1 Phonetics and phonology

The level which concerns itself with the smallest units of language is phonetics. Phonology on the other hand is the functional classification of the sounds of a particular language. It is the system of sounds by means of which meanings are differentiated in a language and which serve as the building blocks for the higher linguistic levels, e.g. morphology.

Phonetics is the study of human sounds in general without saying what function which sounds may have in a particular language. The term 'phonetics' is, however, often used with reference to one language when the emphasis is on the pronunciation of this language. For instance, a book on *The phonetics of Irish* would be about how to pronounce Irish correctly and not necessarily about the functions which the sounds may have in the phonological system of the language.

It is customary to divide the field of phonetics into three branches as follows.

1) *articulatory phonetics* (emission of sounds)
2) *acoustic phonetics* (transmission of sounds)
3) *auditive phonetics* (reception of sounds)

In any language there will be sounds which are used to differentiate meaning and those which do not serve this function. To cope with this situation descriptively one needs three terms to start with.

Phone This is the smallest unit of human sound which is recognisable but not classified. The delimiters used are square brackets: [ ]. Examples: [p], [iː], [t] all three of which are found in *peat*. Phones are unclassified in that nothing is said of their function in the sound system of a language. They are thus different from allophones (see next paragraph but one).

Phoneme The smallest unit of language which distinguishes meaning – the organisational unit of phonology – is termed a phoneme. The brackets used are slashes: / /. Examples from English are: /k/, /uː/, /l/, as seen in the word *cool* /kuːl/. Both consonants and vowels are phonemes, for instance /iː/, /aɪ/, /uː/, /aʊ/

are phonemes in English and can be seen in *beat, bite, boot, bout* respectively. The distribution of phonemes in English is fairly regular (see consonant and vowel charts below), the consonants tend to come in pairs of voiced and voiceless members and the vowels in sets of long and short vowels.

Phonemes in one language are not necessarily phonemes in another. For instance, there is no difference in status between a single, flap [ɾ] and a rolled [r] in English (the sounds in American pronunciations of *writer*, with [-ɾ-], and in a Scottish pronounciation of *roll,* with [r-]). But in Spanish these are used to distinguish different words, e.g. *pero* [peɾo] 'but', *perro* [pero] 'dog'. In English a dark [ɫ] and a clear [l] are just variants determined by their position in a syllable: the clear [l] coming at the beginnning as in *lead* [liːd] and the dark [ɫ] coming at the end as in *deal* [diːɫ]. But in other languages (Russian, Irish, etc.) these sounds can be phonemes, compare Irish *luí* /liː/ [ɫiː] 'lying' (with a dark *l*) and *lí* /lʲiː/ 'complexion' (with a clear *l*).

It is possible to distinguish phonemes not just in the way they are pronounced but also in their relative length. If one takes vowels in English as an example it is obvious that word pairs like *beat* and *bit* or *peat* and *pit* are distinguished by the first item having a long vowel and the second a short vowel. In southern British English many long vowels have become diphthongs (vowels pronounced with a movement of the tongue during their articulation) so that the relationship between long and short vowels is no longer as obvious as in other varieties. For many varieties of American English (and Irish English) the chief difference between the vowels in *bed* and *bade* is one of length, i.e. [bed] versus [beːd].

Length may also be a characteristic of consonants. Such consonants are termed *geminates* (from Latin *gemini* 'twin'). Geminates do not occur in English, but many European languages, such as Italian, Swedish or Finnish have both long and short consonants. For instance, in Italian *bella* /bella/ 'beautiful' the /l/ is long, and must be pronounced longer than the /l/ in a word like *sole* /sɔle/ 'sun'. Long consonants are indicated in transcription by doubling the consonant in question. Vowel length is shown by placing a length mark after the relevant vowel, e.g. *see* /siː/.

Allophone This term refers to the realisation of a phoneme. Bear in mind the phoneme is a unit in the sound system of a language. This means that it is an abstract unit. For instance, one can talk about '/l/ in English' without referring to either of the two forms [l], [ɫ] which it can take (the bracketing used for allophones is similar to that for phones: [ ], square brackets). What one is then doing is talking about the phoneme, the abstract unit which is part of the sound system of English. In actual speech, various *l*-sounds occur. These are realisations of the phoneme /l/. Those at the beginning of a word with turn up as [l] and those at the end as [ɫ]. What one can now say is that [l] and [ɫ] are

non-distinctive realisation of a phoneme. Why non-distinctive? Because the different *l*'s do not realise a difference in meaning. There are no two words in English (see *Minimal pairs* below) which are distinguished solely by a constrast of [l] versus [ɫ]. One could argue that this is in theory impossible in English as the [l] and [ɫ] cannot occur in the same position in a word. This is true, the allophones are in *complementary distribution* because cannot occur in the same position in a syllable. But even those sounds which are in *free variation*, for instance the different forms of /r/ in English, cannot form the basis for a distinction in meaning.

Reasons for allophones There are various reasons why different allophones of a phoneme may exist. For instance, the two types of /l/ in English are determined by syllable position (in RP, not necessarily in other varieties), as discussed above. Another reason for different allophones may be the nature of surrounding sounds. In German, for example, the distribution of [x] and [ç] depends on the preceding vowel. The back variant occurs after low and back vowels, the front one after front vowels: *flach* [flax] 'flat', *doch* [dɔx] 'still'; *ich* [ɪç] 'I', *Pech* [pɛç] 'tar; bad luck'. In French there is no systemic distinction between long and short vowels. However, long vowels occur as allophones before /r/ as one can see in a word pair like *soi* [swa] 'be-SUBJUNCTIVE' and *soir* [swaːr] 'evening'. In English all voiceless stops are aspirated (spoken with a small puff of air at the end), e.g. *top* [tʰɒp] but when they follow an /s/ this is not the case, e.g. *stop* [stɒp] (try saying this word very slowly and you will realise that there is no puff of air after the [t]).

Procedures for determining a phoneme In the majority of cases it is clear what phonemes are, /p/ and /t/ or /s/ and /z/ are clear instances in English. There are however borderline cases. Consider the case of /h/ and /ŋ/ as in *hat* [hæt] and *sing* [sɪŋ]. The former does not occur in syllable-final position and the latter only occurs in syllable-final position, i.e. [ŋæt] and [sɪh] are impossible sound sequences in English. So one could imagine that they are allophones of the same phoneme in complementary distribution, like [l] and [ɫ]. However, the sounds are so phonetically dissimilar that it would be nonsensical to consider them as two realisations of the same phoneme.

