

Chapter 2

Phonology

PHONOLOGY INVOLVES two studies: the study of the production, transmission and reception of speech sounds, a discipline known as 'phonetics', and the study of the sounds and sound patterns of a specific language, a discipline known as 'phonemics'. We shall examine both, the first in Chapter 2 and the second in Chapter 3.

Phonetics

Human beings are capable of producing an infinite number of sounds but no language uses more than a small proportion of this infinite set and no two human languages make use of exactly the same set of sounds. When we speak, there is continuous movement of such organs as the tongue, the velum (soft palate), the lips and the lungs. We put spaces between individual words in the written medium but there are no similar spaces in speech. Words are linked together in speech and are normally perceived by one who does not know the language (or by a machine) as an uninterrupted stream of sound. We shall, metaphorically, slow the process down as we examine the organs of speech and the types of sound that result from using different organs.

The organs of speech

Figure 2 shows the main organs of speech: the jaw, the lips, the teeth, the teeth ridge (usually called the alveolar ridge), the tongue, the hard palate, the soft palate (the velum), the uvula, the pharynx, the larynx and the vocal cords. The mobile organs are the lower jaw, the lips, the tongue, the velum, the uvula, the pharynx and the vocal cords and, although it is possible to learn to move each of these at will, we have most control over the jaw, lips and tongue. The tongue is so important in the production of speech sounds that, for ease of reference, it has been divided into four main areas, the tip, the blade (or lamina), the front and the back as shown in Fig. 3.

Sounds could not occur without air. The air required for most sounds comes from the lungs and is thus egressive ('going out'). Certain sounds in languages can, however, be made with air sucked in through the mouth. Such sounds are called ingressive ('going in'). The sound of disgust in English, a click often written 'Tch! Tch!', is made

on an ingressive air stream. Coming from the lungs the air stream passes through the larynx, which is popularly referred to as the 'Adam's apple'. Inside the larynx are two folds of ligament and tissue which make up the vocal cords. These can, by muscular action, be held in five positions as illustrated in Fig. 4 below. Position 1 involves the cords being wide open as in deep breathing. Position 2 involves the cords being open, the position for voiceless (that is, breathy) sounds. Position 3 involves the cords coming together loosely and vibrating. This is the position for voiced sounds. Position 4 narrows the cords into the position used in whispering. If the cords are held tightly together (position 5) and released sharply, we produce what is known as a glottal plosive, a sound that occurs frequently in Arabic.

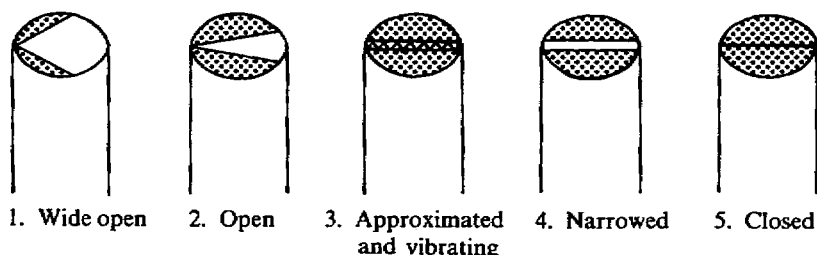


FIG. 4: Possible positions of the vocal cords

Vowels and consonants

Sounds can be divided into two main types. A vowel is a sound that needs an open air passage in the mouth. The air passage can be modified in terms of shape with different mouth and tongue shapes producing different vowels. A consonant is formed when the air stream is restricted or stopped at some point between the vocal cords and the lips. The central sound in the word 'cat' is a vowel. The first and third sounds are consonants. More will be said about vowels and consonants in the course of this chapter but these rough definitions will serve our purpose temporarily.

Articulation

Articulatory settings

Just as each language uses a unique set of sounds from the total inventory of sounds capable of being made by humans, so too each group of speakers has a preferred pronunciation. In English, the most frequently used consonants are formed on or near the alveolar ridge; in French, the favoured consonants are made against the teeth; whereas in India many sounds are made with the tip of the tongue curling towards the hard palate, thus producing the retroflex sounds so characteristic of Indian languages. The most frequently occurring sounds in a language help to determine the position of the jaw, tongue, lips and possibly even body stance when speaking. A speaker will always sound foreign in his or her pronunciation of a language if the articulatory setting of its native speakers has not been adopted.

