3

The Consonants of English

CD 3.1 We will begin this chapter by reviewing some of the gestures involved in producing the consonants of English. In the materials for this chapter on the CD, there are two movies. The first shows the pronunciation of consonants that have different places of articulation. The stops [p, t, k] are illustrated in the nonsense utterances [həpa, həta, həka]. These stops are said to be bilabial, alveolar, and velar. But it is not just the different places on the roof of the mouth that distinguish these sounds. They are equally characterized by the movements of the lips and different parts of the tongue. Look at the movie on the CD and note the rapid movements of the lips for the first consonant, of the tip of the tongue for the second, and of the back of the tongue for the third.

CD 3.2 The second movie on the CD shows different manners of articulation, illustrating the consonants [d, n, s] in the nonsense words [hədɛ, hənɛ, həsɛ]. Look at the movie and then go through it slowly. You can use the right arrow key, which is usually at the bottom right of the keyboard, to step through one frame at a time. In [hədɛ], note how, at the left of the picture, the soft palate rises to form a velic closure in the first few frames, even before the tip of the tongue moves up to form a closure on the alveolar ridge. Conversely, in [hənɛ], note that the soft palate moves up before the tongue moves, but this time only slightly. The soft palate does not make a complete closure and thus allows air to escape through the nose after the tongue tip has made a closure on the alveolar ridge for [n]. The third nonsense word in this movie, [həsɛ], has tongue and soft palate gestures very similar to those in [hədɛ]. The small differences in tongue shape are hard to see in this film, even when you step through it one frame at a time. But if you superimpose tracings of the articulators at the [d] and [s] midpoints, you will find that in the [s], the center of the tongue is slightly hollowed; the location of the constriction in [d] is slightly behind that for [s]. Also, during the [s], the teeth are closer together and slightly more forward than during the [d]. Much of the sound of [s] is produced by a jet of air striking the edges of the teeth. The rapidly moving airstream is formed by the narrow gap between the tongue and the alveolar ridge. These requirements of the [s] sound may explain why this speaker has slightly different tongue and jaw positions for [d] and [s].

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 yourself. Most people have very little voicing going on while the lips are closed during either *pie* or *buy*. Both stop consonants are essentially voiceless. But in *pie*, after the release of the lip closure, there is a moment of **aspiration**, a period of voicelessness after the stop articulation and before the start of the voicing for the vowel. If you put your hand in front of your lips while saying *pie*, you can feel the burst of air that comes out during the period of voicelessness after the release of the stop. CD 3.3

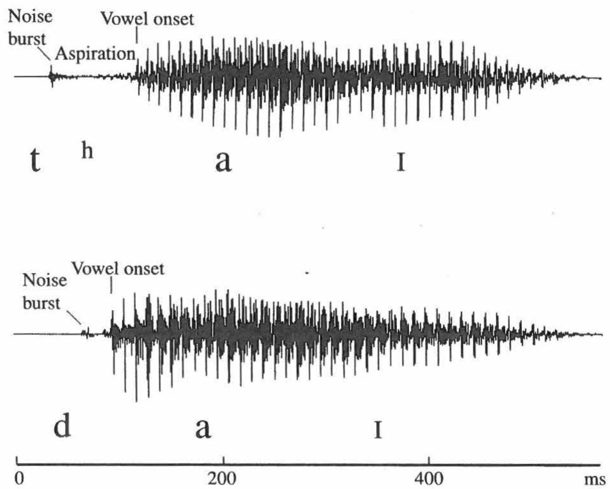
In a narrow transcription, aspiration may be indicated by a small raised *h*, [^{h}]. Accordingly, these words may be transcribed as [p^{h}aɪ, t^{h}aɪ, k^{h}aɪ]. You may not be able to feel the burst of air in *tie* and *kye* because these stop closures are made well inside the mouth cavity. But listen carefully and notice that you can hear the period of voicelessness after the release of the stop closure in each of the words. It is this interval that indicates that the stop is aspirated. The major difference between the words in the first two columns is not that one has voiceless stops and the other voiced stops. It is that the first column has (voiceless) aspirated stops and the second column has (perhaps voiced) unaspirated stops. The amount of voicing in each of the stops [b, d, g] depends on the context in which it occurs. When it is in the middle of a word or phrase in which a voiced sound occurs on either side (as in column 3 in Table 3.1), voicing usually occurs throughout the stop closure. But most speakers of English have no voicing during the closure of so-called voiced stops in sentence initial position, or when they occur after a voiceless sound as in *that boy*.

One of the main objects of this book is to teach you to become a phonetician by learning to listen very carefully. You should be able to hear these differences, but you can also see them in acoustic waveforms. Figure 3.1 is a record of the words *tie* and *die*. It is quite easy to see the different segments in the sound wave. In the first word, *tie*, there is a spike indicating the burst of noise that occurs when the stop closure is released, followed by a period of very small

TABLE 3.1 Words illustrating allophones of English stop consonants. CD 3.3

1	2	3	4	5	6
pie	buy	a buy	spy	nap	nab
tie	dye	a dye	sty	mat	mad
kye	guy	a sky	sky	knack	nag

Figure 3.1 The waveforms of the words *tie* and *die*.

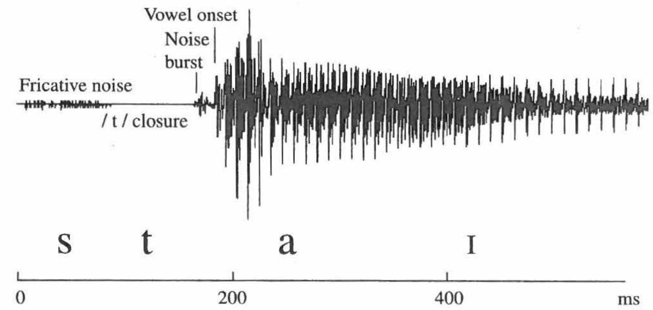


semi-random variations during the aspiration, and then a regular, repeating wave as the vocal folds begin to vibrate for the vowel. In *die*, the noise burst is smaller, and there is very little gap between the burst and the start of the wave for the vowel. As you can see, the major difference between *tie* and *die* is the increase in time between the release of the stop and the start of the vowel. We will discuss this distinction further in Chapter 6.

Now consider the words in the fourth column of Table 3.1. Are the sounds of the stop consonants more like those in the first column or those in the second? As in many cases, English spelling is misleading, and the sounds are in fact more like those in the second column. There is no opposition in English between words beginning with / sp / and / sb /, or / st / and / sd /, or / sk / and / sg /. English spelling has words beginning with *sp*, *st*, *sc*, or *sk*, and none that begin with *sb*, *sd*, or *sg*, but the stops that occur after / s / are really somewhere between initial / p / and / b /, / t / and / d /, / k / and / g /, and usually more like the so-called voiced stops / b, d, g / in that they are completely unaspirated. Figure 3.2 shows the acoustic waveform in *sty*. You can see the small variations in the waveform corresponding to the fricative / s /, followed by a straight line during the period in which there is no sound because there is a complete stop for the / t /. This is followed by a sound wave very similar to that of the / d / in Figure 3.1.

If you have access to a computer that can record sounds and let you see the waveforms of words, you can verify this for yourself. (The freeware program WaveSurfer, included on the CD, will let you do this.) Record words such as *spy*, *sty*, *sky*, *spill*, *still*, *skill*, each said as a separate word. Now find the beginning and end of each / s /, and cut this part out. When you play the edited

Figure 3.2 The waveform of the word *sty*.



recordings to others and ask them to write down the words they hear, they will almost certainly write *buy*, *die*, *guy*, *bill*, *dill*, *gill*.