Another criterion for distinguishing phonemes involves possible contrast. The two pronunciations [wɔːʔə] (with a glottal stop, a 'catch in the throat') and [wɔːtə] for *water* in southern British English does not involve any contrast in meaning so the two sound [ʔ] and [t] are simply allophones in free variation and not independent phonemes.

Not all phonemes in a language have the same functional load. For instance, the difference between /s/ and /z/ or /f/ and /v/, i.e. the distinction

between voiceless and voiced sounds, is essential to the language as the many minimal pairs prove, e.g. *sue* /suː/ : *zoo* /zuː/, *feel* /fiːl/ : *veal* /viːl/. However, the number of words which are distinguished by a voiceless ambidental fricative and a voiced ambidental fricative are few and far between: in initial position the only word pair is *thy* [ðaɪ] and *thigh* [θaɪ]. In final position there are a few more with pairs like *teeth* [tiːθ] and *teethe* [tiːð]. The reason why the two sounds /θ/ and /ð/ have not collapsed to a single one in the history of English is probably because the distinction in voice is so central to the phonology of the language.

Structural considerations Another instance where one may have difficulties determining phonemes is where one is dealing with more than one sound. Clusters of consonants may exist in different languages on a phonetic level but have a different status in each. For example, in English and German the sound sequence /ts/ is found. In English, however, it really occurs only when an inflectional ending is added to a word as in *cat* plus -*s*. This means that there is always a morpheme boundary between the /t/ and the /s/. In German, however, one has /ts/ as part of lexical stems as in *Zeit* /tsaɪt/ 'time' and *Putz* /pʊts/ 'plaster'. Hence one can analyse /ts/ for German as an indivisible cluster, i.e. as a single phoneme.

　　　The existence of consonant clusters in lexical stems is the key structural fact which justifies their analysis as phonemic affricates, i.e. as units which consist of a stop followed by a fricative. This applies to English in other instances, such as /tʃ/ and /dʒ/, which are found in words like *church* [tʃɜːtʃ] and *judge* [dʒʌdʒ] and which do not depend on a morphological inflection as was the case with /ts/ in *cats*.

Minimal pairs It was said above that the phoneme is the smallest unit of language which distinguishes meaning. This definition implies that one can find sets of words which are differentiated only by the sounds in a single slot. Any such set of words is called a minimal pair as the words in question are minimally different on the sound level. This principle applies to all languages as each language avail of the contrasts which can be constructed using the distinctive sounds of that language. Pairs like *stop* /stɒp/ vs. *step* /step/ or *railing* /reɪlɪŋ/ vs. *sailing* /seɪlɪŋ/ illustrate the principle in English as do *Kunst* /kunst/ 'art' and *Gunst* /gunst/ 'favour' in German, *zub* /zub/ 'tooth' vs. *sup* /sup/ 'soup' in Russian, *fiach* /fiəx/ 'hunt' vs. *liach* /liəx/ 'calamity' in Irish.

　　　Phonemes are sound units and independent of letters. This is seen especially clearly in those cases where several letters can be used to represent one phoneme in writing. For example, both English and Irish are notorious for

this as many letters have lost their sound value and are nonetheless retained in writing, e.g. English /au/ in *plough* or Irish /au/ in *cleamhnas* /k^{j}l^{j}aunəs/ 'marriage match'.

1.1   Characterising articulations

1.1.1   Consonants

Consonants are sounds which involve some constriction of the vocal tract during their articulation. The degree of constriction can be very slight as with /w/ or /j/, cf. *wet* /wet/ and *yes* /jes/ respectively, or can be total as with stops, e.g. /p, t, k/ in words like *pea, tea, key*.

In order to characterise the articulation of consonants, reference to three aspects is usually made, yielding so-called *three-term labels*. These cover the majority of cases in English and most other languages. The first term of these labels refers to the point in the vocal tract where constriction occurs. The second term refers to the manner of constriction. e.g. whether there is complete closure as with stops or only approximation as with fricatives. The last aspect refers to the presence or absence of voice, i.e. whether the vocals folds are vibrating during the articulation of a sound or not.

1) Place, 2) Manner of articulation, 3) Voice (voiceless or voiced)

Other languages may need further specifications for system sounds. For instance, both Irish and Russian have a distinction between palatal ('soft' or 'slender') and nonpalatal ('hard' or 'broad') consonants, compare Irish *neart* /n^{j}art/ 'strength' where the first sound is palatal and *naoi* /n^{ɣ}i:/ 'nine' where this is nonpalatal. Similar distinctions are found in other languages, for instance Arabic has a distinction between so-called 'emphatic' and 'nonemphatic' consonants, the distinction here is between an articulation with constriction of the pharynx (the region in the back of the mouth above the larynx) and one without.

When discussing places of articulation one distinguishes various points in the vocal tract as indicated in the graph above. Not all of these points are use in the sound system of every language. There are no sounds in English produced at the uvula and there are no ambi-dental sounds in German, for instance.

labial (< Latin *labium* 'lip') Produced at the lips. The plain stops /p, b/ and the nasal stop /m/ in English are examples for these sounds, cf. *pit* /pɪt/, *bit* /bɪt/, *man* /mæn/.

labio-dental Produced between the lower lip and the upper teeth. Examples from English are /f/ and /v/ as in *fine* /faɪn/ and *vine* /vaɪn/.

dental (< Latin *dens* 'tooth') Produced just behind the upper teeth. Applies to stops in Italian, Spanish or Swedish for example, cf. *notte* [nɔt̪t̪e] 'night' in Italian. A dental pronunciation can be used for English ambi-dental fricatives in some varieties of English, notably in Ireland, but also in New York. Here words like *thought* and *that* would be pronounced as [t̪ɒːt] and [d̪æt] respectively.

ambi-dental Produced with the tongue just behind the teeth when these are slightly apart. This is true of the sounds /θ/ and /ð/ in English *thin* [θɪn] and *this* [ðɪs]. Such sounds are relatively rare in the world's languages. In Europe, for instance, they occur in Spanish, e.g. *servicio* /serˈviθio/ 'service', in Danish, e.g. *mad* /mað/ 'food' and in certain dialects of Italian, e.g. *silencioso* /silenˈθioso/ 'silent' as well as in Greek, e.g. *paidos* /piðos/ ??? 'child'.