Manner of articulation

The ears can judge sounds very precisely, distinguishing the pure resonance of a tuning fork from the buzzing sound of a bee or the sharp report of a gun. More important for speech, perhaps, we can also distinguish between the voiceless sounds like 'p' and 't' in 'pat' and the voiced sounds like 'b' and 'd' in 'bad' or between the voiceless 'p' in 'pat' and the nasal 'm' in 'mat'. Speech exploits all these abilities and many more and scholars have devised ways of classifying sounds according to the way they are made.

The first obstacle the air meets in the vocal tract is in the glottis (the gap between the vocal cords). The vocal cords may be open, in which case the sound will be *voiceless*, or closely approximated, in which case the sound will be *voiced*. The vocal tract is a resonance chamber and different sounds can be produced by changing the shape of the chamber. If you study the various types of closure below, it will help you to describe the different types of sound you can make.

Plosives: These involve complete closure at some point in the mouth.

Pressure builds up behind the closure and when the air is suddenly released a plosive is made. In English, three types of closure occur resulting in three sets of plosives. The closure can be made by the two lips, producing the bilabial plosives /p/* and /b/; it can be made by the tongue pressing against the alveolar ridge, producing

* Phonetic symbols are, by convention, indicated by placing them between two oblique strokes. An explanation of the International Phonetic Alphabet is given on pp. 19–22.

the alveolar plosives /t/ and /d/ and it can be made by the back of the tongue pressing against the soft palate, producing the velar plosives /k/ and /g/.

Fricatives: These sounds are the result of incomplete closure at some point in the mouth. The air escapes through a narrowed channel with audible friction. If you approximate the upper teeth to the lower lip and allow the air to escape you can produce the labio-dental fricatives /f/ and /v/. Again, if you approximate the tip of the tongue to the alveolar ridge, you can produce the alveolar fricatives /s/ and /z/.

Trills: These involve intermittent closure. Sounds can be produced by tapping the tongue repeatedly against a point of contact. If you roll the /r/ at the beginning of a word saying:

r.r.r.roaming

you are tapping the curled front of the tongue against the alveolar ridge producing a trill which is, for example, characteristic of some Scottish pronunciations of English.

Laterals: These sounds also involve partial closure in the mouth. The air stream is blocked by the tip of the tongue but allowed to escape around the sides of the tongue. In English, the initial /l/ sound in 'light' is a lateral; so is the final sound in 'full'.

Nasals: These sounds involve the complete closure of the mouth. The velum is lowered, diverting the air through the nose. In English, the vocal cords vibrate in the production of nasals and so English nasals are voiced. The three nasals in English are /m/ as in 'mat', /n/ as in 'no' and /ŋ/ as in 'sing'.

Affricates: Affricates are a combination of sounds. Initially there is complete closure as for a plosive. This is then followed by a slow release with friction, as for a fricative. The sound at the beginning of 'chop' is a voiceless affricate represented by the symbol /tʃ/. We make the closure as for /t/ and then release the air slowly. The sound at the beginning and end of 'judge' is a voiced affricate, represented by the symbol /dʒ/.

Frictionless continuants: In making the /r/ sound associated with BBC English, the closure is made as for the fricatives /s/ and /z/ but the air is released with less pressure. In BBC English (for a discussion of this term see below, pp. 26–32), this sound cannot occur at the end of a word.

Semi-vowels: The sounds that begin the words 'you' and 'wet' are made without closure in the mouth. To this extent, they are vowel-like. They normally occur at the beginning of a word or syllable, however, and thus behave functionally like consonants. The semi-vowels are represented by the symbols /j/ and /w/.

All sounds can be subdivided into *continuants*, that is, sounds which can be continued as long as one has breath: vowels, fricatives, laterals, trills, frictionless continuants; and *non-continuants*, that is, sounds which one cannot prolong: plosives, affricates and semi-vowels.

Place of articulation

The eight commonest places of articulation are:

Bilabial: Where the lips come together as in the sounds /p/, /b/ and /m/.

Labiodental: Where the lower lip and the upper teeth come together, as for the sounds /f/ and /v/.

