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# Revision of Phonetics

## 1. Consonants

Consonants are normally specified for three descriptive parameters: voicing state, place of articulation and manner of articulation.

**Voicing state.** While we may reasonably describe most consonants as either voiced (with vocal cord vibration) or **voiceless** (without vocal cord vibration), we may also indicate full or partial devoicing by placing the diacritic [̚] beneath the symbol for the appropriate voiced segment, as in [d̚] a devoiced alveolar stop. The symbols we use in this book are mostly taken from the International Phonetic Alphabet (IPA) which is given on p. 11.

**Place of articulation** distinctions are as follows. (See the diagram of the organs of speech on p. 12.) Where the articulators are the lips, the sound in question is **bilabial**. Where the active articulator is the lower lip and the passive articulators are the upper teeth, the sound is **labiodental**. **Dental** sounds are articulated with the tip of the tongue and the upper teeth. **Alveolar** sounds are articulated with the tip/blade of the tongue and the alveolar ridge. **Post-alveolar** sounds are retracted somewhat from this position; an example is the post-alveolar approximant [ɹ] found in many accents of English. In **palatal** sounds, the active articulator is the front of the tongue and the passive articulator is the hard palate. The back of the tongue and the soft palate are, respectively, the active and passive articulators in **velar** sounds, whereas in **uvular** sounds, the articulators are the back of the tongue and the uvula. The walls of the pharynx are the articulators in **pharyngeal** sounds, and the vocal cords themselves are the articulators in **glottal** sounds.

**Manner of articulation** is specified according to degree of stricture (the degree to which the articulators impede the flow of air). The three principal degrees of stricture are as follows:

1. Complete closure, where the articulators seal off the flow of air completely; these sounds are called **stops** or **plosives**.
2. Close approximation, where the articulators come very close to one another without actually sealing off the escape of air, such that turbulence, and thus audible friction, are produced; these sounds are called **fricatives**.
3. Open approximation, where the articulators are not sufficiently close to induce turbulence and audible friction; such sounds are called **approximants**. They are normally defined as being voiced.

We may use these parameters to distinguish speech sounds as follows:

### Bilabial

[p] is a voiceless bilabial stop.

[b] is a voiced bilabial stop.

[ɸ] is a voiceless bilabial fricative: it can be heard in Japanese in, for instance, the word *Fuji* [ɸɯdʒi].

[β] is a voiced bilabial fricative: it occurs in Tamil, as in the word for ‘twenty’ [ɪrɔβɑðɯ].

[β̞] is a voiced bilabial approximant: it can be heard in Spanish in, for example, [ɐβ̞ɛɾ] (‘to have’). The symbol used here is the same as for the fricative, but with the subscript diacritic meaning ‘lowered’ added.

### Labiodental

[f] is a voiceless labiodental fricative.

[v] is its voiced counterpart.

[ʋ] is a voiced labiodental approximant; you can practise this by altering a [v] such that the lower lip does not actually come into contact with the teeth. It occurs in Tamil.

### Dental

It is not easy to hear the difference between, on the one hand, the dental stops [t̪] and [d̪] and, on the other hand, the alveolar stops [t] and [d], but in many languages it is the dental rather than the alveolar stops which occur: in Tamil, Spanish and Polish, for instance.

[θ] is a voiceless dental fricative which occurs in English, as in *thing*.

[ð] is the voiced equivalent. It too occurs in English, although, in words like *that*, there is often little or no friction, in which case the diacritic meaning ‘frictionless’ may be placed beneath the symbol for the fricative, thus [ð̟]. This therefore denotes a voiced dental approximant, of the sort found in the Spanish word *hablado* [ɐbləð̟o].

### Alveolar

In addition to the stops [t] and [d], there are the alveolar fricatives [s] and [z].

Among the approximants and fricatives, there is a distinction between **central** and **lateral** sounds: in central sounds, the airflow escapes along a central groove in the active articulator, while in lateral sounds, there is closure at this central point, with the airflow escaping along the sides of the active articulator. Thus, the voiced lateral alveolar approximant [l] has closure at the centre of the alveolar ridge and lateral escape of airflow, while in the voiced central approximant [ɭ], there is closure between the sides of the tongue and

the gums, with central escape of airflow. This sound, found in many accents of English, is also somewhat retracted (just how much varies considerably among accents) and is therefore said to be post-alveolar.