alveolar (< Latin diminutive of *alveus* 'cavity', referring to the sockets for the upper teeth) The alveolar ridge is the bony protrusion behind the top teeth before the arched roof of the mouth which forms the palate. This is the most commonly used passive articulator and the tip of the tongue is the most frequently used active one, as in such common sounds as /t, d, s, z, n, l/ and (without contact) the /r/ found in most varieties of English.

alveolo-palatal The region immediately behind the alveolar ridge is used for the broad-grooved fricatives of English, /ʃ/ and /ʒ/, and found in the affricates /tʃ/ and /dʒ/ as well. These sounds are articulated with attendant lip-rounding. This can be significant in the developments of sounds, for instance in the pronunciation of short *u* before /ʃ/ where the rounded nature of the fricative probably hindered the unrounding and lowering of /ʊ/ to /ʌ/ as in *but* /bʌt/.

palatal (< Latin *palatum* 'roof of mouth') The palate is the arched roof of the mouth which consists of bone covered by a thin layer of skin. The typical sounds produced here are /j/ and /ç/, the former in *yes* /jes/, *year* /jɪə/ and the latter in some English pronunciations of *huge* [çuːdʒ]. Stops in this region occur as well and are to be found allophonically in English when the following sound is a high front vowel, e.g. *keel* /kiːl/ [ciːl], *gibberish* /ˈgɪbərɪʃ/ [ˈɟɪbərɪʃ]. Historically palatal stops they tend to shift further to affricates as in the development from Latin to Romance: *camera* /k-/ → *chamber* /tʃ-/ (a French loan in Middle English). The process of shift from a back to a front articulation for stops is called *palatalisation* and is attested widely in Slavic languages as well, for example in Russian where it can be seen in present-day inflections, e.g. *dukh* /dux/ 'spirit'-NOMINATIVE : *dusha* /dʌˈʃa/ 'spirit'-GENITIVE. In Irish and Scottish Gaelic there is a whole series of palatal sounds which are used both to

distinguish the lexical forms of words and to indicate grammatical categories, e.g. Irish *cí* /ciː/ 'breast'-GENITIVE : *caoi* /kiː/ 'way, manner'.

velar (< Latin *velum* 'covering', here of nasal opening at rear of mouth) The velum is the soft palate between the hard palate and the uvula at the back of the mouth. Here a number of common sounds are produced such as /k, g/ as in *call* /kɔːl/ and *got* /gɒt/. Many languages also have a velar fricative, e.g. German *Tuch* /tuːx/ 'cloth', Spanish *trabajo* /traˈbaxo/ 'work', Russian *ploxo* /ˈploxə/ 'bad'. The voiced velar fricative is much less common, but does occur in Spanish, e.g. *bodega* /boˈðeɣa/ 'shop' and in Irish, e.g. *a ghort* /ə ɣʌrt/ 'his field'.

uvular (< Latin diminutive of *uva* 'grape') The uvular has the primary function of closing the nose off from the mouth during eating. It is occasionally used in the articulation of sounds, an important one of which is the standard allophone of /r/ in French, e.g. *rouge* /ruːʒ/ [ʁuːʒ] 'red' or German as in *Regen* /reːgən/ [ʁeːgən] 'rain'. The sound also occurs in Danish and in southern Swedish dialects where it has spread from north Germany. A uvular *r* is also found in vernacular forms of English in north-east Leinster (Ireland), e.g. *fear* [fiːʁ] and is the sound referred to as the Northumberland *burr*, found traditionally in the north-east of England.

glottal (< Greek *glotta/glossa* 'tongue') The glottis is strictly speaking the gap which arises when the vocal folds are kept apart. The most frequent sound to be produced here is /h/ which is a voiceless glottal fricative. A plosive can be articulated here as with the glottal stop used as the allophone of /t/ in British English dialects, such as Cockney (and many colloquial varieties of present-day urban English in Britain) as in *butter* [bʌʔə] or in popular Dublin English, e.g. *letter* [lɛʔəɹ].

The points of articulation discussed are complemented by references to the active articulator. This is nearly always the tongue. With labial sounds it can be the lower lip when raised towards to upper teeth as in English /f/ and /v/ in *few* /fjuː/ and *view* /vjuː/, for example. Glottal sounds have no active and passive articulators as they are produced by a movement of both vocal folds.
　　　　The tongue is normally divided into three regions, each of which can be the active articulator. The adjectives used to refer to this parts of the tongue are *apical* 'tip of tongue' (< Latin *apex* 'peak'), *laminal* 'blade of tongue' (< Latin *lamina* 'plate') and *dorsal* 'rear of tongue' (< Latin *dorsum* 'back'). The tip of the tongue is used for /t/ and /d/ in English, but some languages like Swedish use the blade with a large contact area, e.g. *tala* [t̪ɑːlə] 'speak'. The fricatives /s/ and /z/ are pronounced with the blade of the tongue in English, but other

languages, notably Spanish, Dutch, Finnish and Greek among the European languages, use the tip of the tongue which makes their *s* sound like something intermediary between /s/ and /ʃ/, a phonetic feature of those languages which do not have a phoneme /ʃ/ anyway.

Consonants of standard English

	labial	dental	alveolar	palatal-alveolar	palatal	velar	glottal
1)	p b		t d			k g	
2)	f v	θ ð	s z	ʃ ʒ			h
3)				tʃ dʒ			
4)	m		n			ŋ	
5)			l, r				
6)	w				j		
	(labio-velar)				(palatal)		

1) stops, 2) fricatives, 3) affricates, 4) nasals, 5) liquids, 6) glides
The left symbol of each pair is voiceless, the right one voiced.

