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Clinical Phonetics

Lawrence D. Shriberg Raymond D. Kent

Fourth Edition

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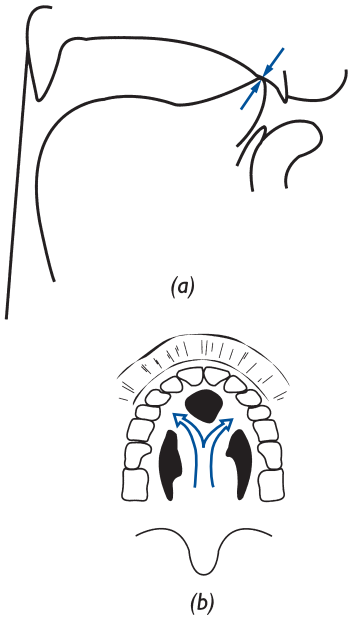


FIGURE 5.3
Articulation of the lateral consonant /l/. A lateral-view articulatory configuration is shown in *(a)*, and an inferior view of the roof of the mouth is shown in *(b)*. Lateral opening around the point of tongue contact shown in *(a)* allows sound energy to pass through the mouth. Regions of tongue contact are shown in *(b)* as dark areas.

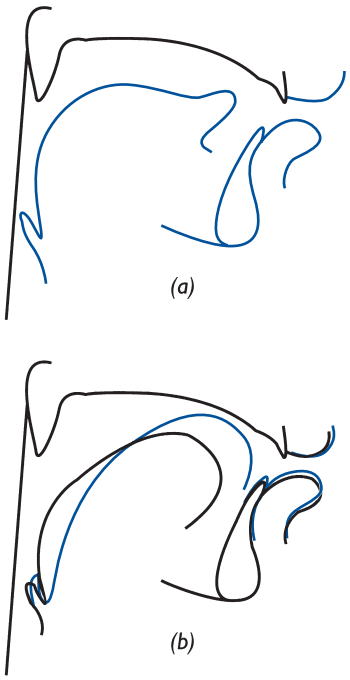


FIGURE 5.4
Articulations of the rhotic /r/. The retroflex articulation is shown in *(a)* and the bunched articulation in *(b)*. The black and blue lines in *(b)* represent the bunched /r/ in two different vowel contexts.

the vibrating vocal folds then passes through the opening between tongue and palatal vault.

Both the lateral sound, as in *Lou,* and the rhotic sound, as in *rue,* are liquids. *A liquid is a vowel-like consonant in which voicing energy passes through a vocal tract that is constricted only somewhat more than for vowels. The shape and location of the constriction is a critical defining property, being distinctive for a given type of liquid.*

Liquids—Articulatory Summary

1. Sound energy from the vocal folds is directed through a distinctively shaped oral passage, one that can be held indefinitely for sustained production of the sound, if required.
2. The velopharynx is always (or at least almost always) closed.
3. The oral passageway is narrower than that for vowels but wider than that for stops, fricatives, and nasals.

The lateral /l/ in *Lou* and the rhotic /r/ in *rue* occur at only one place of articulation in General American English. However, in some dialects and in some speech disorders, lateralized or rhotic modifications occur for other sounds, as discussed in Chapter 6.

Glides

Glide sounds, also known as **semivowels,** are made at two places in English: lingua-palatal and labio-lingua-velar. The lingua-palatal glide (symbolized phonemically as /j/) occurs in the words *you, yes,* and *yawn.* The voiced labio-lingua-velar /w/ occurs in the words *woo, we,* and *one,* and the voiceless labio-lingua-velar /ʍ/ is used by some speakers in the words *why, which,* and *when. A glide sound has a vocal tract constriction somewhat n´arrower than that for vowels but less severe than that for stops and fricatives and is characterized by a gliding motion of the articulators from a partly constricted state to a more open state for the following vowel.* (A glide is always followed by a vowel.) The gliding motion from the constricted state to the following vowel is the distinguishing and defining property of glides. These gliding movements are slower than the closing and opening movements for stops. An illustration of glide production is given in Figure 5.5.

Glides—Articulatory Summary

1. The constricted state for the glide is narrower than that for a vowel but wider than that for stops and fricatives.
2. The articulators make a gradual gliding motion from the constricted segment to the more open configuration for the following vowel.
3. The velopharynx is generally, if not always, closed.
4. The sound energy from the vocal folds passes through the mouth, in a fashion similar to that for vowels.