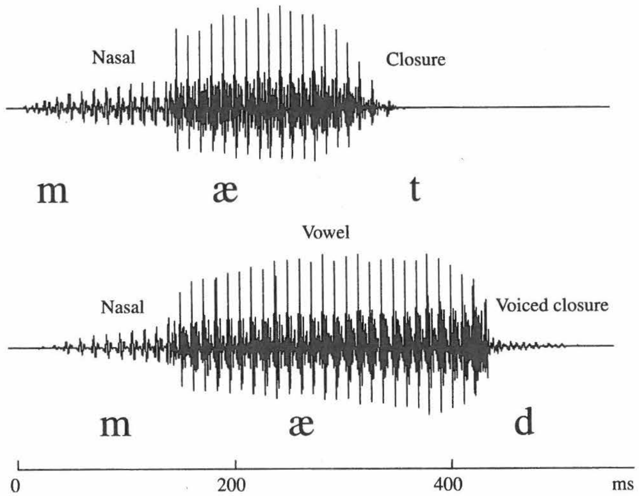
What about the differences between the words in the fifth and sixth columns? The consonants at the end of *nap*, *mat*, *knack* are certainly voiceless. But if you listen carefully to the sounds at the end of the words *nab*, *mad*, *nag*, you may find that the so-called voiced consonants / b, d, g / have very little voicing and might also be called voiceless. Try saying these words separately. You can, of course, say each of them with the final consonant released with a noise burst and a short vowel-like sound afterward. But it would be more normal to say each of them without releasing the final consonants, or at least without anything like a vowel. You could even say *cab* and not open your lips for a considerable period of time if it were the last word of an utterance. In such circumstances, it is quite clear that the final consonants are not fully voiced throughout the closure.

There is, however, a clear distinction between the words in the fifth and sixth columns. Say these words in pairs—*nap, nab; mat, mad; knack, nag*—and try to decide which has the longer vowel. In these pairs, and in all similar pairs—such as *cap, cab; cat, cad; back, bag*—the vowel is much shorter before the voiceless consonants / p, t, k / than it is before the voiced consonants / b, d, g /. The major difference between such pairs of words is in the vowel length, not in the voicing of the final consonants.

You can hear that both speakers on the CD also distinguish these words by vowel length. In these recordings, each of the speakers said the words *nap*, *nab*; *mat*, *mad*; *knack*, *nag* in the same phonetic context, *I'll say* ___ *again*. By saying each word in a separate sentence, it's easier to give each of them the same stress and intonation, and thus avoid the influence of these factors on the length of a word. CD 3.4

This length difference is very evident in Figure 3.3, which shows the waveforms of the words *mat* and *mad*. In this occasion, the vowel in *mad* is almost twice as long as the vowel in *mat*. You can see small voicing vibrations during

Figure 3.3 The waveforms of the words *mat* and *mad*.



the / d / in *mad*, but there is nothing noteworthy at the end of *mat* except the slightly irregular voicing at the time of the closure. We will return to this point later in this section.

Try comparing the length differences in short sentences such as *Take a cap now* and *Take a cab now*. If you say these sentences with a regular rhythm, you will find that the length of time between *Take* and *now* is about the same in both. This is because the whole word *cap* is only slightly shorter than the whole word *cab*. The vowel is much shorter in *cap* than in *cab*. But the consonant / p / makes up for this by being slightly longer than the consonant / b /. It is a general rule of English (and of most other languages) that syllable final voiceless consonants are longer than the corresponding voiced consonants after the same vowel.

The phrases *Take a cap now* and *Take a cab now* also illustrate a further point about English stop consonants at the end of a word (or, in fact, at the end of a stressed syllable). Say each of these phrases without a pause before *now*. Do your lips open before the [n] of *now* begins, or do they open during the [n]? If they open before the [n], there will be a short burst of aspiration or a short vowel-like sound between the two words. Releasing the stops produces a somewhat unnatural pronunciation. Generally, final stops are unreleased when the next word begins with a nasal. The same is true if the next word begins with a stop. The final [t] in *cat* is nearly always unexploded in phrases like *the cat pushed*. In a narrow transcription, we can symbolize the fact that a consonant is unreleased by adding a small raised mark [˺], which stands for "no audible release." We could therefore transcribe the phrase as [ðə ˈkʰæt˺ ˈpʰʊʃt].

CD 3.5

The same phenomenon occurs even within a word such as *apt* [æp˺t] or *act* [æk˺t]. Furthermore, across a word boundary, the two consonants involved can even be identical, as in the phrase *white teeth*. To convince yourself that there are two examples of / t / in this phrase, try contrasting it with *why teeth*. Not only is the vowel in *white* much shorter than the vowel in *why* (because the vowel in *white* is in a syllable with a voiceless consonant at the end), but also the stop closure in *white teeth* is much longer than the stop in the phrase with only one / t /. In *white teeth*, there really are two examples of / t / involved, the first of which is unreleased.

Other languages do not have this rule. For example, it is a mark of speakers with an Italian accent (at least as caricatured in films and on television) that they release all their final stop consonants, producing an extra vowel at the end, as they normally would in their own language. Authors trying to indicate an Italian speaking English will write the sentence *It's a big day* as *It's a bigga day*. They are presumably trying to indicate the difference between the normal [ɪts ə ˈbɪg˺ ˈdeɪ] and the foreign accent [ɪts ə ˈbɪgᵊ ˈdeɪ].

It is interesting that words such as *rap*, *rat*, *rack* are all distinguishable, even when the final consonants are unreleased. The difference in the sounds must therefore be in the way that the vowels end—after all, the rest is silence. The consonants before and after a vowel always affect it, so there is a slight but noticeable difference in its quality. Compare your pronunciation of words such as *pip*, *tit*, *kick*. Your tongue tip is up throughout the word *tit*, whereas in *pip* and *kick* it stays behind the lower front teeth. In *kick*, it is the back of the tongue that is raised throughout the word, and in *pip*, the lip gestures affect the entire vowel. The same is true for words with voiced consonants, such as *bib*, *did*, *gig*. The consonant gestures are superimposed on the vowel in such a way that their effect is audible throughout much of the syllable.

The sounds [p, t, k] are not the only voiceless stops that occur in English. Many people also pronounce a glottal stop in some words. A glottal stop is the sound (or, to be more exact, the lack of sound) that occurs when the vocal folds are held tightly together. As we have seen, the symbol for a glottal stop is [ʔ], resembling a question mark without the dot.

Glottal stops occur whenever one coughs. You should be able to get the sensation of the vocal folds being pressed together by making small coughing noises. Next, take a deep breath and hold it with your mouth open. Listen to the small plosive sound that occurs when you let the breath go. Now, while breathing out through your mouth, try to check and then release the breath by making and releasing a short glottal stop. Then do the same while making a voiced sound such as the vowel [ɑ]. Practice producing glottal stops between vowels, saying [ɑʔɑ] or [iʔi], so that you get to know what they feel like.

One of the most common occurrences of a glottal stop is in the utterance meaning *no*, often spelled *uh-uh*. If someone asks you a question, you can reply *no* by saying [ˈʔʌʔʌ] (usually with a nasalized vowel, which we will symbolize later). Note that there is a contrast between the utterance meaning *no* and that meaning *yes* that is dependent on the presence of the glottal stop. If you had meant to say *yes*, you might well have said [ˈʌhʌ]. We can tell that it is the glottal stop that is important in conveying the meaning by the fact that one could be understood equally well by using a syllabic consonant (shown by putting the mark [̩] under the consonant) instead of a vowel, and saying [ˈm̩hm̩] for *yes* and [ˈʔm̩ʔm̩] for *no*. As long as there is a glottal stop between the two syllables, the utterance will mean *no*, irrespective of what vowel or nasal is used.

Glottal stops frequently occur as allophones of / t /. Probably most Americans and many British speakers have a glottal stop followed by a syllabic nasal in words such as *beaten, kitten, fatten* [ˈbiʔn̩, ˈkɪʔn̩, ˈfæʔn̩]. London Cockney and many forms of Estuary English also have a glottal stop between vowels, as in *butter, kitty, fatter* [ˈbʌʔə, ˈkɪʔɪ, ˈfæʔə]. Many speakers in both Britain and America have a glottal stop just before final voiceless stops in words such as *rap, rat, rack*. Usually, the articulatory gesture for the other stop is still audible, so these words could be transcribed [ræʔ͡p, ræʔ͡t, ræʔ͡k]. When Peter Ladefoged recorded the word *mat* for Figure 3.3, he pronounced it as [mæʔ͡t], with the glottal stop and the closure for [t] occurring almost simultaneously.