The fricatives we identify here should be assumed to be central unless otherwise specified. Lateral fricatives do occur, though: the voiceless alveolar lateral fricative [ɬ] occurs in Welsh, and its voiced equivalent, [ɮ], in Zulu.

There are further manner of articulation distinctions which can often be identified among alveolar sounds. The alveolar **trill** involves a stricture of intermittent closure: with a constant muscular pressure on the tongue, **intermittent closure** is brought about by means of an interaction between the stop closure and the air pressure building up behind that closure. This is an instance of the Bernoulli Effect which underlies vocal cord vibration: as the closure is released, the air pressure drops and the muscular tension closes the articulators again, at which point the air pressure builds up and separates the articulators. In trills, this sequence occurs several times, rather rapidly.

In **taps**, the blade of the tongue closes only momentarily against the passive articulator: we may think of taps as stops of very short duration. The voiced alveolar tap is denoted by the symbol [ɾ], and its voiceless counterpart by the same symbol with the devoicing diacritic, thus [ɾ̥].

Around the alveolar ridge, we must distinguish **retroflex** sounds from non-retroflex sounds: in retroflex sounds, the underside of the blade of the tongue acts as the active articulator against the alveolar ridge. Thus, the voiceless and voiced retroflex stops, represented as [ɖ] and [ɗ], involve complete closure, while the fricatives [ʂ] and [ʐ] involve close approximation. The retroflex [ʂ] is found in Spanish. The retroflex tap [ɽ] is like an alveolar tap, but with the underside of the tongue blade forming a momentary stricture of complete closure with the alveolar ridge. The retroflex lateral approximant [ɭ] involves closure between the underside of the blade and the alveolar ridge, but open approximation between the sides of the tongue and the gums, allowing lateral escape of airflow. Many of these retroflex sounds can be found in the Dravidian and Indo-European languages of the Indian subcontinent; you will often hear them among people with an Indian or Bangladeshi background. The term ‘retroflex’ is usually listed alongside the other place of articulation terms, although it identifies place of articulation by means of the active rather than the passive articulator.

### Palato-alveolar

This term is not terribly precise, covering as it does an area which is part of the continuum from the alveolar ridge to the hard palate. The voiced and voiceless fricatives [ʃ] and [ʒ], which occur in English, as in the words *ship* and *vision*, are often said to be palato-alveolar.

So too are the **affricates** [tʃ] and [dʒ] which occur in the English words *church* and *judge*. Affricates are characterised by a stricture of complete closure followed by a release phase in which there is close approximation between the articulators, and thus audible friction is produced. We may consider affricates as slowly released stops, where it is the absence of instantaneous release which results in a transitional phase of close approximation. Affricates can be produced at most places of articulation: [tʃ] and [dʒ], for instance, are alveolar affricates, with the superscript diacritic indicating that the two symbols should be taken to denote a unitary sound. Similarly, [kx] and [qɣ] are, respectively, voiceless velar and uvular affricates. Precisely what is meant by ‘unitary sound’ is a phonological matter which we will not pursue here. The closure phase and release phase in affricates need not be strictly **homorganic** (occurring at the same place of articulation); thus, in [pf], the closure phase is bilabial while the release phase is labiodental.

You may well encounter, in any further reading you may do, the symbols [č] and [j] for [tʃ] and [dʒ], as well as [š] and [ž] for [ʃ] and [ʒ]. For the fricatives of Polish, we will adopt two extra symbols which are not found in the IPA. The reason for this is as follows. In Polish, there is an important distinction between fricatives and affricates, and amongst alveolar, post-alveolar and what are called pre-palatal sounds. The post-alveolars are articulated with retraction of the tongue body, while the pre-palatals are articulated fairly close to the palatal region, but further forward than strictly palatal sounds. That is, the continuum from the alveolar ridge to the hard palate is divided up into three, rather than two, places of articulation. We may distinguish, among the fricatives, between voiced and voiceless alveolar, post-alveolar and pre-palatal fricatives, and we will use the following symbols for these:

[s] and [z], as is standard, for the alveolars.

[ʃ] and [ʒ] for the post-alveolars.

[š] and [ž] for the pre-palatals.