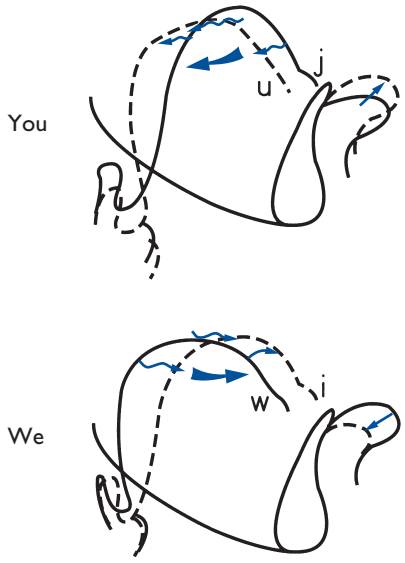


FIGURE 5.5
Articulations for the glide consonants /j/ and /w/ in the words *you* and *we,* respectively. The drawings show lip and tongue movements relative to the jaw. Notice that the glide articulations for *you* are essentially opposite to those for *we*.

There are only three glides in English, represented by the initial sounds in *you* (/j/), *we* (/w/), and *while* (/ʍ/ in some but not all pronunciations).

Affricates

Affricates *are best viewed as combination sounds involving a stop closure followed by a fricative segment.* Air pressure built up during the stop phase is released as a burst of noise, similar in duration to that for fricative sounds. The affricates of English are produced only at the palatal place of production, as in the words *church* and *judge.* In these words, both the initial and final segments are affricates. The basic properties of affricates are illustrated schematically in Figure 5.6.

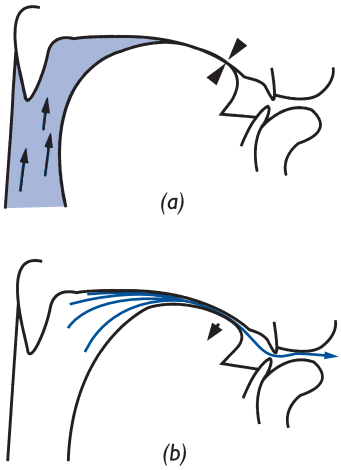


FIGURE 5.6
Schematic illustration of affricate production, showing *(a)* the buildup of air pressure during the stop portion and *(b)* the release of air through a narrow passage during the fricative portion.

Affricates—Articulatory Summary

1. Affricates are a combination of a stop closure and a fricative segment, with the frication noise closely following the stop portion.
2. Affricates are made with complete closure of the velo pharynx.

Place of Articulation

It should be apparent by now that most consonants are formed by completely or nearly closing the vocal tract at some point. Place of articulation describes where the point of closure or constriction is located. An intuitive impression about place of articulation can be gained by reciting the words listed under each place of articulation in Table 5.1 and noting where the italicized sound is produced. The phonetic symbol for each of these sounds is given after the key word. The words *why* and *way* are placed in parentheses to indicate that, for the sound in question, two articulators are involved. The /w/, as in *way* and *wag,* involves constrictions of both lips and tongue, as does the /ʍ/, the voiceless counterpart to /w/.

Bilabials /b/ /p/ /m/ /w/ /ʍ/

Sounds formed at the **bilabial** place of articulation are the voiced and voiceless stops /b/ and /p/, the nasal /m/, and the voiced and voiceless glides /w/ and /ʍ/. The latter two sounds are described as having two places of articulation because they are produced with rounding of the lips and with the tongue in a high-back (/u/-like) position. The tongue-positioning requirement for /w/ and /ʍ/ should be emphasized, because in our experience students sometimes fail to recognize its significance. Notice that no English fricatives or affricates are made at the bilabial place of production.

