɛθər pʰɪgz hæv wĩŋz

5. The following are all English words written in a broad phonetic transcription (thus omitting details such as nasalization and aspiration). Write the words using normal English orthography.

a. [hit]
b. [strok]
c. [fez]
d. [ton]
e. [boni]
f. [skrim]
g. [frut]
h. [pritʃər]
i. [krak]
j. [baks]
k. [θæŋks]
l. [wɛnzde]
m. [krɔld]
n. [kantʃiɛntʃəs]
o. [parləmɛntæriən]
p. [kwəbɛk]
q. [pitsə]
r. [bərak obamə]
s. [dʒɔn məken]
t. [tu θaʊzənd ænd et]

6. Write the symbol that corresponds to each of the following phonetic descriptions, then give an English word that contains this sound.

Example: voiced alveolar stop	[d] *dough*
a. voiceless bilabial unaspirated stop	[ ]
b. low front vowel	[ ]
c. lateral liquid	[ ]
d. velar nasal	[ ]
e. voiced interdental fricative	[ ]
f. voiceless affricate	[ ]
g. palatal glide	[ ]
h. mid lax front vowel	[ ]
i. high back tense vowel	[ ]
j. voiceless aspirated alveolar stop	[ ]

7. In each of the following pairs of words, the bold italicized sounds differ by one or more phonetic properties (features). Give the IPA symbol for each italicized sound, state their differences and, in addition, state what properties they have in common.

Example: ph**o**ne—ph**o**nic
The *o* in *phone* is mid, tense, round.
The *o* in *phonic* is low, unround.
Both are back vowels.

a. ba***th***—ba***th***e
b. redu***c***e—redu***c***tion
c. c***oo***l—c***o***ld
d. wi***f***e—wi***v***es
e. cat***s***—dog***s***
f. i***m***polite—i***n***decent

8. Write a phonetic transcription of the italicized words in the following poem entitled "Brush Up Your English" published long ago in a British newspaper.

I take it you already ***know***
Of ***tough*** and ***bough*** and ***cough*** and ***dough***?
Some may stumble, but not ***you***,
On ***hiccough***, ***thorough***, ***slough*** and ***through***?
So now you are ready, perhaps,
To learn of less familiar traps?
Beware of ***heard***, a dreadful ***word***
That looks like ***beard*** and sounds like ***bird***.
And ***dead***, it's ***said*** like ***bed***, not ***bead***;
For goodness' sake, don't call it ***deed***!
Watch out for ***meat*** and ***great*** and ***threat***.
(They rhyme with ***suite*** and ***straight*** and ***debt***.)
A ***moth*** is not a moth in ***mother***,
Nor ***both*** in ***bother***, ***broth*** in ***brother***.[1]

9. For each group of sounds listed, state the phonetic feature(s) they all share.

Example: [p] [b] [m] Features: bilabial, stop, consonant

a. [g] [p] [t] [d] [k] [b]
b. [u] [ʊ] [o] [ɔ]
c. [i] [ɪ] [e] [ɛ] [æ]
d. [t] [s] [ʃ] [p] [k] [tʃ] [f] [h]
e. [v] [z] [ʒ] [dʒ] [n] [g] [d] [b] [l] [r] [w] [j]
f. [t] [d] [s] [ʃ] [n] [tʃ] [dʒ]

10. Write the following broad phonetic transcriptions in regular English spelling.

a. nom tʃamski ɪz e lɪngwɪst hu titʃəz æt ɛm aɪ ti
b. fənɛtɪks ɪz ðə stʌdi əv spitʃ saʊndz
c. ɔl spokən læŋgwɪdʒəz juz saʊndz prədust baɪ ðə ʌpər rɛspərətəri sɪstəm
d. ɪn wʌn daɪəlɛkt əv ɪnglɪʃ kat ðə naʊn ænd kɔt ðə vərb ar prənaʊnst ðə sem
e. sʌm pipəl θɪŋk fənɛtɪks ɪz vɛri ɪntərɛstɪŋ
f. vɪktərijə framkən rabərt radmən ænd ninə haɪəmz ar ðə ɔθərz əv ðɪs bʊk

[1]T. S. Watt, "Brush Up Your English," Guardian, June 21, 1954. Reprinted by permission.