Manner of articulation

Before discussing the various manners of articulation, it would seem appropriate to remark on linguistic terminology as this is of relevance here. Below you will find the term *obstruent* which refers to both fricatives (like /s, f/), stops (like /p, t/) and affricates (like /tʃ, dʒ/). There is good justification for this label because in many languages the two groups of sound frequently behave as one, for instance by both being subject to a certain rule. Although *obstruent* in a complication with respect to the number of linguistic terms it allows a simpler statement to be made about sound structure. For example, in Russian all obstruents undergo devoicing at the end of a word, e.g. *jug* /juk/ [juk] 'south', *muzh* /muʒ/ [muʃ] 'husband'. However, all sounds which are not obstruents, such as /n, l, r/ do not show this devoicing. One can also refer to the group of non-obstruents, non-vowels and non-glides as *sonorants*. One can now formulate a simple rule in English: only obstruents are found before sonorants in syllable onsets, hence one has *fling*, *pluck* but not **rlick* or **nrod*.

stops Any sound produced with complete blocking of the airstream is a stop. The stop itself is not technically a sound as it consists of a pure closure. Examples are /p, t, k; b, d, g; m, n, ŋ; l; ʔ/. Stops can be either voiceless and voiced but crosslinguistically there is a general preference for them to be voiceless. Indeed some languages do not have voiced stops, e.g. Finnish where

they only occur in some loanwords and as a result of a softening process called 'consonant gradation'. In the North Germanic languages – Danish, Swedish, Norwegian, Faorese and Icelandic as well as in Irish and Scottish Gaelic – the fricatives /s/ and /ʃ/ only occur in voiceless form and loanwords are altered accordingly, e.g. Swedish *etage* /eˈtɑːʃ/ 'storey' (from French).

In English voiceless stops are generally aspirated, i.e. spoken with a small puff of air on their release, but not after /s/. This is not true of other European languages, the Romance and the Slavic languages do not aspirate these stops. Further afield – in Armenian and Georgian, for instance – one finds ejectives, voiceless stops produced by closing the vocal folds and then releasing the stop in the oral tract with a sudden burst of air. Another variant of stop realisation is found in many South Asian languages. Here voiced stops are produced with simultaneous constriction of the vocal folds on their release creating a 'murmuring' effect so that *b* can sound as if were a combination of /b/ and /h/.

fricatives A fricative is a sound which is produced by causing a constriction, but not a closure, anywhere above and including the glottis. The typical sound of a fricative is caused by the air turbulence at the constriction. The latter is realised by drawing the tongue close to a passive articulator such as some point on the top of the mouth as with /s, ʃ, x/ seen in English *sign, shine* and Spanish *junta* /xunta/. Fricatives can be formed at the lips as with /ɸ, β/ and /f, v/ which differ in the use of both lips as opposed to the lower lip and the upper teeth respectively, seen in English *vow* /vau/ and Spanish *neve* /neβe/ 'snow'. A glottal fricative /h/ is produced by drawing the vocal folds together but not closing off the airstream. This sound is not present in all languages, e.g. Italian does not have /h/, and many other have lost it, such as French. In urban varieties of British English, initial /h-/ is usually dropped, but more conservative varieties, such as Scottish, Irish and American English, do not do this. Other varieties may have fricatives not found in standard English. In Irish and Newfoundland English a characteristic fricative is found as a realisation of /t/ at the end of a word before a pause, or between two vowels. This is a kind of whistling sounds produced by bringing the tip of the tongue close to the alveolar ridge, but not forming contact, e.g. *put* [pʌt̞], *putty* [pʌt̞i].

affricates A sequence of stop and fricative is called an affricate. These segments can exist phonetically but their phonological status depends on whether they occur within word stems, i.e. without a morpheme or word boundary between them. Hence one can say that /tʃ/ and /dʒ/ in English are phonemes as they occur in lexical stems like *church* /tʃɜːtʃ/ and *judge* /dʒʌdʒ/, but /ts/ and /dz/ in words like *spots* /spɒts/ and *buds* /bʌdz/ are not phonemes because they have a morpheme boundary between the two sounds in questions, i.e. /spɒt+s/

and /bʌd+z/ respectively where /s/ and /z/ are realisations of the plural morpheme {S}. The situation in German or the Slavic languages is quite different as here /ts/ can occur as a part of a word stem, e.g. Russian *tsena* /tsɪˈna/ 'price', German *Zapfen* /ˈtsapfən/ 'pine cone'.

obstruents A cover term for stops, fricatives and affricates together (see remarks at the beginning of this section).

sonorants This is a cover term which embraces liquids – /l, r/ – and nasals – /m, n, ŋ/. These segments are nearly always voiced (but Welsh is a language in which voiceless sonorants are phonemes). Sonorants tend to act similarly in history and to have similar phonotactics, i.e. occur in similar combinations within words. Thus in German the /x/ is always realised as [ç] following a sonorant /n, l, r/, e.g. *Mönch* [mønç] 'mink', *Milch* [milç] 'milk', *Storch* [ʃtɔːrç] 'stork'. Another phenomenon which shows the interrelatedness of sonorants can be seen from Western Irish where /r/ interchanges with /n/ as in *mná* 'women' /mrɑː/ or *imnigh* /iːmʲrʲiː/ 'worry'. Furthermore, /-r/ has shifted to /-l/ in *feirimeoir* /fʲɛlʲɪmʲoːrʲ/ 'farmer' on borrowing.

nasals Any consonant which is produced with a lowered velum is a nasal because air can escape through the nose causing nasal resonance. A degree of nasality can be present in normal speech depending on the individual or on whether one has a cold or not. But those nasal segments which have phonemic status belong to a small set, in English these are /m, n, ŋ/. Many Romance languages have palatal nasals, e.g. Spanish *España* /espaɲa/ 'Spain', Italian *bagno* /baɲɲo/ 'bath'. French also has nasal vowels (see section *1.1.2 Vowels* below).

liquids This is a cover term for *l* and *r* sounds. The *l* sounds come in at least three different flavours. (1) an alveolar /l/, as in English *lead* [liːd], (2) a velarised [ɫ], as in English *ill* [ɪɫ] or Russian *byl* [bɪɫ] 'was' and (3) a palatal [ʎ] as in Italian *famiglia* /faˈmiʎʎia/ 'family' (palatal *l* and *n* are always geminates in Italian). Historically, palatal /l/ tends to develop into /j/ as in it has done in Spanish, e.g. *pollo* /pojo/ 'chicken', and in French, e.g. *travail* /travaj/ 'work'.