For the affricates, we will use:

[tʃ] and [dʒ], as above, for the alveolars.

[tʃ] and [dʒ] for the post-alveolars.

[č] and [j] for the pre-palatals.

While this choice of symbols is unproblematical for the alveolars and pre-palatals, it does mean that we will be using, in the case of Polish, the symbols [č] and [j], [š] and [ž] to denote sounds which are not palato-alveolar. This should not cause problems.



**Palatal**

The voiceless palatal stop [c] occurs in some of the exercises in this book; it is articulated high up in the oral cavity, with the front of the tongue against the hard palate. The stop in the English word *keep* is fairly close to [c], but [c] is articulated even further forward than that. Its voiced equivalent is [j], which also occurs in the exercises in this book. The fronted stop which occurs in *keep* is usually transcribed using the ‘fronted’ (or ‘advanced’) diacritic, thus [k̟].

[ç] is a voiceless palatal fricative which occurs in German, as in the word *Milch*, and in Scots, as in *driech*. Many English speakers produce something close to this in their pronunciation of *huge* in casual speech.

[j] is its voiced equivalent.

[j̟] is a voiced palatal approximant which occurs in the English word *year*.

[ʎ] is a voiced palatal lateral; it occurs in many accents of Spanish, as in *calle* (‘street’).

**Velar**

[k] is a voiceless velar stop which occurs in many languages, including English.

[g] is its voiced equivalent.

[x] is a voiceless velar fricative. It occurs in Scots in, for instance, *loch*, and in German, as in *Buch*. If you compare this with the palatal fricative [ç], you will notice that the palatal sound has a noticeably higher pitch.

[ɣ] is its voiced equivalent; you will encounter it in the Eskimo data in Chapter 1.

[ɣ̟] is a voiced velar approximant; it occurs in Spanish, as in *bodega*.

**Uvular**

[q] is a voiceless uvular stop; you can practise it by making a [k] and retracting it, so that it is articulated against the uvula. It occurs in the Eskimo data in this book. If you compare it with [k] and [c], you will hear the pitch increase as you progress from [q] to [k] to [c].

[G] is its voiced equivalent.

[χ] is a voiceless uvular fricative. It occurs in Arabic and in French where the voiced uvular fricative [ʁ] is devoiced.

[ʁ̟] is a voiced uvular approximant which occurs in French. As with [ø̟] and [ɣ̟], the symbol for the fricative is used, with the ‘lowered’ diacritic added.

### Pharyngeal

In pharyngeal sounds, it is the walls of the pharynx which act as the articulators. Since these cannot readily form a stricture of complete closure, it is normal to identify only two pharyngeal sounds: [ħ], the voiceless pharyngeal fricative which occurs in Arabic, and [ʕ], the voiced pharyngeal fricative, which also occurs in Arabic.

### Glottal

The glottal stop [ʔ] involves closure, followed by release, of the vocal cords.

The glottal fricative [h] involves close approximation between the vocal cords.

### *Consonants involving more than one articulation*

The approximant [w], which occurs in English, has a stricture of open approximation between the lips, and also between the back of the tongue and the velum. It is therefore usually referred to as a labial-velar approximant. The question arises as to whether one of these articulations should be considered primary with respect to the other. We will take the view that the two are of equal articulatory status in English.

The lateral approximant [l] involves, as we have seen, an alveolar articulation, but this is often accompanied, in accents of English, by a **secondary articulation** of either **palatalisation** or **velarisation**.

Where an alveolar lateral is palatalised, the front of the tongue forms a secondary stricture of open approximation with the hard palate, thus producing a more high-pitched sound. There is often some palatalisation of laterals for speakers of English where the lateral occurs before a high front vowel. In some accents of English (Tyneside English and Highland Scottish English, for instance), most occurrences of laterals are palatalised. The palatalised lateral is often referred to as ‘clear l’. The ‘palatalised’ diacritic is added to the lateral symbol to indicate palatalisation, thus [lʲ].

In velarised laterals, the back of the tongue forms a secondary articulation of open approximation with the velum. For many speakers of English, laterals are velarised when they occur syllable-finally. There are accents, such as Standard Scottish English, where laterals are almost always velarised. To transcribe velarisation, a diacritic is added which runs through the centre of the appropriate symbol, thus [ɫ̠]. The velarised lateral is often referred to as ‘dark l’.

