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Articulatory Phonetics

P honetics is concerned with describing the speech sounds that occur in the languages of the world. We want to know what these sounds are, how they fall into patterns, and how they change in different circumstances. Most importantly, we want to know what aspects of the sounds are necessary for conveying the meaning of what is being said. The first job of a phonetician is, therefore, to try to find out what people are doing when they are talking and when they are listening to speech.

The Vocal Organs

We will begin by describing how speech sounds are made. In nearly all speech sounds, the basic source of power is the respiratory system pushing air out of the lungs. Try to talk while breathing in instead of out. You will find that you can do it, but it is much more inefficient than superimposing speech on an outgoing breath.

Air from the lungs goes up the windpipe (the trachea, to use the more technical term) and into the larynx, at which point it must pass between two small muscular folds called the vocal cords. If the vocal cords are apart, as they normally are when breathing out, the air from the lungs will have a relatively free passage into the pharynx and the mouth. But if the vocal cords are adjusted so that there is only a narrow passage between
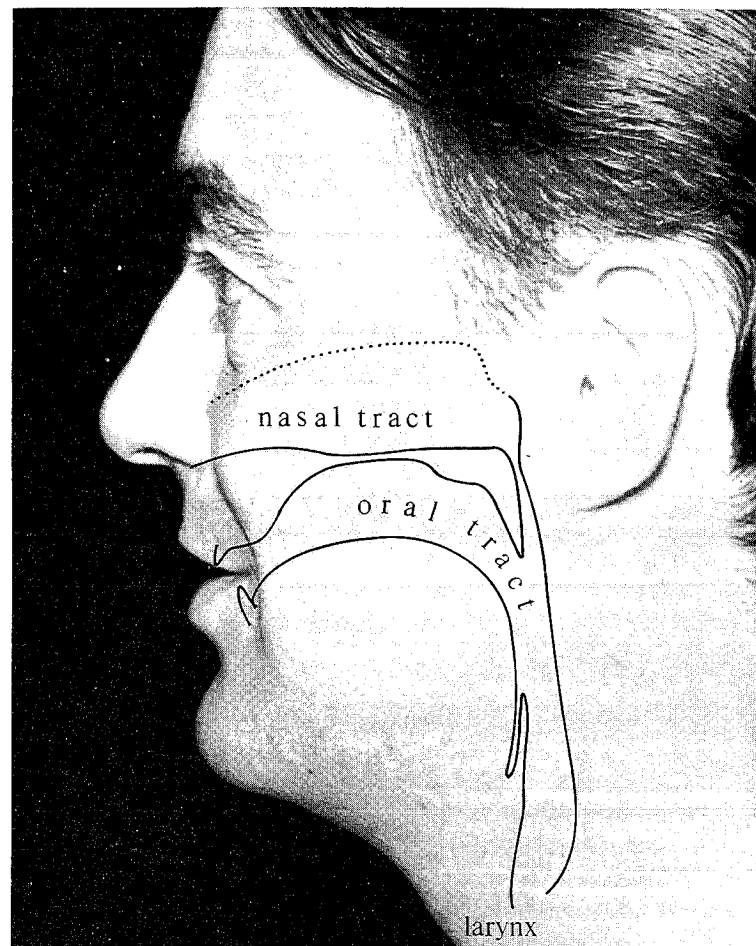
Figure 1.1   *The vocal tract.*

them, the airstream will cause them to vibrate. Sounds produced when the vocal cords are vibrating are said to be **voiced,** as opposed to those in which the vocal cords are apart, which are said to be **voiceless.**

In order to hear the difference between a voiced and a voiceless sound, try saying a long *v* sound, which we will symbolize as [vvvvv]. Now compare this with a long *f* sound [fffff], saying each of them alternately–[ffffvvvvvfffffvvvvv]. Both of these sounds are formed in the same way in the mouth. The difference between them is that [v] is voiced but [f] is voiceless. You can feel the vocal cord vibrations in [v] if you put your fingertips against your larynx. You can also hear the buzzing of the vibrations in [v] more easily if you stop up your ears while contrasting [fffffvvvvv].

The difference between voiced and voiceless sounds is often important in distinguishing sounds. In each of the pairs of words "fat, vat; thigh, thy;

Sue, zoo" the first consonant in the first word of each pair is voiceless, whereas in the second word, it is voiced. To check this for yourself, say just the consonant at the beginning of each of these words and try to feel and hear the voicing as suggested above. Try to find other pairs of words that are distinguished by one having a voiced and the other having a voiceless consonant.

The air passages above the larynx are known as the **vocal tract.** Figure 1.1 shows their location within the head (actually within my head). The shape of the vocal tract is a very important factor in the production of speech, and we will often refer to a diagram of the kind that has been superimposed on the photograph in Figure 1.1. Learn to draw the vocal tract by tracing the diagram in this figure. Note that the air passages that make up the vocal tract may be divided into the oral tract within the mouth and pharynx, and the nasal tract within the nose. The upper limit of the nasal tract has been marked with a dotted line since the exact boundaries of the air passages within the nose depend on soft tissues of variable size.

The parts of the vocal tract that can be used to form sounds are called articulators. The articulators that form the lower surface of the vocal tract often move toward those that form the upper surface. Try saying the word "capital" and note the major movements of your tongue and lips. You will find that the back of the tongue makes contact with the roof of the mouth for the first sound and then comes down for the following vowel. The lips come together in the formation of *p* and then come apart again in the vowel. The tongue tip comes up for the *t* and again, for some people, for the final *l.*

The names for the principal parts of the upper surface of the vocal tract are given in Figure 1.2. The upper lip and the upper teeth (notably the frontal incisors) are familiar enough structures. Just behind the upper teeth is a small protuberance that you can feel with the tip of the tongue. This is
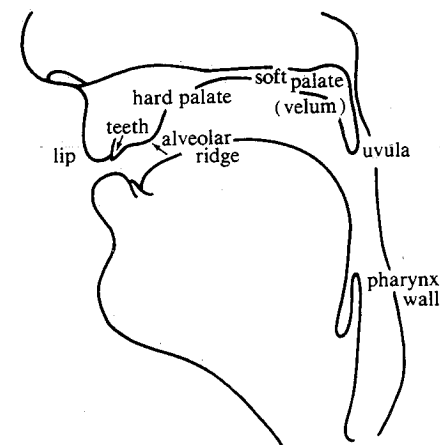

Figure 1.2   *The principal parts of the upper surface of the vocal tract.*

called the **alveolar ridge**. You can also feel that the front part of the roof of the mouth is formed by a bony structure. This is the **hard palate**. You will probably have to use a fingertip to feel further back. Most people cannot curl the tongue up far enough to touch the **soft palate**, or **velum**, at the back of the mouth. The soft palate is a muscular flap that can be raised to press against the back wall of the pharynx and shut off the nasal tract, preventing air from going out through the nose. In this case there is said to be a **velic closure**. This action separates the nasal tract from the oral tract so that the air can go out only through the mouth. At the lower end of the soft palate is a small appendage hanging down that is known as the uvula. The part of the vocal tract between the uvula and the larynx is the pharynx. The back wall of the pharynx may be considered to be one of the articulators on the upper surface of the vocal tract. Figure 1.3 shows the lower lip and the specific names for different parts of the tongue that form the lower surface of the vocal tract.
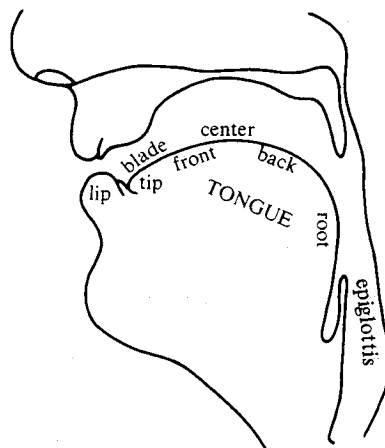

Figure 1.3   *The principal parts of the lower surface of the vocal tract.*

The tip and blade of the tongue are the most mobile parts. Behind the blade is what is technically called the front of the tongue: it is actually the forward part of the body of the tongue, and lies underneath the hard palate when the tongue is at rest. The remainder of the body of the tongue may be divided into the center, which is partly beneath the hard palate and partly beneath the soft palate, the back, which is beneath the soft palate, and the root, which is opposite the back wall of the pharynx. The epiglottis is attached to the lower part of the root of the tongue.

Bearing all these terms in mind, say the word "peculiar" and try to give a rough description of the actions of the vocal organs during the consonant sounds. You should find that the lips come together for the first sound. Then the back and center of the tongue are raised. But is the contact on the

hard palate or on the velum? (For most people, it is centered between the two.) Then note the position in the formation of the *l*. Most people make this sound with the tip of the tongue on the alveolar ridge.

Now compare the words "true" and "tea." In which word is the tongue contact further forward in the mouth? Most people make contact with the tip or blade of the tongue on the alveolar ridge when saying "tea," but slightly farther back in "true." Try to distinguish the differences in other consonant sounds, such as those in "sigh" and "shy" and those in "fee" and "the."

When considering diagrams such as those discussed thus far, it is important to remember that they show only two dimensions. The vocal tract is a tube, and the positions of the sides of the tongue may be very different from that of the center. In saying "sigh," for example, there is a deep hollow in the center of the tongue that is not present when saying "shy." It is difficult to represent this difference in a two-dimensional diagram showing just the mid-line of the tongue—a so-called mid-sagittal view. We will be relying on mid-sagittal diagrams of the vocal organs to a considerable extent in this book. But we should never let this simplified view become the sole basis for our conceptualization of speech sounds.

Places of Articulation

In order to form consonants, the airstream through the vocal tract must be obstructed in some way. Consonants can therefore be classified according to the place and manner of this obstruction. The primary articulators that can cause an obstruction in most languages are the lips, the tongue tip and blade, and the back of the tongue. Speech gestures using the lips are called **labial** articulations; those using the tip or blade of the tongue are called **coronal** articulations; and those using the back of the tongue are called **dorsal** articulations.

If we do not need to specify the place of articulation in great detail, then the articulators for the consonants of English (and of many other languages) can be described using these terms. The word "topic," for example, begins with a coronal consonant; in the middle there is a labial consonant; and at the end a dorsal consonant. (Check this by feeling that the tip or blade of your tongue is raised for the first, coronal, consonant, your lips close for the second, labial, consonant, and the back of the tongue is raised for the final, dorsal, consonant.)

These terms, however, do not specify articulatory gestures in sufficient detail for many phonetic purposes. More specific places of articulation are indicated by the arrows going from one of the lower articulators to one of the upper articulators in Figure 1.4. The principal terms for these particular types of obstruction, all of which are required in the description of English, follow.
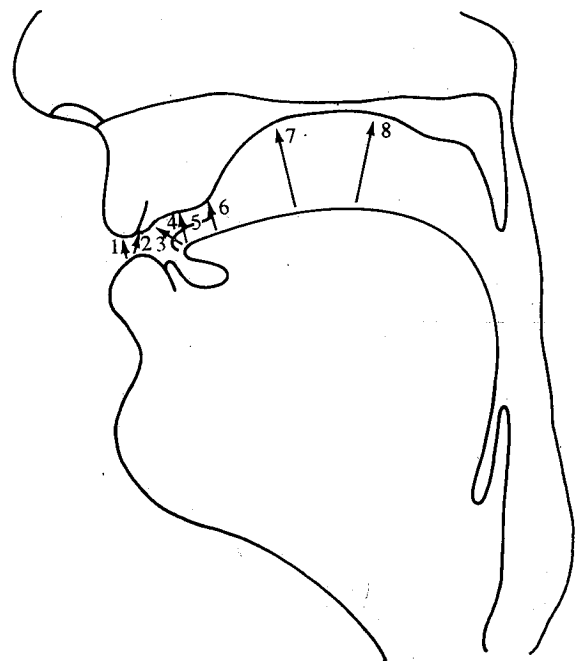
Figure 1.4   *Places of articulation: 1 Bilabial; 2 Labiodental; 3 Dental; 4 Alveolar; 5 Retroflex; 6 Palato-Alveolar; 7 Palatal; 8 Velar.*

1. Bilabial

(Made with the two lips.) Say words such as "pie, buy, my" and note how the lips come together for the first sound in each of these words. Find a comparable set of words with bilabial sounds at the end.

