

File 3.1

The Sounds of Speech

Although languages can in principle use modes of communication other than sound (for instance, visual signals) to convey meaning, it is nevertheless true that most human languages are spoken. This may not be an accident: some theorists have claimed that using the vocal apparatus for language freed human hands to engage in other activities and thus had survival value in the evolution of the species. **Phonetics** is the study of speech sounds, which are known more technically as **phones**.

A whole chain of activities is involved in communicating meaning by sound. First of all, a speaker encodes meaning into sounds, which he or she produces using the tongue, lips, and other articulatory organs. These sounds are transmitted through the air to reach the hearer. Then the hearer perceives them through auditory processes, finally translating them back into meaning. There are therefore three aspects to the study of speech sounds: **articulatory phonetics**, the study of the production of speech sounds; **acoustic phonetics**, the study of the transmission and the physical properties of speech sounds (such as intensity, frequency, and duration); and **auditory phonetics**, the study of the perception of speech sounds.

The study of articulatory phonetics has had the longest history among the three subbranches of phonetics; it was already fairly developed by the nineteenth century. In the popular musical *My Fair Lady*, based on Bernard Shaw's play *Pygmalion*, the eccentric professor Higgins was actually modeled after the phonetician Henry Sweet. Acoustic phonetics, however, has mostly developed only in the past few decades. Acoustic phonetics has had to rely heavily on the use of sophisticated instruments that perform analyses of sound vibration. A particularly important instrument, the **spectrograph**, was invented only in the 1940s. Among the three branches of phonetics, auditory phonetics is the least understood, owing to gaps that remain in our understanding of human neurology and perception.

Articulatory phonetics involves the study of how phones are produced by speakers and the description and classification of those sounds according to their properties. Each of these aspects of articulatory phonetics will be considered in the files that follow, and the basic concepts of acoustic phonetics will be introduced. We will also be learning and using a system of phonetic symbols that linguists have developed for representing speech sounds. In a phonetic transcription one sound is represented by one symbol, and each symbol represents a single sound. Compare this system with English orthography (i.e., spelling), which is full of inconsistencies—for example:

- sometimes the same sound is spelled using different letters, as in *sea*, *see*, *scene*, *receive*, *thief*, *amogba*, *machine*, and *Aesop*.
- sometimes the same letters can stand for different sounds, as in *sign*, *pleasure*, and *resign*, or *charter* and *character*, or *father*, *all*, *about*, *apple*, *any*, and *age*.
- sometimes a single sound is spelled by a combination of letters, as in *lock*, *that*, *book*, *boast*, *shop*, *apple*, or *special*.
- sometimes a single letter represents more than one sound, as in *exit* or *use*.
- sometimes letters stand for no sound at all, as in *know*, *doubt*, *though*, *island*, *thubarb*, or *moose*.

Phonetic transcription, however, is consistent and unambiguous because there is always a one-to-one correspondence between sounds and symbols. This is even true across languages, so that the symbols you will be learning can be used to transcribe the sounds of any language. Phonetic symbols are written within square brackets, [], to distinguish them from letters or words written in ordinary orthography. It is important to remember that these symbols are not the same as letters, and that they represent the sounds of language, not letters of a writing system.

Phonetic Symbols for the Consonants of English

Symbol	Sample Words	
[p]	pit, tip, spit, hiccough, appear	
[b]	ball, globe, amble, brick, bubble	
[t]	tag, pat, stick, pterodactyl, stuffed	
[d]	dip, card, drop, loved, batted	
[k]	kit, scot, character, critique, exceed	
[g]	guard, bag, longer, designate, Pittsburgh	
[ʔ]	uh-oh, hatrack, Batman	(glottal stop)
[f]	foot, laugh, philosophy, coffee, carafe	
[v]	vest, dove, gravel, anvil, average	
[θ]	through, wrath, thistle, ether, teeth	(theta)
[ð]	the, their, mother, either, teethe	(eth [eð])
[s]	soap, psychology, packs, descent, peace	
[z]	zip, roads, kisses, Xerox, design	
[ʃ]	shy, mission, nation, glacial, sure	(s-wedge, s-haček)
[ʒ]	measure, vision, azure, casualty, decision	(z-wedge, z-haček)
[h]	who, hat, rehash, hole, whole	
[ç]	choke, match, feature, righteous, constituent	(c-wedge, c-haček)
[j]	judge, George, Jell-O, region, residual	(j-wedge, j-haček)
[m]	moose, lamb, smack, amnesty, ample	
[n]	nap, design, snow, know, mnemonic	
[ŋ]	sing, think, finger, singer, ankle	(engna)
[l]	leaf, feel, Lloyd, mild, applaud	
[r]	reef, fear, Harris, prune, carp	
[ɹ]	writer, butter, udder, clutter, cutter	(flap)
[w]	with, swim, mowing, queen, twilight	
[y]	you, beautiful, feud, use, yell	
[ɰ]	which, where, what, whale, why (for those dialects in which <i>witch</i> and <i>which</i> do not sound the same)	(voiceless 'w')