Practice producing words with and without a glottal stop. After you have some awareness of what a glottal stop feels like, try saying the words *rap, rat, rack* in several different ways. Begin by saying them with a glottal stop and a final release [ræʔ͡pʰ, ræʔ͡tʰ, ræʔ͡kʰ]. Next, say them without a glottal stop and with the final stops unexploded [ræp˺, ræt˺, ræk˺]. Then, say them with a glottal stop and a final unexploded consonant [ræʔ͡p˺, ræʔ͡t˺, ræʔ͡k˺]. Finally, say them with a glottal stop and no other final consonant [ræʔ, ræʔ, ræʔ].

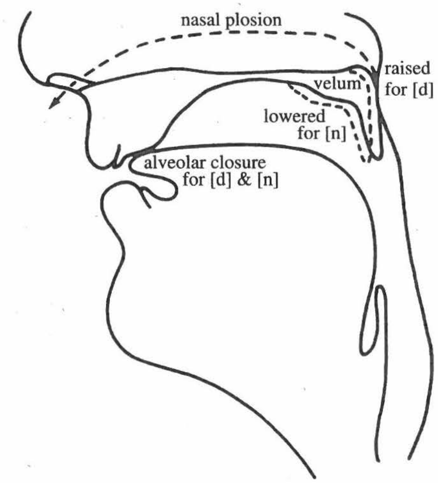
CD 3.6

When a voiced stop and a nasal occur in the same word, as in *hidden*, the stop is not released in the usual way. Both the [d] and the [n] are alveolar consonants. The tongue comes up and contacts the alveolar ridge for [d] and stays there for the nasal, which becomes syllabic [ˈhɪdn̩]. Consequently, as shown in Figure 3.4, the air pressure built up behind the stop closure is released through the nose by the lowering of the soft palate (the velum) for the nasal consonant. This phenomenon, known as **nasal plosion**, is normally used in pronouncing words such as *sadden, sudden, leaden* [ˈsædn̩, ˈsʌdn̩, ˈlɛdn̩]. It is considered a mark of a foreign accent to add a vowel [ˈsædən, ˈsʌdən, ˈlɛdən]. Nasal plosion also occurs in the pronunciation of words with [t] followed by [n], as in *kitten* [ˈkɪtn̩], for those people who do not have a glottal stop instead of the [t], but the majority of speakers of English pronounce this word with a glottal stop [ˈkɪʔn̩].

CD 3.7

It is worth spending some time thinking exactly how you and others pronounce words such as *kitten* and *button*, in that it enables you to practice making detailed phonetic observations. There are a number of different possibilities. Most British and American English speakers make a glottal stop at the end of the vowel, before making an alveolar closure. Then, while still maintaining the glottal stop, they lower the velum and raise the tongue for the alveolar closure. But which comes first? If they lower the velum before making the alveolar closure, there is only [ʔn] and no [t]. If they make the alveolar closure first, we could

Figure 3.4 Nasal plosion.



say that there is [ʔtn], but there would not be any nasal plosion, as there would be no pressure built up behind the [t] closure. Nasal plosion occurs only if there is no glottal stop, or if the glottal stop is released after the alveolar closure has been made and before the velum is lowered.

These are fairly difficult sequences to determine, but there are some simple things you can do to help you find out what articulations you use. First of all, find a drinking straw and something to drink. Put one end of the straw between your lips and hold the other end just (and only just) below the surface of the liquid. Now say [ɑpɑ], and note how bubbles form during [p]. This is because pressure is built up behind your closed lips. Now push the straw slightly farther into your mouth and say [ɑtɑ]. It will not sound quite right because the straw gets in the way of your tongue when it makes the alveolar closure. You may have to try different positions of the straw. Go on until you can see bubbles coming out, and convince yourself that pressure builds up behind the [t]. Now try saying *button*. Of course there will be bubbles during the [b], but are there any at the end of the word, or do you have a glottal stop and no [t] behind which pressure builds up?

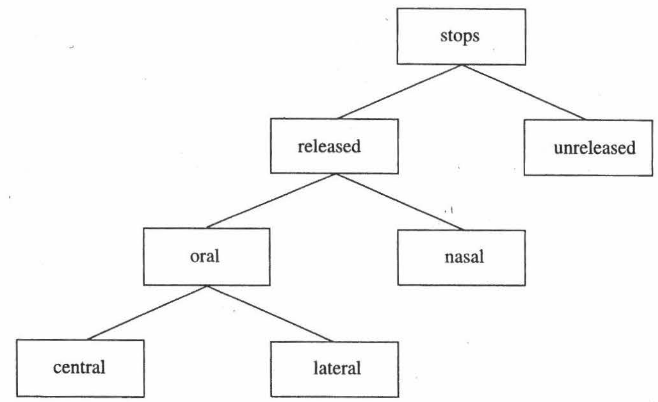
When two sounds have the same place of articulation, they are said to be **homorganic**. Thus, the consonants [d] and [n], which are both articulated on the alveolar ridge, are homorganic. For nasal plosion to occur within a word, there must be a stop followed by a homorganic nasal. Only in these circumstances can there be pressure first built up in the mouth during the stop and then released through the nose by lowering the soft palate. Many forms of English do not have any words with a bilabial stop [p] or [b] followed by the homorganic nasal

CD 3.8 [m] at the end of the word. Nor in most forms of English are there any words in which the velar stops [k] or [g] are normally followed by the velar nasal [ŋ]. Consequently, both bilabial and velar nasal plosion are less common than alveolar nasal plosion in English. But when talking in a rapid conversational style, many people pronounce the word *open* as ['oʊpm̩], particularly if the next word begins with [m], as in *open my door, please*. Quite frequently, when counting, people will pronounce *seven* as ['sɛbm̩], and *something, captain, bacon* are sometimes pronounced ['sʌmpm̩ 'kæpm̩, 'beɪkŋ̍]. You should try to pronounce all these words in these ways yourself.

A phenomenon similar to nasal plosion may take place when an alveolar stop [t] or [d] occurs before a homorganic lateral [l], as in *little, ladle* ['ˀlɪtl̩, 'leɪdl̩]. The air pressure built up during the stop can be released by lowering the sides of the tongue; this effect is called **lateral plosion**. Say the word *middle* and note the action of the tongue. Many people (particularly British speakers) maintain the tongue contact on the alveolar ridge through both the stop and the lateral, releasing it only at the end of the word. Others (most Americans) pronounce a very short vowel in the second syllable. For those who have lateral plosion, no vowel sound occurs in the second syllables of *little, ladle*. The final consonants in all these words are syllabic. There may also be lateral plosion in words such as *Atlantic*, in which the [t] may be resyllabified so that it is at the beginning of the stressed (second) syllable. We should also note that most Americans, irrespective of whether they have lateral plosion, do not have a voiceless stop in *little*. There is a general rule in American English that whenever / t / occurs after a stressed vowel and before an unstressed syllable other than [n̩], it is changed into a voiced sound. For those Americans who have lateral plosion, this will be the stop [d].

This brings us to another important point about coronal stops and nasals. For many speakers, including most Americans, the consonant between the vowels in words such as *city, better, writer* is not really a stop but a quick tap in which the tongue tip is thrown against the alveolar ridge. This sound is written in the IPA with the symbol [ɾ] so that *city* can be transcribed as ['sɪɾi]. Many Americans also make this kind of tap when / d / occurs after a stressed vowel and before an unstressed vowel. As a result, they do not distinguish between pairs of words such as *latter* and *ladder*. But some maintain a distinction by having a shorter vowel in words such as *latter* that have a voiceless consonant in their underlying form. It is as if the statement that vowels are shorter before voiceless consonants had applied first, and then a later rule was applied changing [t]
CD 3.9 into [ɾ] when it occurred between a stressed and an unstressed syllable. Some dialects of North American English, particularly from central Canada, also distinguish between word pairs like *writer* and *rider* which are both said with a tap [ɾ] with an additional vowel quality difference that is redundant with the vowel length difference found in other dialects. So, where a Midwesterner in the U.S. would say [raɪɾɚ] and [raːɪɾɚ], with a length difference in the diphthong, in Canadian vowel "raising" we hear [rəɪɾɚ] and [raːɪɾɚ] with a short "schwa."