The *r* sounds also have different variants. In English a post-alveolar continuant (in narrow transcription an *r* on its head) is the normal realisation of /r/, e.g. *run* /run/ [ɹʌn]. Some traditional varieties of Scottish English have a trill, in narrow transcription an upright *r*, e.g. *rip* [rɪp]. A 'flap' *r* is found in many varieties of English, especially in North America in intervocalic position, e.g. *spider* [spaɪɾɚ]. A uvular *r* is typical of languages in a broad band across

north-west continental Europe from France to southern Sweden, e.g. German *Rand* [ʁant] 'edge'.

The cover term 'liquids' is useful when describing the phonological structure of words. For instance, in English only liquids are allowed in syllable onsets after an obstruent, hence one has *blond*, *break*, *sprat*, *split* but not **bneak* where a nasal follows a stop. The only exception to this is the use of nasals after /s/ as in *sneak, smash* (see section on phonotactics below).

glides These are sounds which occupy an intermediary position between vowels and all other consonants. Different terms can be used such as semi-vowels or approximants. The two glides of English are /w/ and /j/ as in *well* /wel/ and *you* /juː/. In conservative varieties of English, above all in Ireland and Scotland there is also a voiceless glide, transcribed [ʍ], and is used for every occur of written *wh-*, e.g. *which* [ʍɪtʃ], *whale* [ʍe(ː)l], *whet* [ʍɛt] which leads to contrast with words beginning in *w-* [w-], i.e. with *witch, wail, wet* for the words just given. In other varieties this sound has coalesced by [w], that is it has merged with its voiced counterpart.

1.1.2   Vowels

Vowels are sounds which are produced without any constriction of the vocal tract. They are nearly always voiced and are usually produced with airflow solely through the oral cavity. In some languages, such as French and Polish, a number of vowels are produced with the velum lowered so that there is resonance in the nasal cavity as well, cf. French *chanter* [ʃɑ̃te] 'to sing'. Nasals vowels are rarely phonemes but many other languages or varieties have subphonemic nasalising of vowels, especially in pre-nasal position. This is true, for instance, of many forms of American English, especially for the vowel /æ/ as in *man*.

Cardinal vowels In order to characterise vowels satisfactorily a system was introduced at the beginning of the 20th century by the English phonetician Daniel Jones. This is the cardinal vowel system whose basic principle is that extreme positions for the articulation of vowels are taken as reference points and all other possible vowel articulations are set in relation to them. The four corner positions are: /i/, /a/, /ɑ/, /u/ which represent the extremes in the vowel quadrangle of an idealised human mouth in a sagittal view. There are two further horizontal levels of vowels between these vertical extremes: /e/, /ɛ/; /o/, /ɔ/. All the cardinal vowels exist in rounded and unrounded versions, but a low front rounded vowel [œ] does not seem to occur as a phoneme in natural languages. The vowel quadrangle used for the representation of vowels is derived from a side view of the oral cavity with the face turned to the left, that is the position of /i/ is maximally high and front, the position of /u/ is maximally high and back

while the low vowels /a/ and /ɑ/ are maximal low front and low back respectively.

Front		Back	
i y		ɯ u	High
e ø		ɤ o	Mid
ɛ œ		ʌ ɔ	Low mid
a (œ)		ɑ ɒ	Low

The left symbol of each pair above is unrounded; the right one is rounded. There is a general correlation between unroundedness and frontness and roundedness and backness, i.e. these value combinations are much more common than their opposites.

The following chart illustrates the vowel values of standard British English, i.e. Received Pronunciation and vary greatly between varieties of English.

Vowels of standard British English (RP)

Monophthongs

Front				Back	
iː				uː	High
	i		ʊ		
	e	ə	ɜː		Mid
		ʌ		ɔː	Low mid
	æ				
				ɑː ɒ	Low

Examples: *beat* /biːt/, *bit* /bɪt/; *bet* /bet/; *bat* /bæt/, *bard* /bɑːd/, *bo(ttom)* /bɒtəm/; *bull* /bʊl/, *but* /bʌt/; *bought* /bɔːt/, *boot* /buːt/; *(butt)er* /bʌtə/. The word *bird* is pronounced as /bɜːd/ in RP but as [bɚːd] in rhotic varieties of English, i.e in those where /r/ at the end of a syllable is pronounced.

Diphthongs

rising:	aɪ, aʊ, ɔɪ	*bile* /baɪl/	*bow* /baʊ/	*boil* /bɔɪl/
	eɪ, əʊ	*bait* /beɪt/	*boat* /bəʊt/	
centring:	ɪə, ɛə, ʊə	*pier* /pɪə/	*pear* /pɛə/	*poor* /pʊə/

The centring diphthongs do not exist in rhotic varieties of English as their equivalents are sequences of a vowel and /r/, e.g. *pier* /piːr/. The rising

diphthongs /eɪ/ and /əʊ/ vary in their quality across the English-speaking world. Some varieties, such as traditional Scottish and Irish English have monophthongs, i.e. [e(ː)] and [o(ː)] while others have slight diphthongisation, e.g. American English [ɔʊ] as in *goat* [gɔʊt].

There is also a marginal diphthong in a word like *ruin* /ruɪn/ but it is not of importance to the sound system as a whole.

1.2   Phonotactics

The area which is concerned with the possible sequences of sounds in a language is phonotactics. This can be clearly seen if one compares two languages which have the same segments but different orders in which they can occur. The point of reference is the syllable for which there are three positions which are phonotactically relevant: the beginning (syllable-initial), the middle (syllable-medial) and the end (syllable-final). In fact this can be simplified to a two-day distinction between initial and medial/final (the syllable rhyme, see below). Consider an aspect of Irish and English to illustrate what is meant here. In English the sequence /sr/ is found in both languages, cf. English *cars* /kars/. However, in English this sequence cannot occur at the beginning of a word whereas in Irish it can, cf. *srón* /sruːn/ 'nose'. Another example would be fricatives before sonorants, i.e. before /l, n, r/. The only ones which are allowed in English are /f/ and /s/ as in *fling* and *slip*. However, in Irish the other fricatives such as /x/ and /ɣ/ as well as /m/ can occur in this position, e.g. *sa ghleann* /sə ɣlʲan/ 'in the valley', *a mbláthanna* /ə mlɑːhənə/ 'their flowers'. One can conclude that Irish has a different phonotactics than English as there are far fewer restrictions on the combinations of consonants in word-initial clusters.