Two basic lip articulations are needed to produce the five sounds /p b m w ʍ/. The first articulation, lip closure, is required for the bilabial stops /b/ and /p/ and the bilabial nasal /m/. Usually, this articulation consists of a closing phase, a closed phase, and a releasing or opening phase. Both the closing and releasing phases are accomplished in about 50 to 75 ms. These articulations are among the briefest (fastest) in speech. Bilabial closure for /b/ is illustrated in Figure 5.7. Notice that the tongue can take different positions during the bilabial closure; in this illustration, the tongue takes the position for the vowel that follows the /b/. The articulation for /m/ is similar to that for /b/; thus, some

TABLE 5.1
Place of Articulation for English Consonants

Place of Articulation						
Bilabial	Labiodental	Interdental	Alveolar	Palatal	Velar	Glottal
Both lips	Lips and teeth	Tongue tip and teeth	Tongue tip and ridge behind teeth	Tongue blade and palate	Tongue dorsum and velum	Vocal folds
*p*ie /p/	*f*ear /f/	*th*aw /θ/	*t*wo /t/	ru*sh* /ʃ/	ra*ck* /k/	*h*igh /h/
*b*ye /b/	*v*eer /v/	*th*e /ð/	*d*ue /d/	rou*ge* /ʒ/	ra*g* /g/	
*m*y /m/			*s*ue /s/	ri*ch* /tʃ/	ra*ng* /ŋ/	
(*w*ay) /w/			*z*oo /z/	ri*dge* /dʒ/	(*w*ay) /w/	
(*wh*y) /ʍ/			*n*ew /n/	*r*aw /r/	(*wh*y) /ʍ/	
			*L*ou /l/	*y*aw /j/		
			bu*tt*er /ɾ/			

phoneticians regard /m/ as a "nasalized bilabial stop." The voiced and voiceless /b/ and /p/ have basically the same labial articulation, although some authorities describe /p/ as having a forceful articulation involving greater muscular activity. These authorities describe /p/ as tense and /b/ as lax (see, for example, Chomsky & Halle, 1968). The reality of a tense–lax distinction for voiced and voiceless stops is still a matter of some controversy, but physiologic studies should resolve the issue.

Lower lip articulation (hence, bilabial closure) often is assisted by a closing motion of the jaw. Jaw movement is especially likely when the bilabial consonant is preceded or followed by a low or open vowel, as in the words *bob* and *mop*. However, bilabial closure can be achieved even when the jaw is held in an open or lowered position. Figure 5.8 shows X-ray tracings of bilabial closure for /p/ when the jaw is allowed to close and when the jaw is held open by blocks placed between the teeth. Notice that when the jaw is held open, the lips appear to stretch to make contact with one another.

The stops /b/ and /p/ are oral consonants, produced with velopharyngeal closure to permit the containment of air within the oral cavity. The nasal /m/ is produced with

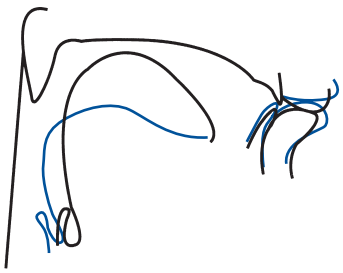
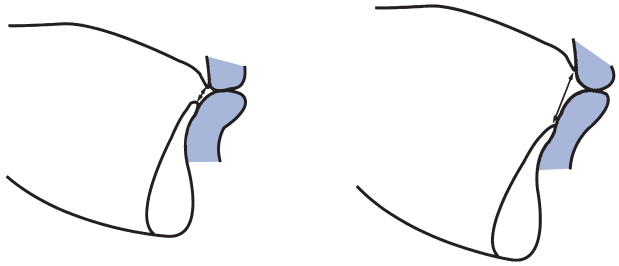


FIGURE 5.7
X-ray tracings of the bilabial closure in /b a/ (black line) and /b u/ (blue line). During the bilabial closure for /b/, the tongue assumes the position for the following vowel.



(*a*) (*b*)

FIGURE 5.8
Bilabial closure for a closed jaw position in *(a)* and an open jaw position in *(b)*.

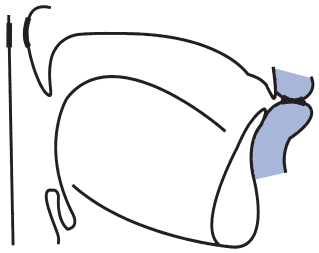


FIGURE 5.9
X-ray tracing of /m/ articulation. Bilabial contact and velopharyngeal opening are emphasized by thickened lines.

an open velopharynx (Figure 5.9), so that sound energy is radiated through the nasal cavities rather than the oral cavity. Otherwise, the articulatory configuration for /m/ is like that for /b/ and /p/.