Syllabic Consonants

[m]	possum, chasm, Adam, bottomless	(syllabic 'm')
[n]	button, chicken, lesson, kittenish	(syllabic 'n')
[l]	little, single, simple, stabilize	(syllabic 'l')
[r]	ladder, singer, burp, percent	(syllabic 'r')

Phonetic Symbols for the Vowels of English

Symbols	Examples	
[i]	beat, we, believe, people, money	('ee' as in <i>feel</i>)
[ɪ]	bit, consist, injury, malignant, business	(capital-'i')
[e]	bait, reign, great, they, gauge	('ay' as in <i>gray</i>)
[ɛ]	bet, reception, says, guest, bury	(epsilon, 'eh')
[æ]	bat, laugh, anger, comrade, rally	(ash, 'a' as in <i>apple</i>)
[u]	boot, who, sewer, duty, through	('u' as in <i>boot</i>)
[ʊ]	put, foot, butcher, could, boogie-woogie	(capital-'u')
[o]	boat, beau, grow, though, over	('o' as in <i>over</i>)
[ɔ]	bought, caught, wrong, stalk, core	(open 'o', 'au' as in <i>caught</i>)
[ɑ]	pot, father, sergeant, honor, hospital	('a' as in <i>Say ah!</i>)
[ʌ]	but, tough, another, oven	(wedge, stressed schwa)
[ə]	among, sofa	(schwa)

Diphthongs

Symbols	Examples
[ay]	bite, Stein, aisle, choir, island
[aw]	bout, brown, doubt, flower, loud
[oy]	boy, doily, rejoice, perestroika, annoy

See Appendix C, pp. 469–70, for a more comprehensive listing of phonetic symbols used in this book, including symbols used for languages other than English and a comparison of some International Phonetic Alphabet (IPA) conventions with the American tradition.

File 3.2

Articulation and
Description of
English
Consonants

English speech sounds are formed by converting the stream of air that is forced out of the lungs through the oral or nasal cavities, or both, into soundwaves; sounds created in this way are said to be made by using a **pulmonic egressive airstream mechanism**. Other airstream mechanisms are possible but will not be discussed here.

Consonants, unlike vowels, are speech sounds produced with a narrowing somewhere in the **vocal tract**, which is usually sufficient to prevent them from functioning as **syllable nuclei** (the nucleus is the "heart" of the syllable, carrying stress, loudness, and pitch information; it usually consists of a vowel). When describing a consonant it is necessary to provide information about three different aspects of the articulation of the consonant:

1. Is the sound voiced or voiceless?
2. Where is the airstream constricted?
3. How is the airstream constricted?

Each of these will be discussed in turn. In the description of speech sounds, three *features* need to be specified: 1. Is the sound voiced or voiceless? 2. Where is its place of articulation? 3. What is the manner of articulation? Please note that in this file and elsewhere, whenever we say things like "[p] is a stop" or "the [p] in *pan*," what we *really* mean is the wordier "the sound represented by the symbol [p]." Remember that we are talking about sounds and sometimes about the phonetic symbols representing them, but not about letters.