Palatalised and velarised laterals do not function to distinguish one meaning from another in English, but palatalisation does have this function in many Slavic languages, as you will see in the exercises on Polish. In that language, it occurs, not with lateral approximants, but with bilabial stops, labiodental fricatives and the dental nasal stop.

**Pharyngealisation**, in which the root of the tongue is retracted towards the pharynx wall, is a common secondary articulation in Arabic, and distinguishes, for instance, pharyngealised alveolar stops from their non-pharyngealised counterparts. To represent this we use [d̠].

## *Aspiration*

In most accents of English, when voiceless stops are followed by voiced segments such as vowels or approximants, there is often a delay between the release phase of the stop and the onset of voicing for the following segment. When this happens, there is an audible release of air from the stop closure which is referred to as **aspiration**. Aspiration is therefore definable as voice onset delay; it is transcribed with a superscript diacritic following the symbol for the voiceless stop, thus [p<sup>h</sup>]. It does not always occur with voiceless stops in English, and we will see that its occurrence is, in many cases, predictable. While the distinction between voiceless aspirated and voiceless unaspirated stops does not serve to distinguish one meaning from another in English, it does have this function in some languages, including Thai, as you will see in Chapter 1.

## *Nasal stops and nasalisation*

**Nasal stops** involve lowering of the velum, accompanied by complete closure within the oral cavity, allowing continual escape of airflow through the nasal cavity; where the sound is voiced, this results in the characteristic resonance which the nasal cavity induces. Nasal stops occur at most places of articulation, as follows:

[m] is a voiced bilabial nasal stop, as in English *map*.

[ŋ] is labiodental, as in English *amphetamines* and *inform*.

[n̪] is dental, as in English *untheatrical*.

[n] is alveolar, as in English *nun*.

[ɳ] is retroflex, as in Tamil [pu:ɳd̪ɔ] ('garlic').

[ɲ] is palatal, as in Tamil [ɲ̪ɪ] ('ginger').

[ŋ] is velar, as in English *sing*.

[N] is uvular.

Where these occur devoiced, the devoicing diacritic is added, thus [n̥].

Where velic opening is not accompanied by a stricture of complete closure in the oral cavity, the resulting sound is said to be **nasalised**. Thus,

the fricative [v], if nasalised, would be [v̄], with the diacritic for nasalisation added. Nasalisation in vowels is much more common than in affricates, fricatives and approximants; examples are [ō] and [ā], in French.

## 2. Vowels

All vowels are articulated with a stricture of open approximation. While voiceless vowels do occur, and are transcribed using the ‘voiceless’ diacritic, vowels are normally voiced. We may distinguish vowels in terms of:

1. The height of the tongue body in the oral cavity.
2. The position of the body of the tongue along the front/back dimension of the oral cavity.
3. The presence or absence of lip rounding.

Two extreme-vowel heights may be distinguished: **close** (or **high**), where the tongue body is as near the hard or soft palate as it can be without causing audible friction, and **open** (or **low**), where the jaw is lowered and the tongue body is as far as possible from the roof of the mouth. Between these extremes, we may pick out two intermediate heights: **close-mid** (or **high-mid**) and **open-mid** (or **low-mid**), where the four heights are said to be equidistant: the tongue is said to move the same distance at each stage of the transition from [i] through [e], then [ɛ], to [a] (see diagram on p. 11). This division allows us an arbitrary but useful division of the **vowel space** (the available space within the oral cavity for the production of vowels).

We can combine this division with the back/front dimension of the vowel space to identify certain peripheral points around the extreme edge of the vowel space. Those points are referred to as the **primary cardinal vowels**. We may depict them in an idealised representation of the vowel space, as in the diagram on p. 11.

Cardinal vowel no. 1 is [i]; it is produced with the lips spread and the tongue as far forward and as high as it can go without creating friction. It is therefore close, front and unrounded.

Cardinal vowel no. 5 is [ɑ]; it is produced without any lip rounding and with the tongue as far back and as low as it can go without producing friction. It is open, back and unrounded.

These two cardinal vowels are the principal points around which our vowel space diagram is organised.

Cardinal vowel no. 2 is [e]; it is articulated with spread lips, with the tongue at the half-close height and as far forward as it can go. It is close-mid, front and unrounded.