11. What phonetic property or feature distinguishes the sets of sounds in column A from those in column B?

	A	B
a.	[i] [ɪ]	[u] [ʊ]
b.	[p] [t] [k] [s] [f]	[b] [d] [g] [z] [v]
c.	[p] [b] [m]	[t] [d] [n] [k] [g] [ŋ]
d.	[i] [ɪ] [u] [ʊ]	[e] [ɛ] [o] [ɔ] [æ] [a]
e.	[f] [v] [s] [z] [ʃ] [ʒ]	[tʃ] [dʒ]
f.	[i] [ɪ] [e] [ə] [ɛ] [æ]	[u] [ʊ] [o] [ɔ] [a]

12. Which of the following sound pairs have the same manner of articulation, and what is that manner of articulation?

a. [h] [ʔ]
b. [r] [w]
c. [m] [ŋ]
d. [ð] [v]
e. [r] [t]
f. [f] [ʃ]
g. [k] [θ]
h. [s] [g]
i. [j] [w]
j. [j] [dʒ]

13. A. Which of the following vowels are lax and which are tense?

a. [i] **b.** [ɪ] **c.** [u] **d.** [ʌ] **e.** [ʊ] **f.** [e]
g. [ɛ] **h.** [o] **i.** [ɔ] **j.** [æ] **k.** [a] **l.** [ə]
m. [aɪ] **n.** [aʊ] **o.** [ɔɪ]

B. Think of ordinary, nonexclamatory English words with one syllable that end in [ʃ] preceded directly by each of the vowels in A. Are any such words impossible in English?

Example: *fish* [fɪʃ] is such a word. Words ending in [-aɪʃ] are not possible in English.

C. In terms of tense/lax, which vowel type is found in most such words?

14. Write a made-up sentence in narrow phonetic transcription that contains at least six different monophthongal vowels and two different diphthongs.

15. The front vowels of English, [i, ɪ, e, ɛ, æ], are all unrounded. However, many languages have rounded front vowels, such as French. Here are three words in French with rounded front vowels. Transcribe them phonetically by finding out the correct IPA symbols for front rounded vowels: (*Hint*: Try one of the books given in the references, or Google around.)

a. *tu*, "you," has a high front rounded vowel and is transcribed phonetically as [ ]
b. *bleu*, "blue," has a midfront rounded vowel and is transcribed phonetically as [ ]
c. *heure*, "hour," has a low midfront rounded vowel and is transcribed phonetically as [ ]

16. Challenge exercise:

A. Take all of the vowels from 13A except the schwa and find a monosyllabic word containing that vowel followed directly by [t], giving both the spelling and the phonetic transcription.

Example: *beat* [bit], *foot* [fʊt]

B. Now do the same thing for monosyllabic words ending in [r]. Indicate when such a word appears not to occur in your dialect of English.

C. And do the same thing for monosyllabic words ending in [ŋ]. Indicate when such a word appears not to occur in your dialect of English.

D. Is there a quantitative difference in the number of examples found as you go from A to C?

E. Are most vowels that "work" in B tense or lax? How about in C?

F. Write a brief summary of the difficulties you encountered in trying to do this exercise.

17. In the first column are the last names of well-known authors. In the second column is one of their best-known works. Match the work to the author and write the author's name and work in conventional spelling.

Example: **a.** [dɪkə̃nz] **1.** [ɔləvər t^{h}wɪst]
Answer: a—1 (Dickens, Oliver Twist)

b. [sɛrvãntɛs] **2.** [ə fɛrwɛl t^{h}u armz]
c. [dãnte] **3.** [æ̃nə̃məl farm]
d. [dɪkə̃nz] **4.** [dõn kihote]
e. [ɛliət] **5.** [greps ʌv ræθ]
f. [hɛ̃mĩŋwe] **6.** [gret ɛkspɛkt^{h}eʃə̃nz]
g. [hõmər] **7.** [gʌləvərz t^{h}rævəlz]
h. [mɛlvɪl] **8.** [hæ̃mlət]
i. [orwɛl] **9.** [mobi-dɪk]
j. [ʃekspir] **10.** [saɪləs marnər]
k. [staĩnbɛk] **11.** [ðə dɪvaĩn k^{h}ãmədi]
l. [swɪft] **12.** [ðə ɪliəd]
m. [t^{h}ɔlstɔɪ] **13.** [t^{h}ãm sɔɪjər]
n. [t^{h}wẽn] **14.** [wor æ̃nd p^{h}is]