Dental: Where the tip or the blade of the tongue comes in contact with the upper teeth as in the pronunciation of the initial sounds in 'thief' and 'then', represented by the symbols /θ/ and /ð/.

Alveolar: Where the tip or blade of the tongue touches the alveolar ridge which is directly behind the upper teeth. In English, the sounds made in the alveolar region predominate in the language. By this we mean that the most frequently occurring consonants /t, d, s, z, n, l, r/ are all made by approximating the tongue to the alveolar ridge.

Palato-alveolar: As the name suggests, there are two points of contact for these sounds. The tip of the tongue is close to the alveolar ridge while the front of the tongue is concave to the roof of the mouth. In English, there are four palato-alveolar sounds, the affricates /tʃ/ and /dʒ/ and the fricatives /ʃ/ and /ʒ/, the sounds that occur, respectively, at the beginning of the word 'shut' and in the middle of the word 'measure'.

Palatal: For palatal sounds, the front of the tongue approximates to the hard palate. It is possible to have palatal plosives, fricatives, laterals and nasals, but in English the only palatal is the voiced semi-vowel /j/ as in 'you'.

Velar: For velars, the back of the tongue approximates to the soft palate. As with other points of contact, several types of sound can be made here. In English there are four consonants made in the velar region, the plosives /k, g/, the nasal /ŋ/ and the voiced semi-vowel /w/ as in 'woo'.

Uvular, pharyngeal and glottal sounds occur frequently in world languages. They are not, however, significant in English and so will not be described in detail. They will, however, be illustrated in Fig. 7 which will summarise all the data presented above.

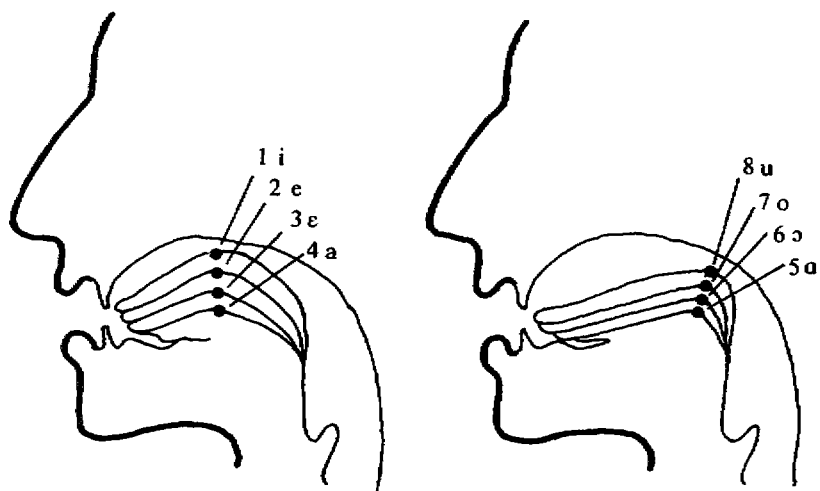
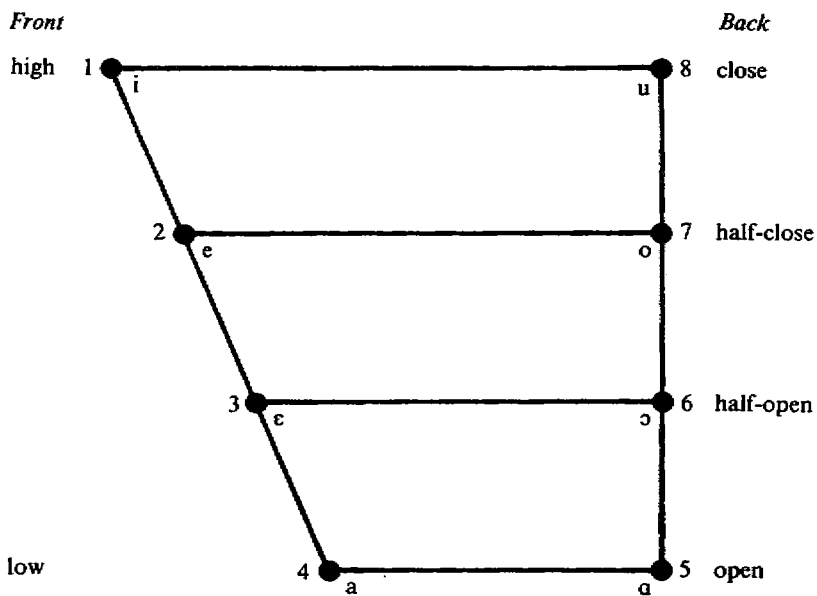