Figure 3.5 Stop consonant releases.



We can summarize the discussion of stop consonants by thinking of the possibilities there are in the form of a branching diagram, as shown in Figure 3.5. The first question to consider is whether the gesture for the stop is released (exploded) or not. If it is released, then is it oral plosion, or is the release due to the lowering of the velum, with air escaping through the nose, making it nasal plosion? If it is oral plosion, then is the closure in the mouth entirely removed, or is the articulation in the midline retained and one or both sides of the tongue lowered so that air escapes laterally? You should be able to produce words illustrating all these possibilities. For coronal stops, there is an additional point not shown in Figure 3.5; namely, is the [t] or [d] sound produced as a tap [ɾ]?

FRICATIVES

The fricatives of English vary less than the stop consonants, yet the major allo- CD 3.10
phonic variations that do occur are in many ways similar to those of the stops. Earlier we saw that when a vowel occurs before one of the voiceless stops / p, t, k /, it is shorter than it would be before one of the voiced stops / b, d, g /. The same kind of difference in vowel length occurs before voiceless and voiced fricatives. The vowel is shorter in the first word of each of the pairs *strife, strive* [straɪf, straɪv]; *teeth, teethe* [tiθ, tið]; *rice, rise* [raɪs, raɪz]; *mission, vision* ['mɪʃn̩, 'vɪʒn].

Stops and fricatives are the only English consonants that can be either voiced or voiceless. Consequently, we can revise our statement that vowels are shorter before voiceless stops than before voiced stops. Instead, we can say that vowels are shorter before all voiceless consonants than before all voiced consonants. In this way, we can capture a linguistically significant generalization that would have been missed if our statements about English had included two separate statements, one dealing with stops and the other dealing with fricatives.

We also saw that a voiceless stop at the end of a syllable (as in *hit*) is longer than the corresponding voiced stop (as in *hid*). Similarly, the voiceless fricatives are longer than their voiced counterparts in each of the pairs *safe, save* [seɪf, seɪv], *lace, laze* [leɪs, leɪz], and all the other pairs of words we have been discussing in this section. Again, because fricatives behave like stops, a linguistically significant generalization would have been missed if we had regarded each class of consonants completely separately.

Fricatives are also like stops in another way. Consider the degree of voicing that occurs in the fricative at the end of the word *ooze*, pronounced by itself. In most pronunciations, the voicing that occurs during the final [z] does not
CD 3.11 last throughout the articulation but changes in the last part to a voiceless sound like [s]. In general, voiced fricatives at the end of a word, as in *prove, smooth, choose, rouge* [pruv, smuð, tʃuz, ruʒ], are voiced throughout their articulation only when they are followed by another voiced sound. In a phrase such as *prove it*, the [v] is fully voiced because it is followed by a vowel. But in *prove two times two is four* or *try to improve*, where the [v] is followed by a voiceless sound [t] or by a pause at the end of the phrase, it is not fully voiced.

Briefly stated, then, fricatives are like stops in three ways. First, stops and fricatives influence vowel length in similar ways—vowels before voiceless stops or fricatives are shorter than before voiced stops or fricatives. Second, final voiceless stops and fricatives are longer than final voiced stops and fricatives. Third, the final stops and fricatives classified as voiced are not actually voiced throughout the articulation unless the adjacent sounds are also voiced. In addition, both these types of articulation involve an obstruction of the airstream. Because they have an articulatory feature in common and because they act together in phonological statements, we refer to fricatives and stops together as a natural class of sounds called **obstruents**.

However, fricatives do differ from stops in that they sometimes involve actions of the lips that are not immediately obvious. Try saying *fin, thin, sin, shin* [fɪn, θɪn, sɪn, ʃɪn]. There is clearly a lip action in the first word as it involves the labiodental sound [f]. But do your lips move in any of the other three words? Most people find that their lips move slightly in any word containing / s / (*sin, kiss*) and quite considerably in any word containing / ʃ / (*shin, quiche*), but that there is no lip action in words containing / θ / (*thin, teeth*). There is also lip movement in the voiced sounds corresponding to / s / and / ʃ /, namely / z / as in *zeal, zest* and / ʒ / in *leisure, treasure*, but none in / ð / as in *that, teethe*.

The primary articulatory gesture in these fricatives is the close approximation of two articulators so that friction can be heard. The lip rounding is a lesser articulation in that the two articulators (the lower lip and the upper lip) approach one another but not sufficiently to cause friction. A lesser degree of closure by two articulators not involved in the primary articulation is called a *secondary articulation*. This particular one, in which the action of the lips is added to another articulation, is called *labialization*. The English fricatives / ʃ, ʒ / are strongly labialized, and the fricatives / s, z / are slightly labialized.

AFFRICATES

This is a convenient place to review the status of affricates in English. An affricate is simply a sequence of a stop followed by a homorganic fricative. Some such sequences, for example the dental affricate [tθ] as in *eighth* or the alveolar affricate [ts] as in *cats*, have been given no special status in English phonology. They have been regarded just as consonant clusters comparable with those at the end of *lapse* and *sacks* (which are not affricates, as the stops and the fricatives are not homorganic). But, as we noted in the discussion of symbols for transcribing English, it is appropriate to regard the sequences [tʃ] and [dʒ] as different from other sequences of consonants. They are the only affricates in English that can occur at both the beginning and the end of words. In fact, even the other affricates that can occur at the end of words will usually do so only as the result of the formation of a plural or some other suffix, as in *eighth*. From the point of view of a phonologist considering the sound pattern of English, the palato-alveolar affricates are plainly single units, but [ts] as in *cats* is simply a sequence of two consonants. One way to convince yourself that the affricates [tʃ] and [dʒ] are phonetic sequences of stop followed by fricative is to record yourself saying *itch* and *badge* and then play them backwards (use the WaveSurfer "reverse" function to do this). The fricative stop sequence is usually pretty easy to hear in the backwards versions.

NASALS

The nasal consonants of English vary even less than the fricatives. Nasals, together with [r, l], can be syllabic when they occur at the end of words. As we have seen, the mark [̩] under a consonant indicates that it is syllabic. (Vowels, of course, are always syllabic and therefore need no special mark.) In a narrow transcription, we may transcribe the words *sadden, table* as [ˈsædn̩, ˈteɪbl̩]. In most pronunciations, *prism, prison* can be transcribed [ˈprɪzm̩, ˈprɪzn̩], as these words do not usually have a vowel between the last two consonants. Syllabic consonants can also occur in phrases such as *Jack and Kate* [ˈdʒæk ŋ̍ ˈkeɪt].

The nasal [ŋ] differs from the other nasals in a number of ways. No English word can begin with [ŋ]. This sound can occur only within or at the end of a word, and even in these circumstances it does not behave like the other nasals. It can be preceded only by the vowels / ɪ, ɛ, æ, ʌ / and / ɑ / (American English) or / ɒ / (British English), and it cannot be syllabic (except in slightly unusual pronunciations, such as *bacon* [ˈbeɪkŋ̍], and phrases such as *Jack and Kate* mentioned above).

One way to consider the different status of [ŋ] is that in the history of English, it was derived from a sequence of the phonemes / n / and / g /. Looking at it this way, *sing* was at an earlier time in history / sɪng /, and *sink* was / sɪnk /. There was then a sound change in which / n / became the new phoneme / ŋ / in those words where it occurred before / g / and / k /, turning / sɪng / into / sɪŋg / and / sɪnk / into / sɪŋk /. Another change resulted in the deletion of / g / (but not of / k /) whenever it occurred after / ŋ / at the end of either a word (as in *sing*) or a stem followed by a suffix such as *-er* or *-ing*. In this way, the / g / would be dropped in *singer*, which contains a suffix *-er*, but is retained in *finger*, in which the *-er* is not a suffix. The second change has been undone in the case of some speakers from the New York area who make *singer* rhyme with *finger*.

APPROXIMANTS

The voiced approximants are / w, r, j, l / as in *whack, rack, yak, lack*. The first three of these sounds are central approximants, and the last is a lateral approximant. The articulation of each of them varies slightly depending on the articulation of the following vowel. You can feel that the tongue is in a different position in the first sounds of *we* and *water*. The same is true for *reap* and *raw*, *lee* and *law*, and *ye* and *yaw*. Try to feel where your tongue is in each of these words.