2. Labiodental

(Lower lip and upper front teeth.) Most people, when saying words such as "fie, vie," raise the lower lip until it nearly touches the upper front teeth.

3. Dental

(Tongue tip or blade and upper front teeth.) Say the words "thigh, thy." Some people (most speakers of American English) have the tip of the tongue protruding between the upper and lower front teeth; others (most speakers of British English) have it close behind the upper front teeth. Both these kinds of sounds are normal in English, and both may be called dental. If a distinction is needed, sounds in which the tongue protrudes between the teeth may be called **interdental.**

4. Alveolar

(Tongue tip or blade and the alveolar ridge.) Again there are two possibilities in English, and you should find out which you use. You may pronounce words such as "tie, die, nigh, sigh, zeal, lie" using the tip of the tongue or the blade of the tongue. Feel how you normally make the alveolar consonants in each of these words, and then try to make them in the other way. A good way to appreciate the difference between dental and alveolar sounds is to say "ten" and "tenth" (or "n" and "nth"). Which *n* is farther back? (Most people make the one in the first of each of these pairs of words on the alveolar ridge and the second as a dental sound with the tongue touching the upper front teeth.)

5. Retroflex

(Tongue tip and the back of the alveolar ridge.) Many speakers of English do not use retroflex sounds at all. But for some, retroflex sounds occur initially in words such as "rye, row, ray." Note the position of the tip of your tongue in these words. Speakers who pronounce *r* at the ends of words may also have retroflex sounds with the tip of the tongue raised in "ire, hour, air."

6. Palato-Alveolar

(Tongue blade and the back of the alveolar ridge.) Say words such as "shy, she, show." During the consonants, the tip of your tongue may be down behind the lower front teeth, or it may be up near the alveolar ridge, but the blade of the tongue is always close to the back part of the alveolar ridge. Try saying "shipshape" with your tongue tip up on one occasion and down on another. Note that the blade of the tongue will always be raised. You may be able to feel the place of articulation more distinctly if you hold the position while taking in a breath through the mouth. The incoming air cools the blade of the tongue and the back part of the alveolar ridge.

7. Palatal

(Front of the tongue and hard palate.) Say the word "you" very slowly so that you can isolate the consonant at the beginning. If you say this consonant by itself, you should be able to feel that the front of the tongue is raised toward the hard palate. Try to hold the consonant position and breathe inward through the mouth. You will probably be able to feel the rush of cold air between the front of the tongue and the hard palate.

8. Velar

(Back of the tongue and soft palate.) The consonants that have the farthest back place of articulation in English are those that occur at the end of "hack, hag, hang." In all these sounds, the back of the tongue is raised so that it touches the velum.

As you can tell from the descriptions of these articulations, the first two, bilabial and labiodental, can be classified as labial, involving at least the lower lip; the next four, dental, alveolar, retroflex and palato-alveolar, are coronal articulations, with the tip or blade of the tongue raised; and the last, velar, is a dorsal articulation, using the back of the tongue. Palatal sounds are sometimes classified as coronal articulations, and sometimes as dorsal articulations, a point to which we shall return.

To get the feeling of different places of articulation, consider the consonant at the beginning of each of the following words: "fee, theme, see, she." Say these consonants by themselves. Are they voiced or voiceless? Now note that the place of articulation moves back in the mouth in making this series of voiceless consonants, going from labiodental, through dental and alveolar, to palato-alveolar.

The Oro-Nasal Process

Consider the consonants at the ends of "rang, ran, ram." When you say these consonants by themselves, note that the air is coming out through the nose. In the formation of these sounds, the point of articulatory closure moves forward, from velar in "rang," through alveolar in "ran," to bilabial in "ram." In each case, the air is prevented from going out through the mouth, but is able to go out through the nose because the soft palate, or velum, is lowered.

In most speech, the soft palate is raised so that there is a velic closure. When it is lowered and there is an obstruction in the mouth, we say that there is a nasal consonant. Raising or lowering the velum controls the oro-nasal process, the distinguishing factor between oral and nasal sounds.

Manners of Articulation

At most places of articulation there are several basic ways in which articulation can be accomplished. The articulators may close off the oral tract for an instant or a relatively long period; they may narrow the space considerably; or they may simply modify the shape of the tract by approaching each other.

Stop

(Complete closure of the articulators involved so that the airstream cannot escape through the mouth.) There are two possible types of stop.

Oral stop If in addition to the articulatory closure in the mouth, the soft palate is raised so that the nasal tract is blocked off, then the airstream will be completely obstructed. Pressure in the mouth will build up and an **oral stop** will be formed. When the articulators come apart, the airstream will be released in a small burst of sound. This kind of sound occurs in the consonants in the words "pie, buy" (bilabial closure), "tie, dye" (alveolar closure), and "kye, guy" (velar closure). Figure 1.5 shows the positions of the vocal organs in the bilabial stop in "buy."

Nasal stop If the air is stopped in the oral cavity but the soft palate is down so that it can go out through the nose, the sound produced is a **nasal**
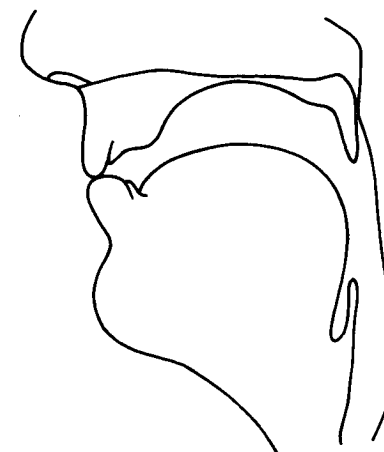
Figure 1.5 *The positions of the vocal organs in the bilabial stop in "buy."*

(velar closure). Figure 1.6 shows the position of the vocal organs during the bilabial nasal stop in "my." Apart from the presence of a velic closure, there is no difference between this stop and the one in "buy"—shown in Figure 1.5. Although both the nasal sounds and the oral sounds can be classified as stops, the term **stop** by itself is almost always used by phoneticians to indicate an oral stop, and the term **nasal** to indicate a nasal stop. Thus the consonants at the ends of the words "bad" and "ban" would be called an alveolar stop and an alveolar nasal respectively. Although the term stop may be defined so that it applies only to the prevention of air escaping through the mouth, it is commonly used to imply a complete stoppage of the airflow through both the nose and the mouth.
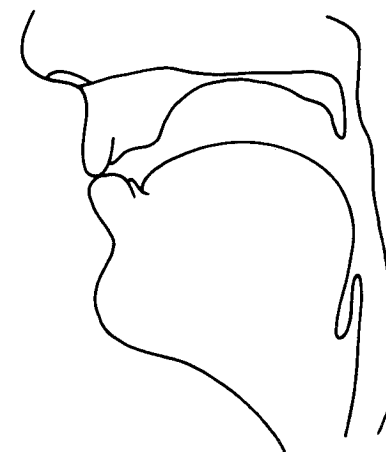

Figure 1.6 *The position of the vocal organs during the bilabial nasal*
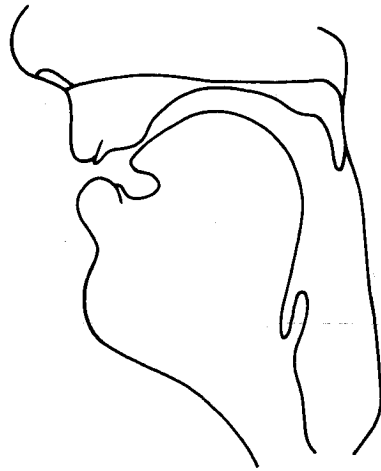
Figure 1.7   *The positions of the vocal organs in the palato-alveolar fricative in "shy."*

Fricative

(Close approximation of two articulators so that the airstream is partially obstructed and turbulent airflow is produced.) The mechanism involved in making these slightly hissing sounds may be likened to that involved when the wind whistles around a corner. The consonants in "fie, vie" (labiodental), "thigh, thy" (dental), "sigh, zoo" (alveolar), and "shy" (palato-alveolar) are examples of fricative sounds. Figure 1.7 illustrates one pronunciation of the palato-alveolar fricative consonant in "shy." Note the narrowing of the vocal tract between the blade of the tongue and the back part of the alveolar ridge. The higher-pitched sounds with a more obvious hiss, such as those in "sigh, shy," are sometimes called **sibilants**.

Approximant

(An articulation in which one articulator is close to another, but without the vocal tract being narrowed to such an extent that a turbulent airstream is produced.) In saying the first sound in "yacht" the front of the tongue is raised toward the palatal area of the roof of the mouth, but it does not come close enough for a fricative sound to be produced. The consonants in the word "we" (approximation between the lips and in the velar region) and, for some people, in the word "raw" (approximation in the alveolar region) are also examples of approximants.

Lateral (Approximant)

(Obstruction of the airstream at a point along the center of the oral tract, with incomplete closure between one or both sides of the tongue and the roof of the mouth.) Say the word "lie" and note how the tongue touches near the center of the alveolar ridge. Prolong the initial consonant and note

how, despite the closure formed by the tongue, air flows out freely, over the side of the tongue. Because there is no stoppage of the air, and not even any fricative noises, these sounds are classified as approximants. The consonants in words such as "lie, laugh" are alveolar lateral approximants, but they are usually called just alveolar laterals, their approximant status being assumed. You may be able to find out which side of the tongue is not in contact with the roof of the mouth by holding the consonant position while you breathe inward. The tongue will feel colder on the side that is not in contact with the roof of the mouth.

Additional Consonantal Articulations

In this preliminary chapter, it will not be necessary to discuss all of the manners of articulation used in the various languages of the world—nor, for that matter, in English. But it might be useful to know the terms **trill** (sometimes called roll), and **tap** (sometimes called flap). Tongue-tip trills occur in some forms of Scottish English in words such as "rye" and "raw." Taps, in which the tongue makes a single tap against the alveolar ridge, occur in the middle of a word such as "letter" in many forms of American English.

The production of some sounds involves more than one of these manners of articulation. Say the word "cheap" and think about how you make the first sound. At the beginning, the tongue comes up to make contact with the back part of the alveolar ridge to form a stop closure. This contact is then slackened so that there is a fricative at the same place of articulation. This kind of combination of a stop immediately followed by a fricative is called an **affricate**, in this case a palato-alveolar affricate. There is a voiceless affricate at the beginning and end of the word "church." The corresponding voiced affricate occurs at the beginning and end of "judge." In all these sounds the articulators (tongue tip or blade and alveolar ridge) come together for the stop; and then, instead of coming fully apart, they separate only slightly, so that a fricative is made at the same place of articulation. Try to feel these movements in your own pronunciation of these words.

To summarize, the consonants we have been discussing so far may be described in terms of five factors: (1) state of the vocal cords (voiced or voiceless); (2) place of articulation; (3) central or lateral articulation; (4) soft palate raised to form a velic closure (oral sounds) or lowered (nasal sounds); (5) manner of articulatory action. Thus the consonant at the beginning of the word "sing" is a (1) voiceless, (2) alveolar, (3) central, (4) oral, (5) fricative; and the consonant at the end of "sing" is a (1) voiced, (2) velar, (3) central, (4) nasal, (5) stop.