FIG. 5: Cardinal Vowel Chart – representing tongue positions

The International Phonetic Alphabet

A regular, consistent, economical system of notation is necessary for describing the sounds that occur in speech and the best-known is the International Phonetic Alphabet (IPA) chart. This alphabet is based on the ordinary roman alphabet, supplemented by other symbols so as to provide scholars with techniques for representing unambiguously all possible sounds.

Vowels cannot be classified by touch because they demand an open air passage through the mouth. They are therefore defined largely by auditory criteria. The most useful method of describing vowels is in terms of the 'Cardinal Vowel Chart'. This chart is a stylised representation of the cubic area of the mouth and it allows us to describe vowels with considerable precision. Figure 5 illustrates the eight primary cardinal vowels, with the dots indicating the highest point of the tongue during the pronunciation of each vowel. High vowels are made with the tongue close to the palate; low vowels are made with the tongue lowered from the palate, and this automatically entails the opening of the mouth. The following descriptions put into words the facts illustrated above.

Cardinal Vowel One is usually referred to as C1 and represented by /i/. C1 is a front close vowel made with the lips spread. The vowel sound in English 'tree' is similar in quality to C1.

C2 is a front half-close vowel represented by /e/. The initial vowel in 'acorn' is similar in quality to C2.

C3 is a front half-open vowel made with spread lips. It is similar in quality to the vowel sound in English 'get' and is represented by /ɛ/.

C4 is an open front vowel represented by /a/. It is made with spread lips and is the lowest vowel capable of being made in the front of the mouth.

C5 is a low back vowel made with neutrally open lips. It is represented by /ɑ/ and is similar in quality to the vowel sound in the southern British pronunciation of 'dance'.

C6 is a half-open back vowel made with slightly rounded lips and represented by /ɔ/. It is similar in quality to the English vowel sound in 'dawn'.

C7 is a half-close back vowel made with rounded lips. It is represented by /o/.

C8 is a close back vowel made with very closely rounded lips. It is represented by /u/ and is the furthest back, closest vowel we are capable of making.

There are no near equivalents of C4, C7 and C8 in southern British English but an approximation of their quality can be given. C4 is

similar in quality to the vowel in the Scottish pronunciation of 'dance'; C7 is similar in quality to a Scottish pronunciation of 'no'; C8 has not got an English analogue. It resembles the vowel sound in 'cool' but is most similar to the sound in French 'boule'.

As well as the primary cardinals, there are eight secondary cardinal vowels, as shown in Fig. 6:

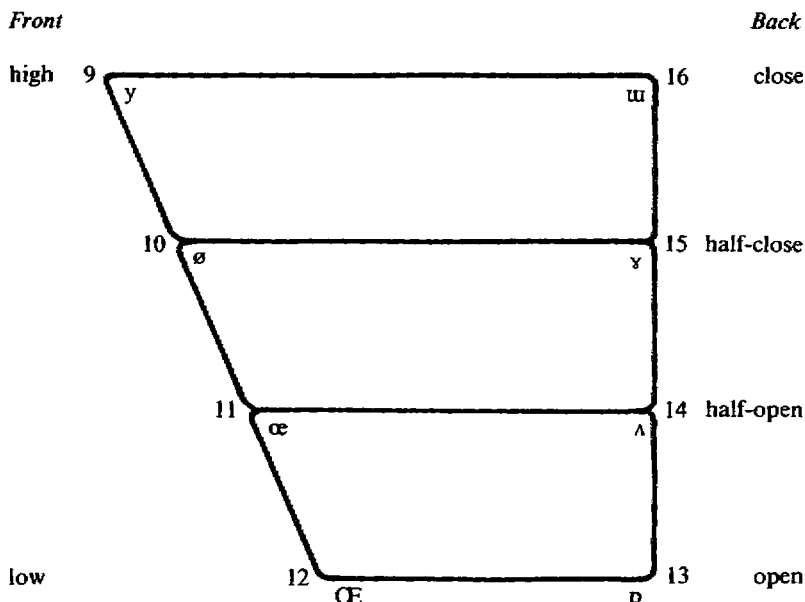


FIG. 6: Secondary cardinal vowels

These vowels are made in exactly the same positions as C1 to C8 but their lip positions are different. Thus C9 is the most advanced and the closest vowel capable of being made. It differs from C1 in that it is made with closely rounded lips. C16, on the other hand, is made in exactly the same way as C8 but the sound is made with the lips widely spread.