Gaps in systems Not all possible phonotactic combinations in a language are actually attested. There will always exist certain gaps. Here one must distinguish between random and systemic gaps. In English there are the words *please* and *prowl* but there is no *prease* or *plowel*. These are random gaps as the second pair of words would be acceptable according to the phonotactics of English. However, systemic gaps are due to phonotactic restrictions, for instance *pnease* and *pnowl* are non-existent and impossible in English. These facts can be summarised in the following table.

Triconsonantal syllable initial slots in English

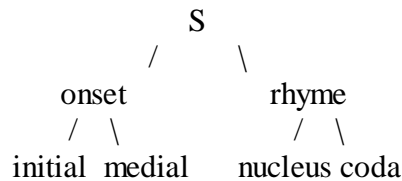|				
1:	/s/		/s/	
2:	/p/		/p, t, k/	
3:	/l, r/	*spray, splay*	/r/	*sprat, stream, screech*

Some combinations may occur in loanwords and with time be accepted as

'normal', i.e. not provide difficulties in pronunciation for native speakers, e.g. all words in English with initial /skl-/, such as *sclerosis*, derive from the Greek word *skleros* 'hard'. Other combinations have been simplified on borrowing, e.g. *pneumonia* is pronounced with an initial /n/ as is *gnostic*.

1.3   Syllable structure

To understand phonotactics more fully it is essential to grasp what syllables are and how they are structured. The syllable is a unit which everyone recognises intuitively. If one asks a nonlinguist how many syllabes in the words *butter, drudgery, education* or *kettle* one usually gets the right answer, namely 2, 3, 4 and 2. But it is notoriously difficult to define a syllable. It is usually a sequence of sounds with a vowel in the middle. However, *kettle* /ketl̩/ and *button* /bʌtn̩/ are regarded as having two syllables, so it must be possible for a sonorant – /l/ or /n/ – to occupy the centre (nucleus) of an (unstressed) syllable in English.
        Despite the difficulties of its ultimate definition the structure of the syllable can be shown as follows:

```
                        S
                      /     \
                 onset       rhyme
                 /  \        /  \
            initial  medial  nucleus coda
```

The simplest type of syllable is one which consists of a consonant followed by a vowel, e.g. *tar* /tɑː/, though the onset need not be present: *eye* /aɪ/. But usually syllables are more complex. The onset can consist of more than one consonant: *star* /stɑː/. The rhyme can have either a short or long vowel or a diphthong as nucleus, *the* /ðə/, *cue* /kjuː/, *sty* /staɪ/. A coda may be present in which case the syllable is closed: *stack* /stæk/. Just like the onset, the coda may also be complex: *stance* /stans/, *sixth* /sɪksθ/. A general feature of syllables is that the most sonorous element is in the middle and the least sonorant elements are found on the edges. The only exception to this is /s/ which can occur before a voiceless stop in English: *spin* /spɪn/. Nonetheless, the principle holds and can be seen in the following example (*pressed*):

onset		nucleus	coda	
/p	r	e	s	t/
vcl. stop	liquid	vowel	vcl. fric.	stop

Other phonotactic restrictions may apply to syllable structure in a given language. In English a final short vowel is not allowed, unless it is an unstressed

shwa as in *to* /tə/, *the* /ðə/, etc. A sequence like /tɪ/ would not be permissible in English, such a syllable must be closed, as in *tick* /tɪk/ or it must have a heavy nucleus, e.g. a diphthong as in *tie* /taɪ/.

The weight of a syllable is determined by the elements in its rhyme (see syllable structure above). There are basically two types here.

	Rhyme
Light syllable	short vowel + single consonant
Heavy syllable	long vowel or diphthong, possibly followed by one or more consonants

Syllable weight is an important factor in any language and can be shown to play a role in its development. At any point in time a language will have rules governing permissible weight. In languages which have long and short vowels and consonants, there may be a specific definition for heavy syllables. For instance, in Swedish a heavy syllable is one which either has a long vowel plus a single consonant (V:C) or a short vowel plus a long consonant (VCC) in its coda. These two types occur but a long vowel and a long consonant (V:CC) does not.

Swedish	*vitt* /vɪtt/	'wide'	VCC
	vit /viːt/	'white'	V:C

In late Old English (around 1000 AD) there was a similar distribution to that just given. It did not develop into a phonotactic rule as so-called superheavy syllables, consisting of a long vowel and more than one consonant, arose due to lengthening of vowels before a cluster of a sonorant and a homorganic consonant (one at the same point of articulation).

dust /dʊst/	VCC	*hām* /hɑːm/ 'home'	V:C
mind /mind/	-VCC →	/miːnd/	-V:CC

The above situation is often described using the term is *mora* which is a unit of syllable quantity. Syllables which contain short vowels as nucleus and simple codas (a single consonant) are said to be *mono-moraic* whereas those which either 1) have a long vowel nucleus or 2) a short vowel nucleus followed by a heavy syllable coda (two or more consonants) are said to be *bimoraic*. The Swedish and Old English situations thus involve the structure of bimoraic syllables.

Stress and vowel quality Syllables can be stressed or unstressed in English. It is generally true that the maximum number of distinctions is found in stressed

syllables, for instance the full range of vowels in English is only found in stressed syllables, e.g. the vowels /æ/ (as in *bat*) and /ʌ/ (as in *but*) are not found in unstressed syllables. The only short vowels which occur in this position are /ɪ/ and /ə/: *naked* /neɪkɪd/, *about* /əˈbaʊt/. English does not allow short stressed vowels in open position. In this case the vowel must be long or a schwa, e.g. *two* [tuː], *to* [tə]. This does not hold for all languages, however. In Irish short stressed vowels in word-final position are allowed, e.g. *te* [tʲɛ] 'hot'.

Epenthesis and metathesis The requirements of syllable structure can lead to changes in the phonetic forms of words, either diachronically or synchronically. The latter case is easily illustrated with examples from varieties of English which have slightly different requirements for syllables than more standard forms of the language. For example, in Irish English there is a restriction on heavy codas – a coda which contains two sonorants, hence the extra vowel in a word like *film* [fɪləm] or *helm* /hɛləm/; this phenomenon is called *epenthesis*.

> Avoidance of heavy codas (i)
>
> resyllabification
>
> *film* /.film./   à   [.fi.ləm.]
>
> *helm* /.hɛlm./   à   [.hɛ.ləm.]