On most occasions it is not necessary to state all these five points. Unless a specific statement to the contrary is made, consonants are usually presumed to be central, not lateral, and oral rather than nasal. Consequently, points (3) and (4) may often be left out, so that the consonant at

the beginning of "sing" is simply called a voiceless alveolar fricative. When describing nasals, point (4) has to be specifically mentioned and point (5) can be left out, so that the consonant at the end of "sing" is simply called a voiced velar nasal.

The Articulation of Vowel Sounds

In the production of vowel sounds, the articulators do not come very close together, and the passage of the airstream is relatively unobstructed. Vowel sounds may be specified in terms of the position of the highest point of the tongue and the position of the lips. Figure 1.8 shows the articulatory position for the vowels in "heed, hid, head, had, father, good, food." As you can see, in all these vowels the tongue tip is down behind the lower front teeth, and the body of the tongue is domed upward. Check that this is so in your own pronunciation. In the first four vowels, the highest point of the tongue is in the front of the mouth. Accordingly, these vowels are called **front vowels.** The tongue is fairly close to the roof of the mouth for the vowel in "heed," slightly less close for the vowel in "hid," and lower still
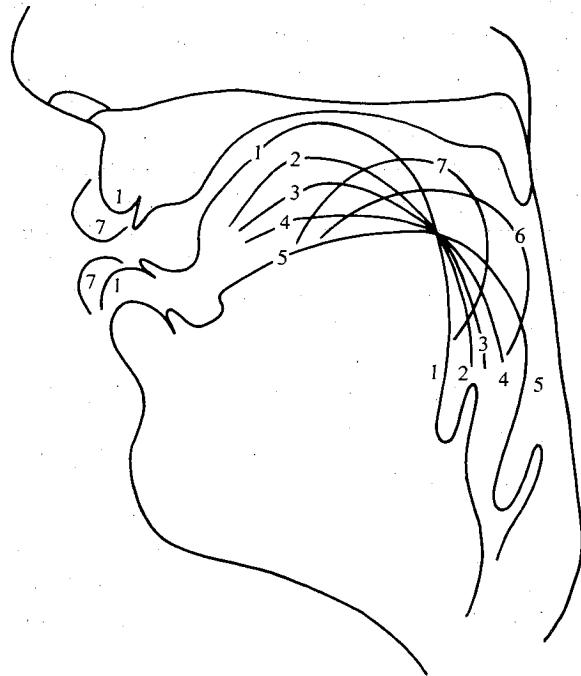

Figure 1.8   *The positions of the vocal organs for the vowels in the words 1 heed, 2 hid, 3 head, 4 had, 5 father, 6 good, 7 food. The lip positions for vowels 2, 3, and 4 are in between those shown for 1 and 5. The lip position for vowel 6 is between those shown for 1 and 7.*

for the vowels in "head" and "had." If you look in a mirror while saying the vowels in these four words, you will find that the mouth becomes progressively more open while the tongue remains in the front of the mouth. The vowel in "heed" is classified as a high front vowel, and the vowel in "had" as a low front vowel. The height of the tongue for the vowels in the other words is between these two extremes, and they are therefore called mid-front vowels. The vowel in "hid" is a mid-high vowel, and the vowel in "head" is a mid-low vowel.

Now try saying the vowels in "father, good, food." Figure 1.8 also shows the articulatory position for these vowels. In all three, the tongue is close to the upper or back surface of the vocal tract. These vowels are classified as **back vowels.** The body of the tongue is highest in the vowel in "food" (which is therefore called a high back vowel), and lowest in the first vowel in "father" (which is therefore called a low back vowel). The vowel in "good" is a mid-high back vowel.

The position of the lips varies considerably in different vowels. They are generally closer together in the mid and high back vowels (as in "good, food"), though in some forms of American English this is not so. Look at the position of your lips in a mirror while you say just the vowels in "'heed, hid, head, had, father, good, food." You will probably find that in the last two words there is a movement of the lips in addition to the movement that occurs because of the lowering and raising of the jaw. This movement is called lip rounding. It is usually most noticeable in the forward movement of the corners of the lips. Vowels may be described as being **rounded** (as in "who'd") or **unrounded** (as in "heed").

In summary, vowels can be described in terms of three factors: (1) the height of the body of the tongue; (2) the front-back position of the tongue; and (3) the degree of lip rounding. The relative positions of the highest points of the tongue are given in Figure 1.9. Say just the vowels in the words given below this figure and check that your tongue moves in the pattern described by the points. It is very difficult to become aware of the position of the tongue in vowels, but you can probably get some impression

Figure 1.9   *The relative positions of the highest points of the tongue in the vowels in 1 heed, 2 hid, 3 head, 4 had, 5 father, 6 good, 7 food.*

of tongue height by observing the position of your jaw while saying just the vowels in the four words, "heed, hid, head, had." You should also be able to feel the difference between front and back vowels by contrasting words such as "he" and "who." Say these words silently and concentrate on the sensations involved. You should feel the tongue going from front to back as you say "he, who." You can also feel your lips becoming more rounded.

As you can see from Figure 1.9, the specification of vowels in terms of the position of the highest point of the tongue is not entirely satisfactory for a number of reasons. First, the vowels that are called high do not have the same tongue height. The back high vowel (point 7) is nowhere near as high as the front vowel (point 1). Second, the so-called back vowels vary considerably in their degree of backness. Third, as you can see by looking at Figure 1.8, this kind of specification disregards considerable differences in the shape of the tongue in front vowels and in back vowels. Furthermore, it does not take into account the fact that the width of the pharynx varies considerably with, and to some extent independently of, the height of the tongue in different vowels. We will discuss better ways of describing vowels in Chapters 4 and 9.

Suprasegmentals

Vowels and consonants can be thought of as the segments of which speech is composed. Together they form the syllables, which go to make up utterances. Superimposed on the syllables there are other features known as suprasegmentals. These include variations in stress and pitch. Variations in length are also usually considered to be suprasegmental features, although they can affect single segments as well as whole syllables.

Variations in stress are used in English to distinguish between a noun and a verb, as in "(an) insult" versus "(to) insult." Say these words yourself, and check which syllable has the greater stress. Then compare similar pairs, such as "(a) pervert, (to) pervert" or "(an) overflow, (to) overflow." You should find that in the nouns the stress is on the first syllable, but in the verbs it is on the last. Thus, stress can have a grammatical function in English. It can also be used for contrastive emphasis (as in "I want a *red* pen, not a black one"). Variations in stress are caused by an increase in the activity of the respiratory muscles (so that a greater amount of air is pushed out of the lungs) and in the activity of the laryngeal muscles (so that there is a significant change in pitch).

You can usually find where the stress occurs on a word by trying to tap with your finger in time with each syllable. It is much easier to tap on the stressed syllable. Try saying "abominable" and tapping first on the first syllable, then on the second, then on the third, and so on. If you say the word in your normal way you will find it easiest to tap on the second syllable. Many people cannot tap on the first syllable without altering their normal pronunciation.

Pitch changes due to variations in laryngeal activity can occur independently of stress changes. When they do, they can affect the meaning of the sentence as a whole. The pitch pattern in a sentence is known as the **intonation**. Listen to the intonation (the variations in the pitch of your voice) when you say the sentence "This is my father." Try to find out which syllable has the highest pitch and which the lowest. In most people's speech the highest pitch will occur on the first syllable of "father" and the lowest on the second. Now observe the pitch changes in the question "Is this your father?" In this sentence the first syllable of "father" is usually on a low pitch, and the last syllable is on a high pitch. In English it is even possible to change the meaning of a sentence such as "That's a cat" from a statement to a question without altering the order of the words. If you substitute a mainly rising for a mainly falling intonation, you will produce a question spoken with an air of astonishment: "That's a *cat*?"

All the suprasegmental features are characterized by the fact that they must be described in relation to other items in the same utterance. It is the relative values of pitch, length, or degree of stress of an item that are significant. You can stress one syllable as opposed to another irrespective of whether you are shouting or talking softly. Children can also use the same intonation patterns as adults, although their voices have a higher pitch. The absolute values are never linguistically important. But they do, of course, convey information about the speaker's age, sex, emotional state, and attitude toward the topic under discussion.
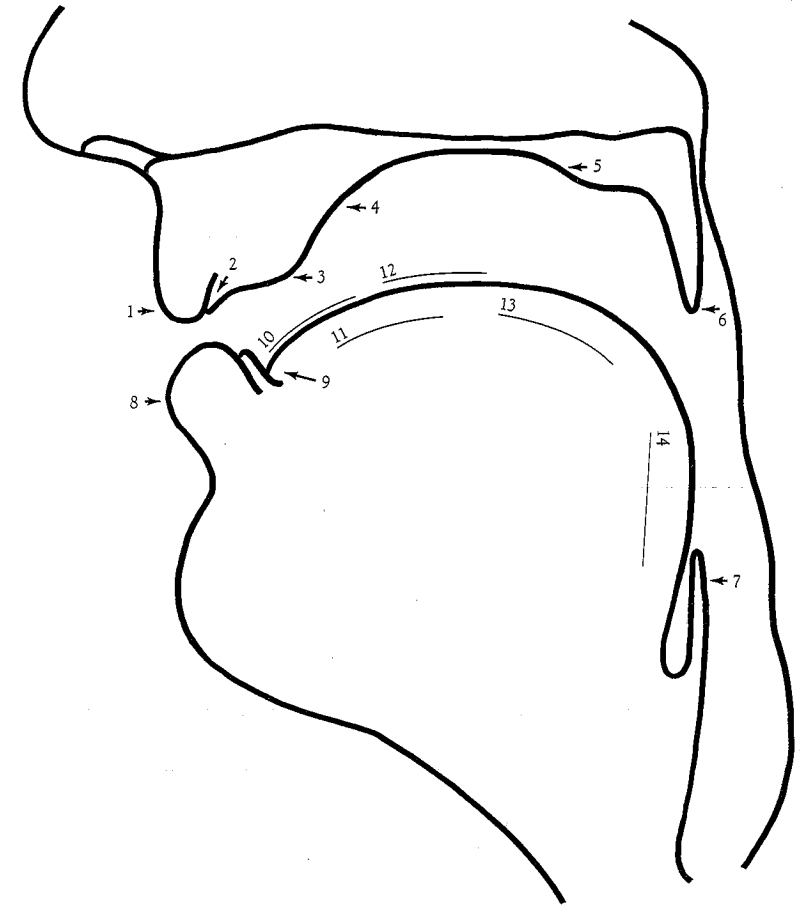
A Fill in the names of the vocal organs numbered in **Figure 1.10** above.