Components of Human Speech Production

There are three basic components of human physiology important for the production of speech. (See Figure 1.) Only two of them will be discussed in detail. One is the **larynx**, which contains the **vocal folds** and the **glottis**; another is the **vocal tract** above the larynx, which is composed of the oral and nasal cavities. The third is the subglottal system, which is the part of the respiratory system located below the larynx. When air is inhaled, it is channeled through the nasal or oral cavity, or both, through the larynx into the lungs. Moving the stream of air out of the lungs and through the larynx and the vocal tract produces English speech sounds. The air passing through the larynx and glottis is the source of sound waves. These sound waves take on their characteristic shape as they are channeled through various possible vocal tract configurations in the oral or nasal cavities.

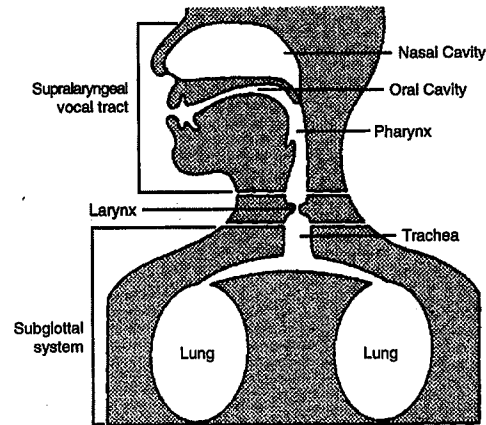


Figure 1. The three components of speech production. From Lieberman and Blumstein, *Speech Physiology* (1990), p. 4. Copyright 1990 Cambridge University Press. All Rights Reserved. Reprinted with permission.

States of the Glottis

Humans have a larynx (sometimes called a voicebox) at the top of the trachea (or windpipe). Within the larynx are folds of muscle called vocal folds (these are popularly known as vocal cords, but they are not really cords). In Figure 2 the front of the throat is uppermost; compare this to the cross-section in Figure 1. A flap of tissue called the epiglottis attaches at the front of the larynx, and can fold down and back to cover and protect the vocal folds, which are stretched horizontally along the open center of the larynx. The opening between these folds is called the glottis. Both of the vocal folds are attached to cartilage at the front of the larynx but are separated at the back; by bringing the two free ends together, the vocal folds can be closed or approximated, allowing air to escape. When the folds are wide open the glottis has roughly the shape of a triangle, as can be seen in Figure 2.

The vocal folds can be relaxed so that the flow of air coming up from the lungs passes through freely. The folds may also be held close together so that they vibrate as air passes through. Try putting a hand lightly on your throat or putting your fingers in your ears, and then making a drawn out [s]. Your vocal folds are separated, so you should feel no vibration. But now make a [z] (again, draw it out), and you will feel a vibration or buzzing feeling. This is due to the vibration of the vocal folds. Sounds made with the vocal folds vibrating are called **voiced** sounds, and sounds made without such vibration are called **voiceless**. The italicized sounds in the following pairs of words differ only in that the sound is voiceless in the first word of each pair and voiced in the second. (It is important not to whisper when articulating these words, because whispering has the effect of eliminating vocal fold vibration.)

a. [f] <i>fat</i>	b. [θ] <i>thigh</i>	c. [s] <i>sip</i>	d. [ʒ] <i>delusion</i>
[v] <i>vat</i>	[ð] <i>thy</i>	[z] <i>zip</i>	[ʒ] <i>delusion</i>
e. [ʃ] <i>rich</i>	f. [p] <i>pat</i>	g. [t] <i>tab</i>	h. [k] <i>kill</i>
[ʒ] <i>ridge</i>	[b] <i>bat</i>	[d] <i>dab</i>	[g] <i>gill</i>