The other lip articulation is one variously known as rounding, narrowing, protrusion, or lengthening. Actually, the different names are justified in that different speakers have somewhat different articulations. Whereas some speakers protrude the lips (pushing them forward from the teeth), other speakers have primarily a narrowing movement in which the lips move toward, but do not reach, closure. The

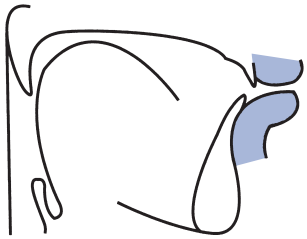


FIGURE 5.10
Lip protrusion, or lip rounding, for the first sound in *we*. Notice the forward extension of lips and the narrow mouth opening.

gesture of rounding or protrusion is shown in Figure 5.10, which is based on X-ray tracings of the /w/ articulation in the word *we*. Photographs of lip rounding are presented in Figure 4.4. The rounding or protrusion articulation is slower than for bilabial closure and generally takes 75 to 100 ms or more.

Labiodentals /f/ /v/

Only the fricatives /f/ (voiceless) as in *fat* and /v/ (voiced) as in *vat* are made as **labiodental** sounds. The basic articulation, shown in Figure 5.11, involves a constriction between the lower lip and the upper teeth (incisors). The fricative energy for /f/ and /v/ is weak compared to that for /s/ and /z/. Because the lower lip is attached to the jaw, the constricting movement of lower lip to upper teeth often is assisted by jaw movement. The lower lip movement for the labiodental constriction is somewhat like that for bilabial closure. The velopharynx is closed, as it is for all consonants except the nasals.

Interdentals (or Dentals) /θ/ /ð/

Only fricatives are formed at the **interdental** (or **dental**) location: the voiceless interdental /θ/ as in *thin* and the voiced interdental /ð/ as in *this*. Figure 5.12 illustrates the articulation, which takes two major forms, interdental and dental. For the interdental, the tongue tip is protruded slightly between the front teeth (incisors), so that a narrow

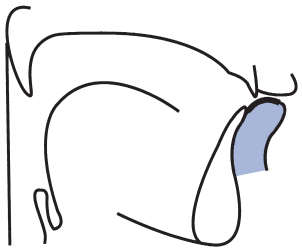


FIGURE 5.11
X-ray tracing of /f/ articulation. Thickened line shows labiodental contact.

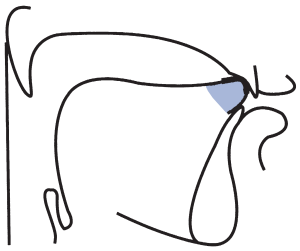


FIGURE 5.12
X-ray tracing of /θ/ articulation. Thickened line shows lingua-dental constriction.

constriction is formed between the tongue and the cutting edge of the teeth. For the dental articulation, the tongue tip contacts the back of the front teeth, so that the constriction is between the tongue and the inside surface of the teeth. The noise energy is weak, comparable to that for /f/ and /v/. In many speakers, the tip of the tongue is visible during /θ ð/ production. Although the jaw often closes somewhat to aid formation of the constriction, it cannot close completely, or there would not be adequate interdental opening for the tongue tip. These sounds tend to be made with a dental, rather than interdental, constriction in rapid speech.

Alveolars /t/ /d/ /s/ /z/ /l/ /n/

Lingua-Alveolar Stops: /t/ and /d/. X-ray tracings of the **lingua-alveolar** consonant closure for /t/ (*two*) and /d/ (*dew*) are shown in Figures 5.13 and 5.14. Note the similarity in articulation. Because both of these sounds are stops and require the development of air pressure behind the point of oral closure, the velopharynx is closed. The jaw often closes partially to aid the lingual contact against the alveolar ridge. The site of lingual contact is nearly identical for /d/ and /t/, but /t/ may have a firmer contact and a more rapid release, both of which are related to the fact that /t/ has a greater air pressure than /d/. In addition, /t/ tends to have a longer duration of closure than /d/. These differences are discussed in the section on voicing later in this chapter.

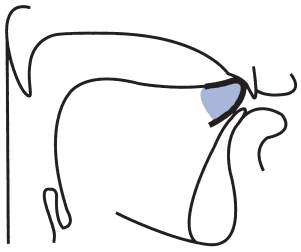


FIGURE 5.13
X-ray tracing of /t/ articulation. Thickened line shows lingua-alveolar contact.