1. _____   8. _____

2. _____   9. _____

3. _____   10. _____

4. _____   11. _____

5. _____   12. _____

6. _____   13. _____

7. _____   14. _____

(a)

(b)

(c)

(d)

(e)

(f)

(g)
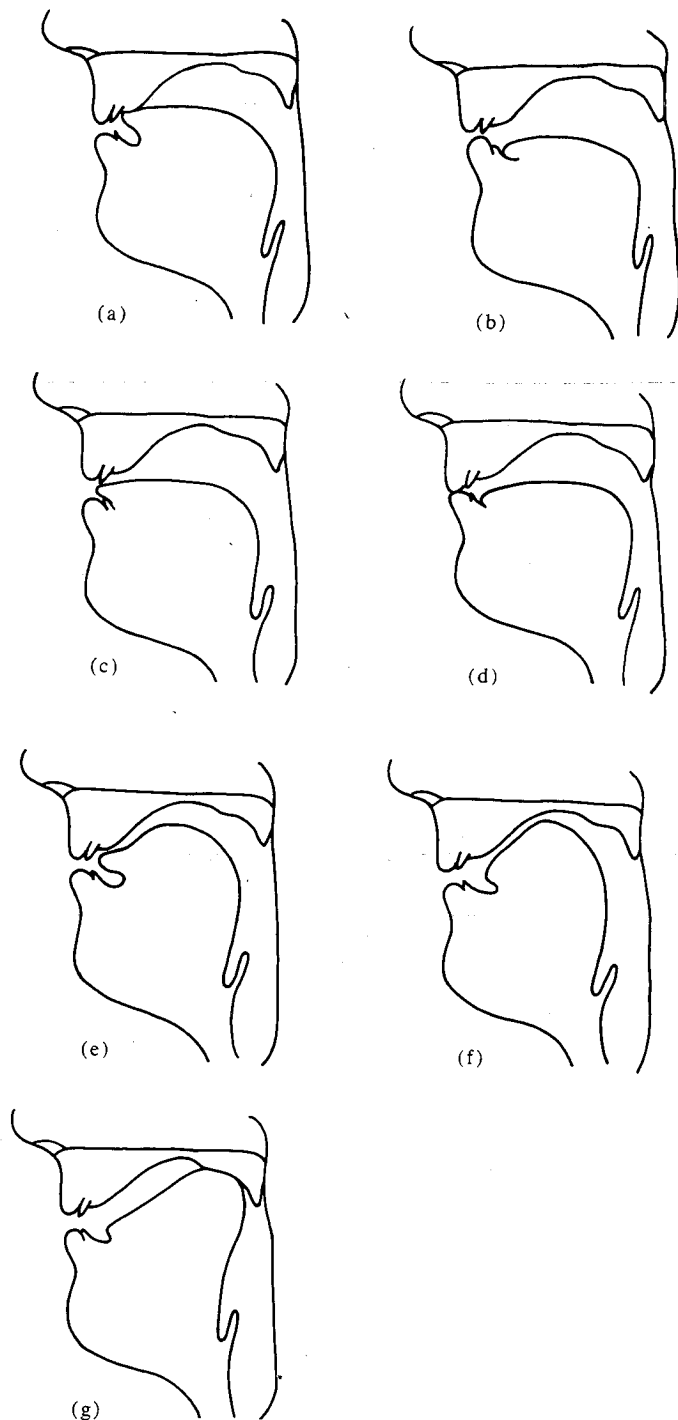
Figure 1.11 *Sounds illustrating all the places of articulation discussed so far, except for retroflex sounds.*

B Describe the consonants in the word "skinflint" using the chart below Fill in all five columns, and put parentheses around the terms that may be left out, as shown for the first consonant.

	1 voiced or voiceless	2 place of articulation	3 central or lateral	4 oral or nasal	5 articulatory action
s	voiceless	alveolar	(central)	(oral)	fricative
k					
n					
f					
l					
t					

C Figure 1.11a–g illustrates all the places of articulation we have discussed so far, except for retroflex sounds (which will be illustrated in Chapter 7). In the spaces provided below, state (1) the place of articulation and (2) the manner of articulation of each sound. In addition, give (3) an example of an English word beginning with the sound illustrated.

	(1) Place of articulation	(2) Manner of articulation	(3) Example
a			
b			
c			
d			
e			
f			
g			

D Studying a new subject often involves learning a large number of technical terms. Phonetics is particularly difficult in this respect. Read over the definitions of the terms in this chapter, and then try the exercises below. Listen to the sounds of the words, and be careful not to be confused by spellings. Using a mirror may be helpful.

1. Circle the words that begin with a bilabial consonant:

   mat   gnat   sat   bat   rat   pat

2. Circle the words that begin with a velar consonant:

   knot   got   lot   cot   hot   pot

3. Circle the words that begin with a labiodental consonant:

   fat   cat   that   mat   chat   vat

4. Circle the words that begin with an alveolar consonant:

   zip   nip   lip   sip   tip   dip

5. Circle the words that begin with a dental consonant:

   pie   guy   shy   thigh   thy   high

6. Circle the words that begin with a palato-alveolar consonant:

   sigh   shy   tie   thigh   thy   lie

7. Circle the words that end with a fricative:

   race   wreath   bush   bring   breathe   bang

   rave   real   ray   rose   rough

8. Circle the words that end with a nasal:

   rain   rang   dumb   deaf

9. Circle the words that end with a stop:

   pill   lip   lit   graph   crab   dog   hide

   laugh   back

10. Circle the words that begin with a lateral:

    nut   lull   bar   rob   one

11. Circle the words that begin with an approximant:

    we   you   one   run

12. Circle the words that end with an affricate:

    much   back   edge   ooze

13. Circle the words in which the consonant in the middle is voiced:

    tracking   mother   robber   leisure   massive

    stomach   razor

14. Circle the words that contain a high vowel:

    sat   suit   got   meet   mud

15. Circle the words that contain a low vowel:

    weed   wad   load   lad   rude

16. Circle the words that contain a front vowel:

    gate   caught   cat   kit   put

17. Circle the words that contain a back vowel:

    maid   weep   coop   cop   good

18. Circle the words that contain a rounded vowel:

    who   me   us   but   him

E Define the consonant sounds in the middle of each of the following words as indicated in the example:

	Voiced or voiceless	Place of articulation	Manner of articulation
adder	*voiced*	*alveolar*	*stop*
father			
singing			
etching			
robber			
ether			
pleasure			
hopper			
selling			
sunny			
lodger			

F Complete the diagrams so as to illustrate the position of the vocal organs during the first consonants in each of the following words. If the sound is voiced, schematize the vibrating vocal cords by a wavy line at the glottis. If it is voiceless, use a straight line.

Example:
mat
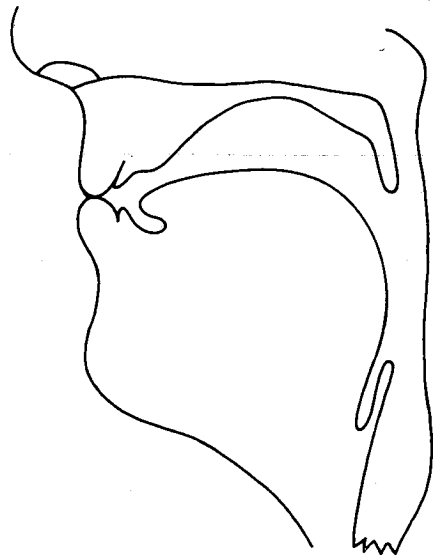
day
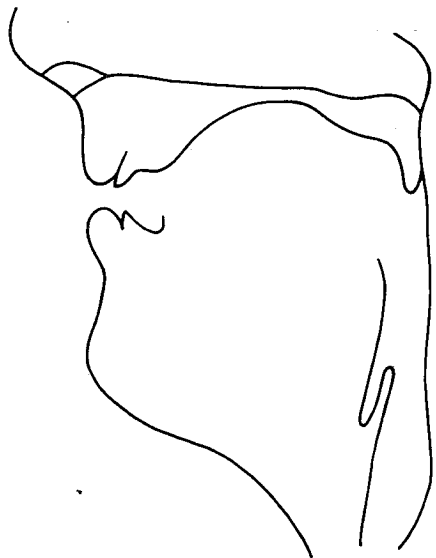
cat

think

nut

2

Phonology and Phonetic Transcription

M any people think that learning phonetics means simply learning to use phonetic transcription. But there is really much more to the subject than learning to use a set of symbols. A phonetician is a person who can describe speech, who understands the mechanisms of speech production and speech perception, and who knows how languages use these mechanisms. Phonetic transcription is no more than a useful tool that phoneticians use in the description of speech.

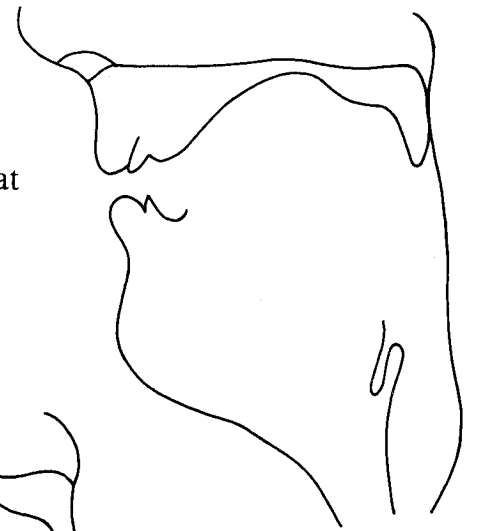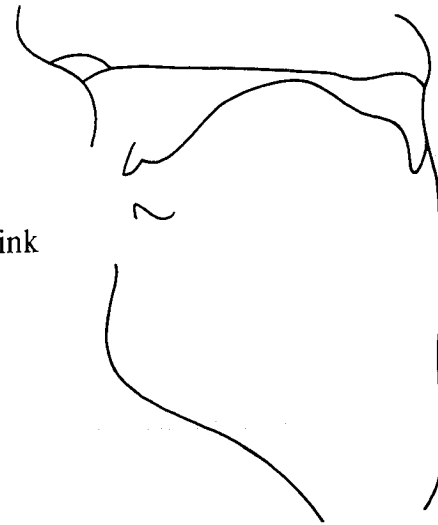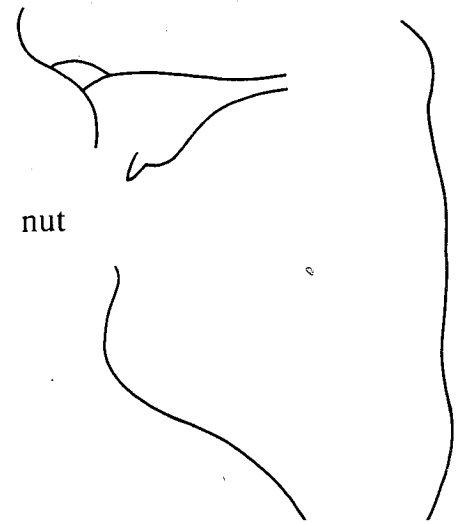When phoneticians transcribe an utterance, they usually do so by noting how the sounds convey differences in meaning. For the most part, they concern themselves with describing only the significant articulations rather than the total set of movements of the vocal organs. For example, when saying the English word "tie," some people pronounce the consonant with the blade of the tongue against the alveolar ridge, others with the tip of the tongue. This kind of difference in articulation does not affect the meaning of the word and is not usually transcribed.

In order to understand how phonetic transcription works, it is necessary to understand the basic principles of phonology. **Phonology** is the description of the systems and patterns of sounds that occur in a language. It involves studying a language to determine its distinctive sounds and to establish a set of rules that describe the set of changes that take place in these sounds when they occur in different relationships with other sounds.

The first task in developing a phonological description of a language is to determine which sounds can convey a difference in meaning. Children

face a similar task when they are learning to speak. To begin with they might not realize that, for example, there is a difference between the consonants at the beginnings of words such as "white" and "right." Later they realize that these words begin with two distinct sounds, and eventually they learn to distinguish all the sounds that can change the meanings of words.

When two sounds can be used to differentiate words they are said to belong to different **phonemes**. There must be a phonemic difference if two words (such as "white" and "right" or "cat" and "bat") differ in only a single sound. There are, however, small shades of sounds that cannot be used to distinguish words, such as the differences between the consonants at the beginning and end of the word "pop." For the first of these sounds, the lips must open and there must be a puff of air before the vowel begins. After the final consonant there may be a puff of air, but it is not necessary. It is not even necessary for the lips to open at all at the end of the word. Both sounds are voiceless bilabial stops; and the differences between them cannot be used to change the meaning of a word in English. They both belong to the same phoneme.