Cardinal vowel no. 3 is [ɛ]; it is articulated as for [e], but with a half-open tongue height. It is therefore front, low-mid and unrounded.

Cardinal vowel no. 4 is [a]; it is unrounded and as open and front as is possible.

Cardinal vowel no. 6 is [ɔ]; it is rounded, open-mid and as far back as is possible.

Cardinal vowel no. 7 is [o]; it is close-mid, fully back and rounded.

Cardinal vowel no. 8 is [u]; it is fully back, close and rounded.

In addition to these, a series of **secondary cardinal vowels** can be identified. The first eight of these (nos 9–16) are identical to the primary cardinal vowels except that they have the opposite values on the rounded/unrounded parameter. They are also represented in the vowel chart on p. 11. Of these symbols, you will often encounter [y], [ø], [œ] and [ɯ] (nos 9, 10, 11 and 16) in this book. While the vowels which occur in human languages are not often as peripheral in the vowel space as the cardinal vowels, these cardinal vowels act as points of reference, in terms of which other vowel qualities can be identified. Thus, in French, there are three front, rounded vowels which are similar to, but not quite as peripheral as, [y], [ø], [œ].

We may use a set of diacritics in conjunction with the symbols for the cardinal vowels to pinpoint fairly precisely where a given vowel is articulated. Thus, the diacritic [±] is used to indicate a position raised with respect to a cardinal position, and [∓] to indicate relative lowering. The representation [ɛ̄] therefore denotes a front, unrounded vowel which is somewhat more close than [e], and [ɛ̇] represents a front, unrounded vowel somewhat lower than [ɛ]. Similarly, the superscript diacritic [˘] indicates a vowel articulation somewhat more centralised than is denoted by the cardinal vowel symbol: [ɛ̄˘] denotes a centralised, half-close, front unrounded vowel, for instance.

We will adopt the practice of not using these diacritics unless the precise details of the vowel in question are of relevance to the problem under discussion. This means, for instance, that we will use [y], [ø], [œ] for the front, rounded vowels of French, even though the actual values are not quite those of cardinal vowels 9, 10 and 11. Similarly, we will often use [ɯ] to represent a vowel which is fairly close, fairly back and unrounded, but not quite cardinal vowel 16. This commits us to a certain degree of phonetic inaccuracy, but one has to assess the degree of phonetic accuracy needed for a given purpose, and for the purposes of an introductory book of this nature, the absence of phonetic detail is, arguably, justified.

Other vowel symbols we will use are:

[ɯ] which is central, close and rounded, and often ‘counts’ as a back vowel in phonological systems.

[ə] referred to as ‘schwa’, which is central on both the vertical and horizontal axes, and is unrounded. Both the term and the symbol are used rather loosely at times by phonologists to cover vowels in a fairly large area in the centre of the vowel space.

[ɐ] which is open, central and unrounded.

In Received Pronunciation (RP), there is a systematic distinction between the long, back, open, unrounded vowel [ɑ:] (see below on length) and the short, front, open, unrounded vowel usually represented as [æ]. This symbol indicates a vowel quality somewhat higher than [a] (cardinal vowel no. 4). The distinction between a front and a back low vowel is absent in many languages and accents; for example, the words *ant* and *aunt*, which are distinct for an RP speaker, are homophones in Lowland Scots. Many writers use the symbol [a] where the frontness/backness of a low vowel is either not known or irrelevant to the task in hand; we will often use [ɐ] where a low vowel is known to be central, and [a] vs [ɑ] for front and back low vowels.

The symbol [ɪ] is used, in transcriptions of words in English and other languages, to denote an unrounded vowel which is less front and less close than [i], as in the word *bit*.

The vowel [ʊ] is back and rounded, but less back than [u], and less high.

The diacritic [:] denotes length, in both consonants and vowels. It is important to bear in mind that length is a *relative* property: [ɑ:] in RP is long with respect to other RP vowels such as [æ]. The same is true of the many long and short consonants you will encounter in this book.

This covers most of the phonetic symbols and terms that we will use in this book (we will define one or two more, where appropriate), but it by no means provides an exhaustive account of all possible human speech sounds. For a description of those, and for greater detail on the sounds described here, you should consult a reliable phonetics textbook, such as Ladefoged (1982).

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