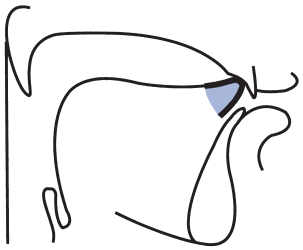


FIGURE 5.14
X-ray tracing of /d/ articulation. Thickened line shows lingua-alveolar contact.

The exact position and shape of the tongue for articulation of /t/ and /d/ varies with phonetic context. One of the most conspicuous contextual effects is that associated with a following dental fricative, as in the words *width* and *eighth.* Because of the influence of the dental fricative, the /d/ and /t/ in these words are made with a dental, rather than alveolar, contact, as illustrated in Figure 5.15. Another fairly frequent modification occurs in the context of palatal sounds, like the /j/ in some pronunciations of *Tuesday* /t j u z d e͡ɪ/. The following palatal causes the /t/ to be articulated with the blade of the tongue elevated toward the palate. Other modifications of the alveolar place of articulation are described in the chapter on diacritics. It should be kept in mind that articulatory descriptions such as lingua-alveolar stop express the *typical* formation of the sound and that the actual place of contact varies with the phonetic context of the sound. Speech articulation is flexible and adaptive.

Lingua-Alveolar Fricatives: /s/ and /z/. These sounds are depicted by the X-ray tracing in Figure 5.16. Because /s/ (*sue*) and /z/ (*zoo*) have the same place and manner of articulation, separate X-ray tracings are not shown. For both /s/ and /z/, the velopharynx is closed to allow air pressure to build up in the mouth. The jaw usually assumes a fairly closed position. The /s/ and /z/ are sometimes called groove fricatives, because a midline groove is formed in the tongue as a narrow passageway for escaping air. Some phoneticians describe /s/ and /z/ as having a blade articulation, because the constriction can be made between the alveolar ridge and the part of the tongue just behind the tip.

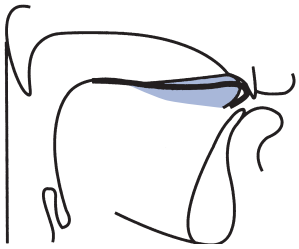


FIGURE 5.15
Alveolar (thin line) and dental (thick line) articulation of /t/.

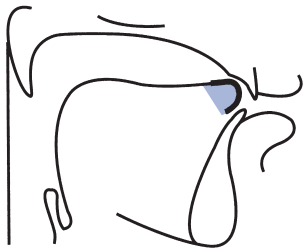


FIGURE 5.16
X-ray tracing of /s/ articulation. Thickened line shows lingua-alveolar constriction.

The lingual articulation for /s/ and /z/ varies somewhat with phonetic context and with speaker. Some speakers consistently use a **dentalized** constriction, in which the tongue makes a constriction with the area just behind the upper front teeth (incisors). These modifications are discussed in detail later in this book.

Lingua-Alveolar Lateral: /l/. The X-ray tracing in Figure 5.17 illustrates the most common articulation of the /l/ (*Lou*) in American English. The tongue tip makes contact with the alveolar ridge, and the dorsum of the tongue assumes a position similar to that for vowel /o/ (*low*). The contact is midline only, so that sound energy radiates through the sides of the mouth, around the midline closure. This sound derives its manner classification from the feature of lateral resonance. The similarity of dorsal tongue position between /l/ and /o/ is shown by the composite X-ray tracings in Figure 5.18. The /l/ might be described as having an /o/-like tongue body and dorsum but a midline contact of the tip. Alveolar contact is not a necessary feature of the sound. Particularly in word-final position, /l/ may be produced without such contact, as shown in Figure 5.19.

Most descriptions of /l/ in phonetics books distinguish between "light *l*" (or "clear *l*") and "dark *l*." However, there is considerable disagreement about the articulatory differences that underlie the distinction of "light" and "dark." The following quotations are illustrative.

> *When [l] is made with the tongue against the teeth, it is referred to as dental [l], or, more often, as clear [l].*

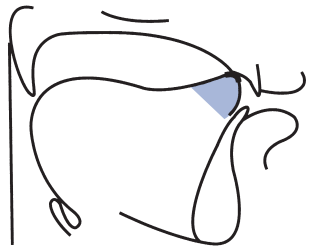


FIGURE 5.17
X-ray tracing of /l/ articulation. Thickened line shows lingua-alveolar contact. (See also Figure 5.3.)