It is important to realize that a phoneme is not a single sound, but a group of sounds. In fact, phonemes are abstract units that form the basis for writing down a language systematically and unambiguously. We often want to record all and only the variations between sounds that cause a difference in meaning. Transcriptions of this kind are called phonemic transcriptions. Languages that have been written down only comparatively recently (such as Swahili, and most of the other languages of Africa) have a fairly phonemic spelling system. There is very little difference between a written version of a Swahili sentence and a phonemic transcription of that sentence. But because English pronunciation has changed over the centuries while the spelling has remained basically the same, phonemic transcriptions of English are different from written texts.

The Transcription of Consonants

Let us begin by considering the contrasting consonant sounds in English. Take, for example, all the words that rhyme with "pie" and have only a single consonant at the beginning. A set of words, each of which differs from all the others by only one sound, is called a minimal set. The second column of Table 2.1 lists a minimal set of this kind. There are obviously many additional words that rhyme with "pie," such as "spy, try, spry," but these words begin with sequences of two or more of the sounds already in the minimal sets. Some of the words in the list begin with two consonant letters ("thigh, thy, shy"), but they each begin with a single consonant sound. "Shy," for example, does not contain a sequence of two consonant sounds in the way that "spy" and "try" do.

Table 2.1

Symbols for transcribing English consonants. (Alternative symbols that may be found in other books are given in parentheses.)

p	pie	pea	
t	tie	tea	
k	kye	key	
b	by	bee	
d	dye	D	
g	guy		
m	my	me	ra*m*
n	nigh	knee	ra*n*
ŋ			ra*ng*
f	fie	fee	
v	vie	V	
θ	thigh		
ð	thy	thee	
s	sigh	sea	li*s*ten
z		Z	mi*zz*en
ʃ (š)	shy	she	mi*ss*ion
ʒ (ž)			vi*s*ion
l	lie	lee	
w	why	we	
ɹ (r)	rye		
j (y)		ye	
h	high	he	

Note also the following:

tʃ (č)	chi(me)	chea(p)
dʒ (ǰ)	ji(ve)	G

Some consonants do not occur in words rhyming with "pie." If we allow the names of the letters as words, then we can find a large set of consonants beginning words rhyming with "pea." A list of such words is shown in the third column of Table 2.1. (Speakers of British English will have to remember that in American English the name of the last letter of the alphabet belongs in this set rather than in the set of words rhyming with "bed.")

Even in this set of words, we are still missing some consonant sounds that contrast with others only in the middle or at the end of words. The letters *ng* often represent a single consonant sound that does not occur at the beginning of a word. You can hear this sound at the end of the word "rang," where it contrasts with other nasals in words such as "ram, ran." There is also a contrast between the consonants in the middle of "mission" and "vision," although there are very few pairs of words that are distinguished by this contrast in English. (One such pair in my English involves

the name of a chain of islands—"Aleutian" versus "allusion.") Words illustrating these consonants are given in the fourth column of Table 2.1.

Most of the symbols in Table 2.1 are the same letters we use in spelling these words, but there are a few differences. One variation between spelling and phonetic usage occurs with the letter *c*, which is sometimes used to represent a [k] sound, as in "cup" or "bacon," and sometimes to represent an [s] sound, as in "cellar" or "receive." Two *c*'s may even represent a sequence of these sounds in the same word, as in "accent, access." Another example is the symbol [g], which is used for the sound "guy" and "guess" but never for the sound in "age" or in the letter *g* itself.

A few other symbols are needed to supplement the regular alphabet. The phonetic symbols we will use are part of the set approved by the International Phonetic Association, a body founded in 1886 by a group of leading phoneticians from France, Germany, Britain, and Denmark. The complete set of IPA symbols is given in the chart in the inside covers of this book. It will be discussed in detail in the final chapter.

The velar nasal at the end of "rang" is written with [ŋ], a letter *n* combined with the tail of the letter *g* descending below the line. The symbol [θ], an upright version of the Greek letter theta, is used for the voiceless dental fricative in words such as "thigh, thin, thimble, ether, breath, mouth." The symbol [ð], derived from an Anglo-Saxon letter, is used for the corresponding voiced sound in words such as "thy, then, them, breathe." Both these symbols are ascenders (letters that go up from the line of writing rather than descending below it). The spelling system of the English language does not distinguish between [θ] and [ð]. They are both written with the letters *th* in pairs such as "ether, either."

The voiceless palato-alveolar fricative [ʃ] in "shy, sheep, rash" is both an ascender and a descender. It is like a long, straightened *s* going both above and below the line of writing. The corresponding voiced symbol [ʒ] is like a long *z* descending below the line (on a typewriter, one can use a figure 3 lowered half a line space). This sound occurs in the middle of words such as "vision, measure, leisure" and at the beginning of foreign words such as the French, "Jean, gendarme."

The sound at the beginning of the word "rye" is written with an upside-down letter *r*. Many books use a regular letter *r* for this sound, but we will reserve this for a trilled *r*. Most forms of both British and American English use an approximant in words such as "red, rose."

Unfortunately, different books on phonetics use different forms of phonetic transcription. This is not because phoneticians cannot agree on which symbols to use, but because different styles of transcription are more appropriate in one circumstance than in another. Thus in this book, where we are concerned with general phonetics, I have used the IPA symbol [j] for the initial sound in "yes, yet, yeast" because I wish to reserve the symbol [y] for another sound, the vowel in the French word "tu." Another reason for using [j] is that in many languages (German, Dutch, Norwegian,

Swedish, and others) this letter is used in words such as "ja," which are pronounced with a sound that in our spelling system would be written with the letter *y*. Books that are concerned only with the phonetics of English often use [y] where this one uses [j]. Some books on phonetics also use [š] and [ž] in place of the IPA symbols [ʃ] and [ʒ] respectively.

There are also disagreements among texts on phonetics on how to transcribe sounds such as the first and last sounds in both "church" and "judge." I have taken the position that these sounds are each sequences of two other consonants and should be written [tʃ] and [dʒ]. You can see that a word such as "choose" might be said to begin with [tʃ] if you compare your pronunciation of the phrases "white shoes" and "why choose." In the first phrase, the [t] is at the end of one word and the [ʃ] at the beginning of the next; but in the second phrase, the sounds occur together at the beginning of the second word. The difference between the two phrases is simply one of the timing of the articulations involved rather than the use of different articulations. Other pairs of phrases that demonstrate this point are "heat sheets" versus "he cheats" and "might shop" versus "my chop." There are no pairs of phrases illustrating the same point for the voiced counterpart [dʒ] found in "jar, gentle, age" because no English word begins with [ʒ].

Some other books on phonetics take the view that the sounds [tʃ] and [dʒ] (as in "church" and "judge") are really single units and are better transcribed with a single symbol, such as [č] and [ǰ]. This view has much to commend it, since the consonants [ʃ] and [ʒ] are not like other consonants such as [ɹ] and [l]. Each of the latter pair of consonants can occur as the second element in many clusters (for example, in "priest, tree, cream, play, clay"). But [ʃ] and [ʒ] cluster only with [t] and [d] respectively. However, as this is a book on phonetics, it seems appropriate to use two symbols for the consonants in words such as "jay" and "age" so as to show that there are two elements in each of them, just as there are in other words containing consonant clusters, such as "tree" and "eats."

There is one minor matter still to be considered in the transcription of the consonant contrasts of English. In many forms of both British and American English, "which" does not contrast with "witch." Accordingly, both "why" and "we" in Table 2.1 are said to begin simply with [w]. But many speakers of English contrast pairs of words such as "which, witch; why, wye; whether, weather." These speakers will have to transcribe the first of each of these pairs of words with an initial [h]. Note that phonetically the [h] is transcribed before [w] in that it is the first part of each of these words that is voiceless.

The Transcription of Vowels

The transcription of the contrasting vowels in English is more difficult than the transcription of consonants for two reasons. First, dialects of English differ more in their use of vowels than in their use of consonants.

Second, authorities differ widely in their views of what constitutes an appropriate description of vowels.

Taking the same approach in looking for contrasting vowels as we did in looking for consonant contrasts, we might try to find a minimal set of words that differ only in the vowel sounds. We could, for example, look for monosyllables that begin with [h] and end with [d], and supplement this minimal set with other lists of monosyllables that contrast only in their vowel sounds. Table 2.2 shows lists of words in the kind of British English that I speak myself. The reason for starting with this kind of English is that it contrasts a larger number of vowels than many others.

In general, speakers of American English can pronounce [ɹ] sounds after vowels, as well as before them. Consequently, they distinguish between words such as "heart" and "hot" not by making a difference in vowel quality (as I do) but by pronouncing "heart" with an [ɹ] and "hot" with the same vowel but without an [ɹ] following it. In "here, hair, hire," these speakers may use vowels similar to those in "he, head, high" respectively, but in each case with a following [ɹ]. Most speakers of British English distinguish these words by using different **diphthongs**—movements from one vowel to another within a single syllable.

Even within American English there are variations in the number of contrasting vowels that occur. Many Midwestern speakers and most Far Western speakers do not distinguish between the vowels in pairs of words such as "odd, awed" and "cot, caught." Some forms of American English make additional distinctions not shown in Table 2.2. For example, some speakers (mainly from the East Coast) distinguish the auxiliary verb "can" from the noun "can," the latter being more diphthongal. But we will have to overlook these small differences in this introductory textbook.

There are several possible ways of transcribing the contrasting vowels in Table 2.2. The two principal forms that will be used in this book are shown in the first and second columns. The first column is suitable for many forms of American English and the second for many forms of British English. The two columns have been kept as similar as possible; as you will see in Chapter 4, I have tried to make the transcriptions compatible with those of well-known authorities on the phonetics of English.

As in the case of the consonant symbols, the vowel symbols in Table 2.2 are used in accordance with the principles of the IPA. Those symbols that have the same shape as ordinary letters of the alphabet represent sounds similar to the sounds these letters have in French or Spanish or Italian. Actually, the IPA usage of the vowel letters is that of the great majority of the world's languages when they are written with the Roman alphabet, including such diverse languages as Swahili, Turkish, and Navajo. The present spelling of English reflects the way it used to sound many centuries ago when it still had vowel letters with values similar to those of the corresponding letters in all these other languages.

Table 2.2

Symbols for transcribing contrasting vowels in English.
Column 1 applies to many speakers of American English,
Column 2 to most speakers of British English.

1	2					
i	i	heed	he	bead	heat	keyed
ɪ	ɪ	hid		bid	hit	kid
eɪ	eɪ	hayed	hay	bayed	hate	Cade
ɛ	ɛ	head		bed		
æ	æ	had		bad	hat	cad
ɑɹ	ɑ	hard		bard	heart	card
ɑ	ɒ	hod		bod	hot	cod
ɔ	ɔ	hawed	haw	bawd		cawed
ʊ	ʊ	hood				could
oʊ	əʊ	hoed	hoe	bode		code
u	u	who'd	who	booed	hoot	cooed
ʌ	ʌ	Hudd		bud	hut	cud
ɝ	ɜ	herd	her	bird	hurt	curd
aɪ	aɪ	hide	high	bide	height	
aʊ	aʊ		how	bowed		cowed
ɔɪ	ɔɪ		(a)hoy	Boyd		
ɪɹ	ɪə		here	beard		
eɹ	ɛə		hair	bared		cared
aɪɹ	aə	hired	hire			
note also						
ju	ju	hued	hue	Bude		cued

One of the principal problems in transcribing English phonetically is that there are more vowel sounds than there are vowel letters in the alphabet. In a transcription of the English word "sea" as [si], the [i] represents a similar (but not identical) sound to that in the Spanish or Italian "si." But unlike Spanish and Italian, English differentiates between vowels such as those in "seat, sit" and "heed, hid." Because the vowels in "sit, hid" are somewhat like those in "seat, heed," they are represented by the symbol [ɪ], a small capital I. Some books, including previous editions of this book, use [ɩ], an undotted form of the letter i, but this symbol is no longer approved by the IPA.