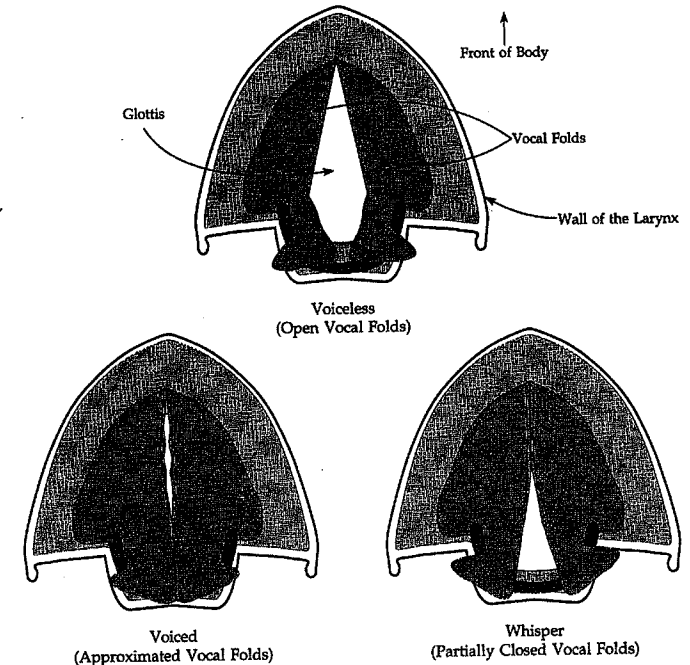


Figure 2. Superior view of the larynx.

The first thing it is necessary to state about a sound when providing an articulatory description, then, is whether it is voiced (the vocal folds are vibrating) or voiceless (there is no vocal fold vibration).

Place of Articulation

In describing a consonant sound, it is also necessary to state where in the vocal tract a **constriction** is made—that is, where the vocal tract is made more narrow. This is referred to as the sound's **place of articulation**. When reading about each of the following points of articulation, refer to Figure 3 below.

- **Bilabial**—bilabial sounds are made by bringing both lips closer together. There are five such sounds in English: [p] *pat*, [b] *bat*, [m] *mat*, [w] *with*, and [ɱ] *where* (present only in some dialects).
- **Labiodental**—labiodental consonants are made with the lower lip against the upper front teeth. English has two labiodentals: [f] *fat* and [v] *vat*.
- **Interdental**—interdentals are made with the tip of the tongue between the front teeth. There are two interdental sounds in English: [θ] *thigh* and [ð] *thy*.
- **Alveolar**—just behind your upper front teeth there is a small ridge called the alveolar ridge. English makes seven sounds with the tongue tip at or near this ridge: [t] *tab*, [d] *dab*, [s] *sip*, [z] *zip*, [n] *noose*, [l] *loose*, and [r] *red*.

- **Palatal**—if you let your finger glide back along the roof of your mouth you will note that the anterior portion is hard and the posterior portion is soft. Sounds made with the tongue near the hard part of the roof of the mouth are called palatal sounds. English makes five sounds in the region of the hard palate: [ʃ] *leash*, [ʒ] *measure*, [tʃ] *church*, [ʃ] *judge*, [j] *yes*. (More precisely, [ʃ, ʒ, tʃ], and [j] are **alveo-palatal** sounds, because they are made in the area between the alveolar ridge and the hard palate. We'll use the shorter term "palatal" to describe these sounds of English, however.)
- **Velar**—the soft part of the roof of the mouth behind the hard palate is called the **velum**. Sounds made with the tongue near the velum are said to be velar. There are three velar sounds in English: [k] *kill*, [g] *gill*, and [ŋ] *sing*.
- **Glottal**—the space between the vocal folds is the **glottis**. English has two sounds made at the glottis. One is easy to hear: [h], as in *high* and *history*. The other is called a **glottal stop** and is transcribed phonetically as [ʔ]. This sound occurs before each of the vowel sounds in *uh-oh*.