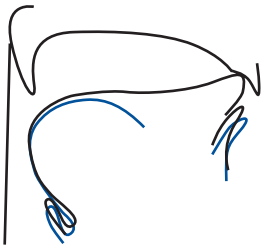


FIGURE 5.18
X-ray tracings of /l/ articulation (black line) and /o/ articulation (red line), showing similarity in root and dorsal positions of the tongue.

> *When it is made alveolarly, it is called "dark l." In Southern, British, and Eastern English, [l] before a front vowel, particularly a high front vowel, is clear. In General American all [l]'s are dark.* (Wise, 1957a, p. 131)
>
> *We should point out here that the so-called "lightness" or "clearness" of an l is not entirely dependent upon the position of the forepart of the tongue. In other words, the terms "front l" and "light l" are not exactly synonymous. A little experimentation will demonstrate that it is possible to keep the tip of the tongue on the upper teeth and produce l's of varying degrees of lightness and darkness.* (Kantner & West, 1941, p. 120)

Kantner and West went on to state that two other factors, besides the point of highest elevation of the tongue, determine the degree of lightness or darkness of /l/. First, increased lip spreading was said to result in a lighter /l/. Second, the back of the tongue was said to be flattened and lowered for a very light /l/ but raised for dark /l/.

Giles (1971) studied /l/ articulation by X-ray motion pictures and concluded that the position of the tongue dorsum distinguishes among three general types of /l/: prevocalic, postvocalic, and syllabic. The postvocalic and syllabic /l/ were quite similar except for the timing of movements for /l/ with respect to the preceding vowel. Postvocalic /l/ differed from the prevocalic variety in having a more posterior (farther back) position of the dorsum. Occasionally, contact of the tongue tip was not made for the postvocalic allophones in words like *Paul* (see Figure 5.19). The only other major variation that was observed in Giles's speech sample was dentalization of /l/ when followed by a dental sound, as in *health* /h ɛ l θ/.

The failure of some normal adult speakers to make tongue tip contact for /l/ in word-final or postvocalic position should be remembered when evaluating /l/ production in children. We frequently hear children produce an /o/-like sound for final /l/ in words like *seal.* Apparently, this "substitution" is not necessarily unusual or deviant, and caution should be observed in evaluating the child's proficiency for /l/ articulation. It is prudent to test /l/ production in more than one context or syllabic position before ascribing the /o/-like sound to an articulatory error.

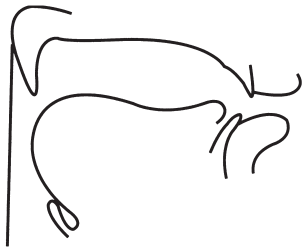


FIGURE 5.19
X-ray tracing of postvocalic /l/ articulated without lingua-alveolar contact.

Lingua-Alveolar Nasal: /n/. As the X-ray tracing in Figure 5.20 shows, /n/ (*new*) is made with a lingua-alveolar contact like that for /t/ and /d/, but with the velopharynx open. Sound energy from the larynx radiates outward through the nasal cavity. Articulatory (allophonic) modifications of the oral closure are similar to those for /t/ and /d/. For example, /n/ is dentalized (made with tongue contact against the upper teeth rather than the alveolar ridge) in words like *ninth,* where it is followed by a dental fricative.

Correct production of /n/ requires that the velopharynx be open during the time of lingua-alveolar closure. Otherwise, it would be heard as a /d/. Therefore, the timing of the velopharyngeal and oral articulations is critical for production of /n/ in running speech. An example of the coordination of velopharyngeal and oral movements is depicted in Figure 5.21, which shows composite tracings for the moment

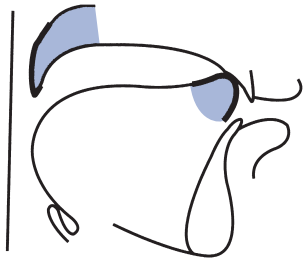


FIGURE 5.20
X-ray tracing of /n/ articulation. Thickened lines show lingua-alveolar contact and velopharyngeal opening.

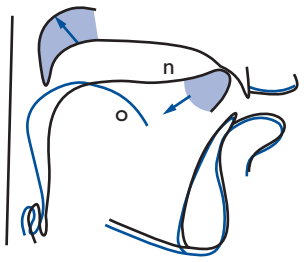


FIGURE 5.21
Articulatory configurations during the word-initial /n/ (black line) and following vowel /o/ in *no one.*