With these cardinal vowels as guides, any vowel from any language can be described in terms of its proximity to a cardinal vowel. To place vowels accurately demands a good ear and a fair amount of practice, but once the skill has been acquired, it is possible to show the relationship between one vowel and another with considerable precision.

It is quite a lot easier to describe and place consonants because one can feel the type of closure made in the mouth. Figure 7 (on p. 22) illustrates the main consonants that occur in languages and the symbols used to represent them. Additional symbols exist to represent more unusual sounds, such as the clicks that occur in some southern Bantu languages, but the consonant chart (Fig. 7) is adequate for the representation of the majority of sounds.

It may prove useful to offer a summary to guide the reader in the techniques to select in describing sounds. In describing a vowel it is important to state:

- (1) the length of the vowel, that is, whether it is long or short
- (2) whether the vowel is oral or nasal*
- (3) the highest point of the tongue
- (4) the degree of closeness
- (5) the shape of the lips

Thus the vowel sound in 'tree' would be classified as a long, oral, front, close, unrounded vowel. The vowel in 'doom' would be a long, oral, back, close rounded vowel. It is well to remember that when the front of the tongue is raised towards the hard palate we have a *front* vowel. When the back of the tongue is raised towards the soft palate, we have a *back* vowel. If the centre of the tongue is raised towards the juncture between the hard and soft palates, then we have a central vowel. The vowel sound in the word 'the' is a central vowel and would be described as short, oral, central, half-open, with neutrally spread lips.

In describing consonants, one should state:

- (1) the type of air stream used (in English *all* speech sounds are made on an egressive air stream although certain sounds of disgust and annoyance are made on an ingressive air stream)
- (2) the position of the vocal cords (apart for voiceless sounds, approximated and vibrating for voiced sounds)
- (3) the position of the velum (raised for oral sounds, lowered for nasal; that is, we must state whether a consonant is oral or nasal)
- (4) the manner of articulation (for example plosive, fricative, and so on)
- (5) the place of articulation (for example bilabial, alveolar, and so on)

Thus, if we were asked to describe the initial sound in 'buy' and the final sound in 'tin' we would say that /b/ is made on an egressive air stream and is voiced, oral, plosive and bilabial, and that /n/ is also uttered on an egressive air stream and is voiced, nasal and alveolar.

* All English vowels are oral.

	<i>Bi-labial</i>	<i>Labio-dental</i>	<i>Dental and alveolar</i>	<i>Retroflex</i>	<i>Palato-alveolar</i>	<i>Alveolo-palatal</i>	<i>Palatal</i>	<i>Velar</i>	<i>Uvular</i>	<i>Pharyngeal Glottal</i>
<i>Plosive</i>	p b	t d	n	ɳ			c ɟ	k ɡ	q ɢ	ʕ
<i>Nasal</i>	m	ɱ	n	ɳ			ɲ	ŋ	ɴ	
<i>Lateral fricative</i>		ɬ ɮ								
<i>Lateral non-fricative</i>		l	ɭ				ʎ			
<i>Rolled</i>		r							ʀ	
<i>Flapped</i>		r	ɾ						ʀ	
<i>Fricative</i>	ɸ β	f v	θ ð s z ʃ ʒ	ʂ ʐ	ʃ ʒ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
<i>Fricationless continuants and semi-vowels</i>	w ɥ	ʋ	j			j (ɥ)	(w)		ʁ	

FIG. 7: The IPA Chart

Suprasegmentals

As well as the sounds that occur in speech, a number of other phenomena are of interest to the linguist. The most significant of these, pitch, stress, tone, intonation and tempo, are called 'suprasegmental features' because they accompany speech sounds and are sometimes a feature of the entire utterance rather than of any individual sound.