These consonants also share the possibility of occurring in consonant clusters with stop consonants. The approximants / r, w, l / combine with stops in words such as *pray, bray, tray, dray, Cray, gray, twin, dwell, quell, Gwen, play, blade, clay, glaze*. The approximants are largely voiceless when they follow one of the voiceless stops / p, t, k / as in *play, twice, clay*. This voicelessness is a manifestation of the aspiration that occurs after voiceless stops, which we discussed at the beginning of this chapter. At that time, we introduced a small raised *h* symbol, [ʰ], which can be used to show that the first part of the vowel is voiceless. When there is no immediately following vowel, we can use the diacritic [̥] to indicate a voiceless sound. We can transcribe the words *play, twice, clay*, in which there are approximants after initial voiceless plosives, as [pl̥eɪ, tw̥aɪs, kl̥eɪ]. The approximant / j / as in *you* [ju] can occur in similar consonant clusters, as in *pew, cue* [pj̊u, kj̊u], and, for speakers of British English, *tune* [tj̊un]. We will discuss the sequence [ju] again when we consider vowels in more detail.

In most forms of British English, there is a considerable difference in the articulation of / l / before a vowel or between vowels, as in *leaf* or *feeling*, as compared with / l / before a consonant or at the end of a word, as in *field* or *feel*. In most forms of American English, there is less distinction between these two kinds of / l /. Note the articulation of / l / in your own pronunciation. Try to feel where the tongue is during the / l / in *leaf*. You will probably find that the tip is touching the alveolar ridge, and one or both sides are near the upper side teeth, but not quite touching. Now compare this articulation with the / l / in *feel*. Try playing *leaf* backwards to see if it sounds like *feel*. Does *feel* backwards sound like *leaf*? Most (but not all) speakers make / l / with the tongue tip touching the alveolar ridge. But in both British and American English, the center of the tongue is pulled down and the back is arched upward as in a back vowel. If there is contact on the alveolar ridge, it is the primary articulation. The arching upward of the back of the tongue forms a secondary articulation, which we

will call **velarization**. In most forms of American English, all examples of / l / are comparatively velarized, except, perhaps, those that are syllable initial and between high front vowels, as in *freely*. In British English, / l / is usually not velarized when it is before a vowel, as in *lamb* or *swelling*, but it is velarized when word final or before a consonant, as in *ball* or *filled*. Also, compare the velarized / l / in *Don't kill dogs* with the one in *Don't kill it*. Most people don't have a velarized / l / in *kill it*, despite the fact that it is seemingly at the end of a word. This is because the *it* in *kill it* acts like a suffix (technically a *clitic*), just like the suffix *-ing* in *killing*. (Note: The differences between the two types of / l / are more noticeable in British English. American English examples of the phenomena cited above are not included on the CD.) CD 3.12

One symbol for velarization is the mark [~] through the middle of the symbol. Accordingly, a narrow transcription of *feel* would be [fiɫ]. For many speakers, the whole body of the tongue is drawn up and back in the mouth so that the tip of the tongue no longer makes contact with the alveolar ridge. Strictly speaking, therefore, this sound is not an alveolar consonant but more like some kind of back vowel.

Finally, we must consider the status of / h /. Earlier we suggested that the English / h / is the voiceless counterpart of the surrounding sounds. At the beginning of a sentence, / h / is like a voiceless vowel, but / h / can also occur between vowels in words or phrases like *behind the head*. As you move from one vowel through / h / to another, the articulatory movement is continuous, and the / h / is signaled by a weakening of the voicing, which may not even result in a completely voiceless sound.

In many accents of English, / h / can occur only before stressed vowels or before the approximant / j /, as in *hue* [hju]. Some speakers of English also sound / h / before / w /, so that they contrast *which* [hwɪtʃ] and *witch* [wɪtʃ]. The symbol [ʍ] (an inverted *w*) is sometimes used for this voiceless approximant. The contrast between / w / and / ʍ / is disappearing in most forms of English. In those dialects in which it occurs, [ʍ] is more likely to be found only in the less common words such as *whether* rather than in frequently used words such as *what*.

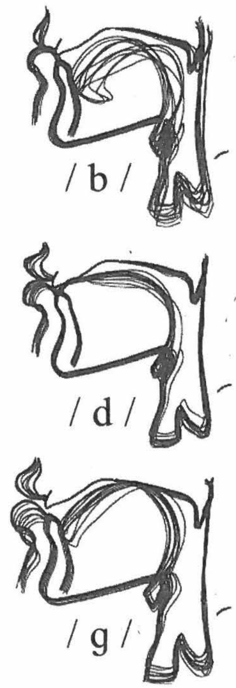
OVERLAPPING GESTURES

All the sounds we have been considering involve movements of the articulators. They are often described in terms of the articulatory positions that characterize these movements. But, rather than thinking in terms of static positions, we should really consider each sound as a movement. This makes it easier to understand the overlapping of consonant and vowel gestures in words such as *bib, did, gig*, mentioned earlier in this chapter. As we noted, in the first word, *bib*, the tongue tip is behind the lower front teeth throughout the word. In the second word, *did*, the tip of the tongue goes up for the first / d / and remains close to the alveolar ridge during the vowel so that it is ready for the second / d /. In the third word, *gig*, the back of the tongue is raised for the first / g / and remains near the soft palate during the vowel. In all these cases, the gestures for the vowels and consonants overlap.

The same kind of thing happens with respect to gestures of the lips. Lip rounding is an essential part of / w /. Because there is a tendency for gestures to overlap with those for adjacent sounds, stops are slightly rounded when they occur in clusters in which / w / is the second element, as in *twice*, *dwindle*, *quick* [t̥waɪs, 'dwɪndl̩, kw̥ɪk]. This kind of gestural overlapping, in which a second gesture starts during the first gesture, is sometimes called *anticipatory coarticulation*. The gesture for the approximant is anticipated during the gesture for the stop. In many people's speech, / r / also has some degree of lip rounding. Try saying words such as *reed* and *heed*. Do you get some movement of the lips in the first word but not in the second? Use a mirror to see whether you get anticipatory lip rounding for the stops [t, d] so that they are slightly rounded in words such as *tree* and *dream*, as opposed to *tee* and *deem*.

We can often think of the gestures for different articulations as movements towards certain targets. A target is something that one aims at but does not necessarily hit, perhaps because one is drawn off by having to aim at a second target. Ideally, the description of an utterance might consist of the specification of a string of target gestures that must be made one after another. The data in Figure 3.6 are traces of the vocal tract during [b], [d], and [g] in a variety of vowel contexts in French; similar observations have been made for English as well. The patterns of stability and variation are interesting. For instance, the traces for [b] show that the lips, jaw, and soft palate have about the same position no matter what the vowel context is, while the tongue position and larynx height varies quite a bit. If you look at the tongue traces closely, you can see tongue positions during [b] for the French vowels [i], [u], [ɑ], and the *umlaut u*, which is transcribed [y] in the IPA. In the traces for [d], we see again that some parts of the vocal tract take the same position in all of the vowel contexts (the tongue tip, soft palate, and jaw are the least variable). Interestingly, tongue body variation is much smaller in [d], which requires a tongue tip or blade gesture, than it is in [b], while in [d] the lip position is more variable. We also see a good deal of variation in the lip positions for [g], as well as a good deal of variation in the front/back location of the tongue—unlike [b] and [d], the place of articulation of [g] varies a good deal as a function of the neighboring vowel. The increased coarticulation of [g] with surrounding vowels, as compared with [d], suggests that the specifications of the consonant and vowel gestures are competing with each other for control of the tongue body. The vowel [u] wants the tongue body to go quite far back in the mouth, as you can see it does in the [b] traces, while the [g] wants the tongue body to be located a bit farther toward the front than this. Similarly, the vowel [i] wants the tongue body to be further front than is required or specified for [g]. What we see in the figure is that the exact location of the [g] stop closure is more variable than are the locations of the stop closures in [b] or [d]. This is probably because [g] requires significant tongue body movement, just as do vowels.