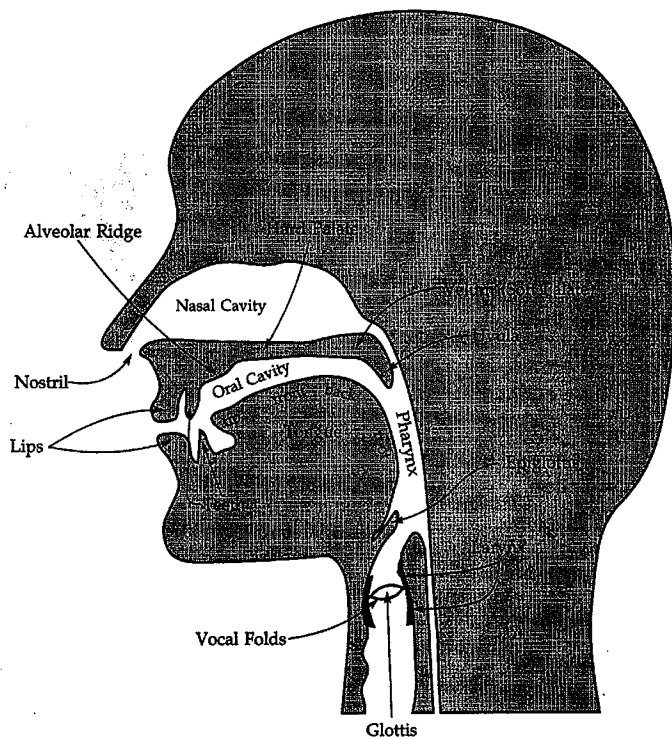


Figure 3. Sagittal section of the vocal tract.

Manner of Articulation

Besides stating whether a sound is voiced or voiceless and giving the sound's point of articulation, it is necessary to describe its **manner of articulation**, that is, how the airstream is modified by the vocal tract to produce the sound. The manner of articulation of a sound depends on the degree of closure of the articulators (how close together or far apart they are).

Stops—stops are made by obstructing the airstream completely in the oral cavity. Notice that when you say [p] and [b] your lips are closed together for a moment, stopping the airflow. [p] and [b] are **bilabial stops**. [b] is a **voiced bilabial stop**. [t], [d], [k], and [g] are also stops. What is the three-part description of each?

The glottal stop, [ʔ], is made by momentarily closing the vocal folds. The expression *uh-oh* has a [ʔ] before each vowel. If you stop halfway through *uh-oh* and hold your articulators in position for the second half, you should be able to feel yourself making the glottal stop. (It will feel like a catch in your throat.) Nasal consonants are also stops in terms of their oral articulation; see below.

Fricatives—fricatives are made by forming a nearly complete stoppage of the airstream. The opening through which the air escapes is so small that friction is produced (much as air escaping from a punctured tire makes a hissing noise). [ʃ] is made by almost stopping the air with the tongue near the palate. It is a **voiceless palatal fricative**. How would you describe each of the following: [f], [v], [θ], [ð], [s], [z], and [ʒ]?

Affricates—an affricate is made by briefly stopping the airstream completely and then releasing the articulators slightly so that friction is produced. (Affricates can be thought of as a combination of a stop and a fricative.) English has only two affricates, [tʃ] and [dʒ]. [tʃ] is a combination of [t] and [ʃ], and so is sometimes transcribed as [tʃ]. It is a **voiceless palatal affricate**. [dʒ] is a combination of [d] and [ʒ], and is sometimes transcribed as [dʒ]. How would you describe [tʃ]?

Nasals—notice that the velum can be raised or lowered. If it is **lowered**, as it is during normal breathing and during the production of nasal sounds, then the airstream can escape out through the nasal cavity as well as through the unobstructed oral cavity. When the velum is **raised** against the back of the throat (also called the **pharynx**), no air can escape through the nasal passages; sounds made with the velum raised are called **oral sounds**. The sounds [m], [n] and [ŋ] are produced with the velum lowered and a complete obstruction in the oral cavity. They are called **nasals** or nasal stops, since the oral cavity is completely obstructed, as it is during the production of oral stops. [m] is made with the velum lowered and a complete obstruction of the airstream at the lips. For [n], the velum is lowered and the tongue tip pressed against the alveolar ridge. [ŋ] is made with the velum lowered and the back of the tongue stopping the airstream in the velar region. In English, all nasals are voiced. Thus [m] is a **voiced bilabial nasal (stop)**; the only difference between [m] and [b] is that the velum is lowered for the articulation of [m], but raised for the articulation of [b]. How would you describe [n]? [ŋ]?