Pitch refers to the normal melodic height of an individual's speech. In English, higher than usual pitch for a speaker is usually associated with excitement or strain.

Human speech may be considered as a succession of syllables, some of which are more strongly stressed than others. Thus, in the word 'debatable', it is the second of the four syllables that receives most emphasis. World languages seem to be divided into two types, 'syllable-timed' languages like French where syllables are produced at regular intervals of time and where stresses occur randomly; and 'stress-timed' languages like English where stresses occur at regular intervals with a random number of syllables occurring between stresses. These differences can be illustrated by looking at the regular number of syllables in the following French couplet:

1 2 3 4 5 6 7 8 9 10 11 12

Sur son dos, ou livrant à leurs fiers appétits

1 2 3 4 5 6 7 8 9 10 11 12

Le trésor toujours prêt des mamelles pendantes.

Charles Baudelaire (1821-67)

Each line has twelve syllables. In the following English couplet, written at approximately the same time, we find four main stresses in each line:

Love is enóugh: though the Wofld be a-wáning, (11 syllables)

And the wóods have no vóice but the voice of compláining (13)

William Morris (1834-96)

but, even in two consecutive lines, the number of syllables varies from eleven to thirteen.

In so-called 'tone-languages', relative pitch can distinguish meanings. In many of the Bantu languages, for example, the word for 'house' differs from the word for 'thread' in terms of pitch difference only. Tone languages make systematic use of high, low, rising and falling pitch to distinguish meanings. Pitch is not systematically employed in this way in English although, on occasion, different meanings can be carried by changes of pitch or stress as in the sentence:

I don't like him because of his money.

If we use a rising pitch and extra stress on 'because', the sentence means that I like him but my liking is not related to the fact that he has money. If we do not stress 'because' the sentence means that I do not like him and his money is responsible for my dislike.

Intonation is associated with pitch in that it involves speech melody over an utterance. The usual intonation for a statement in English involves a slow fall:



I don't like him.

In questions, however, a rise in pitch is involved:



Do you like him?

The tempo or speed of an utterance is usually associated with a speaker's frame of mind. Increased speed may suggest excitement; reduced speed may imply boredom, tiredness or a threat.

The suprasegmentals mentioned here will not be discussed further, but references are provided in the bibliography for readers interested in pursuing this subject.

Exercises

- Give the correct technical terms for the sounds made in the following ways:
 - both lips coming together
 - the bottom lip and top teeth coming together
 - the tongue touching the upper teeth ridge
 - the tongue touching the hard palate
 - the tongue touching the soft palate
- Give the correct technical term for the sounds resulting from the following closures:
 - complete closure followed by slow release of air
 - complete closure of the oral cavity with the air diverted through the nose
 - partial closure where the air stream is blocked by the tip of the tongue but allowed to escape round the sides of the tongue
 - incomplete closure
 - complete closure followed by a sudden release of air

3. Give the symbol for each of the following sounds and give an example of its use in an English word:

- (a) voiced bilabial plosive
- (b) bilabial nasal
- (c) voiceless labiodental fricative
- (d) alveolar lateral
- (e) high front unrounded vowel
- (f) high back rounded vowel
- (g) voiced alveolar fricative
- (h) voiced frictionless continuant
- (i) voiceless velar plosive
- (j) voiced dental fricative

4. Each of the following sets contains an inappropriate member. Pick it out and say why it is inappropriate.

- (a) m, n, ŋ, b
- (b) b, p, n, t
- (c) b, m, p, s
- (d) l, f, v, s, z
- (e) l, o, e, ε
- (f) i, o, ε, e
- (g) t, d, l, n, p
- (h) t, d, p, f, s
- (i) b, d, z, r, s
- (j) t, k, ŋ, g

5. Describe the similarities and differences in the sounds represented by the underlined elements in the following sets. (Remember you are dealing with *sounds* and not *letters*.)

- (a) leaf leaves
- (b) assure azure
- (c) sad sat
- (d) seat set
- (e) jut shut
- (f) notion nodding
- (g) rough rub
- (h) feel fall
- (i) vine wine
- (j) sing sin