Figure 3.6 Mid-sagittal sections of [b], [d], and [g] adjacent to different vowels. (*Courtesy of Anne Vilain, Pierre Badin, Christian Abry*)



Coarticulation between sounds will always result in the positions of some parts of the vocal tract being influenced quite a lot, whereas others will not be so much affected by neighboring targets. The extent to which anticipatory coarticulation occurs depends on the extent to which the position of that part of the vocal tract is specified in the two gestures. The degree of coarticulation also depends on the interval between them. For example, a considerable amount of lip rounding occurs during [k] when the next sound is rounded, as in *coo* [ku]. Slightly less lip rounding occurs if the [k] and the [u] are separated by another sound, as in *clue* [klu], and even less occurs if there is also a word boundary between the two sounds, as in the phrase *sack Lou* [sæklu]. Nevertheless, some rounding may occur, and sometimes anticipatory coarticulations can be observed over even longer sequences. In the phrase *tackle Lou* [tækl̩lu], the lip rounding for the [u] may start in the [k], which is separated from it by two segments and a word boundary.

There is no simple relationship between the description of a language in terms of phonemes and the description of utterances in terms of gestural targets.

A phoneme is an abstract unit that may be realized in several different ways. Sometimes, the differences between the different allophones of a phoneme can be explained in terms of targets and overlapping gestures. The difference between the [k] in *key* and the [k] in *caw* may be simply due to their overlapping with different vowels. Similarly, we do not have to specify separate targets for the alveolar [n] in *ten* and the dental [n̪] in *tenth*. Both are the result of aiming at the same target, but in *tenth*, the realization of the phoneme / n / is influenced by the dental target required for the following sound. However, the differences between some allophones are actually the result of aiming at different targets. For many American English speakers, the initial [r] in *reed* is made with a tongue gesture that is very different from that for the final [r] in *deer*. In most forms of British English, the [l] in *leaf* and the [l] in *feel* differ in ways that cannot be ascribed to coarticulation. Perhaps the most extreme example of the difference between phonemes and gestures is in the realization of the / t / phoneme in *ten* [tʰɛn] and in *button* [bʌʔn], in which the one phoneme is realized by two completely different gestures, [tʰ] and [ʔ]. Sometimes, the differences between allophones are the result of overlapping gestures, producing what have been called *intrinsic allophones*; sometimes, they involve different gestures, which may be called *extrinsic allophones*. Because phonemes are composed of these two types of allophones, they cannot be equated with gestures.

To summarize, gestural targets are units that can be used in descriptions of how a speaker produces utterances. Phonemes are more abstract units that can be used in descriptions of languages to show how words contrast with one another. Virtually all the gestures for neighboring sounds overlap. Differences in the timing of one gesture with respect to another account for a wide range of the phenomena that we observe in speech. The next section provides a number of additional examples.

RULES FOR ENGLISH CONSONANT ALLOPHONES

A good way of summarizing (and slightly extending) all that we have said about English consonants so far is to list a set of formal statements or rules describing the allophones. These rules are simply descriptions of language behavior. They are not the kind of rules that prescribe what people ought to do. Like most phoneticians, we would not presume to be arbiters of fashion who can declare what constitutes "good" speech. But phonetics is part of an exact scientific discipline, and that means we should be able to formalize descriptions of speech in terms of a set of precise statements.

Given the discussion of consonant allophones in this chapter, we can give a number of descriptive rules. One of these deals with consonant length.

(1) Consonants are longer when at the end of a phrase.

You can see the application of this statement by comparing the consonants in words such as *bib, did, don, nod*. Use WaveSurfer (on the CD) to make a recording of these words, and then play the recording backward. Are the first two words the same backward and forward? Do the third and fourth words sound like each other when played in reverse?

Most of the allophonic rules apply to only selected groups of consonants.

(2) Voiceless stops (i.e., / p, t, k /) are aspirated when they are syllable initial, as in words such as *pip, test, kick* [pʰɪp, tʰɛst, kʰɪk].

(3) Obstruents—stops and fricatives—classified as voiced (that is, / b, d, g, v, ð, z, ʒ /) are voiced through only a small part of the articulation when they occur at the end of an utterance or before a voiceless sound. Listen to the / v / when you say *try to improve*, and the / d / when you say *add two*.

(4) So-called voiced stops and affricates / b, d, g, dʒ / are voiceless when syllable initial, except when immediately preceded by a voiced sound (as in *a day* as compared with *this day*). Use WaveSurfer to listen to the *sday* part of *this day*. Does it sound like *stay*?

(5) Voiceless stops / p, t, k / are unaspirated after / s / in words such as *spew, stew, skew*.

(6) Voiceless obstruents / p, t, k, tʃ, f, θ, s, ʃ / are longer than the corresponding voiced obstruents / b, d, g, dʒ, v, ð, z, ʒ / when at the end of a syllable.

Words exemplifying this rule are *cap* as opposed to *cab* and *back* as opposed to *bag*. Try contrasting these words in sentences, and you may be able to hear the differences more clearly.

(7) The approximants / w, r, j, l / are at least partially voiceless when they occur after initial / p, t, k /, as in *play, twin, cue* [pl̥eɪ, tw̥ɪn, kj̊u].

This is due to the overlapping of the gesture required for aspiration with the voicing gesture required for the approximants. (Note that the formal statement says *at least partially voiceless*, but the transcription marks the approximants as being completely voiceless. Conflicts between statements and transcriptions of this kind will be discussed further below.)

(8) The gestures for consecutive stops overlap, so that stops are unexploded when they occur before another stop in words such as *apt* [æp̚t] and *rubbed* [rʌb̚d].

(9) In many accents of English, syllable final / p, t, k / are accompanied by an overlapping glottal stop gesture, as in pronunciations of tip, pit, kick as [tɪʔ͡p, pɪʔ͡t, kɪʔ͡k]. (This is another case where transcription cannot fully describe what is going on.)

This rule does not apply to all varieties of English. Some people do not have any glottal stops in these circumstances, and others have glottal stops completely replacing some or all of the voiceless stops. In any case, even for those who simply add a glottal stop, the statement is not completely accurate. Many people will have a glottal stop at the end of *cat* in phrases such as *that's a cat* or *the cat sat on the mat,* but they will not have this allophone of / t / in *the cat eats fish.*

(10) In many accents of English, / t / is replaced by a glottal stop when it occurs before an alveolar nasal in the same word, as in beaten [ˈbiʔn̩].

(11) Nasals are syllabic at the end of a word when immediately after an obstruent, as in *leaden, chasm* [ˈlɛdn̩, ˈkæzm̩].

Note that we cannot say that nasals become syllabic whenever they occur at the end of a word and after a consonant. The nasals in *kiln, film* are not syllabic in most accents of English. We can, however, state a rule describing the syllabicity of / l / by saying simply:

(12) The lateral / l / is syllabic at the end of a word when immediately after a consonant.

This statement summarizes the fact that / l / is syllabic not only after stops and fricatives (as in *paddle, whistle* [ˈpædl̩, ˈwɪsl̩]), but also after nasals (as in *kennel, channel* [ˈkɛnl̩, ˈtʃænl̩]). The only problem with this rule is what happens after / r /. It is correct for words such as *barrel* [ˈbærl̩] but does not work in most forms of American English in words such as *snarl* [snɑrl], when / r / has to be considered as part of the vowel.

When it is not part of the vowel, / r / is like / l / in most forms of American English in that it, too, can be syllabic when it occurs at the end of a word and after a consonant, as in *saber, razor, hammer, tailor* [ˈseɪbr̩, ˈreɪzr̩, ˈhæmr̩, ˈteɪlr̩]. If we introduce a new term, **liquid,** which is used simply as a cover term for the consonants / l, r /, we may rephrase the statement in (12) and say:

(12a) The liquids / l, r / are syllabic at the end of a word when immediately after a consonant.