A related change is *metathesis* which involves a reordering of the sequence of sounds in a syllable. Again in Irish English the heavy coda prohibition has led to instances of V/r/ being reversed to /r/V as in *modern* [mɒdrən] or *pattern* [pætrən].

> Avoidance of heavy codas (ii)
>
> shift of segment from coda ($_c$) to onset ($_o$)
>
> *modern* /mɒ[d]$_o$ə[rn]$_c$/   à   [mɒ[dr]$_o$ə[n]$_c$]
>
> *pattern* /pæ[t]$_o$ə[rn]$_c$/   à   [pæ[tr]$_o$ə[n]$_c$]

Metathesis between /r/ and a vowel is very common and can be seen by comparing related forms across languages, e.g. English *burn* and German *brennen*. It is also in evidence within a language if one examines different forms, e.g. *work* and *wrought* (as in *wrought iron*). Diachronic comparisons can show where metathesis has taken place, e.g. Middle English *bridde* and Modern English *bird*. Metathesis is also recognisable in firstnames. The names *Christine* has a few alternatives, one of which shows the sequence V/r/ rather than /r/V: i.e. *Kersti(n)*.

1.4   Prosody

Prosody is a term to refer to properties of language such as pitch, loudness, tempo and rhythm. Importantly, prosody also covers the phenomenon of *stress* which is found in most languages. This means that, in words of more than one syllable, there is one which is more acoustically prominent than the others. This prominence can be realised on the phonetic level by one of the following three features or a combination of them.

> 1)   greater relative length of the stressed syllable
> 2)   relatively high pitch
> 3)   greater relative loudness

(1) is nearly always a characteristic of stressed syllables. However, languages usually have either (2) or (3) as well. (3) is most common for so-called lexical stress, that is the normal stress on a word said without particular emphasis, e.g. the second syllable in *polite* or the first in *constant*. There is also the phenomenon of contrastive stress which refers to a situation where the speaker wishes to highlight a whole word and does this by altering the prosody of the syllable carrying lexical stress. In English, syllables given contrastive stress tend to have a higher pitch so that in a phrase like *He struck the* ''*teacher!* there is a recognisable rise on the first syllable of *teacher*. Not all languages do this, German, for instance, tends to mark contrastive stress by loudness and length of the highlighted word, e.g. *Er hat seinen neuen* ''*Wagen kaputtgefahren!* 'He crashed his new car!'.

Role of stress and stress placement The use of pitch for lexical stress is not, however, unknown. It is a feature of Finnish, where the first syllable of a word has a rise in pitch followed by all subsequent syllables at a lower pitch. This brings one to the question of why there are stressed syllables at all in a language. The obvious answer is that the rhythm provided by sequences of stressed and unstressed syllables make it easier for the listener to follow what is being said (try saying a sentence of some length in a flat, dead pan accent and see how strange this is). In addition, if the stress is always on a certain syllable, the first in Finnish, the penultimate in Polish, then it is also easier to recognise the word structure of the sentences one is listening to. But this does not hold for all languages. Some have variable stress, e.g. Russian which often has a stress shift to the last syllable of the word in an oblique case, e.g. *stol* /stol/ 'table'-NOMINATIVE : *stola* /stʌˈla/ 'table'-GENITIVE. English has a complex stress system because alongside the inherited Germanic system of stressing the stem of a word, e.g. ˈ*friendship,* ˈ*hundred, for*ˈ*gotten, be*ˈ*set,* it has also got a system with Romance words which favours stressing the last heavy syllable counting from the end of the word, e.g. *per*ˈ*ceive, do*ˈ*nation, com*ˈ*puter.* This

may of course mean that the first syllable is stressed if the word does not have a heavy syllable (and you cannot move further back from the end than the first syllable), e.g. ˈ*fallible,* ˈ*posit,* ˈ*service*. In addition there are more recent French loans which always have the stress on the last syllable irrespective of whether this is long or not, e.g. *ho*ˈ*tel, su*ˈ*preme, po*ˈ*lice*.

Timing in languages Languages which exhibit acoustic prominence on a certain syllable of a multi-syllable word are called *stress-timed*, because the length of time from one stressed syllable to the next is approximately equal. All the languages mentioned in the previous paragraphs belong to this category. An additional term is used here, a *foot*, which refers to the distance between two peaks of acoustic prominence, i.e. stressed syllables, irrespective of the number of unstressed syllables in between (this term is important in the formal analysis of verse poetry).

A correlation of stress-timing is that those syllables which are not stressed are phonetically reduced. This is true of English and has had far-reaching consequences in the history of the language leading to the reduction and loss of inflectional endings with subsequent large-scale changes in grammar.

There are some languages which have a more or less equal distribution of stress across all syllables of a word, that is they have no apparent stress pattern. Such languages are *syllable-timed* because the length of time between syllables is roughly equal. French and Jamaican Creole and many African languages (of the very large Bantu family) are examples of syllable-timed languages as are the varieties of English used by speakers of these languages. If any syllable tends to be prominent in a syllable-timed language then it is the final syllable of a word. No contrastive stress exists in such languages.

Contrastive stress A stress-timed language has an additional characteristic mentioned at the end of the previous paragraph. It can, and does in several cases, distinguish words by stress alone. There are many words in English which are distinguished by stress. The reason for the stress contrast in English is that certain French loanwords – generally called Romance loans – entered the language in the Middle English period (twelfth to fifteenth century) and probably then had final stress as part of their prosodic makeup. Later on nouns received initial stress conforming to the dominant pattern of Germanic words in English. But the verbs did not always experience a fronting of stress, so that there are now many word pairs which differ only in stress.

> ˈ*convert* : *con*ˈ*vert,* ˈ*review* : *re*ˈ*view,* ˈ*convict* : *con*ˈ*vict*
> ˈ*discharge* : *dis*ˈ*charge,* ˈ*combat* : *com*ˈ*bat,* ˈ*refill* : *re*ˈ*fill*
> *per*ˈ*mit* : ˈ*permit, re*ˈ*mould* : ˈ*remould, re*ˈ*make* : ˈ*remake*

Contrastive stress is found between verbs and adjectives in English also:

ˈ*absent* : *ab*ˈ*sent*, ˈ*frequent* : *fre*ˈ*quent*. The general rule would seem to hold that Romance verbs have stress on the second syllable, irrespective of whether they contrast with nominal forms or not: *at*ˈ*tract*, *con*ˈ*firm*, *re*ˈ*sent*. The small number of Romance verbs with initial stress would appear to be nominal derivations: ˈ*comment*, ˈ*preface*.