Liquids—when a liquid is produced, there is an obstruction formed by the articulators, but it is not narrow enough to stop the airflow or to cause friction. The [l] in *leaf* is produced by resting the tongue on the alveolar ridge with the airstream escaping around the sides of the tongue. Thus it is called a **lateral liquid**. Liquids are usually voiced in English: [l] is a **voiced alveolar lateral liquid**. There is a great deal of variation in the ways speakers of English make *r*-sounds; most are voiced and articulated in the alveolar region, and a common type also involves curling the tip of the tongue back behind the alveolar ridge to make a **retroflex** sound. For our purposes [r] as in *red* may be considered a **voiced alveolar retroflex liquid**.

Nasals and liquids are classified as consonants. However, they sometimes act like vowels in that they can function as syllable nuclei. Pronounce the following words out loud, and listen to the liquids and nasals in them: *prism*, *prison*, *table*, and *hiker*. In these words the nucleus of the second syllable consists only of a syllabic nasal or liquid; there is no vowel in these second syllables. In order to indicate the syllabic character of these nasals and liquids, a short vertical line is placed below the phonetic symbol. The final *n* of *prison* would be transcribed [n̩]; likewise [m̩], [l̩], and [r̩] in *prism*, *table*, and *hiker*.

Glides—glides are made with only a slight closure of the articulators. In fact, if the vocal tract were any more open, the result would be a vowel sound. [w] is made by raising the back of the tongue toward the velum while rounding the lips at the same time, so it is classified as a *voiced bilabial glide*. (Notice the similarity in the way you articulate the [w] and the vowel [u] in the word *woo*: the only change is that you open your lips a little more for [u].) [ɹ] is produced just like [w], except that it is voiceless; not all speakers of English use this sound. [j] is made with a slight closure in the palatal region. It is a *voiced palatal glide*. (Notice the similarity between [y] and the vowel [i] in the word *yes*.)

The chart in Figure 4 of the consonants of English can be used for easy reference. To find the description of a sound, first locate the sound on the chart. You can find out the state of glottis by checking whether the sound is in the shaded part of the box or not—this will tell you whether the sound is voiced or voiceless. Then check the label at the top of the vertical column that the sound is in to see what its place of articulation is. Finally, check the manner of articulation label at the far left of the sound's horizontal row. Locate [ð], for example. It lies in a shaded region indicating that the state of the glottis during the production of this sound produces voicing. Now look above [ð]. It is in the vertical column marked interdental. Looking to the far left you see it is a fricative. [ð], then, is a *voiced interdental fricative*.

You can also use the chart to find a sound with a particular description by essentially reversing the above procedure. If you wanted to find the *voiced palatal fricative*, first look in the fricative row, then under the palatal column, and locate the symbol in the row marked "voiced": this is [ʒ].

The chart can also be used to find classes of sounds. For instance, to find all the alveolars, just read off all the sounds under the alveolar column. Or, to find all the stops, read off all the sounds in the stop row.

You should familiarize yourself with the chart so that you can easily recognize the phonetic symbols. The list of phonetic symbols for consonants, which was presented in File 3.1, should also help you remember which symbol represents which consonant. Remember that we are talking about *sounds* and not letters.

		Place of Articulation						
		Bilabial	Labiodental	Interdental	Alveolar	Palatal	Velar	Glottal
Manner of Articulation	Stop	p			t		k	ʔ
	Fricative		f	θ	s	ʃ		h
	Affricate					tʃ		
	Nasal							
	Lateral Liquid							
	Retroflex Liquid							
	Glide	w						
	State of the Glottis:		<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 10px; background-color: white; border: 1px solid black; margin-right: 5px;"></div> Voiceless <div style="width: 20px; height: 10px; background-color: black; border: 1px solid black; margin-right: 5px;"></div> </div>					

Figure 4. The Consonants of English.

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2005)

CONSONANTS (PULMONIC)

© 2005 IPA

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k ɡ	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	ɴ		
Trill				ʀ					ʁ		
Tap or Flap				ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant				ɹ		ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	ʟ			

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

CONSONANTS (NON-PULMONIC)

Clicks	Voiced implosives	Ejectives
◌ ɸ Bilabial	ɓ Bilabial	ʼ Examples:
◌ ɗ Dental	ɗ Dental/alveolar	◌ ɓ' Bilabial
◌ ɗ̥ (Postalveolar)	ɟ Palatal	◌ ɗ' Dental/alveolar
◌ ɗ̥ ɟ̥ Palatoalveolar	ɡ Velar	◌ ɡ' Velar
◌ ɗ̥ ɡ̥ Alveolar lateral	ɠ Uvular	◌ ɡ' Alveolar fricative