The next statement also applies more to American English than to British English. It accounts for the / t / in *fatty, data* [ˈfæɾi, ˈdeɪɾə]. But note that these are not the only contexts in which these changes occur. This is not simply a change that affects / t / after a stressed vowel and before an unstressed one, in that / t / between two unstressed vowels (as in *divinity*) is also affected. However, not all cases of / t / between vowels change in this way. The / t / in *attack* (i.e., before a stressed syllable) is voiceless, and / t / after another consonant (for example, in *hasty* and *captive*) is also voiceless. Note also that most American English speakers have a very similar articulatory gesture in words containing / d / and / n / in similar circumstances, such as *daddy* and *many*. The first of these two words could well be transcribed [ˈdæɾi]. The second has the same sound, except that it is nasalized, so it could be transcribed [ˈmɛɾ̃i] in a narrow transcription. Nasalization is shown by the diacritic [˜] over a symbol. The following statement accounts for all these facts:

(13) Alveolar stops become voiced taps when they occur between two vowels the second of which is unstressed.

Many speakers of American English require a similar rule to describe a sequence of an alveolar nasal followed by a stop. In words such as *painter* and *splinter*, the / t / is lost and a nasal tap occurs. This has resulted in *winter* and *winner* and *panting* and *panning* being pronounced in the same way. For these speakers, we can restate (13), making it:

(13a) Alveolar stops and alveolar nasal plus stop sequences become voiced taps when they occur between two vowels the second of which is unstressed.

There is a great deal of variation among speakers with respect to this statement. Some make taps in familiar words such as *auntie*, but not in less common words such as *Dante*. Some make them only in fast speech. Try to formulate a statement in a way that describes your own speech.

(14) Alveolar consonants become dentals before dental consonants, as in *eighth, tenth, wealth* [eɪt̪θ, tɛn̪θ, wɛl̪θ]. Note that this statement applies to all alveolar consonants, not just stops, and often applies across word boundaries, as in *at this* [æt̪ ðɪs]. This is a statement in which, in English, the gestures for these two consonants overlap so much that the place of articulation for the first consonant is changed.

In a more rapid style of speech, some of these dental consonants tend to be omitted altogether. Say these words first slowly and then more rapidly, and see what you do yourself. It is difficult to make precise statements about when consonants get deleted, because this depends so much on the style of speech being used. Alveolar stops often appear to get dropped in phrases such as *fact finding*. Most people say *most people* as [ˈmoʊs ˈpipl̩] with no audible [t], and they produce phrases such as *send papers* with no audible [d]. We could state this as follows:

(15) Alveolar stops are reduced or omitted when between two consonants.

Rule (15) raises an interesting point of phonetic theory. Note that we said "alveolar stops often *appear* to get dropped," and there may be "no *audible* [d]". However, the tongue tip gesture for the alveolar stop in *most people* may be present but just not audible because it is completely overlapped by the labial stop following. More commonly, it is partially omitted; that is to say, the tongue tip moves up for the alveolar stop but does not make a complete closure. When we think in terms of phonetic symbols, we can write [ˈmoʊs ˈpipl̩] or [ˈmoʊst ˈpipl̩]. This makes it a question of whether the [t] is there or not. But that is not really the issue. Part of the tongue tip gesture may have been made, a fact that we have no way of symbolizing.

Check how you say phrases such as *best game* and *grand master*. Say these and similar phrases with and without the alveolar stop. You may find it difficult to formulate a statement that takes into account all the contexts where alveolar stops may not appear in your speech.

We must state not only where consonants get dropped, but also where they get added. Words such as *something* and *youngster* often get pronounced as [ˈsʌmpθiŋ] and [ˈjʌŋkstɚ]. In a similar way, many people do not distinguish between *prince* and *prints*, or *tense* and *tents*. All these words may be pronounced with a short voiceless stop between the nasal and the voiceless fricative. But the stop is not really an added gesture. It is simply the result of changing the timing of the nasal gesture with respect to the oral gesture. By rushing the raising of the velum for the nasal, a moment of complete closure—a stop—occurs. The apparent insertion of a stop into the middle of a word in this way is known as **epenthesis**. If we wanted to make a formal statement of this phenomenon, we could say:

(16) A homorganic voiceless stop may occur after a nasal before a voiceless fricative followed by an unstressed vowel in the same word.

Note that it is necessary to mention that the following vowel must be unstressed. Speakers who have an epenthetic stop in the noun *concert* do not usually have one in verbal derivatives such as *concerted*, or in words such as *concern*. Nothing need be said about the vowel before the nasal. Epenthesis may—like the [t]-to-[ɾ] change in statement (13)—occur between unstressed vowels. It is possible to hear an inserted [t] in both *agency* and *grievances*.

Statement (16) raises a theoretical point similar to that discussed in connection with (15), where we were concerned with whether a segment had been deleted. Now we are concerned with whether a segment has been added. In each case, it is better to treat these as misleading questions and to think about the gestures involved rather than worry about the symbols that might or might not represent separate segments. It may be convenient to transcribe *something* as [ˈsʌmpθiŋ], but transcription is only a tool and should not be thought of as necessarily portraying the units used in the production of speech.

CD 3.13

The next statement accounts for the shortening effects that occur when two identical consonants come next to one another, as in *big game* and *top post*. It is usually not accurate to say that one of these consonants is dropped. There are two consonantal gestures, but they overlap considerably. Even in casual speech, most people would distinguish between *stray tissue*, *straight issue*, and *straight tissue*. (Try saying these in sentences such as *That's a stray tissue* and see for yourself.) But there clearly is a shortening effect that we can state as follows:

(17) A consonant is shortened when it is before an identical consonant.

We can describe the overlapping gestures that result in more advanced articulations of / k / in *cap, kept, kit, key* [kʰæp, kʰɛpt, kʰɪt, kʰi] and of / g / in *gap, get, give, geese* [gæp, gɛt, gɪv, gis]. You should be able to feel the fronted position of your tongue contact in the latter words of these series. We can say:

TABLE 3.2 Some diacritics that modify the value of a symbol.

̥	Voiceless	w̥	l̥	kw̥ɪk, pl̥eɪs	*quick, place*
ʰ	Aspirated	tʰ	kʰ	tʰæp, kʰɪs	*tap, kiss*
̪	Dental	t̪	d̪	æt̪ðə, hɛl̪θ	*at the, health*
̃	Nasalized	r̃	æ̃	mæ̃n	*man*
u	Velarized	ɫ		pʰɪɫ	*pill*
̩	Syllabic	n̩	l̩	ˈmɪʔn̩	*mitten*

(18) Velar stops become more front before more front vowels.

Finally, we need to note the difference in the quality of / l / in *life* [laɪf] and *file* [faɪɫ], or *clap* [klæp] and *talc* [tæɫk], or *feeling* [filɪŋ] and *feel* [fiɫ].

(19) The lateral / l / is velarized when after a vowel or before a consonant at the end of a word.

Note that there are clearly distinct gestures required for / l / in the different circumstances. These are not differences that can be ascribed to overlapping gestures.

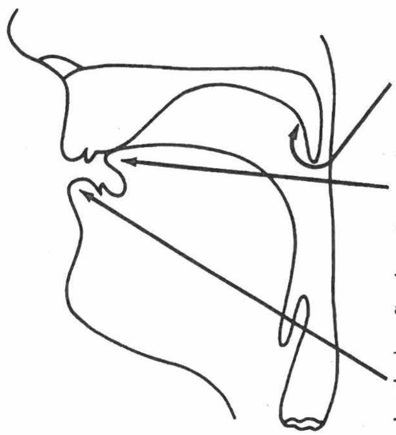
DIACRITICS

In this and the previous chapter, we have seen how the transcription of English can be made more detailed by the use of diacritics, small marks added to a symbol to narrow its meaning. The six diacritics we have introduced so far are shown in Table 3.2. You should learn the use of these diacritics before you attempt any further detailed transcription exercises. Note that the nasalization diacritic is a small wavy line above a symbol (the "tilde" symbol), and the velarization diacritic is a tilde through the middle of a symbol. Nasalization is more common among vowels, which will be discussed in the next chapter.

EXERCISES

(Printable versions of all the exercises are available on the CD.)

A. The sequence of the following annotated diagrams illustrates the actions that take place during the consonants at the end of the word *bench*. Fill in the blanks.