The vowels in words such as "hay, bait, they" are transcribed with a sequence of two symbols [eɪ], indicating that for most speakers of English these words contain a diphthong. The first element in this diphthong is similar to sounds in Spanish or Italian that use the letter e, such as the Spanish word for milk, which is written "leche" and pronounced [letʃe]. The second

element in the English words "hay, bait, they" is [ɪ], the symbol used for transcribing the vowel in "hid."

Two symbols that are not ordinary letters of the alphabet, [ɛ] and [æ], are used for the vowels in "head" and "had" respectively. The first is based on the Greek letter epsilon, and the second on the letters a and e joined together. They may be referred to by the names epsilon and digraph.

Most Americans have the same vowel sound in the words "heart" and "hot" and can use one form of the letter a. They would transcribe these words as [haɹt] and [hat]. But some East Coast Americans and speakers of British English who do not pronounce [ɹ] sounds after a vowel distinguish between these words by the qualities of the vowels and have to use two different forms of the letter a. They would transcribe these words as [hat] and [hɒt].

Most speakers of British forms of English, and many American speakers, distinguish between pairs of words such as "cot, caught; not, naught." The symbol [ɔ], an open letter o or an inverted letter c, may be used in the second of each of these pairs of words and in words such as "bawd, bought, law." Many Midwestern and Far Western American speakers do not need to use this symbol in any of these words, as they do not distinguish between the vowels in words such as "cot" and "caught." They may, however, have different vowels in words such as "moss" and "morse," so that they, like many other Americans, would use the symbol [ɔ] when there is a following [ɹ] sound.

Another special symbol is used for the vowel in "hood, could, good." This symbol [ʊ] may be thought of as a letter u with the ends curled out. Some books, including previous editions of this book, use the symbol [ʊ], but this symbol is no longer approved by the IPA.

The vowel in "hoe, dough, code" is a diphthong. For most American English speakers, the first element is very similar to sounds that are written in Spanish, or Italian with a letter o. Many speakers of English from the Southern parts of Britain use a different sound for the first element of the diphthong in these words which we will symbolize with [ə], an upside down letter e. We will discuss this sound more fully in a later section. The final element of the diphthong in words such as "hoe, code" is somewhat similar to the vowel [ʊ] in "hood."

An upside down letter v, [ʌ] is used for the vowel in words such as "bud, hut." This symbol is sometimes referred to by the name *wedge*.

Another symbol, [ɜ], a reversed form of the Greek letter epsilon, is used for the sound in "pert, bird, curt," as pronounced by most speakers of British English and those speakers of American English who do not have an [ɹ] in these words. In most forms of American English, the r is fully combined with the vowel, and the symbol [ɝ] is used. The little hook [ˎ] indicates the r-coloring of the vowel.

The next three words in Table 2.2 contain diphthongs composed of elements that have been discussed already. The vowel in "hide" [haɪd] begins

with a sound between that of the vowel in "cat" [kæt] and that in "hard" [had] or [haɹd], and moves towards the vowel [ɪ] as in "hid" [hɪd]. The symbol [a] is used for the first part of this diphthong. The vowel in "how" [aʊ] begins with a similar sound but moves towards [ʊ] as in "hood." The vowel in "boy" [bɔɪ] is a combination of the sound [ɔ] as in "bawd" and [ɪ] as in "hid."

Most Americans pronounce the remaining words in Table 2.2 with one of the other vowels followed by [ɪ], while most British English speakers have additional diphthongs in these words. In each case, the end of the diphthong is [ə], the same symbol as we used for the beginning of the diphthong in "hoe" for most British English speakers. We will discuss this symbol further in the next paragraph. Some British English speakers also use a diphthong in words like "poor, cure" that can be transcribed as [ʊə]. Some people (myself included) have a diphthong [aə] in words such as "fire, hire." Others pronounce these words as two syllables (like "higher" and "liar"), transcribing them as [faɪə, haɪə].

The words in Table 2.2 are generally monosyllables. Consequently, none of them contains both stressed and unstressed vowels. By far the most common unstressed vowel is [ə], the one we noted at the end of the diphthongs in most forms of British English. It is often called by its German name, *schwa*. It occurs at the ends of words such as "sofa, soda" ['soʊfə, 'soʊdə], in the middle of words such as "emphasis, deprecate" ['ɛmfəsɪs, 'dɛpɹəkeɪt], and at the beginnings of words such as "around, arise" [ə'ɹaʊnd, ə'ɹaɪz]. (In all these words, the symbol ['] is a stress mark that has been placed before the syllable carrying the main stress. Stress should always be marked in words of more than one syllable.)

In British English, [ə] is usually the sole component of the "-er" part of words such as "father, brotherhood, simpler" ['faðə, 'bɹʌðəhʊd, 'sɪmplə]. In forms of American English with r-colored vowels, these words are usually ['faðɚ, 'bɹʌðɚhʊd, 'sɪmplɚ]. As with the symbol [ɝ], the small hook on [ɚ] symbolizes the r-coloring. Both [ə] and [ɚ] are very common vowels, [ə] occurring very frequently in unstressed monosyllables such as the grammatical function words "the, a, to, and, but." In connected speech these words are usually [ðə, ə, tə, ənd, bət].

Some of the other vowels also occur in unstressed syllables, but because of the varieties of English, it is a little more difficult to say which vowel occurs in which word. For example, nearly all speakers of English differentiate between the last vowels in "Sophie" and "sofa" or "pity" and "patter." But some dialects have the vowel [i] as in "heed" at the end of "Sophie, pity, only, corny." Others have [ɪ] as in "hid." Similarly, most dialects make the vowel in the second syllable of "taxis" different from that in "Texas." Some have [i] and some have [ɪ] in "taxis." Nearly everybody pronounces "Texas" as ['tɛksəs]. (Note that in English the letter x often represents the sounds [ks].)

Exercises

Find the errors in the transcription of the consonant sounds in the following words. In each word there is one error, indicating an impossible pronunciation of that word for a native speaker of English of any variety. Circle this error, and write the correct symbol in the space provided after the word.

1. "strength"	[ˈstɹɛngθ]	should be	[	]
2. "crime"	[ˈcɹaɪm]		[	]
3. "wishing"	[ˈwɪshɪŋ]		[	]
4. "wives"	[ˈwaɪvs]		[	]
5. "these"	[ˈθiz]		[	]
6. "hijacking"	[ˈhaɪjækɪŋ]		[	]
7. "yelling"	[ˈjɛllɪŋ]		[	]
8. "chipping"	[ˈtʃɪppɪŋ]		[	]
9. "sixty"	[ˈsɪxti]		[	]
10. "thesis"	[ˈðisɪs]		[	]

Now try another ten words in which the errors are all in the vowels. Again, there is only one possible error; but because of differences in varieties of English, there are sometimes alternative possible corrections.

11. "man-made"	[ˈmanmeɪd]	should be	[	]
12. "football"	[ˈfʊtbol]		[	]
13. "tea chest"	[ˈtitʃest]		[	]
14. "tomcat"	[ˈtomkæt]		[	]
15. "tiptoe"	[ˈtiptoʊ]		[	]
16. "avoid"	[æˈvɔɪd]		[	]
17. "remain"	[ɹəˈman]		[	]
18. "roommate"	[ˈɹɔmmeɪt]		[	]
19. "umbrella"	[umˈbɹɛlə]		[	]
20. "manage"	[ˈmænædʒ]		[	]

Now correct the following words, again by circling the error and noting the correction. There is still only one per word, but it may be among the vowels, the consonants, or the stress marks.

21. "magnify"	[ˈmægnifaɪ]	should be	[	]
22. "traffic"	[ˈtɹæfɪc]		[	]

23. "simplistic"   ['sɪmplɪstɪk]   [   ]
24. "irrigate"   ['ɪɹɪgeɪt]   [   ]
25. "improvement"   [ɪm'pɹʊvmənt]   [   ]
26. "demonstrate"   ['dɛmɑnstɹeɪt]   [   ]
27. "human being"   [humən 'biɳ]   [   ]
28. "appreciate"   [ə'pɹeʃieɪt]   [   ]
29. "joyful"   ['dʒɔyfʊl]   [   ]

Finally, transcribe the following words or phrases as you pronounce them. Give a rough label for your accent (e.g., Southern Californian, New York, London, Scottish), and try to make the transcription illustrate your ordinary conversational style. Do not use a reading pronunciation or one that you think you ought to use. Say the words aloud and listen to what you normally do. Be careful to put in stress marks at the proper places.

accent _____

30. chocolate pudding

31. modern languages

32. impossibility

33. boisterous

34. youngster

35. another

36. diabolical

37. nearly over

38. red riding hood

39. inexcusable

Consonant and Vowel Charts

So far we have been using the consonant and vowel symbols mainly as ways of representing the contrasts that occur among words in English. But they can also be thought of in a completely different way. We may regard them as shorthand descriptions of the articulations involved. Thus [p] is an abbreviation for "voiceless bilabial stop" and [l] is equivalent to "voiced alveolar lateral approximant." The consonant symbols can then be arranged in the form of a chart as in Figure 2.1. The places of articulation are shown across the top of the chart, starting from the most forward articulation (bilabial) and going toward those sounds made in the back of the mouth (velar). The manners of articulation are shown on the vertical axis of the chart. By convention, the voiced-voiceless distinction is shown by putting the voiceless symbols to the left of the voiced symbols.

The symbol [w] is shown in two places in the consonant chart in Figure 2.1. This is because it is articulated with both a narrowing of the lip aperture, which makes it bilabial, and a raising of the back of the tongue toward the soft palate, which makes it velar. The symbol [h] does not appear anywhere on the chart. In English, [h] acts like a consonant, but from an articulatory point of view it is the voiceless counterpart of the sur-

Place of articulation

Manner of articulation	bilabial	labio-dental	dental	alveolar	palato-alveolar	palatal	velar
nasal (stop)	m			n			ŋ
stop	p b			t d	ʧ		k g
fricative		f v	θ ð	s z	ʃ ʒ		
(central) approximant	(w)			ɹ		j	w
lateral (approximant)				l			

Figure 2.1 *A phonetic chart of the English consonants we have dealt with so far. Whenever there are two symbols within a single cell, the one on the left represents a voiceless sound. All other symbols represent voiced sounds. Note also the consonant* [h], *which is not on this chart, and the affricates* [tʃ, dʒ], *which are sequences of symbols on the chart.*
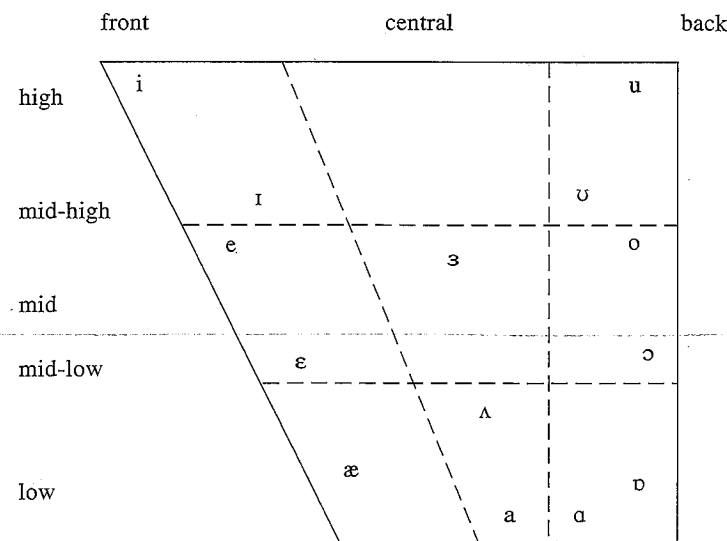
Figure 2.2 *A vowel chart showing the relative vowel qualities represented by some of the symbols used in transcribing English. The symbols [e, a, o] occur as the first elements of diphthongs.*

rounding sounds. It does not have a precise place of articulation, and its manner of articulation is similar to that of the vowels before and after it.