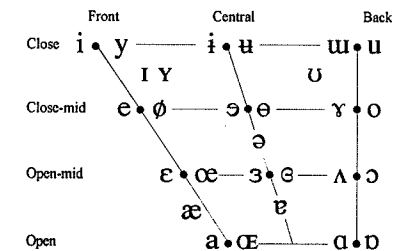
OTHER SYMBOLS

- ◌ ʌ Voiceless labial-velar fricative
- ◌ ʷ Voiced labial-velar approximant
- ◌ ɥ Voiced labial-palatal approximant
- ◌ ʜ Voiceless epiglottal fricative
- ◌ ʕ Voiced epiglottal fricative
- ◌ ʕ̰ Epiglottal plosive
- ◌ ɕ Alveolo-palatal fricatives
- ◌ ɺ Voiced alveolar lateral flap
- ◌ ɻ Simultaneous ʃ and x
- ◌ ʎ Affricates and double articulations can be represented by two symbols joined by a tie bar if necessary.

DIACRITICS Diacritics may be placed above a symbol with a descender, e.g. ɲ̰

◌ ɔ Voiceless	◌ ɲ ɳ	◌ ʙ Breathy voiced	◌ ɓ ɗ	◌ ʈ Dental	◌ ɖ
◌ ɔ̥ Voiced	◌ ʂ ʐ	◌ ɓ̰ Creaky voiced	◌ ɗ̰	◌ ʈ̰ Apical	◌ ɖ̰
◌ ɔ̥ ʰ Aspirated	◌ ʈ̰ ɖ̰	◌ ɓ̰ Linguolabial	◌ ʈ̰ ɖ̰	◌ ʈ̰ Laminar	◌ ɖ̰
◌ ɔ̥ ʷ More rounded	◌ ɟ̰	◌ ɓ̰ Labialized	◌ ʈ̰ ɖ̰	◌ ʈ̰ Nasalized	◌ ɖ̰
◌ ɔ̥ ʷ Less rounded	◌ ɟ̰	◌ ɓ̰ Palatalized	◌ ʈ̰ ɖ̰	◌ ʈ̰ Nasal release	◌ ɖ̰
◌ ɔ̥ ʷ Advanced	◌ ɟ̰	◌ ɓ̰ Velarized	◌ ʈ̰ ɖ̰	◌ ʈ̰ Lateral release	◌ ɖ̰
◌ ɔ̥ ʷ Retracted	◌ ɟ̰	◌ ɓ̰ Pharyngealized	◌ ʈ̰ ɖ̰	◌ ʈ̰ No audible release	◌ ɖ̰
◌ ɔ̥ ʷ Centralized	◌ ɟ̰	◌ ɓ̰ Velarized or pharyngealized	◌ ʈ̰		
◌ ɔ̥ ʷ Mid-centralized	◌ ɟ̰	◌ ɓ̰ Raised	◌ ɟ̰ (ɹ = voiced alveolar fricative)		
◌ ɔ̥ ʷ Syllabic	◌ ɟ̰	◌ ɓ̰ Lowered	◌ ɟ̰ (ɓ̰ = voiced bilabial approximant)		
◌ ɔ̥ ʷ Non-syllabic	◌ ɟ̰	◌ ɓ̰ Advanced Tongue Root	◌ ɟ̰		
◌ ɔ̥ ʷ Rhoticity	◌ ɟ̰ ɞ̰ ɞ̰	◌ ɓ̰ Retracted Tongue Root	◌ ɟ̰		

VOWELS



Where symbols appear in pairs, the one to the right represents a rounded vowel.

SUPRASEGMENTALS

- ◌ Primary stress
- ◌ Secondary stress
- ◌ Long
- ◌ Half-long
- ◌ Extra-short
- ◌ Minor (foot) group
- ◌ Major (intonation) group
- ◌ Syllable break
- ◌ Linking (absence of a break)

TONES AND WORD ACCENTS LEVEL CONTOUR