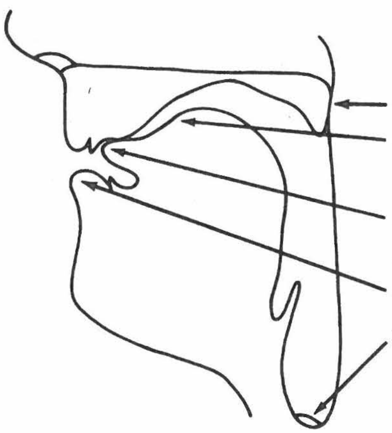


Before the vowel ends the soft palate ____________ so that air ____________ ____________.

At the end of the vowel the blade of the tongue is raised to make contact with ____________, preventing air from ____________ ____________.

The lips remain ____________.

The vocal folds continue ____________.

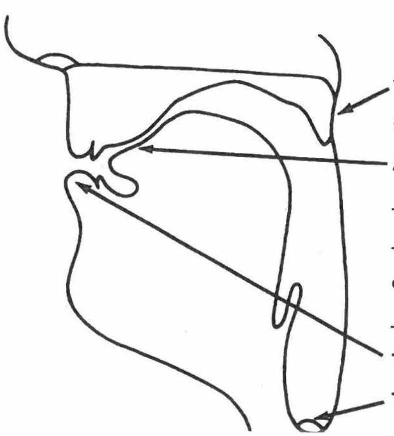


Then the ____________ is raised and the ____________ of the tongue is raised,

while the ____________ of the tongue remains in the same place.

The lips become more ____________.

The vocal folds ____________.



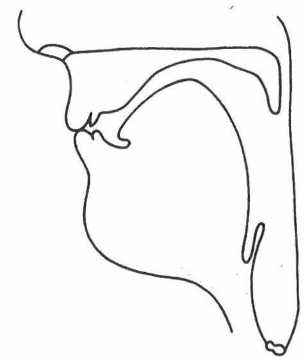
The ____________ remains ____________ throughout the end of the word.

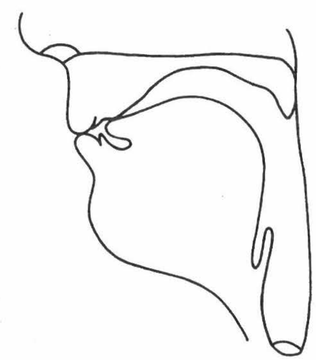
After a short period the ____________ ____________ moves downward, but the ____________ remains close enough to the alveolar ridge to ____________ ____________.

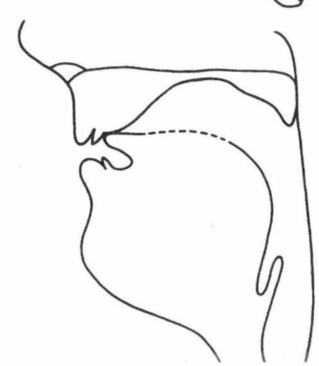
The ____________ are ____________.

The vocal folds ____________.

B. Annotate the diagram below so as to describe the actions required for the consonants in the middle of the word ***implant***. Make sure that your annotations mention the action of the lips, the different parts of the tongue, the soft palate, and the vocal folds in each diagram. Try to make clear which of the vocal organs moves first in going from one consonant to another. The pronunciation illustrated is that of a normal conversational utterance; note the position of the tongue during the bilabial nasal.







C. Draw and annotate diagrams similar to those in the previous exercises, but this time illustrate the actions that occur in pronouncing the consonants in the middle of the phrase *thick snow*. Make sure you show clearly the sequence of events, noting what the lips, tongue, soft palate, and vocal folds do at each moment. Before you begin, say the phrase over to yourself several times at a normal speed. Note especially whether the back of your tongue lowers before or after the tip of the tongue forms the articulation for subsequent consonants.

D. As a transcription exercise, give a number of examples for each of Statements (2) through (19) by making a narrow transcription of some additional words that fit the rules. Your examples should not include any words that have been transcribed in this book so far. Remember to mark the stress on words of more than one syllable.

Statement (2) three examples (one for each voiceless stop)

Statement (3) seven examples (one for each voiced obstruent)

Statement (4) eight examples (two for each voiced stop or affricate)

Statement (5) four examples (one for each approximant)

Statement (6) three examples (one for each voiceless stop)

Statement (7) four contrasting pairs (one for each place of articulation)

Statement (8) six examples (one for each voiced and voiceless stop)

Statement (9) three examples (not necessarily from your own speech)

Statement (10) three examples (use three different vowels)

Statement (11) three examples (use at least two different nasals)

Statement (12a) six examples (three each with / l / and / r /)

Statement (13a) six examples (two each with / t, d, n /, one being after an unstressed vowel)

Statement (14) three examples (one each for / t, d, n /)

Statement (15) three examples (any kind)

Statement (16) two examples (use two different nasals)

Statement (17) three examples (any kind)

Statement (18) four examples (use four different vowels)

Statement (19) two contrasting pairs (try to make them reversible words)

E. As a more challenging exercise, try to list two exceptions to some of these statements.

Statement ( ) ______

Statement ( ) ______

F. Write a statement that describes the allophones of / h /.

G. Transcribe both the British and the American speaker saying the following.

British English speaker

Once there was a young rat named Arthur,
who could never make up his mind.
Whenever his friends asked him
  if he would like to go out with them,
he would only answer, "I don't know."
He wouldn't say "yes" or "no" either.
He would always shirk making a choice.

American English speaker

Once there was a young rat named Arthur,
who could never make up his mind.
Whenever his friends asked him
  if he would like to go out with them,
he would only answer, "I don't know."
He wouldn't say "yes" or "no" either.
He would always shirk making a choice.

PERFORMANCE EXERCISES

A. Learn to produce some non-English sounds. First, in order to recall the sensation of adding and subtracting voicing while maintaining a constant articulation, repeat the exercise saying [sssszzzssszzz]. Now try a similar exercise, saying [mmmm̥m̥m̥mmmm̥m̥m̥]. Make sure that your lips remain together all the time. During [m̥], you should be producing exactly the same action as when breathing out through the nose. Now say [m̥] between vowels, producing sequences such as [ɑm̥ɑ, im̥i], etc. Try not to have any gap between the consonant and the vowels.

B. Repeat this exercise with [n, ŋ, l, r, w, j], learning to produce [ɑn̥ɑ, ɑŋ̊ɑ, ɑl̥ɑ, ɑr̥ɑ, ɑw̥ɑ, ɑj̊ɑ] and similar sequences with other vowels.

C. Make sure that you can differentiate between the English words *whether, weather; which, witch*, even if you do not normally do so.

Say:

[hwɛðə(r)]	*whether*
[wɛðə(r)]	*weather*
[hwɪtʃ]	*which*

D. Learn to produce the following Burmese words. (You may for the moment neglect the tones, indicated by accents above the vowels.)

Voiced nasals	**Voiceless nasals**
mâ 'lift up'	m̥â 'from'
nǎ 'pain'	n̥ǎ 'nose'
ŋâ 'fish'	ŋ̊â 'borrow'

E. Working with a partner, produce and transcribe *several* sets of nonsense words. You should use slightly more complicated sets than previously. Make up your own sets on the basis of the illustrative set given below, including glottal stops, nasal and lateral plosion, and some combinations of English sounds that could not occur in English. Remember to mark the stress.

'kl̥ɑntʃʊps'kweɪdʒ

'ʒiʒm̩'spobm̩

'tsɪʔɪ'bɛʔɪdl̩

mbu'tr̥ɪgŋ

'tw̥aɪbrɛʔɪp

F. To increase your memory span in perceiving sounds, include some simpler but longer words in your production–perception exercises. A set of possible words is given below. Words such as the last two, which have eight syllables each, may be too difficult for you at the moment. But try to push your hearing ability to its limit. When you are listening to your partner dictating words, remember to try to (1) look at the articulatory movements; (2) repeat, to yourself, as much as you can immediately afterward; and (3) write down as much as you can, including the stress, as soon as possible.

'kiputu'pikitu

'bɛgɪ'gɪdɛ'dɛdɪ

tr̥i'tʃɪʔitʃu'drudʒi

'rilɛ'tolɛ'mɑnu'dʊli

'faɪθiði'vɔɪðuvu'θifi