The symbols we have been using for the contrasting vowels may also be regarded as shorthand descriptions for different vowel qualities. There are problems in this respect, in that we have been using these symbols somewhat loosely, allowing them to have different values for different dialects. But the general values can be indicated by a vowel chart as in Figure 2.2. The symbols have been placed within a quadrilateral, which shows the range of possible vowel qualities. Thus [i] is used for a high front vowel, [u] for a high back one, [ɪ] for a lower high front vowel, [e] for a raised mid-front vowel, [ɛ] for a lowered mid-front vowel, and so on.

The simple vowel chart in Figure 2.2 shows only two of the dimensions of vowel quality, and (as we will see in later chapters) even these are not represented very accurately. Furthermore, Figure 2.2 does not show anything about the variations in the degree of lip rounding in the different vowels, nor does it indicate anything about vowel length. It does not show, for example, that in most circumstances [i] and [u] are longer than [ɪ] and [ʊ].

Phonology

There is another reason why it is only approximately true that in our transcriptions of English the symbols have the values shown in Figures 2.1

and 2.2. In the style of transcription we have been using so far, some of the symbols may represent different sounds when they occur in different contexts. For example, the symbol [t] may represent a wide variety of sounds. In "tap" [tæp] it represents a voiceless alveolar stop. But the [t] in "eighth" [eɪtθ] may be made on the teeth, because of the influence of the following voiceless dental fricative [θ]. This [t] is more accurately called a voiceless dental stop, and we will later use a special symbol for transcribing it. In my form of British English and in many forms of American English, the [t] in "bitten" is accompanied by a glottal stop, and we will later be using a special symbol for this sound. For most Americans, the [t] in "catty" ['kæti] symbolizes a voiced, not a voiceless, sound.

Similarly, other symbols represent different sounds in different contexts. The symbols [l] and [ɹ] normally stand for voiced approximants. But in words such as "ply" [plaɪ] and "try" [tɹaɪ] they represent voiceless sounds. Vowel sounds may also vary. The [i] in "heed" [hid] is usually very different from the [i] in "heel" [hil]

Many of the variations we have been discussing can be described in terms of simple statements about regular sound patterns. Statements of this kind may be considered rules. In most forms of American English, for example, it is a rule that [t] becomes voiced not only in "catty," but on all occasions when it occurs immediately after a stressed vowel and before an unstressed vowel (for example, in "bitty, matter, utter," etc.). In English of nearly all kinds, it is also a rule that whenever [t] occurs before a dental fricative, it is pronounced as a dental stop, so that we may use the special symbol [t̪]. The same is true of [d], as in "width" [wɪd̪ð], [n], as in "tenth" [tɛn̪θ], and [l], as in "wealth" [wɛl̪θ]. In all these cases, the mark [ˌ] may be added under the symbol in order to indicate that it represents a dental articulation.

Variations in words that can be described in terms of rules are called **alternations**. There are many rule-governed alternations in English. For example, there are rules that will account for variations in the placement of stress or for alternations in vowel quality. Consider the ways in which the second letter *e* is pronounced in "serene" [sə'ɹin], "serenity" [sə'ɹɛn-], and "serendipitous" ['sɛɹən-]. In the first word it is [i], in the second [ɛ], and in the third [ə]. (I have not transcribed the last parts of the second and third words because there are dialect differences. Think how you would transcribe each of these words.) Note that similar variations occur for the *e* in "convene, convention," and "invention, inventory."

We can consider words such as "melody, melodic, melodious" to consist of a constant stem "melod-" followed by various affixes. When we describe the sound patterns that occur in English, we want to be able to say that in some sense there are always the same underlying sounds in both the stems and the affixes. But these underlying sounds may change when the stems and affixes are put together to form words and sentences. The

phonology of a language is the set of rules that describe the changes in the underlying sounds when they occur in speech. The underlying sounds are the abstract units called phonemes, described at the beginning of this chapter.

When we transcribe a word in a way that shows none of the details of the pronunciation that are predictable by phonological rules, we are making a phonological transcription. The phonemic segments are usually placed between slanting lines. Thus we may say that the underlying phonemic segments in "ten" and "tenth" are /tɛn/ and /tɛnθ/. But the phonetic segments that are actually pronounced are [tɛn] and [tɛn̪θ].

The variants of the phonemes that occur in detailed phonetic transcriptions are known as **allophones**. They are generated as a result of applying the phonological rules to the segments in the underlying forms of words. We have already discussed some of the rules that generate different allophones of the segment /t/. For example, we know that in most varieties of American English, /t/ has a voiced allophone when it occurs between a stressed vowel and an unstressed vowel.

The transcription used in the first part of this chapter is not, strictly speaking, a phonological transcription. The symbols in Tables 2.1 and 2.2 distinguish all the oppositions that occur in actual pronunciations of English words. But these are not the underlying segments. There are several ways in which we could change our notational system into a more abstract one that uses a simpler set of symbols.

One way would be to show the differences in length between pairs of vowels. Our present transcription indicates the difference in quality in the vowels in a pair or words such as "bead, bid" [bid, bɪd] or "fool, full" [ful, fʊl], or "laid, led" [leɪd, lɛd]. But it is also a fact that the vowel in the first word of each pair is longer than the vowel in the second: [i] is longer than [ɪ], [u] than [ʊ], and [eɪ] than [ɛ]. We have presumed that the symbols that indicate differences in quality also indicate differences in length. But we could use the symbol [ː] to indicate greater length and then redefine the phonetic values of the vowel symbols. The symbol [i] can be said to have the value appropriate for the vowel in "bead" when it occurs before a length mark as in [biːd]. But it has the value appropriate for the vowel in "bid" when it occurs without a length mark, which would then be transcribed as [bid]. Remember that there is nothing sacred about the phonetic value of a symbol. Some phoneticians transcribe "bead, bid" as [bid, bɪd] as I have done in this book, while others transcribe these same words as [biːd, bid]. Using the same principle, they might transcribe "cooed, could" not as [kud, kʊd], as we do, but as [kuːd, kud]. Finally, "laid, led" would not be [leɪd, lɛd], but [leːd, led]. In this style of transcription, the differences in quality are treated as if they depended on the differences in length. The symbols /i/ and /u/ would be said to represent higher vowels when long, and the symbol /e/ would be said to represent a diphthong in these circumstances. This style of transcription uses an additional symbol for

length, but it more than compensates for that by eliminating the vowel symbols [ɪ, ɛ, ʊ].

Another way to reduce the number of vowel symbols would be to regard some other combinations of vowels as pairs. It can be shown that there are rules governing the alternations in vowel quality that occur in "line, linear; sign, signal; mine, mineral." In each of these pairs /aɪ/ occurs in the first word and /ɪ/ in the second. Similar rules govern the alternations between /i/ and /ɛ/, as in "sleep, slept," /eɪ/ and /æ/ as in "mania, manic," /oʊ/ and /ɑ/ as in "tone, tonic," and /ju/ and /ʌ/, as in "punitive, punish." It would be possible to devise a transcription based on differences of this kind instead of differences in length. The English spelling system does this to some extent. Beginning readers are often taught that each of the letters *a, e, i, o, u* has two values, exemplified by words such as "made, mad; Pete, pet; hide, hid; robe, rob; cute, cut." Thus the English spelling system is not as nonphonemic as at first it might appear.

We can now see why there are various possible ways of transcribing a language. Even if we consider only one particular dialect of the language, it might be appropriate in some cases to symbolize one aspect of a contrast, such as the length, and in other cases to symbolize another, such as the quality. In addition, we may choose to make a transcription that shows only the underlying phonemes, or we may choose to represent some allophonic differences. Even if we are representing only the underlying phonemes in a particular dialect of English, we may do so using only simple symbols, such as [r], or more unusual symbols, such as [ɹ], which convey more specific information on the phonetic quality. The term **broad transcription** is often used to designate a transcription that uses a simple set of symbols. Conversely, a **narrow transcription** is one that shows more phonetic detail, either just by using more specific symbols or by also representing some allophonic differences. The use of **diacritics**, small marks that can be added to a symbol to modify its value, is a means of increasing precision. One such diacritic is a small circle, [̥], that can be placed under a symbol to make it represent a voiceless sound, so that "ply" and "try," for instance, can be written [pl̥aɪ] and [tɹ̥aɪ]. Another useful diacritic is the mark [̪] beneath a consonant. This indicates that the sound is dental and not alveolar. We used it to transcribe the example near the beginning of this section, "eighth," more accurately as [eɪt̪θ].

Every transcription should be considered as having two aspects, one of which is often not explicit. There is the text itself, and at least implicitly, there is a set of conventions for interpreting the text. These conventions are usually of two kinds. First, there are the conventions that ascribe general phonetic values to the symbols. It was with these conventions in mind that I said earlier that a symbol could be regarded as an approximate specification of the articulations involved. In the second, there are the rules that specify the allophones that occur in different circumstances. Thus when I

transcribe the word "peels" as [pilz], I am assuming that the reader knows a number of the rules of English, including those that make /i/ somewhat lower and more central when it occurs before /l/ and a final /z/ voiceless toward the end.

On a few occasions, a transcription cannot be said to imply the existence of rules accounting for allophones. This is at least theoretically possible in the case of a narrow transcription so detailed that it shows *all* the rule-governed alternations among the sounds. A transcription that shows the allophones in this way is called a completely **systematic phonetic transcription**. In practice, it is difficult to make a transcription so narrow that it shows every detail of the sounds involved. On some occasions, a transcription may not imply the existence of rules accounting for allophones because, in the circumstances when the transcription was made, nothing was known about the rules. When writing down an unknown language or when transcribing a child or a patient not seen previously, one does not know what rules will apply. In these circumstances, the symbols indicate only the phonetic value of the sounds. This kind of transcription is called an **impressionistic transcription**.

Features

Another way of describing the sounds of English is by specifying the **features** of which they are composed. We may regard a feature as a phonetic property that can be used to classify sounds. A set of features that can be used for classifying the sounds of English is given in Table 2.3. In each case, the name of the feature is given first, and then the classificatory possibilities are shown. Thus the first feature is called Voice, and all English segments may be classified as being [+ voice] or [− voice]. When a feature can be used to classify sounds in terms of two possibilities in this way, it is said to be a **binary feature**. I will follow the practice of using a capital letter when naming a feature, and putting square brackets around the values of a feature used for classifying or describing a sound.

The next step in classifying English sounds is to specify the place of articulation. There are three major possibilities: Labial, Coronal, and Dorsal. The first of these requires no further subdivision. When we are simply classifying sounds in terms of phonological oppositions, we do not need to distinguish between labial and labiodental sounds; they can all be regarded as simply Labial. Coronal sounds have to be further split into those that are made on or in front of the alveolar ridge, which are called [+ anterior], and those made behind the alveolar ridge, which are [− anterior]. Dorsal sounds involve the use of the back of the tongue, and, like Labial sounds, need no further differentiation in English.