The time when Romance loans entered English can make a difference. Later loans generally have final stress and often contrast with the same word borrowed earlier which had been adapted to the initial stress type for nouns, e.g. ˈ*moral*, *mo*ˈ*rale*; ˈ*liquor*, *li*ˈ*queur*; ˈ*critic*, *cri*ˈ*tique*, ˈ*risky, ris*ˈ*qué*. (the later loans also tend to retain the French spelling). Often there is a difference in pronunciation because unstressed vowels are frequently reduced in quality in English. However, one or two instances only have a stress contrast, e.g. ˈ*billow* and *be*ˈ*low*.

Metrics The stress patterns of words can be grouped according to where the stress falls in a word. The area of phonology which is concerned with this issue is called *metrics* and the phenomenon of stress placement within a word is *metre*. In the following *u* stands for an unstressed syllable (usually short) and */* symbolises a stressed syllable (usually long). In metrics the term *ictus* is used for the syllable which carries stress.

Metre type	1	2	3	4	Examples
iamb	u	/			Eng. *a*ˈ*bout*
trochee	/	u			Eng. ˈ*butter*
anapaest	u	u	/		Eng. *Paki*ˈ*stan*
dactyl	/	u	u		Eng. ˈ*allophone*
spondee	/	/			Eng. *(a)* ˈ*black* ˈ*board*
paeon	/	u	u	u	Eng. ˈ*ordinary*

These are general types which do not always occur in natural languages. In English the last type is only found in slow pronunciation, normally the sample word would be [ˈɔːdɪnri], that is a dactyl. The spondee is typical of syntactic groups and not of lexicalised compounds as seen in the example above which contrasts in stress with the trochee pattern in *blackboard* (see next section).

Stress types in English The discussion so far has concerned stress as if it were a unified feature. But there are different levels of stress. For English one must distinguish at least two, *primary* and *secondary* stress. Secondary stress can only occur when a syllable is separated from the primarily stressed syllable by at least one further syllable. Primary stress is indicated by a superscript vertical stroke while secondary stress is shown by a subscript stroke.

Primary stress:	*linguist*	[ˈlɪŋgwɪst]
Secondary stress:	*education*	[ˌedjuˈkeɪʃən]

Level stress Apart from differences in stress among the syllables of a word, English has a phenomenon known as *level stress*. By this is meant that two syllables in a word are equally stressed. This is very common with syntactic phrases and proper names.

Level stress: ˈWorld ˈWar ˈTwo, ˈHong ˈKong, ˈTime ˈSquare

Level stress can contrast with cases of primary stress. Usually the latter is found with phrases which have become compounds and are now semantically opaque or at least treated as a unit.

Level stress:	ˈblack ˈbird	(syntactic group)
Primary stress:	ˈblackbird	(compound)

1.5   Writing and sound

It is essential to distinguish between writing and sound. Because people have gone through a school system in which the orientation is towards writing it is difficult to abstract away from the written word and think in terms of sounds and not of letters. One should bear in mind that the system of writing is historically an afterthought to represent sounds in a fixed form. Writing is furthermore only a pale imitation of the sound structure of language as so many characteristics, such as the prosodic features discussed in the previous section, cannot be represented in writing at all. For this section on phonetics it is important to note that the orthography of a language is more or less inconsistent. It is the exception rather than the rule for a language to have a one-to-one relation between letters and sounds. In the European context, Finnish is probably the best example with languages like Dutch and Russian not far behind. Others, like English, French, Danish and Irish have many letters which in pronunciation have moved away from the sounds associated with them originally.

The relationship between the written and the spoken form of words leads to a fourfold set of distinctions – depending on the nature of the relationship – which are captured by the following labels.

Homophony Two words are pronounced the same, e.g. *father* and *farther*; *court* and *caught* (this only applies to non-rhotic varieties of English), *meat* and *meet*.

Homography Two words are written the same but not pronounced the same, e.g. *convert* (noun) and *convert* (verb); *lead* (metal) and *lead* (cord for controlling a dog's movements). Homography is not present in languages which

do not have contrastive stress or the same manner of writing long and short vowels.

Homonymy Two words are written and pronounced the same, e.g. *bear* and *bear*; *bank* and *bank* in English. These words are not related etymologically. It is purely a matter of coincidence that they have developed to be written and pronounced the same.

Polysemy Two distinguishable meanings of a single word form exist. For example in English the word *neck* exists with the meaning 'part of the body' and 'narrow strip of land joining two larger parts'. In this case the second meaning is derived from the first one which is basic or primary. Seen historically, polysemous forms stem from the same root in contradistinction to homonyms which have come to be written and pronounced the same by chance.

Summary

- *Phonetics* is the study of human sounds and *phonology* is the classification of the sounds within the system of a particular language or languages.

- Phonetics is divided into three types according to the production (*articulatory*), transmission (*acoustic*) and perception (*auditive*) of sounds.

- Three categories of sounds must be recognised at the outset: *phones* (human sounds), *phonemes* (units which distinguish meaning in a language), *allophones* (non-distinctive units).

- Sounds can be divided into consonants and vowels. The former can be characterised according to 1) *place*, 2) *manner of articulation* and 3) *voice* (voiceless or voiced). For vowels one uses a coordinate system called a *vowel quandrangle* within which actual vowel values are located.

- *Phonotactics* deals with the *combinations* of sounds possible and where sounds can occur in a *syllable*.

- The basic structure for the organisation of sounds is the *syllable*. It consists of an *onset* (beginning), a *rhyme* (everything after the beginning) which can be sub-divided into a *nucleus* (vowel or vowel-like centre) and a *coda* (right-edge).

- *Prosody* is concerned with features of words and sentences above the level of individual sounds, e.g. stress, pitch, intonation. Stress is frequently contrastive in English.

- The unstressed syllables of English show characteristic phonetic *reduction* and words containing this are called *weak forms*.

- It is essential to distinguish between *writing* and *sound*. There are various terms (*homophony*, *homography*, *homonymy*) to characterise the

relationship between the written and the spoken form of words depending on what the *match* between the two is like.

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