The feature Stricture is a **multivalued** feature. It specifies three possibilities in English. In the category [stop] are all those sounds in which there

is a complete coming together of two articulators. In addition to the oral stops [p, t, k, b, d, g], the nasals also fall into this category. The sounds classified as [fricative] are those in which there is a slightly lesser degree of coming together of two articulators. All other sounds have an even lesser degree of approximation of two articulators and are classified as [approximant].

The features Nasal and Lateral are both binary features. The application of each of them to the classification of English segments needs no further comment for the moment.

Table 2.3

Some of the features required for classifying English segments.

Feature name	Classificatory possibilities	English segments
Voice	[+ voice]	b, d, g, m, n, v, ð, z, ʒ, ɹ, l, j (and all vowels)
	[− voice]	p, t, k, f, θ, s, ʃ
Labial	—	p, b, m, f, v
Coronal	[+ anterior]	θ, ð, t, d, n, s, z, l, ɹ
	[− anterior]	ʃ, ʒ, j (and front vowels)
Dorsal	—	k, g, w (and back vowels)
Stricture	[stop]	p, t, k, b, d, g, m, n
	[fricative]	f, θ, s, ʃ, v, ð, z, ʒ
	[approximant]	w, ɹ, l, j (and all vowels)
Nasal	[+ nasal]	m, n
	[− nasal]	(all other segments)
Lateral	[+ lateral]	l
	[− lateral]	(all other segments)
Sibilant	[+ sibilant]	s, ʃ, z, ʒ, (and č, ǰ)
	[− sibilant]	(all other segments)
Height	[maximum]	(all consonants except w, j)
	[4 height]	i, u, w, j
	[3 height]	e, ɪ, o, ʊ
	[2 height]	ɛ, ɔ
	[1 height]	æ, ɑ
Back	[+ back]	u, o, ʊ, ɔ, w, k, g
	[− back]	i, e, ɪ, ɛ, æ (and all other consonants)
Syllabic	[+ syllabic]	(all vowels)
	[− syllabic]	(all consonants, including w, j)

The feature Sibilant is different from the features we have been considering so far. It refers to an acoustic (as opposed to an articulatory) property of the sounds being classified. This feature specifies (roughly speaking) the amount of hissing noise in a sound. We will be discussing it in more detail

	Labial	Coronal		Dorsal	
		+ ant.	− ant.		
+ nasal	m	n		ŋ	
− sibilant					
− nasal	p b	t d		k g	stop
+ sibilant			č ǰ		
		s z	ʃ ʒ		fricative
− sibilant	f v	θ ð			fricative
− lateral	w	ɹ		j	
					approximant
+ lateral		l			

Figure 2.3 *A phonological chart illustrating some of the distinctive features of English consonants.*

later. It is needed here primarily to provide a way of distinguishing the denti-alveolar fricatives [s, z] (which are [+ sibilant]) from [θ, ð] (which are [− sibilant]). If the affricates [tʃ, dʒ] are considered to be single units [č ǰ] they may also be classified as [+ sibilant].

The next two features, Height and Back, are primarily concerned with the classification of vowels. In the analysis of English suggested here, vowels can be assigned any one of four vowel heights. Consonants are assigned maximum height values. Both vowels and consonants can be classified in terms of binary values of the feature Back in English.

The final feature in Table 2.3, Syllabic, separates vowels from consonants. It thus classifies [i] and [u] as being distinct from [j] and [w].

Given these features specifications, we can arrange the consonants of English in terms of a chart as shown in Figure 2.3. This chart shows the phonological properties of English segments—the way in which they can be grouped when classifying oppositions—rather than their general phonetic properties, which are given by the chart in Figure 2.1. When classifying sounds in terms of phonological features, we have to use at least three sides of the chart to show how the features divide the sounds into classes.

Exercises

A Which of the two transcriptions below is the narrower?
"Betty cried as she left in the red plane."
(a) [ˈbɛti ˈkraɪd əz ʃɪ ˈlɛft ɪn ðə ˈrɛd ˈpleɪn]
(b) [ˈbɛdi ˈkɹaɪd əz ʃɪ ˈlɛft ɪn̪ ðə ˈɹed ˈpl̥eɪn]

B State rules for converting the transcription in (a) into that in (b). Make your rules as general as possible, so that they cover not only this pair of transcriptions but also other similar sentences (for example, [t]→ [d] when it occurs after a stressed vowel and before an unstressed vowel).

C Read the following passages in phonetic transcription. Both passages use a fairly broad style of transcription, showing few allophones. The first represents a form of British English of the kind I speak myself. The second represents an American pronunciation typical of a Midwestern speaker. By this time you should be able to read transcriptions of different forms of English, although you may have difficulty in pronouncing each word exactly as it is represented. Nevertheless, read each passage several times and try to pronounce it as indicated. Take care to put the stresses on the correct syllables, and say the unstressed syllables with the vowels as shown. Note any differences between each transcription and your own pronunciation of the corresponding words.

British English
[ɪt ɪz ˈpɒsəbl tə træn'skraɪb fə'netɪklɪ ˈɛni ˈʌtrəns, ɪn ˈɛni ˈlæŋgwɪdʒ, ɪn ˈsɛvrəl ˈdɪfrənt ˈweɪz ˈɔl əv ðəm ˈjuzɪŋ ði ˈælfəbɛt ənd kən'vɛnʃnz əv ði ˈaɪ pi ˈeɪ, (ðə ˈseɪm ˈθɪŋ ɪz ˈpɒsəbl wɪð ˈməʊst ˈʌðə ɪntə'næʃənl fə'netɪk ˈælfəbɛts.) ə træn'skrɪpʃn wɪtʃ ɪz ˈmeɪd baɪ ˈjuzɪŋ ˈlɛtəz əv ðə ˈsɪmpləst ˈpɒsəbl ˈʃeɪps, ənd ɪn ðə ˈsɪmpləst ˈpɒsɪbl ˈnʌmbə, ɪz ˈkɔld ə ˈsɪmpl fəʊ'nimɪk træn'skrɪpʃn.]

American English
[ɪf ðə ˈnʌmbɚ əv ˈdɪfɪənt ˈlɛdɚz ɪz ˈmɔɪ ðən ðə ˈmɪnəməm æz də'faɪnd ə'bʌv ðə tɪæn'skrɪpʃn wɪl ˈnɑt bi ə fə'nimɪk, bəd ən ælə'fɑnɪk wʌn. ˈsʌm əv ðə ˈfoʊnimz, ˈðæd ɪz tə ˈseɪ, wɪl bɪ ɪepɪə'zɛntəd baɪ ˈmɔɪ ðən ˈwʌn ˈdɪfɪənt ˈsɪmbl. ɪn ˈʌðɚ ˈwɝ-dz ˈsɝ-tn ˈæləfoʊnz əv ˈsɝ-tn ˈfoʊnimz wɪl bɪ ˈsmɡld ˈaʊt fɚ ɪepɪəzɛn'teɪʃn ɪn ðə tɪæn'skrɪpʃn, ˈhɛns ðə ˈtɝ-m ælə'fɑnɪk.]

(Both the above passages are adapted from David Abercrombie, *English Phonetic Texts* [Salem, N.H.: Faber & Faber, 1964].)

D Transcribe the following phrases as you would say them yourself using (a) a fairly broad transcription, and (b) a narrower transcription.

accent_____

"Please come home."

(a)

(b)

"He is going by train."

(a)

(b)

"The angry American."

(a)

(b)

"His knowledge of the truth."

(a)

(b)

"I prefer sugar and cream."

(a)

(b)

"Sarah took pity on the young children."

(a)

(b)

Performance Exercises

As I said in the preface, it is extremely important to develop practical phonetic skills and at the same time learn the theoretical concepts. One way to do this is to learn to pronounce nonsense words. You should also transcribe nonsense words that are dictated to you. By using nonsense words you are forced to listen to the sounds that are being spoken. Accordingly, you should find another student to work with, so that you can do the following exercises in pairs.

A Learn to say simple nonsense words. A good way is to start with a single vowel, and then add consonants and vowels one by one at the beginning. In this way you are always reading toward familiar material, rather than having new difficulties ahead of you. Make up sets of words such as:

ɑː

zɑː

ɪˈzɑː

trˈzɑː

ˈætrˈzɑː

ˈmætrˈzɑː

ʌˈmætrˈzɑː

tʌˈmætrˈzɑː

B Choose an order in which to say the following "words" (for example, say the second word first, the fourth word next, and then the fifth, third, and first words). Write this order down as you dictate the words to your partner—whose task is, of course, to write down the order in which you have said them. Reverse roles and repeat the exercises. You may find it advisable to repeat each word twice.

spoken   heard

pⁱˈsuz

pⁱˈsus

pⁱˈzus

pⁱˈzuz

pⁱˈzuʒ

C Repeat this exercise with the following sets of words:

spoken	heard	spoken	heard
	tɑˈθɛð		ˈkipik
	tɑˈθɛθ		ˈkɪpik
	tɑˈðɛθ		ˈkipɪk
	tɑˈðɛð		ˈkɪpɪk
	tɑˈfɛð		ˈkɪpɪt

spoken	heard	spoken	heard
	ˈlæmæm		ˈmʌlʌl
	ˈlæmæn		ˈmʌɹʌl
	ˈlænæm		ˈmʌwʌl
	ˈlænæn		ˈnʌlʌl
	ˈlænæŋ		ˈnʌɹʌl

D Look at the following nonsense words, and either say these to your partner or (preferably, since your partner has seen these words, too) make up a set similar to them, and say these instead. Your words can differ from the sample set in as many sounds as you like. But I suggest that you should not make them much longer at first. You will also find it advisable to write down your words and practice saying them for some time by yourself, so that you can pronounce them fluently when you say them to your partner.

ˈskɑnzil
ˈbɹaɪgbluzd
ˈdʒɪŋsmæŋ
flɔɪʃˈθɹaɪðz
pjutˈpeɪtʃ

When you have finished saying each word several times and your partner has written the words down, compare notes. Try to decide whether any discrepancies were due to errors in saying the words or in hearing them. If possible, the speaker should try to illustrate discrepancies by pronouncing the word in both ways, saying, for example, "I said [ˈskɑnzil] but you wrote [ˈskɑnsil]."

There is no one best way of doing ear training work of this kind. I find it helpful to look carefully at a person pronouncing an unknown word, then try to say the word myself immediately afterwards, getting as much of it right as possible, but not worrying if I miss some things on first hearing. I then write down all that I can, leaving blanks to be filled in when I hear the word again. It seems important to me to get at least the number of syllables and the placement of the stress correct on first hearing, so that I have a framework in which to fit later observations.

Repeat this kind of production and perception exercise as often as you can. You should do a few minute's work of this kind every day, so that you spend at least an hour a week doing practical exercises.

3

The Consonants of English

This chapter will discuss the consonants of English and, at the same time, introduce some important general phonetic notions.

Stop Consonants

Consider the difference between the words in the first column in Table 3.1 and the corresponding words in the second column. This opposition may be said to be between the set of voiceless stop consonants and the set of voiced stop consonants. But the difference is really not just one of voicing during the consonant closure, as you can see by saying these words

Table 3.1

Words illustrating allophones of English stop consonants.

1	2	3	4	5
pie	buy	spy	nap	nab
tie	die	sty	mat	mad
kye	guy	sky	knack	nag